Dr. Hagen.

ON

DIMORPHISM IN THE HYMENOPTEROUS GENUS

CYNIPS,

WITH AN APPENDIX, CONTAINING HINTS FOR A NEW CLASSIFICATION OF CYNIPIDÆ AND A LIST OF CYNIPIDÆ, INCLUDING DESCRIPTIONS OF SEVERAL NEW SPECIES, INHABITING THE OAK-GALLS OF ILLINOIS.

BY BENJ. D. WALSH, M. A.

[From the Proceedings of the Entomological Society of Philad., March, 1864.]

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More than two years ago Baron Osten Sacken directed the attention of American Entomologists to the remarkable fact, that Hartig had "collected about 28,000 galls of *Cynips divisa* and reared 9 to 10 thousand *Cynips* from them, all ♀ ♀"; and that "of *Cynips folii* likewise he had thousands of specimens of the ♀ sex without a single ♂"; whence he concluded "that these insects were agamous, or in other words that the ♂ ♂ did not exist at all."—(*Proc. Ent. Soc. Phil.* I, p. 49.)

I have myself examined in all, at various times, some in the closet and some in the field, about a thousand specimens bred from or taken

ERRATA.

Page 471, line 20 for "1st dorsal" read "2nd dorsal."
" 478, line 24 for "cockoo-bees" read "cuckoo-bees."
" 479, line 13 for "connate *joint*" read "connate."
" 490, line 3 from bottom for "joint 1" read "joint 2."

are commonly called, on which I experimented, were an isolated and scattering group of 50 or 60 black oaks (quercus tinctoria), situated on a blue-grass prairie and without any other kind of forest-trees intermixed with them. The distance from this group to the nearest timberland is about 150 yards. For many years I have procured from this source just as many *Cynips q. aciculata* as I wanted, the galls occurring in prodigious exuberance there; and I had noticed three years ago that upon 6 or 7 of the largest black oaks in this group, on which the *Cynips* had hitherto been almost exclusively found, being cut down for fuel.

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I have myself examined in all, at various times, some in the closet and some in the field, about a thousand specimens bred from or taken out of the gall of *Cynips quercus aciculata*—a species described by Osten Sacken from two specimens furnished by myself—and they were all beyond a doubt ♀ ♀. There can be no mistake here, because in this genus the ♂ is distinguishable at a glance by its differently shaped and very much smaller abdomen; but to prevent the possibility of error, in most cases I ascertained the presence of the ovipositor.

In the spring of 1863 I determined, if possible, to solve this mystery; and as the subject is of high physiological importance, it will be advisable, before stating the conclusions arrived at, to specify in some considerable detail, as extracted from my journal, the facts upon which those conclusions are based.

The trees from which I obtained the galls, or "oak-apples" as they are commonly called, on which I experimented, were an isolated and scattering group of 50 or 60 black oaks (quercus tinctoria), situated on a blue-grass prairie and without any other kind of forest-trees intermixed with them. The distance from this group to the nearest timberland is about 150 yards. For many years I have procured from this source just as many *Cynips q. aciculata* as I wanted, the galls occurring in prodigious exuberance there; and I had noticed three years ago that upon 6 or 7 of the largest black oaks in this group, on which the *Cynips* had hitherto been almost exclusively found, being cut down for fuel.

the insect shifted its quarters to some other large trees which stood at the other end of the group, passing over a number of much smaller and younger trees lying in the intermediate space. One of these last large trees in particular was so badly infested by *Cynips* in 1863, that it must have borne from 400 to 500 galls. I have, however, occasionally found these galls elsewhere on quite young trees and even on saplings.

These same galls occur on the black oak in two or three other localities near Rock Island, Illinois, but by no means so abundantly. They are, however, exceedingly local, and if all the black oaks within two miles of Rock Island were divided into groups of the same size as the one above described, I am confident that for one such group where these galls exist, certainly fifty and perhaps one hundred will be entirely destitute of them. I speak the more confidently on this point, because one of my favorite modes of collecting is by "beating," and because it is scarcely possible to "beat" an oak, where these large and conspicuous galls or "oak-apples" exist, without becoming aware of their presence. Another fact leads to the same conclusion. Every spring in the locality above referred to dozens and dozens of oak-apples of last year's growth may still be seen hanging on the trees, being almost invariably those from which the *Cynips* or its parasites have made their exit. In the winter of 1863–4 I have carefully looked for such oak-apples in many black oak patches where I had failed to find them in the summer, and could not discover a single one. Yet the trees being mostly leafless a single specimen would have been easily seen. On the same prairie mentioned above there is another group of black oaks, similar and similarly situated to the one that swarms with oak-apples, and distant from it about ¼ mile. Yet a careful search in the winter failed to discover a single oak-apple hanging on the boughs. On the other hand I had no difficulty in finding on the same occasion many of these galls still hanging on the trees in the two or three localities where I commonly find them in small numbers in the summer; nor in finding numerous galls of *Cynips quercus inanis* O. S. on the red oak still hanging on the tree. Yet that gall is not one-twentieth part so abundant as the one which produces *aciculata*.

There are found near Rock Island the following species of oak, named in the order of their relative abundance, and on none of them,

except the black oak, have I ever found the kind of gall which produces *aciculata*:—Quercus tinctoria, (black oak, by far the most abundant of any,) alba (white oak), rubra (red oak), macrocarpa (burr oak), imbricaria (laurel oak), and prinus variety discolor (swamp white oak.) Q. coccinea (the scarlet oak) is believed by my friend Dr. Fred. Brendel, to be a mere variety of Q. tinctoria, (*Trees and Shrubs of Illinois*, by Dr. Brendel, *Trans. Ill. State Agr. Soc.* III, p. 596,) but it does not, so far as I am aware, occur in this vicinity. The identity of Q. tinctoria and Q. coccinea is an important fact, because Osten Sacken allows that his *Cynips quercus coccineæ*, bred by him from Q. coccinea, is scarcely distinguishable from *C. q. spongifica*, bred by him from Q. tinctoria, and only separates them on account of the supposed distinctness of the galls from which the two insects were bred, and the supposed distinctness of these two so-called species of oak. (*Proc. Ent. Soc. Philad.* I, p. 247—8.)*

On May 17th, 1863, I visited the above described group of black oaks, and although their leaves were only about ¼ grown, I noticed, in addition to several of last year's dry and brown oak-apples, a very great number of green and freshly formed ones, many of which had attained their full size. On cutting a few of them open, I found the larva of the *Cynips* about ½ grown. Some of these galls had the terminal nipple attributed to the gall of *spongifica* by Osten Sacken, some were smoothly spherical as the gall of *aciculata* is described by the same author, many had several nipples scattered irregularly over their surface, and 2 or 3 had as many as 12 or 14. The few I cut into had a rind or skin as thick as that of the normal gall of *aciculata*. I noticed a single specimen which was irregularly lobed like a common tomato.

On May 24th some of these galls contained full-grown larvæ, and on May 25th I found in several of them ♀ pupæ. On June 4th I opened several galls gathered May 24—5, and found in them some larvæ and pupæ, and one ♂ and two ♀ imagos of *C. q. spongifica* O. S. Shortly afterwards I collected about 100 galls, as they were beginning to get

* Of the four other species of oak known to occur in Illinois—q. obtusiloba (post-oak), q. nigra (black jack or barren oak), q. castanea (yellow chestnut oak) and q. palustris (pin oak)—the two first are confined to Central and Southern Illinois, so far as is hitherto known.

ripe, and bred from them in all during the month of June, 6 ♂ ♂ and about 20 ♀ ♀ of *spongifica*, besides a great number of the Cynipidous inquiline or guest gall-fly, *Synophrus læviventris* O. S., and of two distinct species of parasitic Chalcididæ belonging apparently to Callimome and Decatoma, and a single Bracon very near *mellitor* Say. Up to June 14 all the galls that produced *spongifica* flies were thin-shelled and of the type of the gall *q. coccineæ*. Such galls were then brown and ripe, whereas the more hard-shelled and thick-shelled ones were then more or less green and succulent. On June 14th, however, I bred a ♂ *spongifica* from one of the latter description of galls, and many ♀ ♀ afterwards from such galls; and I found that all the intermediate grades between the two types occurred in the galls that produced *spongifica*, some having a shell no thicker than writing-paper which wrinkled and collapsed and shrivelled up in drying, and some a shell as thick as ordinary cardboard, so as to retain their plump, apple-like appearance under the roughest usage; some again having a terminal nipple, some many nipples, and some none at all or next to none. The last *spongifica* (a ♂) came out June 18, and after that date no more made their appearance, nor after the last day of June any more inquilines or parasites except a single ♀ Callimome (?) on July 23d. Of the whole number of galls somewhere about ½ remained on hand imperforated by any insect, those that were perforated having been from day to day picked out and thrown away. About the last of June, the thicker shelled galls having now become partially ripe and dry, I gathered 2 or 3 hundred more from the same locality, selecting of course those which had not been perforated by any insect.

During the month of June I had endeavored to experiment on the mode in which these galls are generated, by enclosing the boughs of of different species of oak with gauze-bags and placing therein freshly-hatched specimens of ♂ ♀ *spongifica*. Owing to the mischievous propensities of certain unknown persons, the only fact I was enabled to arrive at was, that this insect when fed on white sugar, which it appears to eat freely, lives only 6 or 8 days.

On July 16th I examined the group of black oaks, from the accessible boughs of which I had sometime before stripped all the galls. There were no new galls formed there, neither were there any subsequently formed there during the summer. Out of about 16 or 18 galls

left on a particular tree, three or four which I opened contained each a lively cynipidous larva in the central nucleus, and full one-half of the whole number were not perforated.

On September 6th I opened two of the oak-apples gathered early in June, and found a black ♀ pupa, apparently *aciculata*, in each. On Sept. 17th and 18th I found in the same lot of oak-apples 7 ♀ *aciculata* in the imago state, and during the month of October and the early part of November I bred very numerous imagos of the same, say from 50 to 60, all ♀. On October 25th I obtained three specimens from galls with a thinnish shell, and one from a gall with a shell as thin as paper and a distinct nipple at the tip. Of three others bred the same day from thick-shelled galls, one came from a gall with a terminal nipple, and the other two from spherical galls. On October 27, out of 11 or 12 ♀ *aciculata* that came out, several came from galls with a terminal nipple and from galls covered with nipples all over, the rest from spherical galls. Other specimens continued to come out till November 16, and a single one after that date. Not a single parasite had made its appearance since July 23rd. On January 20, 1864, I cut into 30 or 40 of the remaining galls and found in them 9 *aciculata* ♀ fresh and limber but dead, and 2 specimens dead and dried up, besides some dead and dried up parasites.

Besides the locality above referred to, I reared in 1862 a ♂ *spongifica* and several ♀ *aciculata* from a different locality, the gall of the former gathered in the spring and that of the latter in the autumn and both found on q. tinctoria.

From the above facts I draw the following conclusions:—

1st. *Cynips q. spongifica* O. S. is identical with *C. q. coccineæ* O. S., as there are confessedly no distinctive specific characters of any importance, and the galls occur on the same species of oak (q. tinctoria) and are connected by all the intermediate grades. The spongy matter of the gall of *q. coccineæ* is said to be "whiter" than that of *q. spongifica*, but I noticed several galls of *aciculata*, the spongy matter of which was in January, 1864, almost pure white.

2nd. *C. q. spongifica* O. S. occurs ♂ ♀ exclusively on q. tinctoria, and emerges not later than June from galls that commenced their growth in the preceding month of May.

3rd. *C. q. aciculata* O. S. is a dimorphous form of *C. q. spongifica*

O. S., occurs exclusively in the ♀ sex and exclusively on q. tinctoria, and emerges from the last of September to the middle of November, and many of them not till the following spring, from galls that commenced their growth in the preceding May, which are undistinguishable from those which produce *C. q. spongifica*, the same kinds of gall from the same lot of trees, gathered at the same time, producing *spongifica* ♂ ♀ in June and *aciculata* ♀ in October and November, and nothing whatever but a solitary parasite in the intervening period.

Suppose, for argument's sake, that *aciculata* and *spongifica* are distinct species. Then we are met immediately by the following difficulties:—1*st*. Is it likely that two distinct species of *Cynips* should produce, on the same species of oak, galls which are undistinguishable? I know of no such case in the whole Class Insecta. 2*nd*. Is it likely that when *spongifica*, as above shown, is so local that it is only found in one station out of fifty near Rock Island, *aciculata* should select that particular station instead of some other one of the remaining 49? 3*rd*. If *aciculata* is a distinct species, then we are compelled to believe with Hartig in the existence of agamous species, i. e. of species that propagate from year to year *ad infinitum* without sexual intercourse with a distinct individual. I cannot believe that any species in the whole Animal Kingdom is uniformly agamous, for the simple reason that we should then have almost as many races, and finally species, as individuals. Monstrosities and remarkable variations, which with bisexual species are mostly eliminated by intercrossing with normal individuals, would then by the laws of inheritance be always intensified and exaggerated from generation to generation, and what was originally one homogeneous species would split up into an almost infinite number of distinct and sharply defined types.*

That it may not be supposed that I approached this subject biassed in favor of the conclusions above announced, it is proper to state that my original guess was, that there were two broods of this *Cynips* every year, the first a spring brood ♂ ♀ of the type *spongifica*, the second an autumnal brood, ♀ only, of the type *aciculata*, generated in the ordinary course by the first brood, and in its turn generating by

* Mr. Darwin has avowed a similar belief in the case of hermaphrodite species, but for a different reason, viz., that close interbreeding tends to produce sterility. (*Origin of Species*, p. 235, Amer. edition.)

parthenogenesis the spring brood of *spongifica* in the following year. It is scarcely necessary to add, that the facts utterly overthrow this hypothesis. On the subject of Dimorphism, see my Paper on Pseudoneuroptera. (*Proc. Ent. Soc. Philad.* II, p. 221—2.)

The differences between these two dimorphous forms are so striking, that at the very first glance every entomologist who saw them for the first time would pronounce them to be distinct species, and there are no intermediate grades of any consequence. I have now before me 6 ♂, 5 ♀ of *spongifica*, and 30 ♀ of *aciculata*, and the following differences are observable:—

1st. The fovea at the base of the scutel is twice or thrice as deep in *spongifica*, and the longitudinal carina which bisects it is twice or thrice as lofty.

2nd. In *spongifica* there are three deep and wide, transversely corrugated, longitudinal striæ or sutures in front of the scutel, one central one extending nearly to the collare, but becoming narrower as it approaches it, and two divergent lateral ones fading out as they approach the humerus. In *aciculata* it is only in particular lights that traces of these striæ are discoverable, and they do not extend nearly so far forwards.

3rd. In *aciculata* on each side of the notum, beginning at the collare and terminating suddenly about half-way to the scutel, is an almost invariably conspicuous, obtuse, glabrous carina, each parallel with the other and distant from the other about as far as the two posterior ocelli are. In *spongifica* it is only in two or three specimens and in certain lights, that faint traces of these two carinæ are discoverable.

4th. In *aciculata* the mesonotum is very finely aciculate, or covered with fine regularly parallel rugæ before the scutel, except in two or three specimens where it is somewhat irregularly but very finely rugose. In *spongifica* it is very coarsely rugose. There is some little variation in both these two forms, but comparing the most coarsely sculptured *aciculata* with the most finely sculptured *spongifica*, the rugosities are at least twice as coarse in the latter, i. e. each rugosity is twice as wide.

5th. The sculpture of the rest of the thorax and also of the head is about twice as coarse in *spongifica* as in *aciculata*.

6th. The body of *aciculata* is uniformly black except that the abdo-

men is sometimes piceous below. In two ♀ *spongifica* the thorax is almost rust-red, (as observed in a single ♀ *C. q. coccineæ* by Osten Sacken, *Proc. Ent. Soc. Phila.* I, p. 244,) and the abdomen piceous red; in another ♀ the thorax is tinged with rust-red and the abdomen is piceous; and in the fourth ♀ the thorax is black and the abdomen is piceous red, the remaining ♀ specimen being uniformly black as are also both ♂ ♂. In the closely allied or identical species *q. inanis*, however, one of my two ♂ ♂ has a piceous red abdomen and all my 9 ♀ ♀ have a black thorax and a piceous red abdomen.

7th. Viewed laterally, the upper edge of the second abdominal joint (counting the peduncle as the first joint) describes a circular arc of about 60° in both forms. Taking the chord of this arc as a definite and permanent basis of measurement, in *spongifica* ♀ the lower or ventral edge proceeds straight downwards exactly at right angles with this chord for a distance equal to ½ or ⅓ the length of the chord, before it curves gradually backwards to form the ventral arch. In *aciculata* ♀ on the contrary, instead of being at right angles (90°) with the chord, it forms with it an angle of about 110°, so as to exhibit a most extraordinary bulge in front, and it curves much further downwards from the peduncle and in a more compressed and knife-edged form, so that the abdomen is vertically at least as wide as long and almost always much wider, whereas in *spongifica* ♀ it is always longer than wide and generally much longer. The above variation in each form is caused by the terminal abdominal joints being more or less telescopically drawn out in different specimens, so that in each form the second abdominal joint sometimes occupies dorsally ½ the entire length of the abdomen exclusive of the peduncle, and sometimes almost ⅔. St. Fargeau has observed the same thing of the genus Megachile, (*Hymenopt.* II, p. 338,) and I only notice it here because Osten Sacken, having only a few specimens of each form on hand, supposes the relative length of the 2nd abdominal joint with regard to the terminal joints to be a permanent character of each. (*Proc. Ent. Soc. Phil.* I, p. 246.)

