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Alfred Charles Kinsey, Kenneth D Ayres

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VARIETIES OF A ROSE GALL WASP. By ALFRED C. KINSEY and KENNETH D. AYRES.

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Studies of Some New and Described Cynipidæ (Hymenoptera)[1]

By ALFRED C. KINSEY, *Assistant Professor of Zoölogy in Indiana University*

THIS paper, with the appended paper, offers descriptions of 107 American gall wasps, 70 of which have not been previously described, revises *Plagiotrichus*, a genus not heretofore recognized in the American fauna, recognizes one new genus, *Heterœcus*, and offers some data on the variation, distribution, life histories, and phylogeny of the insects. Seventy of the cynipids described are from the Pacific Coast of the United States.

Probably the most notable departure in this paper is the recognition of varieties. No varieties have been recognized previously in American Cynipidæ, and only a very limited use has been made of them in Europe. This is too true for most fields of entomology. Two practices have been followed: closely similar forms have been considered as haphazard variations of one species; or varieties have been considered as distinct species, as have 18 of the varieties treated in this paper, belonging to seven species. However, variations are usually orderly and abrupt, and much biologic data has been buried by ignoring minor differences. In many cases where the related forms were described as distinct it was due to ignorance of previously described forms, and they have been maintained as distinct by later workers thru continued ignorance of the meanings of the descriptions. Most of these descriptions are truly unusable because they make no comparisons with other forms, and usually fail to describe the very characters in regard to which there is any variation. Great confusion has been introduced by the reduction to synonomy of these related things; in the process much biologic data has been scrapped, not to be recovered without difficulty. I acknowledge having copied all of these practices in my own previous publications.

[1]Contribution from the Zoölogical Laboratory of Indiana University No. 186 (Entomological No. 2).

It cannot be hoped that I have now entirely untangled the confusions regarding even the species treated in this paper, but perhaps my method will ultimately prove profitable.

By the use of trinomials the specific unity of a group is recognized, and means are provided for the introduction of comparisons to discover the character of the variations and possibly some of the factors; to distinguish differences in physiologic characters such as host preference, gall form, date of emergence, and occurrence of heterogeny, in regard to all of which closely related varieties may vary; and to give a basis for the understanding of questions of distribution. The only possible objection to the recognition of varieties will be the less convenient nomenclature necessary, but this is not a great consideration in view of the advantages of the practice.

In recognizing the limits of varieties these are the general rules I follow: (1) The morphology of the adult insect, rather than the gall characters or other such data, is the prime consideration. (2) Any character, no matter how trivial or intangible, is of importance if it is constant in any large proportion of individuals. (3) No variety is based on trivial morphologic characters alone; physiologic characters as expressed in the structure of the gall, in the choice of host, geographic distribution, or other general biologic characteristics always contribute evidence for a similar interpretation. (4) Conversely, no single sort of biologic data, nor set of such data, is the basis for recognizing a variety unless it is paralleled by morphologic evidence. (5) No variety has been designated unless at least one of the varieties of the species is represented by material from more than one locality. If there is any exception to the above rules, it is because the data of certain sorts are overwhelmingly good for the attitude taken. Statistical methods applied to lesser differences may disclose the existence of still further order in variation. I have not employed this method simply because other, more important problems with Cynipidæ demand our present attention, and are likely to do so for some time.

The question of host relationships of cynipids is considerably cleared up by this treatment of varieties. It appears that some species show no constant variation (unless possibly discernible by statistical methods) when occurring upon different oaks in the same region, while other species have de-

veloped distinct varieties on each host. In this case the amount of host variation is usually less than that of geographic varieties, but sometimes it is more. In every case the varieties of a single species are confined to either white or to black oaks, altho closely related species may occur on oaks of both groups.