8th. In consequence of the above bulge on the anterior abdomen in *aciculata*, (See *Appendix*, Fig. I,) the distance from the "ventral valve" (Fig. I, *v*,)* to the "dorsal valve" (Fig. I, 7)* is proportion-

* These terms are explained in the Appendix.

ally twice as long as in *spongifica*, and consequently the sheaths of the ovipositor (Fig. I, *ss*) are also proportionally twice as long, though their proportional breadth in both forms is nearly the same.

9th. With the exception of a single specimen, my 30 ♀ *aciculata* are ¼ broader and longer than my 5 ♀ *spongifica* and my 9 ♀ *inanis*, all 14 of which are remarkably uniform in size, save a single ♀ *inanis* which is a little smaller than the rest.

These nine differences are sufficiently remarkable, and but for the evidence of dimorphism would undoubtedly be viewed by every entomologist as of specific value. Three other differences stated by Osten Sacken I do not find to be strictly correct.

1st. In both forms the antennæ are of a uniform, opaque, dark reddish brown, and not "pitch black" in *aciculata* and "brown or reddish brown especially towards the tip" in *spongifica*. (*Proc. Ent. Soc. Phila.* I, pp. 56 and 242.) The two basal joints, however, are blacker and a little inclined in some specimens to be polished.

2nd. In both forms the areolet is, on the average of specimens, equally distinct and not "more distinct" in *aciculata*. (*Ibid.* p. 57.) Of course, on account of the larger size of the insect, it is absolutely but not relatively larger in *aciculata*.

3rd. In both forms the antennæ ♀ are 13-jointed, the last joint nearly as long as the two preceding ones put together and with *one* more or less distinct transverse impression slightly behind its middle; or, to state the same thing in other terms, the antennæ ♀ are 14-jointed, the two last joints connate and almost confluent. Osten Sacken erroneously says that in *spongifica* ♀ the antennæ are 13-jointed, the last joint "with *two* indistinct transverse sutures foreshadowing the 14th and 15th joints of the ♂;" and that in *aciculata* ♀ the antennæ are "14-jointed, the last joint being separated from the penultimate one by a suture as distinct as that of all the other joints." (*Proc. Ent. Soc. Phila.* I, p. 246.) In some specimens of *aciculata*, and it was probably such that Baron Osten Sacken received from me, the connate suture or transverse impression of the 13th joint is much more distinct than in others, but even in such specimens it disappears when viewed in certain lights, the other or true sutures remaining visible. In no specimens is it a true or free suture, as I ascertained by examining and re-examining dozens of specimens both in life and in death. Neither

could I find more than *one* transverse impression on the 13th antennal joint of any ♀ *spongifica* or ♀ *inanis*, though I carefully examined all my specimens while they were alive for that express purpose, and have verified the fact in the dried specimen. Both here and in the case of *C. q. palustris* (*Proc. Ent. Soc. Phila.* I, pp. 63 & 251) Baron Osten Sacken seems to have been led into error by supposing that in the *typical* Cynipide the antennæ ♀ ought to have as many joints as the antennæ ♂.

Two problems still remain to be solved, one of which I will myself endeavor to investigate in the coming season, and to the other I earnestly invite the attention of European entomologists.

1st. What, if any, is the generative function of *aciculata?*

2nd. Are Hartig's agamous species dimorphous forms, like *aciculata*, of some known or unknown bisexual species?

In regard to the first question I have shown above that *spongifica* ♂ ♀, which come out in June, only live 6 or 8 days, and it is therefore utterly improbable that ♂ *spongifica* should survive till October, so as to copulate with ♀ *aciculata* that appear in that month, and still more improbable that it should survive till the following spring, so as to copulate with the *aciculata* that pass the winter inside of the gall. What place in Nature, then, does *aciculata* fill, or does it fill no place at all? I can only guess, on the analogy of Apis, Bombus, &c., that *aciculata* ♀ generates galls which produce by parthenogenesis ♂ *spongifica* exclusively, and that ♀ ♀ *spongifica* coupling in June with these ♂ ♂ oviposit in the same month in the young buds of the oak, the eggs lying dormant till the following spring, when some of the eggs produce ♀ *spongifica* in June and some ♀ *aciculata* in the autumn or early in the following spring, which last in their turn, as before mentioned, generate ♂ *spongifica* to appear in the following June. It may also be the case that some few ♂ *spongifica* are generated by ♀ *spongifica*. By this arrangement the life of *aciculata* from egg to imago would be 16—22 months, and of *spongifica* ♂ generally 8—2 months, while that of ♀ *spongifica*, and perhaps occasionally of ♂ *spongifica*, would be 12 months. We know that the small ♀ of Bombus generates by parthenogenesis an autumnal crop of ♂ Bombus, for the assertion of that most inaccurate writer St. Fargeau, that there is a summer brood of small ♂ Bombus, which copulates with small ♀ Bombus. is contrary to the authority of

all other writers on the subject and contrary to my experience with regard to North American species, ♂ Bombus appearing exclusively in the autumn.* We know also, on the authority of Huber, that the working honey-bee occasionally lays ♂ eggs, although that writer states that these eggs are invariably destroyed by the other working-bees three days after they are sealed up in their cells. (Quoted by St. Farg. *Hymenopt.* I, p. 359.) Bevan, however, (quoted by Westw. *Intr.* II,

* See Westw. *Intr.* II, p. 279, note * and p. 281: St. Farg. *Hymenopt.* I, pp. 449 and 452, who quotes Dahlbom and Huber as being of the opinion contrary to his own. Some conspicuous proofs of St. Fargeau's inaccuracy may here be mentioned. 1*st.* He asserts (*Hymenopt.* I, p. 46) that there are no apterous species in Hymenoptera, although Gravenhorst had long before established the apterous Ichneumonide genus *Pezomachus*, to say nothing of the Chalcidide genus *Chorcius* and the Cynipide genus *Biorhiza*. 2*nd.* In Vol. II, pp. 212–214, two species of bees are described under the genus *Melitta*, and in pp. 145–7 of the same volume a new genus, Kirbya, is established to contain these same two species of bees, of which slightly different descriptions are given, and all this without a word of comment or explanation. 3*rd.* In Vol. II, p. 261, "lagopus" (hare-footed) is translated "pied de loup" or wolf-footed. 4*th.* In Vol. III, p. 509, he finds fault with a certain Italian Committee of Naturalists, who had issued a most interesting Report on the well-demonstrated fact that Scolia, unlike other Fossores, does not make a nest and carry its prey thereto, but attaches its eggs to the larvæ of Oryctes, like an Ophion or a Tachina. "One would suppose," says he, "that the gentlemen of the Committee were not aware that three years before they wrote their Report I had divided Hymenoptera into two Suborders, Ovitithers (egg-placers) and Oviscapters (egg-diggers) which last lay their eggs inside the body which serves to nourish them." As if the Ichneumonide Ophion was not, according to his own arrangement, an "Oviscapter"! or as if that genus had not been proved, not only three years but many years before he wrote, to attach its eggs *externally* to the body of its victim just like the "Ovitither" Scolia! Even if his division had been natural and correct, such half-Latin and half-Greek terms, as "ovitithers" and "oviscapters," might well have grated harshly upon the ears of a Committee, composed of descendants of the ancient Romans. 5*th.* The "Vallonia" in which the abovementioned Oryctes larva occurred is not, as St. Fargeau erroneously supposes, "tannée" (tan-bark), but a kind of acorn so called and extensively employed in tanning. (See Macculloch, *Diction. Commerce.*, "Vallonia.") Hence St. Fargeau's remark that "he cannot conceive why M. Passerini stops to combat the opinion that the larva of Scolia may possibly be *frugivorous*, seeing that there were no *fruits* either whole or chopped up near it," and that such a supposition is "neither sustained nor sustainable," is based upon a misapprehension of the meaning of the common word "Vallonia." For Vallonia acorns are certainly *fruits*, in the botanical sense of the term, though "tan-bark" is not. (*Ibid.* p. 506, note 1, and p. 507.)

p. 279, note*) distinctly states that some working-bees "differing in shape from the rest, are occasionally fertile, depositing eggs but which only produce males." And according to Kirby and Spence (*Introd.* Letter 19), "Riem of Lauten of the *Palatinate Apiarian Society*, and Wilhelmi of the *Lusatian* affirm that the queen lays the eggs which produce the queens and workers and the workers those that produce the drones or males"; which is valuable as the testimony of practical bee-masters to the fact of the workers occasionally, at all events, producing male offspring. Again, we know from Huber, that if the coitus of the queen-bee is delayed till the 21st day after her birth, which may be considered as an ineffectual coitus or no coitus at all, she ever thereafter gives birth to nothing but ♂ eggs; (St. Farg. *Hymenopt.* I, p. 324) and it is well known that every queen-bee normally impregnated produces ♀, or which is the same thing, ♀ eggs for 10 or 11 months, and finally, when the effect of the impregnation may be supposed to have died out, ♂ eggs. (St. Fargeau *Hymen.* I, p. 324.) Furthermore, we learn through Huber, on the authority of M. Perrot, that in the wasps there are "small ♀ ♀ *not bigger than the workers* which lay only ♂ eggs." (Quoted Kirby and Spence, *Introd.* Letter 18, p. 108=p. 348.) And Kirby and Spence state generally that "*like those of the wasps* and hive-bees the minor queens [of Bombus] produce only *male* eggs, which come out in time to fertilize the young females that found the vernal colonies" (*ibid.* p. 353); i. e. come out in the autumn, when those "young females" are well known to make their first appearance, and when only, as I know by long observation, the ♂ ♂ either of *Polistes*, *Vespa* or *Bombus* are to be met with. Whether in the case of the wasps and the humble bees we choose to call these individuals that lay only ♂ eggs "minor queens" or "small females" or "workers," is a matter of taste; for there is in these two groups no external character but size, or occasionally trifling differences in coloration, to distinguish them from the large ♀ ♀ that found the colonies in the spring. But in the case of the hive-bee, where there are marked structural characters that separate the worker from the female or queen-bee, it was most satisfactorily demonstrated by Huber, that the individuals that laid the ♂ eggs had ALL the structural characters of workers; (quoted St. Farg. *Hymen.* I, p. 356—8;) and here therefore it would be manifestly incorrect to call these individuals "small queens." The

truth of the matter seems to be, that authors have been misled by the erroneous term "neuters"; and when they found a so-called neuter wasp or neuter humble-bee laying ♂ eggs, have thought it necessary to call the insect by some other name, as if knowledge consisted in words and not in things. So far as my own limited experience goes, I believe that there are only three distinct types either in *Apis*, *Bombus* or *Vespa*, viz. 1*st*. the large copulative ♀ queen or founder of the nest generating both ♂ ♂ and ♀ ♀, 2*nd*. the small agamous ♀ or so-called neuter generating ♂ ♂ only, which in *Apis* is not only smaller than but structurally distinct from the first type, and 3*rd*. the ♂ or drone. In a nest of *Bombus virginicus* examined October 7, by Mr. Cresson, 30 ♀ ♀ were "all of the largest size," i. e. about 12 lines, and 38 workers or small ♀ ♀ "5—8 lines." (*Proc. Ent. Soc. Phil.* II, p. 165.) And this coincides exactly with what I found to be the case in the only nest of *Bombus* that I ever examined myself. I believe further, though the fact still remains to be proved, that the first of these three types is homologous with ♀ *spongifica*, the second with the agamous ♀ *aciculata*, and the third with ♂ *spongifica*. And if this be correct, the old opinion that the working bee is not a distinct dimorphous form but nothing but a mere stunted ♀, is manifestly untenable; for ♀ *aciculata* lives in exactly the same kind of gall as ♀ *spongifica*, and one can be no more stunted than the other. Finally it is recorded that three generations of a moth (*Hypogymna dispar*) have been obtained without impregnation, "the last of which consisted entirely of males," (Westw. *Intr.* II, p. 384,) and it is notorious that in Aphis generation after generation of ♀ ♀ are produced by parthenogenesis, until the original impregnation may be supposed to have died out, when a generation of ♂ ♂ comes into the world. All these facts seem to indicate, that when the fecundating ♂ principle is absent, or rather when it has more or less partially died out, whatever is born is of the ♂ sex. It is possible, of course, that *aciculata* ♀ may perform no generative function whatever, but both here and in the case of Apis and other social insects it seems difficult to understand, how any dimorphous type can subsist for an indefinite time without at least occasionally exercising some generative function. Like produces like, either in the next or in some succeeding generation, and if the type *aciculata* was uniformly sterile, it would surely in an indefinite number of ages tend to be elimi-

nated and gradually cease to make its appearance. As an apparent confirmation of the hypothesis that *aciculata* produces ♂ ♂ exclusively, Baron Osten Sacken has called my attention to the fact, that "he found three galls in the spring *on the same branch*, and on cutting them open found ♂ *spongifica* in two and the third was probably also a ♂." (See *Proc. Ent. Soc. Phila.* I, p. 244.) May it not be possible that the working-bee generates ♂ bees more frequently than has been supposed, so as to admit of a queen bee being occasionally fertilized by one of them? On this hypothesis a difficulty which has much exercised Mr. Darwin would be thoroughly cleared up, viz., how instincts acquired by "neuter" insects come to be inherited. (*Origin of Species*, chap. 7.) The small ♀ ♀ of *Bombus* are normally fertile; analogy would lead us to suppose that the ♀ of *Apis* should be at least occasionally fertile. May not the well known fact that in certain insects one or the other sex greatly preponderates in numbers, and the further fact, so familiar to all breeders of insects, that with a given species one brood will be almost exclusively ♂ and another brood almost exclusively ♀, be also accounted for on the above theory?

In regard to the second problem, it may be asked why, if Hartig's agamous species are mere dimorphous forms of bisexual species, did he fail to discover the bisexual forms? I can only say in reply, that I once argued in print, that it was impossible that the army-worm moth (*Leucania unipuncta* Haw.) should exist in the Eastern States, for if it did it *must* have been found there either by Dr. Harris or Dr. Fitch; and that scarcely had the argument been published, when it was proved by indubitable evidence that it did so exist. Negative evidence is at the best always more or less unreliable. I recollect distinctly that the common English "oak-apples" which are, I believe, formed by *Cynips quercus terminalis*, attain their full size like the North American oak-apples of *spongifica*, by the end of May, because 30 years ago it was the custom to cover them with gold-leaf and employ them in the celebration of King Charles's day, May 29th. Will not some English entomologist collect a hundred or so of them and see if they do not produce a dimorphous ♀ form in the autumn?

To those who are desirous either of verifying the dimorphism of *spongifica* and *aciculata*, or of investigating the probable dimorphism of European species, it may be suggested that a very cheap, convenient

and successful way of breeding from "oak-apples," is to pin up several dozen in a newspaper. Placed in a glass jar, especially if very green, they are far more apt to mould and spoil, and the moisture that is continually exhaling from them settles on the jar, even when dry sand is placed at the bottom, and wets the wings of the imagos as they appear. Moreover, when breeding on a large scale, the expense of providing a sufficient number of jars would be quite considerable.

There is still another most interesting question connected with the Natural History of *Cynips q. spongifica*. Baron Osten Sacken bred a form allowed by him to be undistinguishable from it (*C. q. inanis*) in June, from entirely different galls found either on quercus coccinea or on q. rubra, but which species is uncertain; but he succeeded in obtaining two ♀ specimens only. In June, 1863, I obtained 2 ♂ 9 ♀ and some parasites from about 50 such galls, and I am certain that these galls occur near Rock Island exclusively on the red-oak (q. rubra), and as stated by Osten Sacken, on young trees and occasionally on mere saplings. The gall-fly described by Dr. Fitch as *Callaspidia confluenta* Harris (*N. Y. Rep.* II, § 317) and said to occur on the red-oak, is manifestly from the description of its gall identical with *inanis* O. S; but neither did Dr. Fitch succeed in obtaining the ♂ sex. The insect however is evidently not a Callaspidia, for that genus has the ♂ antennæ 14-jointed, not 15-jointed like *inanis* ♂, and the scutel "clathrate" or covered with raised network, and truncate behind, not rounded behind as in *inanis*. (Brullé *Hymenopt.* IV, p. 635.) I can bear witness to the fact that both sexes of *inanis* are undistinguishable, except in the few unimportant particulars mentioned above, from ♂ ♀ *spongifica*. Having about 30 of the galls remaining on hand imperforated by any insect till the autumn, I had fully expected to obtain *aciculata* or some other dimorphous ♀ type from them; but to my great mortification, on cutting them open in January, 1864, I discovered that 15 or 16 of them had been attacked by a small parasitic Chalcidide, 8 or 9 of the larvæ of which were found clinging together in a round ball inside of the central cell, some of the others contained what was probably a dead larva of *inanis*, one a dead imago of *inanis* all mouldy, and the rest irrecognizable matter. Six I reserved untouched, for the chance of breeding the Chalcididous imago. The failure to breed any dimorphous autumnal form from these galls may very pro-

bably have been caused by their having been put in a glass jar instead of in paper; for they were quite green when gathered and moulded considerably in spite of all my care. Thus the question still remains to be settled, whether *inanis*, as well as *spongifica*, has an autumnal dimorphous form. I strongly suspect that it has. It is possible, however, that it has not, and it is possible that it may have an autumnal dimorphous form entirely distinct from *aciculata*. Similarly the ♂ ♂ and ♀ ♀ of *Formica aphidicola* Walsh, and *F. latipes* Walsh, are scarcely or not at all distinguishable, while the ♀ ♀ are as different as two species of the same genus can well be. In either of the above two cases it will be necessary to consider *C. q. inanis* as a distinct species, and I therefore consider it provisionally as distinct; though I am inclined to believe that it is merely a distinct race of *C. q. spongifica*, which has acquired a permanent habit of attacking the red-oak exclusively instead of the black-oak, just as I have shown that there is a distinct race of *Clytus pictus* Drury, which has acquired a permanent habit of attacking the locust exclusively instead of the hickory. (See my Paper *Proc. Bost. Soc. Nat. Hist.*, Feb. 1864.)

I infer that the form *inanis* does not sometimes attack the red-oak producing *inanis* galls, and sometimes the black-oak producing *spongifica* galls, from the following fact:—The red-oak near Rock Island grows exclusively upon high bluffy land, where it is intermixed promiscuously with black-oak. But although the gall of *C. q. inanis* is tolerably abundant there on the red-oak, I never saw but a single gall of *spongifica* (which it will be remembered attacks the black-oak) on the bluffs, nor any anywhere within half a mile of the spot where my *inanis* galls were all gathered, nor within half a mile of any spot where I ever found the gall *inanis*. On the other hand on the flat sandy bottom land, where the galls of *spongifica* occur in profusion, there are no red-oaks, so that the converse of the above question, viz., whether the form *spongifica* sometimes attacks the black-oak producing *spongifica* galls and sometimes the red-oak producing *inanis* galls, cannot be tested.

The galls of *inanis* and *spongifica*, although at first sight essentially distinct, are constructed upon the same fundamental principle, viz., a central nucleus, in which the larva lies, connected with a more or less thin and irregularly spherical shell by radiating filaments. The only differences are, that the gall of *inanis* ranges from ¾ to 1¼ inch, and

that of *spongifica* from ¾ to 1¾ inch in diameter, and that in *inanis* the space between the filaments is empty, and in *spongifica* is filled by a dense spongy substance. May not this last difference, as suggested by Osten Sacken, be caused by the different re-action of the two different species of oak against the sting of the same *Cynips?* I must confess analogy is generally opposed to the supposition; for the very remarkable and peculiar galls of *Cynips q. palustris* were found by Osten Sacken on quercus tinctoria, coccinea and falcata, and I have found them on trees of quercus tinctoria and imbricaria growing by the side of each other with their limbs interlaced, while Mr. Bassett has found a similar gall producing a slightly different insect on q. ilicifolia. (*Proc. Ent. Soc. Phila.* II, 329.)* An observation of Mr. Ratzeburgh's to the same effect has been quoted by Osten Sacken (*Proc. Ent. Soc. Phila.* I, 248.) On the other hand an instance is quoted by the same writer where somewhat different galls on different oaks produce apparently the same species of *Cynips* (*Ibid.* p. 51.) There is considerable variation in the shape of the gall of *inanis*, as in that of *spongifica*, some specimens occurring that are not smooth and spherical but covered with excrescences. I noticed two that grew, not out of the leaf, but out of the stem close to the origin of the leaf.

So far as the identity of the parasites infesting *spongifica* and *inanis* might be supposed to prove the identity of the two species themselves, the evidence is indecisive. I have obtained from both in June a beautiful green *Callimome* (?), and the chalcidide larva mentioned above as found in January in the galls of *inanis*, occurs also in the same month in those of *spongifica;* on the other hand I have bred from *spongifica* alone a large *Decatoma* (?) with spotted wings and a single specimen of a *Bracon*, and from *inanis* alone a small Pteromalide, all in June. The inquiline or guest gall-fly *Synophrus? læviventris* O. S., also occurs in June exclusively on *spongifica*.

Baron Osten Sacken, by the way, remarks that "respecting the true relation of the Inquilinæ to the Psenides * * not a single direct observation seems to be extant, and that the fact of their parasitism is therefore merely inferred from the circumstance of their having been reared

* Specimens ♂ ♀ obligingly sent me by Mr. Bassett are identical with specimens bred by myself from q. tinctoria.—March 14, 1864.

from the same galls." (*Proc. Ent. Soc. Phila.* I, p. 49.) I have repeatedly observed that the little cells of the above-named inquiline are placed in great numbers—sometimes 20 or 30 of them—immediately under the outer skin or rind of the gall of *spongifica*, whence the imago emerges through orifices like pin-holes; and on two occasions I have found in the central cell of *spongifica* galls, that were full of such little cells under the rind, not the *spongifica* fly itself indeed, but what comes to the same thing, its parasitic destroyer the large green Callimome (?) above referred to. Hence three results follow:—1*st*. That it is not the *Synophrus* that makes these galls, for it only occurs in some few of them. 2*nd*. That the eggs of the *Synophrus* must have been deposited after the gall had attained some considerable growth; for if the eggs that produce the *Synophrus* had been laid in the bud of the oak along with that of *spongifica*, it seems difficult to understand how they could get invariably to the rind of the gall, or why they should do so. 3*rd*. That the *Synophrus* does not interfere with the health and prosperity of the original proprietor or builder of the gall, and is consequently not what is generally called a parasite but a true inquiline or guest gall-fly.—Some important observations to the same effect have been recently published by Mr. Bassett. (*Proc. Ent. Soc. Phila.* II, p. 329–331.)

It is proper to add, in conclusion, that Baron Osten Sacken writes me word that "according to Dr. Rheinhardt *spongifica*, *inanis*, &c., belong to a new genus" distinct of course from Cynips. Both Latreille and Westwood state that *Cynips* (= *Diplolepis* Latr.) has ♂ antennæ 15-jointed and ♀ antennæ 14-jointed (Latr. *Gen. Cr. et Ins.* IV, p. 18 and West. *Intr.* II, Synops. p. 56.) Yet on examining a ♀ specimen of *C. gallæ tinctoriæ*, a species obtained from the "nut-galls" of commerce and which Westwood expressly refers to *Cynips*, I find that the ♀ antennæ are distinctly 13-jointed, (not 14-jointed,) the last joint full as long as the two preceding ones put together and divided into two by a rather obvious connate suture, which however disappears in certain lights when the adjoining ones do not, and is entirely invisible on holding the antennæ up to the light, while the others are very plain. Our ♂ *spongifica* and ♂ *inanis* have both of them 15-jointed antennæ, but the ♀ ♀, as above shown, including *aciculata*, have all the 13th and 14th joints of their antennæ connate and almost confluent, and their antennæ are therefore, in the usual sense of the term, 13-jointed,

like those of *C. gallæ tinctoriæ*. Again, Westwood says that in *Cynips* the three sides of the areolet are of equal thickness. (*Ibid.*) Yet in the above specimen of *C. gallæ tinctoriæ*, as well as in all N. A. Cynipidæ known to me, I find the terminal vein thicker than the others, and Dr. Fitch observes the same thing of all N. A. Cynipidæ known to him. (*N. Y. Rep.* II, §309, p. 28.) In all other respects but these, *spongifica*, *inanis*, &c., agree well with the characters of *Cynips*, and unless they are referred to that genus, there seems to be no other described genus to which they can with propriety be referred. Hartig, it appears, does not consider the number of the antennal joints as of generic value, for the species of *Aulax* Hartig, and of some others of his genera, vary in this character. (*Proc. Ent. Soc. Phila.* II, p. 34, &c.) It is remarkable that all our N. A. Cynipidæ, as has been observed by Dr. Fitch, have the abdomen highly polished and nearly glabrous, while *C. gallæ tinctoriæ* (Asia) has the abdomen opaque and strongly and coarsely pubescent. And it is still more remarkable that the ♂ of *C. nubilipennis* Harris, actually has *sixteen-jointed* antennæ. (*See the Appendix.*)

Few things are more striking in the history of the different families of gall-producing insects, than the manner in which certain genera are almost exclusively confined to certain genera of plants. Authors long ago noticed the innumerable species of *Cynips* and its allies that infest the different species of oak. We learn from Osten Sacken that the Cynipide genus *Diastrophus* affects the bramble both in America and Europe, and that the Cynipide genus *Rhodites* (10 species) is found on the rose and only on the rose both in America and Europe. Three species of gall-producing Psylladæ (Homoptera) have been noticed by him, as he has kindly informed me, to inhabit the hackberry, (Celtis occidentalis,) all forming very different galls. One only of these, *Psylla* (?) *venusta* O. S. MS., was bred by him to the imago; a second one I have myself bred in great numbers, and I can testify to its specific distinctness from *venusta*, as I have been favored with specimens of the latter; the third species is still unknown in the imago.* Again, there are three

* My insect as well as *venusta* evidently belongs to a genus distinct from *Psylla*. The antennæ are 8-jointed (not 10-jointed) with the 8th joint long and clavate, and the 3rd joint the longest; and there are no spurs to the hind legs, whereas Psylla has two strong spurs there. No Psylladæ known to me form

species of *Phylloxera* (Aphidæ) which form very distinct galls on the black or shag-barked hickory, *Ph. caryæfoliæ* Fitch, *Ph. caryæglobuli* Walsh, and *Ph.* (*pemphigus*) *caryæcaulis* Fitch, which last was only known to Dr. Fitch in the gall and was referred by him to *Pemphigus*, but both Baron Osten Sacken and myself have obtained from it the perfect insect which is scarcely distinguishable from *caryæglobuli*. Finally, there are certainly 3 and probably 6 species of *Byrsocrypta* (Aphidæ) forming distinct galls on the cottonwood (Populus angulata) and other poplars, viz., *B.* (*pemphigus*) *populicaulis* Fitch, *B. pseudobyrsa* Walsh, and *B. vagabunda* Walsh, which last, since the description was published, I have ascertained to inhabit smooth, hollow, green galls at the tips of the young shoots of the cottonwood, shaped much like the garden flower known as "cockscomb," and about 1—1½ inch in diameter. I have recently seen similar galls similarly situated on the Balm of Gilead (P. balsamifera.)

The same propensity to inhabit certain genera of plants has been observed in many other genera of Insects that do not produce galls. For instance, *Dryocampa* affects the oaks, *Vanessa* and allied genera the nettles, *Hipparchia* the grasses, and *Argynnis* the violets. These facts have a clear significance on the theory of the Derivative Origin of Species; on the Creative Theory they are inexplicable.

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true galls, but *Ps. buxi* and also *Livia juncorum* produce deformities upon leaves: and there is no Psyllade genus, so far as I am aware, to which these insects can be referred. For the benefit of those who, more fortunate than myself, have access to good Entomological Libraries, it may be added here that Baron Osten Sacken writes me word, that there is a Paper on the generic arrangement of Psylladæ by Foerster, in *Rheinländsche Verhandlungen*, and another by Flor, in *Bulletin des Natur. de Moscou*, 1861, Art. 2.

APPENDIX.

The very curious subject of the Guest gall-flies or Inquilines has already been referred to. For our knowledge on this subject, and for an explanation of the distinction between the True Gall-flies (*Psenides*) that make the galls and the Guest gall-flies (*Inquilinæ*) that inhabit the galls made by the others, without however necessarily starving or destroying them, we backwoods entomologists are indebted to Baron Osten Sacken. (*Proc. Ent. Soc. Phila.* I, pp. 48–9.) That writer has clearly shown that Dr. Fitch was not aware of the existence of Guest gall-flies, because, having bred a Guest gall-fly (*oneratus* Harris) from a gall made by a true Gall-fly (*q. globulus* Fitch) he supposed that the two insects must have come from two different kinds of gall. (*Ibid.* pp. 67–8.) Having myself bred this Guest gall-fly from the gall of *q. globulus*, I can confirm the fact of its not being produced from a distinct kind of gall.

I have also reared a very great number of gall-flies from the Oak-fig gall (*q. ficus* Fitch) which correspond accurately with Dr. Fitch's description of his *Cynips q. ficus*, and which are not true gall-flies but inquilines, and identical with the species that I know, as before stated, to be an inquiline in the oak-apple of *spongifica*—*Synophrus læriventris* O. S. It is therefore not improbable that Dr. Fitch's *Cynips q. ficus* is an inquiline and a mere synonym of the above-named species, with which, as will be shown below, it agrees in the number of its antennal joints, 15 ♂, 13 ♀. Mr. Bassett also bred nothing but "parasites" from this gall, by which term he, as well as Baron Osten Sacken, denotes not only the true parasites (*Ichneumonidæ*, *Chalcididæ*, &c.) but also the Guest gall-flies. Further than this, I have bred another inquiline (*Synophrus albipes* n. sp.) from a gall (*q. flocci*) apparently identical with *q. lana* Fitch; and as Dr Fitch's description of his *Cynips q. lana* (♀ with 15-jointed antennæ and ♀ only known to him) agrees very well with that of ♂ *Synophrus læriventris* O. S., which has 15-jointed antennæ and which may readily be mistaken for ♀ on account of the large size of the ♂ abdomen in this genus, I incline to believe that in this case also he has described by mistake the Guest gall-fly for the True Gall-fly, and that the latter in both of these two cases still remains to be described. In the case of the gall *q. flocci* (=*q. lana*)

I can supply the deficiency, having bred an undoubted True Gall-fly from it, which will be found described below as *Cynips q. flocci* n. sp., quite distinct from Dr. Fitch's species. In the case of the gall *q. ficus*, the deficiency can be supplied with probability but not with certainty, as the Cynips (*C. forticornis* n. sp.) which I have obtained from that gall in addition to the Guest gall-fly is subapterous, and consequently the chief character which distinguishes the *Psenides* from the *Inquilinæ* is absent.* Thirdly, from the gall *q. pisum* Fitch, Baron Osten Sacken has bred another subapterous species, specifically distinct from the one obtained by me from the gall *q. ficus*, but like that species apparently a true gall-fly; and it is very probable, therefore, that *Cynips q. pisum* Fitch is a Guest gall-fly, and *C. pezomachoides* O. S. the true maker of the gall *q. pisum*. Indeed Dr. Fitch's description of his *C. q. pisum* agrees very well with the guest gall-fly *Synophrus læviventris* O. S., (which I have found to inhabit several distinct kinds of galls,) even down to the antennal joints ♂ 15, ♀ 13.

Judging from Dr. Fitch's observation that "the second veinlet of the fore wings is curved like a bow" in all the species which he refers to the genus *Callaspidia*, but not in "the species of the genus *Cynips*," and that this "appears to be a generic character of much value" (*N. Y. Rep.* II, §318), and knowing that all the three species which he refers to *Callaspidia* are true Cynips, it would seem to follow that he habitually refers *Cynips* to *Callaspidia* and the *Inquilinæ* or Guest gall-flies to *Cynips*. If this reasoning be correct, all the eight species catalogued and described by him under the genus *Cynips* are probably Guest gall-flies. The only fact at variance with this hypothesis is, that he refers *seminator* Harris, which is a true Gall-fly, to *Cynips* and not to *Callaspidia*. But Baron Osten Sacken notices several differences between the true *Cynips* obtained by him from the gall *seminator* and those described by Dr. Fitch; and as the true Gall-flies and the Guest gall-

* Mr. Bassett has bred both *C. q. forticornis* in November and December and *Synophrus læviventris* in the following summer from *q. ficus* galls, and has kindly sent me specimens of both species. I had given him my views on the subject, and he writes me word that "he is quite confident that *forticornis* is the true Gall-fly of Fitch's *q. ficus*, having found more than once the remains of a perfect fly *in the central cells* of that gall about the 20th of November."—March 14, 1864.

flies obtained from the same gall often resemble each other very closely, except generically, I rather infer that *C. seminator* Fitch, is a Guest gall-fly, differing from the true *C. seminator* obtained by Harris and Osten Sacken in having the thorax ♀ "cinnamon red" (40 specimens, Fitch) not "black" (Harris and 44 specimens O. S.), and in the ♂ antennæ being "bright tawney yellow" (Fitch) instead of "yellow at their base but decidedly brownish on their latter half" (O. S.—Compare *N. Y. Rep.* II, §315 and *Proc. Ent. Soc. Phila.* I, p. 69.)* Harris in describing the thorax of *C. seminator* as "black" says nothing about the sexes; and there seems to be no foundation for Dr. Fitch's assertion that "it is the ♂ only which is described by Harris." It might easily be ascertained from the Harrisian Collection at Boston, whether the Harrisian specimens are really all ♂ ♂.

One reason why such a mistake should have been made as describing the same Guest gall-fly two or three times over as the maker of two or three distinct galls is, that several species—including the one specially referred to—are remarkably variable both in their size and in their coloration, and specimens taken from the two extremes of a specific series might well pass for distinct species. Dr. Fitch himself remarks that "several species of true gall-flies differ from each other only very slightly, * * being known with more certainty from the different galls from which they come than from the characters which the flies themselves present." (*N. Y. Rep.* II, §309.) Since, as will be shown below, the same species of Guest gall-fly inhabits several different kinds of galls, and from the same galls two different species of Guest gall-flies have been bred by me, (*Synerges mendax* n. sp. and *S. rhoditiformis* n. sp.) this latter criterion in their case is worth little or nothing.