Many undescribed varieties have been previously overlooked because of a charming lack of knowledge of faunal areas and possible factors of distribution. It would be the rankest sort of farce to delimit faunal areas on the basis of the published records of distribution of Cynipidæ, based on determinations which neglect varietal differences! We have yet to learn that some of the distribution work has no better foundation than such careless taxonomy. It now appears that each variety is restricted to a limited, more or less continuous geographic area; in no case does a single variety extend over more than one faunal zone, and in only two or three of the Cynipidæ I have studied does more than a single variety of one species occur in a single faunal area. These areas I have of necessity in part defined by studying Cynipidæ themselves, when the several species of a region prove to agree most remarkably in the extent of their range. A consideration of the ranges of other organisms has been of some help in these interpretations, but there is not much trustworthy literature available. For the Pacific Coast good work on oaks has been done by Jepson (1910, Mem. Univ. Calif., II, pp. 202-241), and there is a remarkable study of the distribution of beetles by Van Dyke (1919, Ann. Ent. Soc. Amer., XII, pp. 1-12). My studies of Cynipidæ very largely bear out Van Dyke's conclusions as far as we have covered the same fields. Undoubtedly many factors have contributed in limiting the distribution of cynipid species. Host distributions do not appear to have had much if any positive influence, altho acting negatively to some extent, as when oaks are entirely absent from a region. I must admit some prejudice for believing that the past geologic history of an area is the most potent factor in present distributions. The newer country, geologically, appears to possess the newer varieties. All of these questions I shall consider in detail after a further study of Cynipidæ.

The genera of Cynipidæ have always needed revision, and the introduction of two terms new to American literature is

part of my program of revision of gall wasp genera. All of the generic terms used in this paper define distinct, phylogenetic groups with the exception of the term *Andricus*. A good genus *Andricus* can be separated some day, building about the type species, but until then the term covers a waste basket. I do not mean to imply the close relationships of the species here placed in *Andricus*, but rather to indicate that their generic positions cannot yet be defined. I employ *Cynips* to indicate a good genus, of which *Cynips folii* Linnæus is the type (designated by Westwood, 1840, Synop. Gen. Brit. Ins., p. 56, and reaffirmed by Rohwer and Fagan, 1917, Proc. U.S. Nat. Mus., LIII, p. 364). The majority of the species placed by both European and American authors in *Cynips* do not belong to that genus, and some of those placed in *Dryophanta* Förster (isogenotypic with true *Cynips*) and *Diplolepis* Dalla Torre and Kieffer (not *Diplolepis* Geoffroy!) belong to true *Cynips*. *Cynips* is here used in a restricted sense which I shall more fully explain later. I am not using the name *Callirhytis* because its type is unrecognizable. In the original establishment of the genus Förster included his *Callirhytis hartigi* and designated it as type. *Hartigi* was poorly described, without a host record, and without a locality record, altho probably the insect came from Germany. As far as I know, the insect has never again been recognized. Later authors have more or less generally adopted characters to restrict the term, particularly that of a simple tarsal claw. However, it is not known whether *hartigi* had simple or toothed claws, and until we again recognize that species the later restrictions on the term *Callirhytis* cannot have any standing. Certain it is that the group as generally defined today in no sense defines a phylogenetic unit, and is meaningless. I prefer to reduce these meaningless terms, and shall use only *Andricus* in that way.

Some years ago I heard Dr. W. M. Wheeler remark that what we needed in taxonomy was not longer, more detailed descriptions, but pointed comparisons of related forms. These comparisons are possible only when much material is available. As far as possible I have used the method, and I think with highly satisfactory results.

I have no interest in taxonomy *per se*, for it is not a science concerned with questions of cause and effect. But until the foundation of cynipid taxonomy is developed we shall not be

able to build the structure of cynipid biology. The students of cynipid taxonomy must be the ultimate critics of the biologic hypotheses we build, and for that reason I have included a considerable body of biologic data with the taxonomic record of each insect. These data are brought together in the index. After the taxonomists have criticized, I shall draw these data together into a more general form.