The classification of *Cynipidæ* is at present in a state of chaos. According to the latest authorities, Hartig and Rheinhardt, *Cynipidæ*

* Mr. Bassett writes me word that on a hurried examination "among several hundred *C. seminator* he finds a very few individuals that answer to Dr. Fitch's description of the ♀ as regards the cinnamon-red color of the thorax; that they are much smaller than the ♀ ♀ that have a black thorax and abdomen, of which last there are a great number, and that he has always looked upon the first as parasites." Several dozen ♀ ♀ that he sent me were true Psenides, and all had a black thorax.—March 14, 1864.

(genuini) are separated as a distinct family from *Figitidæ*, with which preceding authors had united them, by the following characters:— (See *Proc. Ent. Soc. Phila.* I. p. 48.)

Cynipidæ. Second* abdominal segment longer than [any one of?] the others (Hartig) or longer than half the length of the abdomen. (Rheinhardt.)

Figitidæ. Third* abdominal segment longer than [any one of?] the others (Hartig) or second segment shorter than half the length of the abdomen. (Rheinhardt.)

The objections to this arrangement are manifold:—

1st. As has been stated before, (p. 450.) in *Cynipidæ* the terminal abdominal joints are telescopically drawn out in a manner which varies greatly in different specimens of the same species, so that in one specimen the second joint shall occupy only ⅓, in another full ½ of the whole abdomen, and thus one specimen shall appear, according to Rheinhardt, to belong to *Figitidæ* and another to *Cynipidæ*. Moreover where is the length to be measured? Dorsally or laterally? In most species it makes a very great difference which way the measurement is taken. For example, in *C. gallæ tinctoriæ* (Asia) joint 2 occupies about ½ of the dorsal length, but scarcely occupies ⅓ of the whole lateral surface.

2nd. In one genus, *Aulax*, according to Dr. Rheinhardt himself, as quoted by Osten Sacken, (*Proc. Ent. Soc. Phila.* II, pp. 35, 37, 43.) the ♂ has the abdominal joints 2 and 3 subequal, the other joints being short, whereas in the ♀ joint 2 almost entirely covers the succeeding ones; so that here the ♂, according to Rheinhardt, belongs to *Figitidæ* and the ♀ to *Cynipidæ!* Again, in *Amblynotus ensiger* n. sp.?, in the ♂ joint 2 is dorsally nearly as long as 3, while in the ♀ joint 2 is dorsally scarce ½ as long as 3; showing a great sexual variation in what is assumed to be a family character. Observe that *Aulax*, as well as *Amblynotus*, are inquilinous in their habits, at least in certain species. if not in all.

3rd. In the genus *Diastrophus*, according to Osten Sacken, the 2nd and 3rd abdominal joints are subequal, and *Diastrophus* must therefore, according to Dr. Rheinhardt's definition, belong to *Figitidæ*. (*Proc. Ent. Soc. Phila.* II, pp. 38–9.) Observe that this genus is a gall-making one.

4th. *Figites* and *Allotria* have been long known to be true internal

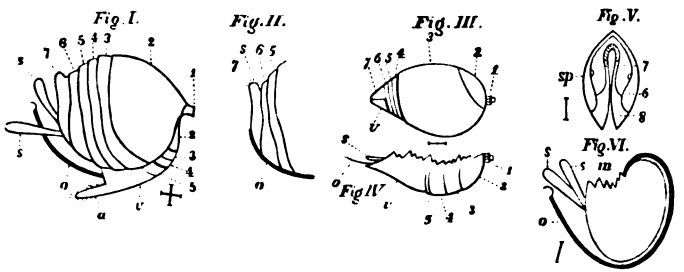
* Counting the peduncle as the first segment.

parasites in their habits.* Consequently to the same natural family *Figitidæ* there will appertain, according to the above classification, a gall-producing fly (*Diastrophus*), Guest gall-flies (*Aulax* ♂ and *Amblynotus* ♂ ♀) and internal parasites. (*Figites* and *Allotria*.) This is possible, but exceedingly improbable.

5th. In *Figitidæ* (as defined above) the suture connecting the 2nd and 3rd abdominal joints is a connate one and only indicated by a very faint stria, perceptible in some specimens of a given species and scarcely perceptible in others. I assert this after a careful examination of numerous specimens of several distinct species. Practically, therefore, such a classification as that above quoted is unreliable.

6th. By the above arrangement such genera as *Amblynotus*, which have a general family likeness to *Cynipidæ*, and agree in their habits with the Inquilinous group of that family, are separated therefrom and classed with *Figites*, a parasitic genus to which they have scarcely any family likeness.

Let us compare *Cynips* and *Figites*, and see if other distinctive characters cannot be pointed out, which shall be somewhat more definite



and more easily recognizable. Figure I represents the abdomen of *Cynips quercus aciculata* ♀ O. S. with the organs of oviposition exserted, Fig. II the tip of the same with the organs as in repose, Fig. III the abdomen of *Figites* (*diplolepis*) 5-*lineatus* ♀ Say, and Fig. IV the venter of the same, which, except its extreme tip, is completely enclosed and hidden by the dorsal joints as an oyster is enclosed and

* "Some *Figites*," says Latreille, "are delighted with human excrement." (*Gen. Cr. et Ins.* IV, p. 19.) Doubtless they oviposit in the soft dung-feeding larvæ that abound there. I found a beautiful undescribed Braconide swarming in South Illinois, in a similar situation.

hidden by its two shells, the lower edges of the dorsal joints closing together so tightly as to appear united. In all four figures *o* is the ovipositor, *ss* the two sheaths of the ovipositor, *v* what is apparently the terminal ventral joint, and 5—1 the others. In Fig. I, *a* is an appendage to *v* which only exists in certain species, e. g. *q. spongifica* O. S., *q. inanis* O. S., and *gallæ tinctoriæ* (Asia.) As the ovipositor in certain specimens of several species often reposes in the piece *v*, projecting more or less from its tip, it is liable to be confounded with this appendage, but may always be distinguished by its not being hairy and by its non-presence there in other individuals of the same species.

From the above comparison and from a careful examination of many dozen species in my Cabinet, besides those catalogued below as infesting the oaks of Illinois, and also from repeated dissections, I propose to separate the two families as follows:—

Cynipidæ. Venter visible nearly throughout its entire length ♂ ♀, more conspicuously so in ♀, or if retracted within the abdomen leaving a gaping suture below. The joint which is apparently the last ventral, and which for convenience I call in ♀ the "ventral valve"* (Fig. I, *v*) very long, and forming in ♀ a sheath-like receptacle, convex below, concave above, which is occupied by the ovipositor, (Fig. I, *o*.) Sheaths (Fig. I, *ss*) of the ovipositor, erected in repose, either vertically, or obliquely backwards and upwards, and strongly

* The presence of this "ventral valve" in ♀ is a very useful character to distinguish the sexes in *Cynipidæ*, when, as often happens, the joints of the antennæ are difficult to count, and the 3rd joint ♂ antennæ is scarcely curved or excised below. Generally the "ventral valve" is small, weak, thin and inconspicuous: in the genus *Synergus* it is better developed: but in the genus *Rhodites* ♀, in *Tribalia* n. g. *batatorum* ♀ n. sp., and in *Synergus rhoditiformis* ♀ n. sp., it is abnormally enlarged and thickened, and forms a very conspicuous, thorn-like feature in the profile view of the abdomen. (See Harris *Inj. Ins.* Plate viii, figs. 6 & 7, *Rhodites dichlocerus*.) Baron Osten Sacken mentions this as a characteristic of the genus *Rhodites*, but has inadvertently omitted to say that it is peculiar to the ♀ sex as he kindly informs me. (*Proc. Ent. Soc. Phila.* II, p. 44, and compare pp. 46 & 48.) In *Rhodites* ♀ (which belongs to Cynipidæ) there is ordinarily an angle of 45°—80° between the tip of the dorsum of the abdomen and the "ventral valve": but occasionally these two parts close together, the acutely pointed "ventral valve" projecting beyond the tip of the abdomen. In Figitidæ these same parts are incapable of divaricating at an angle of more than 5° or 6°, and usually are closely appressed to each other as in Fig. III, and one does not project beyond the other because *the two united* form a boring apparatus: whereas in *Rhodites* it is the "ventral valve" *alone* that forms the boring apparatus.

divaricate with the "ventral valve." Dorsal joints of the abdomen free, except in certain genera the suture between the 2nd and 3rd dorsal and probably in *Ibalia* the suture between the 6th and 7th dorsal, which are connate. Tip of the ♀ abdomen bluntly and widely rounded or truncate. Tip of the ♂ abdomen angular or subangularly rounded, and only when the terminal segments are retracted, truncate, joints 4—7 being each vertically narrower than the preceding one.

Habits, so far as known, gallivorous.

Figitidæ. Venter retracted within the abdomen with the suture below barely perceptible, entirely internal and invisible ♂ except a minute portion of its tip, entirely so in ♀ except the tip of the terminal joint (Fig. III, *v*), which tip is horny, vertically flattened, and acutely angular, and in close conjunction with the similarly shaped terminal dorsal joint forms an angular horny borer. Concealed between the dorsal and ventral pieces of this borer lie the ovipositor (Fig. IV, *o*) and its sheaths (Fig. IV, *s*). Sheaths of the ovipositor horizontally porrect. Dorsal joints of the abdomen free except the suture between joints 2 and 3, which is connate. Tip of ♂ abdomen truncate, joints 4—7 being each vertically nearly as wide as the preceding one, except that joint 7 is often excised below and shows underneath it a small portion of the tip of the last ventral.

Habits, so far as known, insectivorous.

Cynipidæ and Figitidæ differ from all other families of insects known to me in the imago having but a single pair of abdominal spiracles, which are placed laterally close to the base of the 7th or what is apparently the last dorsal segment (Fig. V, *sp.*) There are many dipterous larvæ (e. g. *Midas*) which have only a single pair of abdominal spiracles which are placed on the penultimate joint; but the imagos and pupæ of these very larvæ have the usual number of abdominal spiracles, i. e. one pair on each joint except the last. Authors do not appear to have hitherto noticed this anomaly. It will be shown below that there exists an 8th dorsal joint in ♀ Cynips, and there is an 8th dorsal joint, cylindrical and armed on each side with a horizontal bristle, in ♂ Cynips also, which is occasionally exserted but generally retracted within the abdomen. In Figitidæ ♂ ♀ the 8th dorsal joint is entirely concealed by the 7th, which, as in Cynipidæ ♂ ♀, bears a basal, lateral spiracle. As there are the same number of dorsal joints in the Tenthredinidous, Uroceridous and Cynipidous abdomen, viz. eight, and as in the two former families the venter is 7-jointed, besides the terminal piece which bears the organs of oviposition, while in Cynipidæ the venter has only 6 joints, (Fig. I,) besides the terminal piece (Fig. VI) which is here

internal, it is probable that here the long 6th ventral joint (Fig. I *v*) is typically composed of two confluent joints.

By the above arrangement the Inquilinous genera *Aulax*, *Amblynotus*, *Sarothrus*, &c., and the gall-making genus *Diastrophus* will be grouped with *Cynipidæ*, where their habits and their general appearance indicate that they belong. What could be more apparently unnatural, than to refer *Diastrophus*, which makes galls on the bramble, to *Figitidæ*, and *Rhodites*, which makes galls on the rose, to *Cynipidæ?* The genus *Ibalia*, which I do not know, will also appertain to *Cynipidæ*, and from its pterological characters appears to belong to the true Gall-flies. (Latr. *Gen. Cr. et Ins.* IV, p. 17.) Dr. Rheinhardt forms this genus into a distinct family, Ibaliidæ (Blanch.), because "the segments of the abdomen are of equal length exclusive of course of the peduncle or 1st joint." (*Proc. Ent. Soc. Phila.* I, p. 48.) It is remarkable that Westwood figures *Ibalia* with an abdomen which, including the peduncle or first joint, is dorsally 6-jointed, the last joint full twice as long as any of the preceding. (*Intr.* II, p. 121, fig. 22.) From the fact that the dorsum of the normal Cynipidous abdomen is apparently 7-, not 6-jointed, though in reality it is 8-jointed, as will be shown below, I infer that this large terminal joint in Professor Westwood's figure is in the actual living insect divided by a suture, perhaps a connate one, into two, and thus, as Rheinhardt asserts, the six principal dorsal joints of the abdomen (2–7) will become equal in length.

I have a remarkable ♀ Cynipide, forming apparently a genus intermediate between *Cynips* and *Ibalia*, and thus confirming the fact that *Ibaliidæ* are not a distinct family, as Dr. Rheinhardt thinks. I obtained it, dead and with the wings undeveloped, from an irregular mass of several dozen egg-shaped cells with a very smooth internal surface, connected by fleshy potato-like matter, and each about .17 or .18 inch long, the whole, as I learned from a reliable source, attached, apparently by a woody peduncle, to a common potato, many other such galls having been found on other potatoes. Numerous dead larvæ, evidently Cynipidous, were found in the other cells, one only in each. Generically this insect may be thus characterized:—

TRIBALIA, n. g. Abdomen with its dorsum apparently 7-jointed, much compressed and knife-edged below; peduncle or 1st joint small; all the sutures between 2 and 7 free. The second dorsal joint only

occupies about ½ of the lateral or ⅓ of the dorsal surface; 3—5 subequal, 6 and 7 somewhat shorter. Venter unusually large and apparently 5-jointed, the last joint very long. Last ventral joint (or "ventral valve") robust and horny ♀ and presenting laterally the appearance of a highly polished, glabrous, tapering, acute spine 2½ times as long as its basal width, projecting horizontally and very slightly turned upwards at the extreme tip. Last dorsal joint ♀ squarely truncate and bearing on its posterior surface a distinct "caudal groove,"* without however any "dorsal valve,"* in which groove the sheaths of the ovipositor, which are normal, are entirely hidden. On the side of dorsal joints 2—6 there is a large, medial, impressed, shallow puncture, simulating a spiracle, and at the lateral base of 7 there is the spiracle usually seen in other Cynipidæ but sometimes overlapped by joint 6.† Between the "ventral valve" and the last dorsal ♀ there is a large angular opening, which, as the dorsal joints open out above, becomes more contracted. Antennæ ♀ 14-jointed, 1 and 2 short and subequal, 3 half as long again as 1 and 2 put together, 4—6 gradually shorter, 6—13 short, and 14 a little longer than 13. Wings ———. Differs from *Ibalia* in the ♀ antennæ not being 13-jointed with the last joint no longer than the penultimate, in the scutel being unarmed, in the 1st dorsal joint of the abdomen being considerably larger than any of the following ones, and in the hind legs, especially the basal joint of the hind tarsi, not being abnormally long. From *Rhodites* it is separated by its much more compressed abdomen and the comparatively small size of the 2nd dorsal joint, and also by the comparative shortness of the 3rd joint of the antennæ, and by having no vestige of any "dorsal valve" (see below) whereas *Rhodites* ♀ has a very distinct one.

Tribalia batatorum n. sp. ♀ Black. *Head* with the vertex opaque and glabrous; front very finely rugose, almost aciculate transversely; antennæ robust and ⅔ as long as the body. *Thorax* moderately polished, obsoletely rugose, the three usual mesonotal striæ very distinct, except as they approach the collare, and widely and deeply impressed, the two outer ones converging but slightly behind; on each side of the tip of the central one a very short longitudinal stria not quite attaining the collare, and another rather longer one above the

* These terms will be explained below.

† There is one small dorsal joint succeeding 7 in Cynipidæ, as will be shown below, and therefore Cynipidæ form no exception to the general rule, that the last abdominal joint is not spiraculiferous.

origin of the front wings. Scutel with a deep basal transverse suture but no foveæ, longitudinally semioval, opaque, not very finely rugose and with a subobsolete longitudinal slightly polished line. *Abdomen*, when viewed laterally, ¼ longer than wide, the dorsal edge in a quadrant and after relaxing the specimen almost in a semicircle from the joints opening out dorsally: joint 2 moderately polished, horny and glabrous, the following joints of a somewhat softer consistence and opaque, except where their polished basal portion has been exposed by the relaxation, but scarcely rugose under the lens. *Legs* reddish brown, hind tibiæ and the tips of the intermediate ones and all the six tarsi, brown-black. *Wings* not expanded, but evidently not abortive. Length ♀ .16 inch; ♂ unknown. One ♀.

With regard to the subdivision of *Cynipidæ* into true Gall-flies (*Psenides*) and Guest gall-flies (*Inquilinæ*), so far as my limited experience goes, all the species belonging to A. I., "Radial area narrow, areolet opposite its base," are gall-makers, and all belonging to A. II., "Radial area broad, short; areolet opposite its middle," are Guest gall-flies. (See *Proc. Ent. Soc. Phila.* I, p. 48.) According to Hartig, some species belonging to A. I. are Guest gall-flies and some belonging to A. II. are gall-makers. (*Ibid.* p. 49.) It may be so; but it is possible that Hartig may have been deceived, as he was in all probability deceived about his agamous species. Until some good observer succeeds in obtaining two distinct species belonging to A. I. from the same gall, we may well hesitate to believe that any species of that group is inquilinous in its habits. May it not be possible that Hartig obtained two dimorphous forms of some true gall-fly from the same gall, and supposing them to be distinct species concluded that one of them must be an Inquiline? Again, because a particular observer has hitherto bred nothing but species belonging to A. II. from a particular gall, it does not follow that no future observer will succeed in breeding from the same gall a species belonging to A. I. which may be the true maker of the gall. From over a hundred galls of *C. q. palustris* I bred one year nothing but great numbers of *Chalcididæ*, and it was not till the next year that, under a slightly different mode of treatment, I succeeded in obtaining the real maker of the gall in abundance. Some authors would have jumped to the conclusion at once, that the Chalcididæ made the galls.

I observe in *C. q. aciculata* ♀, *C. q. spongifica* ♀, *C. q. inanis* ♀, *C. nubilipennis* ♀, and with two apparent exceptions in all the other species known to me, nearly twenty in number, which belong to A. I.,

and also in the sub-apterous *C. forticornis* n. sp., a peculiar arrangement for poisoning the tip of the ovipositor, which does not appear to have been noticed by authors.* Hitherto it has only been inferred analogically that Cynips ♀ has an apparatus for poisoning its ovipositor, when it lays an egg in the bark or the bud. The following facts go to explain the physical means by which this very curious process is accomplished.

Take a recent or a relaxed specimen of some gall-making ♀ Cynipide, e. g. *C. q. aciculata* ♀, and it will be noticed that almost invariably in repose, instead of the sheaths of the ovipositor being exserted, as they are in the Inquilines, nothing is seen resembling a sheath but a small, hairy, tuberculiform projection, which I shall call the "dorsal valve," at the top of the 7th abdominal joint. (See Fig. II, 7.)† Now take a pin and push this "dorsal valve" backwards, and the sheaths will start out and assume the position shown in Fig. I. *ss*, disengaging from between them the tip of the ovipositor (Fig. I. *o*), which is curiously curved so as to lie conveniently between them when they are in their usual position (Fig. II. *o*.) A further examination and a dissection of the parts will show that this "dorsal valve" (Fig. II. 7) composes the upper part of a narrow vertical groove, visible only from behind, sufficiently deep to receive the whole breadth of both sheaths, and formed by the sides of the 8th dorsal joint, which is united by a free suture with the 7th, but with the exception of the "dorsal valve" can only be seen when viewed from behind. (Fig. V, 8.) This groove I shall call the "caudal groove." Concealed in the abdomen, with its edge occasionally slightly projecting towards the "ventral valve" (Fig. I. *v*) there lies a singular, horny, circular, vertically compressed, black, polished piece (Fig. VI.,) from which the sheaths (*ss*) behind and the ovipositor (*o*) in front take their origin, and which is strongly connected by a muscular attachment (*m*) to the upper part of the dorsal joints 6 and 7. This piece is figured by Westwood (*Introd.* II, p. 121, fig. 19 *b*), and is evidently from the organs attached to it the homologue of the ter-

* I observe the same thing in six other species belonging to A. I. recently received from Baron Osten Sacken and Mr. Bassett.—March 14, 1864.

† There ought to be a suture between the 7th dorsal and the "dorsal valve," but through a blunder of my own it is not shown either in Fig. I or Fig. II though it appears in Fig. VI.

minal ventral piece in Tenthredinidæ and Uroceridæ. (*Ibid.* p. 94, figs. 12*b* and 15 *b* and p. 115, fig. 13 *b*.) In all species known to me belonging to A. I. the sheaths are capable of being concealed for their whole breadth in this "caudal groove"; and it is only in one undescribed N. A. species belonging to A. I. (a unique specimen)* and also in *C. gallæ tinctoriæ* (Asia, another unique specimen) that I have found the sheaths projecting a little beyond the tip of the "dorsal valve." In all the rest which are known to me they do not, when reposing in the "caudal groove," project at all from the "dorsal valve." Each sheath is elongate-spoon-shaped, the convex side outwards, so that when they are compressed together in the "caudal groove," they form a hollow cylinder, rounded and closed at tip. In *aciculata* (12—15 specimens) they are curiously channelled on the inside, as if an impression in wax had been taken of the curved ovipositor with its fine hair-like tip (Fig. I. *a*); and there is a strong appearance, in many freshly relaxed specimens, of a membranous tubercle lying at the interior tip of the sheath in the curve corresponding to the hair-like tip of the ovipositor. In fact in the recently relaxed sheath its whole interior surface seems occupied by membrane, so as to present a plane surface with a groove sculptured in it of the exact shape of the ovipositor, while the very same sheath when dried will be concave inside with the groove indicated only by a shining stripe on an opaque surface. This tubercle may be, and perhaps is, the poison-secreting gland. On three or four occasions, on disengaging the ovipositor of *aciculata* from its sheaths, in the manner described above, I have found its recurved tip covered with a mass of whitish gummy matter soluble in water, and in two specimens, which happened to die with the ovipositor disengaged, I notice the very same thing.* Hence, and from the peculiar structure of the parts, so different from what we find in any other Spiculifera, I infer that the use of the "caudal groove" is to compress the sheaths of the ovipositor, so as to enable them to form a suitable gum-tight receptable for the gummy matter, and that this gummy matter is the gall-producing poison, and probably secreted from the tip of the sheath itself.

* This species turns out to be *C. q. operator* O. S., as I have ascertained from specimens of that species sent me by Mr. Bassett.—March 14, 1864.

On the other hand, in all the species belonging to A. II. which are known to me, the sheaths of the ovipositor project considerably beyond the "dorsal valve" and often very considerably. *Synerges rhoditiformis* n. sp. forms an apparent exception, but on relaxing a specimen it is found that that species has the "dorsal valve" unusually small, and that what seems the "dorsal valve" is in reality the projecting tip of the sheaths. Not only is it the case that in all species belonging to A. II. the sheaths project beyond the "dorsal valve," but it is also very generally found here that the tip of the ovipositor in many individuals of each species projects from between the tips of the sheaths. For instance, out of 28 ♀ *rhoditiformis* 19 individuals have the tip of the ovipositor thus projecting. On the contrary, out of nearly two hundred ♀ specimens of various species belonging to A. I. now before me, the only two I can find with the ovipositor thus projecting are the very two which, as before stated, have the sheaths themselves projecting from the "dorsal valve," viz. *C. gallæ tinctoriæ* and the unique specimen before referred to.* The reason is obvious. If the spoon-shaped tips of the sheaths are compressed in the "caudal groove," as in the group A. I. with the exception of the above mentioned two species, they allow no exit to the ovipositor, and at the same time prevent the gummy matter, which I suppose to be the gall-producing poison, from oozing out. If on the other hand, as in all the species known to me belonging to A. II., the spoon-shaped tips of the sheaths project beyond the "dorsal valve," the result will be that the ovipositor, as we find to be

* Out of 34 ♀ specimens sent me by Mr. Bassett of *C. q. operator* O. S., the anomalous Psenide above referred to, 20 have the ovipositor detached from the sheaths and reposing in the "ventral valve", and 14 have it projecting from the tip of the sheaths.—March 21, 1864.

(☞ The following note refers to p. 474 line 28, and was accidently omitted.)

* The hair-like recurved tip of the ovipositor, which makes its appearance in all the specimens, over 20 in number, which I have examined, is shown by a good lens to be composed of the two normal bristles thrust forwards from the tip of a more robust and apparently channelled seta, in which they travel backwards and forwards. Probably, after the tips of the two bristles have absorbed the gall-producing poison, they are retracted into the robust seta, before the whole apparatus is thrust into the leaf, bud or bark, whence the future gall will arise. Thus the poison will be sure of being conveyed, undiminished in volume, to the appropriate spot.

actually the case, has a free exit from the tips of the sheaths, and that even if Nature secreted any poisonous fluid into the sheaths it would be apt to leak out from their tips, especially if the sheaths, as in most Inquilines, projected considerably from the "dorsal valve." It would seem as if the Guest gall-flies were compelled to sponge upon the true Gall-flies for food and lodging for their young larvæ, because Nature has denied them the peculiar poison adapted to cause the growth of the various kinds of galls, or at all events has denied them a suitable apparatus for making use of that poison. Similarly, the cuckoo-bees, (*Nomada*, *Epeolus*, *Cœlioxys*, &c.) lay their eggs in nests constructed and provisioned with pollen by pollen-collecting species, because Nature has denied to them the appropriate pollinigerous organs. But just as certain Fossorial Wasps are strictly fossorial in their habits, though their legs approximate in their armature to the Vespade type,* so the two exceptional Cynipidæ mentioned above, or one of them at all events as we know, are strictly Psenidous in their habits, though the structure of the organs of oviposition in both approximates to a certain extent to the Inquilinous type. The whole subject is a curious one, and well deserves further and fuller investigation.

It is observable that in the Guest gall-fly *Aulax sylvestris* O. S., contrary to the general rule in the group A. II., the radial area is open, i. e. is not closed by a marginal vein. (*Proc. Ent. Soc. Phila.* II, p. 37.)† In all my Cynipidæ belonging to A. II. (Guest gall-flies) the radial area is distinctly closed, and, as I consider it, by a true vein which is a prolongation of the costal vein, and not a mere "thickening of the margin of the wing," as hinted by Osten Sacken. (*Ibid.* p. 36.) I draw this inference and the further inference that the closing of the radial area, though useful as a subsidiary character, is not a character of any high systematic value, at all events in true *Figitidæ*, from the following facts:—I have six species of *Figites*, differing in size and in the sculpture and armature of the scutel and the sculpture of the head

* E. g. *Miscophus*, which is said by Westwood (*Intr.* II, p. 187) to be "destitute of spines on the fore-legs," but on p. 189 is said to be "very sparingly armed with short simple spines," as it is figured p. 188 fig. 6, t 1.

† I observe in specimens of this species obligingly sent me by Baron Osten Sacken, that in certain lights the radial area seems to be closed by a brownish vein which is not seen on the other part of the costal edge.—March 21, 1864.

and thorax. In one (*F. impatiens* Say, 8 ♂, 6 ♀) and another much smaller species (1 ♀ n. sp.?), the radial area is completely closed by a stout brownish vein, evidently a prolongation of the costal. In another (1 ♀ n. sp.?) the radial area is closed, the closing vein brownish and tapering to nothing at tip. In a fourth (1 ♂, n. sp.?) and a fifth (1 ♀ n sp.?) the brownish closing vein tapers to nothing half-way to the tip of the radial area; and in a sixth, *Figites* (*Diplolepis*) *5-lineatus* Say, (1 ♂, 3 ♀) the radial area is entirely open, the costal vein tapering to nothing before it attains the costal margin. Again, in *Diplolepis armatus* Say, (3 ♂, 2 ♀,) a true Figitide which I take to be an *Ægilips*, the radial area is open, and in another congeneric species (1 ♂, n. sp.?) it is distinctly closed.*

The results thus far obtained may be conveniently tabulated as follows:—

Cynipidæ, subfamily **Psenides**, (True Gall-flies.) Wings with the second transverse vein so bent or incurved towards their base, that the areolet is opposite the base of the radial area. Radial area scarcely ever closed by a prolongation of the costal vein.† Sheaths of the ovipositor scarcely ever projecting beyond the tip of the "dorsal valve."‡ Ovipositor scarcely ever projecting from between the tips of the sheaths.

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* If I am right in referring these two last insects to *Ægilips* Haliday, that genus must appertain to true *Figitidæ* Walsh. and in that case *Ægilips* (?) *obtusilobæ* O. S. (*Proc. Ent. Soc. Phila.* I, p. 68), which is a guest gall-fly, must be incorrectly referred to *Ægilips*. Very likely, however, I may be wrong, and the genus *Ægilips* may belong to the true Inquilinous Cynipidæ.

† Osten Sacken states that it is closed in *Rhodites ignota* O. S. (*Proc. Ent. Soc. Philad.* II, p. 49,) and I observe that it is so in *Rh. rosæ* Linn. It will be noticed that almost all the distinctive characters laid down above admit of certain rare exceptions, and yet, taken as a whole, they are perhaps more naturally distinctive than a single dichotomous character which of course could admit of no exception. *Fossores* are sufficiently distinct from *Diplopteryga*, and yet there is not one single character that distinguishes them but what admits of occasional exceptions.

‡ In certain species individuals occur with the sheaths withdrawn from the caudal groove, (as in Fig. I, *ss*), but it is easy to see that if the sheaths were replaced there they would not project beyond the "dorsal valve." I notice the above peculiarity only in 11 out of 13 ♀ ♀ of *C. q. forticornis* n. sp., which were all dug out of the gall dead and therefore perhaps not in their normal condition, and in 1 out of 5 ♀ ♀ *C. q. flocci* n. sp. All my other ♀ *Psenides*, nearly 200 in number, have the sheaths entirely hidden in the caudal groove excepting of course the two species mentioned above, in which the *tips* of the sheaths project from the *tip* of the "dorsal valve."

Cynipidæ, subfamily **Inquilinæ,** (Guest gall-flies.) Wings with the second transverse vein so straight, that the areolet is nearly opposite the middle of the radial area. Radial area almost always more or less closed by a prolongation of the costal vein. Sheaths of the ovipositor always projecting more or less beyond the "dorsal valve," generally projecting greatly. Ovipositor in almost all the species often projecting from between the tips of the sheaths.

It might be thought that in assuming a Cynipide to be a Guest gall-fly, merely because it is bred from a gall known to be produced by a true Gall-fly, we are jumping too fast to a conclusion. May it not, it will be said, be a true Parasite, like the various Chalcididæ and Ichneumonidæ bred so often from galls, or like *Figites* and *Allotria?* The answer is simple. 1*st.* It is known with certainty that one genus (*Synophrus*) is, in the full sense of the term, a mere Guest in the gall of the true gall-producing *Cynips* (see p. 460), and 2*nd. Ichneumonidæ, Chalcididæ,* &c. are reared from all kinds of larvæ, belonging to all the different Orders of Insects, but nobody ever reared a Guest gall-fly except from a gall. Hence it seems a legitimate inference that they prey on the gall itself, and not on the gall-producing insect; for if they are larvivorous, why do they not devour other kinds of larvæ besides those of Cynipidæ? It is probable from certain facts which it would be tedious to particularize, that in some cases they starve out the original maker of the gall, or that Nature has given to certain of them the instinct to destroy the original maker of the gall in its early larva state, as I believe to be the practice of the cockoo-bees (*Cœlioxys* &c.) towards the true pollinigerous bees, (*Megachile* &c.;) but this is a very different thing from the action of the true Parasites properly so called (*Ichneumonidæ, Chalcididæ* &c.), which feed upon the living body of their victims, and upon that body exclusively.

As regards the generic determination of Cynipidæ, the subject is full of difficulties. Hartig, the original discoverer of the Natural History of the Guest gall-flies, has, it appears, founded a number of imperfectly characterized genera, which even Baron Osten Sacken finds himself mostly unable to recognize. One of the chief characters employed by him for this purpose is said to be the number of joints in the palpi, which in these minute insects can scarcely be ascertained satisfactorily without dissection under the microscope. Practically, it would be about as convenient to found new genera of Cynipidæ upon the number of convolutions in the intestinal canal. Even the number of joints in the

antennæ is, in the smaller species of these insects, sometimes exceedingly difficult to count. It would be easy to mention a dozen cases where authors have erred in counting them, and subsequently corrected their own errors; and frequently two different authors disagree as to the number of antennal joints in the same species. Dahlbom, for example, says that *Ibalia cultellator* Latr., has the ♂ antennæ 14-jointed, and Westwood says that they are 15-jointed and figures them as 15-jointed! (See Brullé *Hymenopt.* IV, p. 636, Westw. *Intr.* II, p. 121, fig. 17 and p. 126.) I have myself frequent occasion in this Paper to differ from other writers on this subject, and can only say that if I err in so doing it has not been for the want of pains-taking. As in many species there is a long terminal joint in the ♀ antenna, with or without a medial connate joint or obsolete suture, and as this false suture has sometimes been inadvertently taken for a true one, I have stated in each description the proportional length of the last joint, and whether it has a false suture or not. In reality a 13-jointed ♀ antenna with a long 13th joint, with or without a medial connate suture, is evidently the equivalent of a 14-jointed ♀ antenna with the two last joints short.

On the whole, in the present state of science, generic determinations of Cynipidæ must necessarily be provisional, and I have therefore in each case merely attempted to approximate to accuracy, and to supply the deficiency by careful statements of such characters as appear to be of generic value. Taking *Synophrus* (*?*) *læviventris* O. S., *Amblynotus* (*?*) *petiolicola* O. S., and *Synerges* (*?*) *oneratus* Harris, as types of three inquilinous genera called provisionally *Synophrus*, *Amblynotus* and *Synerges*, I find the following generic distinctions to be common to the different species which I have arranged under those generic names.

Synophrus. Antennæ ♂ 15-jointed, ♀ 14-jointed, or 13-jointed with the last joint long. Thorax glabrous under the lens before the scutel; scutel rugose. Pleura of thorax with a large spot under the wings, which is glabrous and as highly polished as the abdomen. Abdominal peduncle rather indistinct, simple and truncate-conical, the *large* end of the cone towards the 2nd abdominal joint. Second abdominal joint occupying nearly or quite the entire abdomen, exclusive of the peduncle.

Amblynotus. Antennæ ♂ 15-jointed, ♀ 12-jointed, the last joint full twice as long as the penultimate. The other characters the same as *Synophrus*, except that what appears at first sight to be the second abdominal joint is divided by a very faint connate suture into two joints, which are dorsally subequal ♂, but

the first of which in ♀ is dorsally scarce half as long as the second. This suture, however, in some specimens is scarcely distinguishable and in none can be seen without difficulty.

Synerges. Antennæ ♂ 15-jointed, ♀ 14-jointed, or 13-jointed with the last joint long. Thorax transversely rugose under the lens before the scutel: scutel rugose. Pleura of thorax scarcely glabrous or polished. Abdominal peduncle apparently constricted strongly in the middle, but in reality composed of two parts, the first a short cylinder, the second much larger and in the form of a truncate cone, the *small* end of the cone towards the second abdominal joint. Second abdominal joint occupying nearly or quite the whole abdomen, exclusive of the peduncle.

Hitherto *Synerges* has occurred exclusively in hard, woody galls, and the other two genera in the more soft and fleshy ones. The inquilinous genus *Aulax*, which is peculiar in having the 2nd and 3rd joints ♂ abdomen subequal, while in ♀ the 2nd joint covers the succeeding ones, I have not yet met with.*

* According to the arrangement proposed above, the genera *Cynips* Linnæus (=*Diplolepis* Geoffroi and Latreille, = *Callaspidia* Fitch non Dahlbom), *Biorhiza* Westwood, *Philonix* Fitch, *Diastrophus* Hartig, *Rhodites* Hartig, *Ibalia* Latreille and *Tribalia* Walsh, will all of them belong to Cynipidæ Psenides: *Synophrus* Hart. and O. S., *Synerges* Hart. O. S., *Amblynotus* Hart. O. S., *Sarothrus* Rheinh. O. S. and *Aulax* Hart. O. S. to Cynipidæ Inquilinæ; and *Figites* Latr., *Onychia* (?) Haliday, *Callaspidia* (?) Dahlbom non Fitch, *Allotria* (?) Westw., *Kleidotoma* (?) Westw., *Eucoila* (?) Westw. and *Ægilips* (?) Haliday to Figitidæ. *Onychia* is said to have the scutel "canaliculate," which seems to be peculiar to true Figitidæ, and *Callaspidia*, according to Dahlbom, is closely allied to *Onychia*. (See Brullé *Hymenopt.* IV, p. 635.) *Allotria* is parasitic in Aphis. If I have rightly identified *Kleidotoma* and *Eucoila*, both are true Figitidæ, and both have the wings fringed like a *Mymar* (Proctotrupidæ), and the former has them emarginate at tip with the radial area in my species distinctly open, and the latter simple at tip with the radial area in my species marginally closed by a coarse brown vein. A species of *Eucoila* was supposed by Westwood to infest the turnip, but several species are asserted by Walker to be parasitical, (Westw. *Introd.* II, p. 132,) and in that case Westwood's species was probably parasitical upon some other insect that infested the turnip. For "it seems hardly probable," as Baron Osten Sacken well observes, "that species of the same genus should sometimes be true gall-producers and sometimes parasites." (*Proc. Ent. Soc. Phila.* I, p. 49.) Respecting the genus *Ægilips* see the note on page 477.

I notice that in *Aulax sylvestris* O. S. and probably in other *Aulax*, the ♂ abdomen is proportionally as much smaller than the ♀ abdomen as it is in the genus *Cynips*. This is not the case in the above-mentioned three inquilinous genera.—March 21, 1864.

LIST OF ILLINOIS OAK-INHABITING CYNIPIDÆ AND THEIR GALLS.

†† *Galls upon Leaves.*

1. BLACK OAK (q. tinctoria.) Gall *q. spongifica* O. S. or "Oak-apple" (vernal). See above, pp. 458—9.

GALL-FLY, *Cynips q. spongifica* O. S., and its dimorphous ♀ autumnal form *C. q. aciculata* O. S. = *C. confluens* Harris, 1862 = *C. confluentus* Harris, 1841. See above, pp. 443—452.

GUEST GALL-FLY, *Synophrus læviventris* O. S. See p. 460 and below.

2. RED OAK (q. rubra.) Gall *q. inanis* O. S. (vernal). See above, pp. 458—9.

GALL-FLY, *C. q. inanis* O. S. = *Callaspidia confluenta* Fitch non Harris. See above, pp. 457—8

GUEST GALL-FLY, probably none. Galls like this and that of *C. nubilipennis* Harris, and *C. q. palustris* O. S., which consist scarcely of anything else but a central cell and a thin rind, without any spongy or woody matter intervening, seem to produce no Guest gall-flies.

3. BLACK OAK. Gall *q. pilulæ* n. sp., (autumnal.) A dark blood-red, spherical, but somewhat depressed gall .06—.20 inch in diameter, its upper surface roughish and opaque and often divided by deep striæ into 12—20 four- five- or six-sided compartments like the back of a tortoise, growing on the upper side of the leaves, but partly projecting also on the under side in a flattened disk with a central nipple, both of them the color of the leaf. Never placed on the principal veins and containing only a single very large cell. Frequently two or more galls are confluent, and they then assume an ellipsoidal or irregular form and contain two or more cells divided by thin partitions. Preserves its shape and color well when dry. Its general appearance is like that of *q. pisum* Fitch, figured and described *N. Y. Rep.* II, §319, but that gall occurs on the white oak, and is said to grow on the under side of the leaves only and on their principal veins and to contain usually two cells. *Pilulæ*, however, in a few cases—say 1 out of 500—does grow on the under side of the leaf. Very abundant but local near Rock Island, Illinois.

GALL-FLY unknown. On May 18th I found at the bottom of the jar, in which a number of these galls had been placed in the preceding autumn, 10 or 12 orange-colored Cynipidous larvæ dead and dry. Pro-

bably these may belong to the true Gall-fly, and it may go underground to assume the pupa state. A gall that I then cut into had a living, or at all events a succulent whitish larva in it, and one cut into in February had three such larvæ all in one ordinary sized cell. The former was probably the larva of the Guest gall-fly; the latter might have been Chalcididous, though I bred no Chalcididæ from these galls, as I have done from almost all the other kinds which have afforded me Cynipidæ. Eight of these galls cut open April 1st. contained each a single dead and dried up orange-colored larva, apparently Cynipidous, and probably identical with those found at the bottom of the jar. There was no earth in the jar for the larvæ when they came out of the galls to burrow into. Four-fifths of the galls are found in the winter to be burst open at the top and vacated by their tenants, which most likely had gone underground in the preceding autumn. Frequently at that period the whole top of the gall is abraded, so as to leave nothing but a flat ring on the leaf.

GUEST GALL-FLY, *Amblynotus inermis* n. sp. Came out May 18th from last year's galls. See below.

4. WHITE OAK? Gall *q. flocci*, in all probability identical with *q. lana* Fitch, which occurs on the white oak and is figured and described *N. Y. Rep.* II, §316. That gall is said to be "the size of a hazelnut or walnut," and the cells contained in it to be "about the size of grains of wheat," the length of the ♀ fly being given as .09 inch. The gall *q. flocci* varies from .20 to .40 inch in diameter, and is sometimes irregularly elongated in the direction of the midrib of the leaf. The cells contained in it are much smaller than grains of wheat and more in proportion to the size of the fly produced from them. Rare.

GALL-FLY, **C. q. flocci** n. sp. ♀. Black. *Head* with the vertex glabrous and a little polished, and the face brownish and apparently pubescent; palpi brown; antennæ ⅔ as long as the body, 13-jointed, the last joint more than ½ as long again as the penultimate, their basal ½ rufous and their terminal ½ dark brown. *Thorax* glabrous, somewhat polished, with two acute longitudinal striæ converging on the scutel, and in one or two specimens with a faint medial stria also, obsolete before. Pleura sometimes entirely opaque subpubescent, sometimes with a moderately polished spot under the wings. Scutel finely rugose, not polished, its basal foveæ large but shallow. *Abdomen* polished, viewed laterally as wide as long, the 2nd joint occupying about ½ its surface, and the dorsal edge of the 2nd joint forming a circular arc of about 25°. The front edge of the abdomen forms with the chord of this arc an angle of 100°, as

in *C. q. palustris*. "Ventral valve" small, subhyaline, its tip rectangular; the ovipositor stouter than usual and projecting, more or less far, from the "ventral valve." *Legs* all uniformly honey-yellow verging on rufous, except that the tarsal tips are obfuscated. *Wings* hyaline, the principal veins and the cross-veins brown but rather fine. Areolet large and distinct. Radial area open and 3—3½ times as long as wide. Length ♀ .08—.10 inch.

Five ♀; ♂ unknown. Came out in June from last year's galls. Very near *C. q. palustris* O. S., but may be distinguished by its shorter and slenderer antennæ, its opaque and sculptured scutel, and its much finer wing-veins. I omitted to label these galls, and cannot therefore be certain that they grew on the white oak, but I think they did. Quite recently I have found precisely similar galls on the white oak.

GUEST GALL-FLY, *Synophrus albipes* n. sp. Bred the first week in August from last year's galls, four or five of the insects coming out of a single gall. See below.

5. WHITE OAK. Gall *q. erinacei* n. sp.? (= *q. pisum?* Fitch = *pezomachoides?* O. S.) Attached by a single point to the leaf and growing on one of the principal veins, occasionally on the under side of the leaf but twice as often on the upper side, a spherical gall .12—.45 inch in diameter, or occasionally egg-shaped and .35—.60 inch long and .25—.40 inch wide. In a single specimen two spherical galls are placed side by side, but in eleven others there is but a single gall on a leaf. The surface of this gall is "finely netted with fissures or cracks and intervening elevated points like the surface of a strawberry," as *q. pisum* is described by Dr. Fitch, but, in addition, in 11 out of 13 specimens the "elevated points" are prolonged in the form of slender prickles, which are occasionally tinged with pink on one side of the gall, and are .02—.05 inch long, so as to present a beautiful burr-like appearance or something like that of the European hedge-hog, whence the specific name. The general color, when dry, is nearly that of the dry leaf, but is sometimes browner, sometimes yellower. Rather rare.

The above were found in February on young white oaks and saplings that had not shed their leaves. The gall *q. pisum* is said by Dr. Fitch to be "not rare" and "to grow on the under side of the leaf" exclusively, and the same thing is observed by Osten Sacken of the leaf that produced his three *C. pezomachoides*. Almost all of my galls when found were perforated by 1—3 holes, each .02—.03 inch in diameter, and always located on the surface next the leaf so as to

be seen with difficulty. On cutting into one of them in the field that I had noticed to be bored, I discovered that besides the central cells, which were empty, there were other cells near the exterior surface tenanted by living larvæ apparently cynipidous. Hence I conclude that these last are the larvæ of guest gall-flies, and that the true maker of the gall, which I have little doubt is *pezomachoides* O. S., had come out in the preceding autumn or winter. Baron Osten Sacken's species came out January 7 or later, in the latitude of Washington and Philadelphia, and the nearly allied *forticornis* n. sp., the presumed architect of the gall *q. ficus* Fitch, comes out in November and December in the latitude of Connecticut, as we know from the observations of Mr. Bassett already recorded. As I find that nearly all the galls of *q. tuber* Fitch, are bored in the winter, and as I have recently noticed many of them which, although bored, contained living larvæ, apparently Cynipidous, in February, I infer that the maker of that gall also comes out in the autumn and the guest gall-fly in the following spring; and the same is probably the case with the maker of the gall *q. pilulæ* Walsh, except that that species appears to come out in the autumn in the larva state and go underground for the winter, instead of coming out at once in the imago state.

GALL-FLY, *C. pezomachoides?* O. S.

GUEST GALL-FLY, *C. q. pisum?* Fitch = *Synophrus læviventris?* O. S. See above, p 463.

6. RED OAK? Gall *q. sculpta*, Bassett. I have several times met with this very remarkable, grape-like gall, and can testify that it is pleasantly subacid, crisp and eatable. I have always considered that it must be these galls, and not those of *q. innis* (=*confluenta* Fitch) which the school-teacher informed Dr. Fitch were eaten almost incessantly by the pupils at a certain school in Michigan. (*N. Y. Rep.* II, § 317.)

GALL-FLY, *C. q. sculpta* Bassett. I could never succeed in breeding it.

7. RED OAK. Gall *nubilipennis* Harris, (unknown to Osten Sacken.) This is well described by Dr. Fitch (*N. Y. Rep.* II, § 318), who, however, had not bred the insect from it and only inferred it to belong to the *C. nubilipennis* of Harris, from the "brief indefinite notice" of that writer. Sometimes these galls, "which have a third of the sphere

projecting from the upper surface of the leaf and the remainder opposite on its under side" (Fitch), grow near the margin of the leaf without however quite touching that margin, sometimes one-half of them projects outside from the margin. The galls mentioned by Dr. Fitch, as "perfectly the same, except that they show no vestiges of any attachment to the leaf, being smooth and even on every side," are most probably small specimens of *q. inanis* O. S. (= *confluenta* Fitch.) The galls *nubilipennis*, like *q. inanis*, vary much in size, my largest specimen being .60 inch in diameter, and others only .30 inch; and the central cell is nearly twice as long as wide, whereas that of *q. inanis* is scarcely ½ as long again as wide. They were gathered in June from a tree full of the galls *q. inanis*, which however are at once distinguished by being attached to the leaf only by a single point.

GALL-FLY, *C. nubilipennis* Harris (= *C. q. singularis* Bassett.) The ♂ of this species, as noticed by Mr. Bassett who was the first to discover it, is very remarkable for having 16-jointed antennæ, 14—16 equal in length, and the suture between 15 and 16 beyond all doubt free, as correctly stated by that writer from 12 specimens. The ♀ antennæ, as stated both by Fitch and Bassett, are 13-jointed, the last joint robust and nearly as long as the two preceding and occasionally with indications of a medial connate suture; the terminal joints gradually thicker. The ♂ antennæ are full as long as the body, the ♀ antennæ scarcely more than ½ as long. The sculpture of the head and thorax is proportionally nearly as coarse as in *spongifica*, and there is a distinct short stria on each side of the abbreviated tip of the middle mesonotal stria. In all three of my ♀ ♀ and one ♂ the abdomen is piceo-rufous, in the other ♂ black. The hind femora and tibiæ are almost always dark reddish brown, and occasionally in a lesser degree the intermediate ones. The wings are uniformly, but slightly, tinged with dusky, without any dark spot on the second cross-vein as in *spongifica*, *aciculata* and *inanis;* the veins all dusky or brownish, and both cross-veins robust and shining brown-black. The dorsum of abdominal joint 2 describes a circular arc of 45°, and the tip of the "ventral valve" is in a right angle, with a hairy filiform appendage. The "dorsal valve" is hairy and very large. Length ♂ .12—.14 inch. ♀ .14—.16 inch. Two ♂, three ♀, none of which were able to perforate the outer rind of the gall, though several had perforated the central cell. Con-

sequently, as they lay in the gall unobserved till the following winter, I can say nothing as to the natural time for their appearance. But we learn from Mr. Bassett that his specimens came out "about the 10th of July," and Dr. Harris gives June as the month when the transformations of this insect are completed.

There can be no possible mistake as to the correlation of the ♂ with the ♀, as my galls were all gathered off the same tree and the insects were all taken out of the gall itself. Mr. Bassett who has favored me with specimens of his *C. q. singularis* ♂ and ♀, thought it possible that the ♂ might belong to the inquilinous genus *Aulax;* but the ♂ neuration is not inquilinous and is exactly identical with that of *spongifica* and *inanis* and also with that of the ♀. Dr. Fitch's ♀, which he refers to *nubilipennis* Harris, is much larger, (.20 inch instead of .14—.16 inch Walsh, and .15 inch Bassett). It also has the abdomen "black" instead of "piceous red" Walsh, or "red or dull brick-red" Bassett. Finally, it was found "among fallen oak-leaves early in April," instead of occurring in June (Harris) or early in July (Bassett). In all these three characters it differs from Mr. Bassett's and my ♀ ♀, precisely as the dimorphous form *aciculata*, which appears in October and the following April, differs from *spongifica*, which appears in June. It is therefore not improbable that we have here another species with dimorphous ♀ ♀, and a species too which many authors, on account of the extraordinary 16-jointed antennæ of the ♂, would be inclined to make the type of a new genus. No other described species of Psenides, so far as known to me, has 16-jointed ♂ antennæ. It would be interesting to know whether the abdomen of Dr. Fitch's April ♀ differs in its shape from that of the June and July ♀, as that of *aciculata* differs from that of *spongifica*. My ♀ ♀ *nubilipennis* have the abdomen shaped nearly as in *spongifica* ♀, except that the terminal segments happen to be more retracted. Both sexes of this species are readily distinguishable from *C. q. globulus* by the number of the antennal joints—in the former ♂ 16, ♀ 13, in the latter ♂ 15, ♀ 14.

It may well admit of a question, whether the very short and indefinite notice of *nubilipennis* by Dr. Harris, though perhaps sufficient to identify the insect, ought to give his name priority over that of Mr. Bassett, who has described both sexes fully and accurately. The law of priority has its conveniences, but it has also its injustices.

8. SWAMP WHITE OAK (q. prinus, var. discolor.) Gall *q. petiolicola* (vernal). It is well described by Osten Sacken, but the author of the gall was unknown to him. (*Proc. Ent. Soc. Phil.* I, pp. 66–7.) Some of these galls, when occupying the base of the leaves, reach .60 inch in diameter, and produce each 9 or 10 flies, judging from the holes through which they have made their escape.

GALL-FLY, *C. q. petiolicola* Bassett. My specimens differ from Mr. Bassett's description as follows, with a few additional characters:— 1*st*. The face in the living specimen is sometimes rufescent, but in the dried specimen it is black and not even "brown;" under a good lens it is very finely aciculate, with a flat glabrous carina from the origin of the antennæ to the mouth. 2*nd*. The antennæ are uniformly pale reddish brown or dull rufous, scarcely darker at tip, 13-jointed, the last joint nearly as long as the two preceding ones put together, and in two or three specimens showing indications of the normal division into two joints, as in some of Mr. Bassett's specimens. The ♂ antennæ are 15-jointed, 13—15 subequal. 3*rd*. Besides the two lateral striæ (or parapsidal grooves) of the mesonotum, there is in five or six ♀ ♀ a distinct central stria reaching halfway from the scutel to the collare, and a shorter stria in the other ♀ ♀ and in my ♂. 4*th*. It is only the femora and tibiæ of the hind legs that are generally dark brown, the tarsi of the hind legs as well as the whole of the other four legs being pale reddish brown, the tips of all six tarsi brown as described. 5*th*. The 2nd abdominal joint ♀ generally occupies dorsally ⅔ but laterally only ½ of the length of the abdomen, exclusive of the peduncle; and its dorsal edge describes a circular arc of about 45°. The "ventral valve" is subhyaline, its tip in an angle of 80° or 90°, and with a setiform appendage as long as itself; and the "dorsal valve" projects slightly above the dorsal line. The radial area is 2½—3 times as long as wide. Length ♂ .09 inch, ♀ .10—.11 inch.

One ♂, nineteen ♀. Bred the end of June and forepart of July from galls produced the same year. Mr. Bassett's remark as to the somewhat greater comparative length of the abdominal peduncle in ♂ is perfectly correct.

GUEST GALL-FLY, *Amblynotus ensiger* n. sp.? See below. One ♂, four ♀ at the same time with the above, and from July 31 to August 14 five ♂, eight ♀. Greatly resembles the gall-fly, but, besides the

generic distinctions, differs as follows:—The antennæ are a trifle slenderer, the legs are honey-yellow instead of dull rufous, the hind femora and tibiæ are never obfuscated, the areolet is twice as large, and the sheaths of the ovipositor project like a sting about .03 inch above the line of the back.

9. BLACK OAK and LAUREL OAK (q. imbricaria.) Early vernal gall *q. palustris* O. S. The galls from the Laurel oak produced nothing but true Parasites (*Chalcididæ*), but as the parasites were specifically identical with those produced from the galls on the Black oak, and as the two species of oak grew side by side, each full of these galls, and the galls themselves were indistinguishable, I have no doubt that *C. q. palustris* inhabits the Laurel oak.

GALL-FLY. *C. q. palustris* O. S.

†† *Galls on Limbs. Twigs, &c.*

10. WHITE OAK. Gall *q. globulus* Fitch, (autumnal.) Well described and figured by Dr. Fitch, *N. Y. Rep.* II, §312.

GALL-FLY, *Cynips* (*callaspidia*) *q. globulus* Fitch. I have not reared this, but have received ♀ ♀ from Mr. Bassett.

GUEST GALL-FLY, *Synerges* (*cynips*) *oneratus* Harris and Fitch. See below.

11. WHITE OAK. Gall *Seminator* Harris, (autumnal.) Well described and figured by Dr. Fitch, *N. Y. Rep.* II, §315, except that, as noticed by Osten Sacken, (*Proc. Ent. Soc. Philad.* I, p. 69) the figure does not show the numerous "angular projections" which exist in nature. Rather rare near Rock Island, Ill.

GALL-FLY, *Cynips seminator* Harris and O. S. I have not reared this but have received numerous specimens ♂ ♀ from Mr. Bassett.

GUEST GALL-FLY? *Cynips seminator* Fitch non Harris. See above, pp. 464—5. Mr. Bassett says that "the galls *seminator* and *q. operator* have not yielded flies of any sort from the first of August to October; yet there still in October remain in many of the cells small, perfect, living larvæ." (*Proc. Ent. Soc. Philad.* II, p. 333.) Are these the larvæ of a guest gall-fly, or of a dimorphous ♀ form of *C. seminator*, destined in either case, as suggested by Mr. Bassett, (*ibid.*)

to appear "when the gall season again arrives"? The question is an interesting one.*

12. WHITE OAK. Gall *q. ficus* Fitch, (autumnal.) Well figured and described. *N. Y. Rep.* II, §314. Some of the central cells in these galls contain in February living larvæ about .05 inch long and occasionally a blackish pupa about .08 inch long, evidently from the structure of its antennæ Chalcididous. About one-fourth of these galls in the winter exhibit external perforations, and their central cells are then invariably perforated, indicating that the maker of the gall had already vacated his cell. With such as are not perforated, the central cell generally contains in February and March the above-mentioned chalcididous larva or pupa, which is no doubt identical with a Chalcidide that I have bred abundantly in May from these galls. The cells in which the guest gall-fly most probably lives are attached to the external rind of some few galls only, in addition to the central cell which is found in every gall and in which, according to all analogy, the maker of the gall must reside. I have found larvæ in March in some of these external cells; and in the same gall in which one of the external cells was tenanted by a larva, the central cell was also tenanted by a chalcididous larva; thus furnishing confirmatory evidence, that in certain cases the guest gall-fly does not destroy the gall-fly, or, which is the same thing, its chalcididous parasite. The twigs on which the galls are placed, unless very large, always perish the next season, and where recent galls are found, a great quantity of old, last year's, dry galls on dry and half-rotten twigs may always be observed. This circumstance seems to have led Dr. Fitch to imagine that there were two crops of these galls every year. He makes the same supposition with regard to the galls *seminator* Harris, and *q. inanis* O. S. (=*confluenta* Fitch), but in the latter case I know from close and continued observation that the supposition is incorrect. I doubt the fact of any oak-inhabiting Psenide

* Mr. Bassett has subsequently discovered that he was mistaken in supposing the few ♀ gall-flies with a red thorax, which he had observed to be mixed up with numerous *C. seminator*, to be parasites or inquilines. (See above, page 465, note.) They proved to be specimens of *C. q. operator* O. S., the gall of which, though it occurs on different oaks, closely resembles that of *seminator*, and small pieces of which must have been accidentally mixed up by him with the *seminator* galls.—March 31, 1864.

being double-brooded. The gall *q. ficus* occurs near Rock Island, Ill., chiefly on unthrifty sprouts 2 or 3 feet high growing round the stumps of young white oaks, and never on trees of any size. Dr. Fitch found them "on the long slender shoots of young and thriftily growing white oaks." I have seen them only once or twice in such a situation and then not 7 feet from the ground. The fact of their not occurring on large trees is explained by the gall-producing insect being, as I believe, subapterous.

GALL-FLY? **Cynips q. forticornis** n. sp. ♀. Rufo-sanguineous. *Head* transverse, nearly twice as wide as long and twice as wide as the thorax, glabrous, scarcely polished. Eyes, ocelli and antennæ brown-black, the antennæ opaque, nearly as long as the body, very robust so that all the joints but 1, 3, 4 and 14 are as broad as long, 14-jointed, the joints very distinct, the last joint ½ as long again as the penultimate, and 1 and 3 tapering to almost nothing at base. *Thorax* narrow, glabrous, a little polished, with only two rather coarse mesonotal striæ converging but slightly at the scutel. Scutel small, opaque, longitudinally semioval, much elevated, the suture before it deeply impressed but without any foveæ. *Abdomen* black, highly polished, the 2nd joint occupying about ½ of its dorsal or ½ of its lateral length, the 1st joint or peduncle very small. Viewed laterally it is a little longer than wide, and the dorsal edge of 2 describes a circular arc of about 25°. "Ventral valve" very hairy, yellowish subhyaline, its tip in an angle of about 80°. "Dorsal valve" large, hairy, prominent and distinct. Sheaths of the ovipositor generally exserted and directed upwards and backwards, but in two specimens distinctly lying in the "caudal groove," their tips just attaining the tip of the "dorsal valve." Ovipositor generally reposing in the "ventral valve" with its tip exserted. *Legs* dull rufous or reddish brown, the hind femora and tibiæ and all the tarsal tips generally browner. *Wings* subobsolete, reduced to an elongate-triangular gray scale upon each side, only extending ½ of the way along the 2nd abdominal joint. Length ♀ .07—.10 inch.

Thirteen ♀; ♂ unknown. Dug on May 17 fourteen ♀ ♀, dead but not decayed, out of the galls of *q. ficus* gathered the preceding autumn. Mr. Bassett, as already stated, bred this insect in November and December. Comes very near to another subapterous species, *C. pezomachoides* O. S., reared from the galls of *C. q. pisum* and probably the true Gall-fly of that gall, but differs in the head and thorax having no brown markings, in the tip of the scutel not being "recurved upwards," in the last tarsal joint not being "a little larger than usual," and in there being no "yellowish spot" on each side of abdominal joint 1. Nothing is said, either, as to the antennæ of that species being much stouter than usual. Probably the "short double projection with a fan-

shaped pencil of yellowish hairs", described in *pezomachoides* as attached to the tip of the abdomen, is the hairy "dorsal valve" with the two sheaths lying in it. Dr. Fitch has founded a new genus, *Philonix*, (which according to the Greek etymology that he himself favors us with should be *Philonips*,) to receive two subapterous species found on the snow in the winter, which however are specifically distinct from *forticornis*. As many species of insects sometimes occur with long wings, and sometimes with mere rudimental ones, it seems unnatural to place an insect in a separate genus merely and simply on account of the wings being rudimental. *Biorhiza* Westwood, which Dr. Fitch has most unnecessarily and inelegantly changed into *Biarhiza*, (*N. Y. Rep.* II, 5th Rep. p. 1,) has no wings at all. It is singular that all these apterous and subapterous Cynipidæ, (in all, six European and N. A. species,) have hitherto occurred only in the ♀ sex.

GUEST GALL-FLY, *Synophrus læviventris* O. S. (= *C. q. ficus?* Fitch. See above, p. 463.) Bred at various times before and after May 17, (from the same lot of galls as *forticornis*,) 31 ♂, 5 ♀.

13. BLACK OAK. Gall *q. podagræ* n. sp.? (autumnal.) Rough, hard, woody, gnarled and scaly swellings on such twigs and limbs as run from ¼ to 1½ inch in diameter, never at their tips but often 4 or 5 feet from their tips. Occasionally these swellings are placed at the side of a limb, but more generally they encircle it, enlarging it in an irregular, longitudinally ellipsoidal or egg-like form, so as to double or treble its natural diameter. Frequently several of these swellings run one into the other, so as to form a very elongate tumor with a sinuate outline, thus presenting a fanciful resemblance to a gouty or dropsical limb, whence the specific name. Sometimes when a small twig is affected the swelling has 7 or 8 times the diameter of the twig, which then ceases to grow beyond the gall and projects from its tip like a tail. Each gall is polythalamous, i. e. contains numerous cells, connected by woody matter. I have observed three trees in different localities affected by these galls, one so badly that it was almost killed and was probably on that account cut down. As illustrating the local nature of *Cynips* galls, it may be added that of two exactly similar, isolated, black oaks, growing so close together that their boughs almost touched, one had one-tenth part of its boughs covered by these galls, and the other had

not a single gall on it so far as I could discover when it was bare of leaves. The affected limbs and twigs perish before the next season.

GALL-FLY, **Cynips q. podagræ** n. sp.? (= *C. q. punctata* Bassett?) ♀ Black. *Head* with the face and vertex very finely rugose, the face almost aciculate and in certain lights with whitish pubescence. Palpi rufous, tips often darker. Antennæ dull rufous at base, gradually deepening to a dull, dark brown at tip, 14-jointed, the last joint ½ longer than the preceding. *Thorax* opaque before the scutel, occasionally a little polished, with no perceptible general sculpture under the lens except a few very fine rugosities in front close to the collare. Three acute longitudinal dorsal striæ, the outer ones converging on the scutel and often with an almost microscopic row of punctures adjoining their inner edge, the middle one with a short stria on each side of its tip; another short longitudinal stria above the origin of the wings. Collare rather finely rugose. Scutel rather finely rugose or almost confluently punctate, with two deep, hemispherical, basal pits. *Abdomen* highly polished, black in the dried specimen, in the living immature insect shining piceous, the 2nd joint occupying about ½ its lateral surface with the upper edge describing a circular arc of about 30°. "Ventral valve" thin, yellowish-subhyaline or piceous, unarmed, its tip in an angle of about 60°. "Dorsal valve" large, prominent and hairy. Ovipositor occasionally reposing in the "ventral valve." *Legs* dull rufous or pale reddish brown, the hind femora almost invariably dark brown, and all 6 tarsal tips brown. *Wings* hyaline, veins moderately coarse, tinged more or less with brown. Areolet distinct and large. Radial area open and 3—3½ times as long as wide. Length ♀ .10—.15 inch.

Twenty-three ♀; ♂ unknown. April 18—20, I had 51 ♀ ♀ come out from last year's galls and many more in the few succeeding weeks, without a single ♂ amongst them. It is remarkable that Mr. Bassett also reared 100 ♀ ♀ of his *punctata* without a single ♂. Very near indeed to that species, which was reared from somewhat similar galls on the Red oak instead of the Black oak, but differs by the vertex being rugose and the face rugose and pubescent, not simply "pubescent," and on the other hand by the thorax before the scutel not having its general surface "finely and beautifully punctate," even under an excellent double lens. It is possible, however, that Mr. Bassett may refer to microscopic punctation, though he says nothing to that effect, and says nothing either of the obvious sculpture of the head.* I

* I have since received eight specimens of *punctata* from Mr. Bassett. The only perfectly constant character that separates *punctata* from *podagræ* is that the lower part of the abdomen in the former is decidedly "reddish brown" as described, instead of "black" as in all the dried specimens of the latter. Individuals of both forms have the peculiar "stump of a vein" on the second trans-

am familiar with the gall *q. tuber* Fitch, and it is quite different from *q. podagræ*, besides that it grows exclusively on the White oak. The gall *q. arbos* Fitch, is described as growing exclusively on the tips of the limbs of aged White oaks. The gall *q. batatus* Fitch, also occurs on the White oak and somewhat resembles *q. podagræ*, but the fly is described as having its legs "dull pale yellow" and all its thighs "black," and besides its antennæ are 13-jointed ♀, not 14-jointed. Most probably, as shown above, pp. 464-5, the flies of all these three last galls described by Dr. Fitch, are guest gall-flies and not true gall-flies.

GUEST GALL-FLIES, *Synergus rhoditiformis* n. sp. and *S. mendax* n. sp. See below. Both species came out between May 10 and 15, 3 or 4 weeks after the first *C. q. podagræ* and from the same galls.

14. WHITE OAK. Gall *q. tuber* Fitch. Described and figured *N. Y. Rep.* II, §309. Dr Fitch says that "a single gall always suffices to kill the limb at and above the point where it is situated," and observes that there are two distinct varieties, one "growing upon the ends of the limbs" and another "lower down upon their sides." Near Rock Island the recent galls always grow upon the tips, never at the side, of twigs, and frequently the twig is not killed by it and growing out of the tip of the old gall closes over the perforation made by the Cynips, and presents the appearance of having a recent gall upon its side instead of at its tip. The knife speedily dispels the illusion.

GALL-FLY, unknown? I have never bred from these galls.

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verse vein which Osten Sacken notices as a constant character in *Rhodites bicolor* Harris: others again are without it. I suspect that, like *spongifica* and *inanis*, *podagræ* and *punctata* are distinct races of the same species, which have acquired a habit of exclusively attacking the Black oak or the Red oak: in other words, that they are what Mr. Darwin would call "incipient species." Probably in the course of a few thousand years other distinctive characters, besides the coloration of the abdomen, will by the laws of Variation and Inheritance be gradually produced, and they will then become distinct species.

It is possible, however, since only the ♀ ♀ of these two forms are at present known, and since those ♀ ♀—judging from the great numbers reared both by Mr. Bassett and myself without a single ♂ amongst them—are perhaps the secondary dimorphous ♀ forms corresponding to *aciculata*, that either the primary dimorphous ♀ forms corresponding to *spongifica*, or the ♂ ♂, or both of them, may differ so much from each other that *podagræ* and *punctata* must be considered as distinct species. Hence it will be advisable for the present to treat them as provisionally distinct.—March 21, 1864.

GUEST GALL-FLY, *Cynips q. tuber?* Fitch. Dr. Fitch notices the very great similarity between this fly and his *C. q. ficus* which is in all probability a Guest gall-fly. (*N. Y. Rep.* II, §314.) See above pp. 464—5 and p. 484.

15. BLACK-JACK OAK? (q. nigra.) Gall *q. operator* O. S.

GALL-FLY, *C. q. operator* O. S. Captured at large by myself, but whether in North or South Illinois I cannot be certain. If captured in North Illinois, it must inhabit a different species of oak from any on which it has hitherto been found. Baron Osten Sacken reared it from the black-jack oak (q. nigra) and Mr. Bassett from q. palustris and q. ilicifolia, the last of which is not found in Illinois, and the other two do not occur near Rock Island, Illinois. (See p. 445.) As already stated, my specimen is identical with specimens received by me from Mr. Bassett.

INQUILINES OR GUEST GALL-FLIES.

16. SYNOPHRUS LÆVIVENTRIS O. S. (= *C. q. ficus?* Fitch = *C. q. pisum?* Fitch.) ♂ ♂ bred in June from the gall of *C. q. spongifica* differ as follows from Baron Osten Sacken's description of a single ♀ (?) bred from the same gall, but which I believe to have been in reality a ♂ :— The *head* varies from pale yellowish to dark reddish brown, the pale individuals having generally a round black spot enclosing the ocelli, but sometimes only a small black transverse line connecting them, and the darkest individuals having the space behind the eyes and the entire vertex brown-black as far as the insertion of the antennæ, and an obscure dusky line descending downwards nearly to the mouth from the origin of each antenna. The antennæ are 15-jointed, joints 13—15 equal in length, and they vary from yellowish immaculate through yellowish tipped with reddish brown to rufous tipped with brown. The *abdomen* varies from black immaculate to brown-black above on its anterior ⅔ and pale transparent yellowish on its posterior ⅓ above and on the entire lower surface. The 2nd joint very generally, but not always, completely covers the terminal joints. The *legs* vary from pale yellowish to rufous, the tarsal tips always brown, all the 6 femora sometimes vittate above with brown-black. The veins of the wings are generally hyaline, but sometimes, even in but moderately dark specimens, they are brownish. Length ♂ .06—.10 inch. Twenty-three ♂ .

The ♂ has an abdomen as long as the ♀ and but for the absence of the "ventral valve" and of the sheaths of the ovipositor might be easily mistaken for ♀. In all the above variations intermediate grades occur.

On comparing 33 ♂ ♂ bred in May from the gall *q. ficus* with the above 23 ♂ ♂, their size varies within exactly the same limits, but the range of the coloration of the former is not so extreme. None have the femora, so far as can be seen, vittate above with brown-black, but several have the hind tibiæ thus vittate, which does not occur in those bred from *spongifica*. It is observable that Dr. Fitch describes *C. q. ficus* as having its "hind shanks dusky." The wing-veins are almost always brownish. Evidently the two broods of insects are identical, as the markings of the legs are in Cynipidæ quite an inconstant character.

On comparing 5 ♀ ♀, bred in May from the gall *q. ficus*, with the description of the ♀ (?) by Osten Sacken, they differ as follows:—The antennæ are 13-jointed, the last joint ½ as long again as the preceding, (not "14-jointed.") The scutel is not even "slightly reddish" at tip, and it was only occasionally so in the ♂ ♂ bred from *spongifica* galls. The abdomen is black, immaculate, and joint 2 never occupies more than ⅘ of its lateral length exclusive of the peduncle. The hind femora are scarcely "infuscated," but the hind tibiæ are vittate above with brown-black. The wing-veins are rather fine, but almost always brownish. Length ♀ .09—.10 inch.—It may be added that the 2nd abdominal joint in all the specimens ♂ ♀ describes dorsally a circular arc of 45°, that the tip of the "ventral valve" is unarmed and in an angle of 30°, and that the sheaths project at least .02 inch above the line of the back. As these very conspicuous sheaths are not mentioned in the description, and as it is expressly stated that the 2nd abdominal joint conceals all the following ones, which is a peculiarity of the ♂ sex, I infer that Baron Osten Sacken, having only a single specimen to guide him, mistook ♂ for ♀. In any case he has, as it seems, unless I have incorrectly identified my species with his, miscounted the antennal joints, which are ♂ 15, ♀ 13, whereas he gives them as ♀ 14. They are peculiarly difficult to count in this species.

Judging from the brief description of *C. q. pisum* Fitch, that fly also, as well as *C. q. ficus* Fitch, appears to be identical with the Guest gall-fly, *læviventris* O. S. It has already been stated that Osten Sacken obtained what is apparently a true Gall-fly from the gall *q. pisum* Fitch,

(pp. 464 & 483.) Thus we have certainly one and perhaps two autumnal galls inhabited by this Guest gall-fly, *q. ficus* and *q. pisum*, and one vernal gall, *q. spongifica;* whence it follows that the insect is double-brooded. It was shown that the gall *spongifica* must be punctured by the *Synophrus* after that gall has acquired some considerable size, say towards the middle of May, and not at the time when the egg that produces it is inserted in the bud, viz., in the June of the preceding year, (p. 460.) We can understand now what becomes of the *Synophrus* between the June of one year, when it emerges from the *spongifica* gall, and the May of the following year, when it is necessary for it to be on hand to puncture the young and tender *spongifica* gall. The intermediate time is evidently passed in the larva aud pupa state in such autumnal galls as *q. ficus*

17. **Synophrus albipes** n. sp. ♂ ♀.

Differs from *S. læviventris* O. S., only as follows:—1st. The entire body, including the head with the exception of the palpi which are whitish or pale yellowish, is always black. 2nd. The antennæ ♀ are 14-jointed, (not 13-jointed,) the last joint ½ longer than the preceding one. 3rd. The 2nd abdominal joint always covers the terminal joints both in ♂ and ♀. 4th. The legs are whitish, scarcely tinged with yellow, with the tarsal tips brown, but otherwise immaculate except in a single ♂, where the hind femora and tibiæ and in a less degree the intermediate ones, are brown. 5th. The sheaths of the ovipositor do not project beyond the line of the back, or scarcely and in a single ♀ only, though the ovipositor often projects from between them, which is not seen in any of my five *læviventris* ♀.—Length ♂ .04—.07 inch, ♀ .07—.09 inch. Twelve ♂, eight ♀, bred from the gall *q. flocci* (=*q. lana?* Fitch), on the 4th of August, when I obtained 41 ♂, 9 ♀, and other specimens August 1st and after August 4th, all from galls of the preceding year's growth. Hence it would seem that this species is not double-brooded like *læviventris*.

18. **Amblynotus ensiger** n. sp.? (=*A. petiolicola?* O. S.) ♂ ♀ Black. *Head* with the face opaque with the appearance of short whitish pubescence, and a glabrous slightly elevated black stripe descending to the mouth from between the origin of the antennæ; palpi honey-yellow; vertex glabrous, slightly polished. Antennæ ♂ ♀ with joint 3 shorter than usual, ♂ 15-jointed with 13—15 subequal, ♀ 12-jointed with 12 fully equal to 10 and 11 put together, and occasionally with indications of a connate medial suture on 12, ♂ ♀ honey-yellow

immaculate or rufous with the two basal joints and a few terminal ones brownish. *Thorax* glabrous opaque, with the appearance of fine appressed pubescence: two acute longitudinal striæ, subobsolete in front, converging on the scutel, and a central one extending from the scutel halfway or less to the collare. A large, highly polished spot under the wings. Scutel finely rugose, the basal foveæ obsolete or subobsolete. *Abdomen* glabrous, joint 1 short and truncate conical, 2 and 3 connate and together covering from ⅓ to ½ of its whole lateral surface except joint 1, the dorsal edge of these two joints describing a circular arc of 25°; 2 basally with appressed pubescence, and dorsally in ♂ nearly equal in length to 3, but in ♀ only half as long. "Ventral valve" ♀ yellowish and thin, moderately large, its tip unarmed and in an angle of 60°. Sheaths polished and projecting about .03 inch above the dorsal line, often with the ovipositor protruding from their tips. *Legs* honey-yellow, tarsal tips brown, and the tip of the hind tibiæ often brownish ♂. *Wings* hyaline, veins moderately fine, yellowish-subhyaline, the principal ones sometimes lightly tinged with brown. Areolet large, but with its basal side often subobsolete. Radial area distinctly closed, scarcely twice as long as wide, the areolet placed about ⅓ of the way from its base to its tip. Length ♂ .06—.07 inch, ♀ .07— 10 inch.

Six ♂, twelve ♀, bred from the gall *q. petiolicola* O. S. and Bassett. Differs from *A. petiolicola* O. S., bred from the same gall and described from a single ♀ specimen, in the antennæ ♀ being properly 12-jointed not 13-jointed, in the abdomen being black and not "dark brown," in the legs being honey-yellow except sometimes the tip of the ♂ hind tibia, not "infuscated except at the joints," and in the areolet being only ⅓ of the way from the base of the radial area, instead of "corresponding to its middle." Notwithstanding all the above differences, Baron Osten Sacken's insect is very probably identical with mine, as he says his *petiolicola* is closely allied in all respects to another species reared by him from *q. tuber* and stated to have "12-jointed antennæ, if the last very elongated joint is counted for one." (*Proc. Ent. Soc. Phil.* I, p. 72.) *Amblynotus* Rheinhardt, it appears, ought to have ♂ 14-, ♀ 13-jointed anteunæ, instead of ♂ 15, ♀ 12 as in our insect. Baron Osten Sacken also doubts the fact of his *petiolicola* belonging to *Amblynotus* because "the 2nd segment of the abdomen is much shorter than the 3rd. (*Ibid.* p. 67.) In the ♂, but not ♀ *ensiger*, these two segments, as above stated, are dorsally equal in length. I should not have described my species but for my happening to possess numerous specimens of both sexes all from the same brood. *Ensiger* ♀ might be easily mistaken at first sight for the large-sized and dark-colored specimens of *Synophrus læviventris* O. S., but is distinguish-

able, not only generically, but by the tip of the "ventral valve" being in an angle of 60° instead of 30°, and by the sheaths of the ovipositor being proportionally longer.

19. **Amblynotus inermis** n. sp. ♂ ♀.

Differs from the above only as follows:—The 2nd and 3rd abdominal joints ♂ ♀ nearly conceal the succeeding ones; the "ventral valve" is longer and slenderer—its tip in an angle of 45°—and also more horny; the sheaths of the ovipositor do not nearly attain the line of the back, instead of projecting about .03 inch above it; the legs are yellowish-white not honey-yellow; and the basal $\frac{1}{3}$—$\frac{4}{5}$ of all 6 femora ♂ ♀ is deep black, the black color extending further in each successive pair. Length ♂ ♀ .07 inch. One ♂, one ♀, bred from the gall *q. pilulæ* n. sp., early in August.

20. SYNERGES ONERATUS Harris. Baron Osten Sacken, noticing a discrepancy in the size between his specimen (.21 inch) and the size given by Dr. Fitch (.15 inch) doubts whether it is the same species. (*Proc. Ent. Soc. Phila.* I, p. 68.) But Dr. Fitch says also that its size is similar to that of *nubilipennis* and *confluenta*, which are given by him as respectively ♀ .20 inch and ♀ .25 inch. Mr. Bassett's specimens were "as large or even larger" than Osten Sacken's. (*Ibid.* II, p. 328.) It has been shown above that there is a great variation in size, in other inquilinous species also, in the same brood reared from the same galls. (E. g. *Synophrus læviventris*, and see below *Synerges rhoditiformis*.) From the gall *q. globulus*.

21. **Synerges mendax** n. sp. ♀. Black. *Head* with the space behind the eyes (but not the occiput) and also the face below the origin of the antennæ and the mouth, dull yellowish brown varying from dark to pale, the vertex glabrous and moderately polished, the rest of the head opaque and the face finely pubescent. Antennæ nearly as long as the body, 14-jointed with the last joint scarcely longer than the penultimate, yellowish-brown with the two basal joints blackish. *Thorax* with the collare very finely rugose, the mesonotum before the scutel with coarser transverse waving striæ or rugosities, and with two acute longitudinal striæ converging on the scutel, between the base of which striæ is a shallow but widely impressed fovea. Scutel rugose, with the two basal foveæ subobsolete. Under the wings a small but highly polished round spot. *Abdomen* highly polished; the joints succeeding the 2nd concealed by it; the 2nd joint dorsally describing a circular arc of 30°. "Ventral valve" moderate, thin, brownish subhyaline, its tip unarmed and in an angle of 45°. Sheaths extending a little below or a little above the line of the back, with the ovipositor generally protruding from between them. *Legs* dull pale brown or brown-

black, the trochanters, the knees and the tarsi except their tips, honey-yellow or dull rufous, each successive pair of legs a little darker than the preceding. *Wings* hyaline; veins rather fine, the principal ones lightly tinged with brown, the cubitus hyaline and indistinct. Areolet moderate, its two basal sides hyaline. Radial area about 2½ times as long as wide, distinctly closed by a brownish vein, the areolet placed scarcely more than ⅓ of the way from its basal end. Length ♀ .08—.10 inch; ♂ unknown.

Eight ♀, bred at the same time with the following species and from the same galls, (*q. podagræ* n. sp.) May be easily confounded with the dark varieties of that species, but differs in being slenderer, in the antennæ being longer and slenderer and having one more joint ♀, in the "ventral valve" being unarmed and much shorter, and subhyaline and thin not thick and black, and in the radial area being proportionally longer and in a more acute angle at tip (30° instead of 45°.) From the true gall-fly that produces the gall *q. podagræ* it is at once distinguished by its radial area being closed and proportionally shorter, and having the areolet placed further from its base.

22. **Synergus rhoditiformis** n. sp. ♂ ♀. Rather robust, honey-yellow or rufous, ranging both in the living and the dried ♀, but not in ♂, to very dark reddish brown, or almost brown-black. *Head* glabrous opaque, with a black spot enclosing the ocelli and sometimes extending laterally nearly to the eyes and in front to the origin of the antennæ; extreme tips of mandibles black. Eyes black. Antennæ honey-yellow or rufous ♂ ♀, in the dark ♀ ♀ reddish-brown, ¾ as long as the body in ♂, a little over ½ as long in ♀, 15-jointed in ♂ joint 3 much excised below and 13—15 subequal, 13-jointed ♀ the last joint ½ as long again as the penultimate and occasionally in certain lights with a slight transverse medial impression. *Collare* glabrous opaque or almost microscopically rugose, always with an equilaterally obtrigonate black spot covering its whole dorsal length. *Thorax* laterally a little polished, dorsally opaque and with fine transverse rugæ; two acute striæ converging on the scutel and an intermediate one, all three often indistinct throughout or obsolete in front. Scutel finely rugose. The entire meso- and meta-notum black, the black color ceasing suddenly on the suture dividing the mesonotum from the collare. *Abdomen* black, highly polished, often in the paler specimens laterally and beneath piceous or rufous, joint 2 dorsally describing a circular arc of 30°. "Ventral valve" ♀ horny and thick, very large, extending beyond the tip of the dorsum, its color a highly polished black, its tip, when viewed laterally, in an angle of 45° terminating in a short, obtuse, slender, setiform, hairy appendage, channelled above for the reception of the ovipositor. Sheaths of the ovipositor projecting but slightly from the "dorsal valve," their tips just about attaining the dorsal line, with the ovipositor often exserted from between them. *Legs* varying from yellowish white to honey-yellow ♂, the tarsal tips brown; honey-yellow to dull rufous ♀, in the dark ♀ ♀ all the femora and tibiæ often obfus-

cated and the hind tibiæ brown. *Wings* hyaline, veins rather fine, the principal veins generally brownish, sometimes even in the darkest specimens yellowish hyaline. Areolet large, distinct. Radial area closed, about twice as long as wide, with the areolet placed ⅓ of the way from its base.—Length ♂ .07—.10 inch. ♀ .07—.14 inch.

Thirteen ♂, thirty-one ♀. Came out from the gall *q. podagræ* n. sp. May 10—15, and very numerous specimens subsequently. I ascertained by keeping the pale ♀ ♀ four days alive and exposed to the light, that the pale color did not become darker, and I noticed very dark ♀ ♀ that must have hatched out within 24 hours. Similar variations occur also in *C. q. spongifica*, whence we may infer that the rust-red color there is not due to immaturity. Comes very near to *S. lignicola* O. S., which was bred from a woody gall on q. palustris, but differs as follows:—1*st*. That species, described from "numerous specimens," has its ground color always "yellow." 2*nd*. The last joint ♀ antennæ in *rhoditiformis* never shows "*two* slight sub-divisions" and not often even *one*. 3*rd*. The collare in *rhoditiformis* always has a large dorsal black spot, instead of being immaculate as is specially mentioned of *lignicola*. 4*th*. Nothing is said under *lignicola* of the very remarkable "ventral valve" found in *rhoditiformis*.—This insect is of a much more robust habit than either *S. oneratus* or *S. mendax*, and as the ♀ antennæ have one joint less than in those two species, and the ventral valve is so remarkably developed, it might perhaps form a separate genus. Since, however, in Cynipidæ there are already far too many imperfectly characterized genera, I prefer to refer it provisionally to *Synerges*.

Rock Island, Illinois, Feb. 15, 1864.

ERRATUM.

Page 459, line 8 from bottom, for "Dorcatoma" read "Decatoma."