The material on which these studies are based was mostly collected during 1919 and 1920 while I held a Sheldon Travelling Fellowship of Harvard University. Fully half of the new Cynipidæ I obtained at that time are not yet described, and the volume of biologic data is not yet touched. This is the second paper I have based largely on this material, the first having been published recently (1922, Bull. Amer. Mus. Nat. Hist., XLVI, pp. 279-295), and others should follow soon. Great credit is due the Harvard University authorities, especially Dr. William Morton Wheeler, who made the trip possible.

Eleven of the new varieties are described from material which was collected and bred by Dr. J. T. Patterson, of the Zoölogy Department of the University of Texas. Dr. Patterson is undertaking probably the most extensive work which has yet been done on cynipid life histories and genetics. I greatly appreciate the opportunity to describe his material, most of which I have not yet been able to study. Mr. C. W. Johnson, of the Boston Society of Natural History, Mr. William Beutenmuller, and Dr. A. L. Melander collected types, each of one of the new varieties.

A great number of friends have contributed largely to my work. Mrs. Kinsey has generously contributed encouragement, time, and skillful criticism. I have secured gifts or loans of material, particularly types, and other favors from the Museum of Comparative Zoölogy, the American Museum of Natural History, Mr. S. A. Rohwer and Mr. L. H. Weld at the U.S. National Museum, Dr. Isabel McCracken at Stanford University, Pomona College, Professor A. Trotter of Portici, Italy, and a host of friends who are not biologists. Mr. Frank A. Leach, of Diablo, Calif., is sending me material. Dr. F. E. Lutz and Mr. Andrew J. Mutchler, of the American Museum, have especially aided the work. The authorities of Indiana University, particularly the members

of the Zoölogy Department, have been liberal in their encouragement and material help. Mr. S. B. Parish, then of San Bernardino, Calif., introduced me to the Pacific Coast oaks. Dr. Forrest Shreve helped very considerably in my travel in Arizona. Mr. W. H. Vance and Mrs. I. T. Wilson have capably worked in mounting my material for study. For all of this help I am greatly indebted. Most of this work would have been impossible without such coöperation. I have not had access to the paratypes in the private collections of two of the cynipid workers, and I feel that if any injustices have been done their species some of the blame is due them.

The holotypes of all these new Cynipidæ, with one exception, are in The American Museum of Natural History. Paratypes have been distributed as widely as possible among the museums, and I shall be glad to lend or give paratypes or other material, as long as it is sufficient, to students of these insects. Any material of these species labelled cotypes should be considered paratypes.

Andricus californicus (Bassett)

FEMALE.—Brownish rufous, head and thorax hairy; median groove about lacking; areolet large; first abscissa of the radius sharply angulate; length 3.0-5.0 mm. HEAD: Distinctly narrower than the thorax, broadened behind the eyes; light to dark brownish rufous, tips of the mandibles piceous to black; finely rugose, smoother about the eyes, most rugose between the eyes and the mouth, not densely hairy, almost naked on the front. Antennæ pubescent, with 14 or 15 segments, the second almost globose, the third one-third longer than the fourth, the last almost twice the length of the preceding. THORAX: Light to dark brownish rufous; mesonotum punctate and coriaceous, not densely hairy; parapsidal grooves distinct, complete or incomplete; median groove very short or lacking; anterior parallel lines fine, distinct; lateral lines moderately broad, smooth, naked; scutellum somewhat longer than wide, well rounded posteriorly, rugose, hairy, the anterior depression rugose, smoother laterally, forming more or less distinct foveæ; pronotum laterally rugoso-punctate, hairy; mesopleuræ rugose dorsally, mostly smooth and finely rugoso-punctate, scatteringly hairy. ABDOMEN: Smooth; finely and microscopically punctate posteriorly, naked except for patches of hairs latero-basally, hairs on the edges of the posterior segments, and on the ventral spine and valves; longer than broad, somewhat produced dorsally; second segment covering not more than half the area, edges of segments oblique, well rounded ventrally; ventral spine rather long, slender. LEGS: Including the coxæ, uniform in color with the rest of the body; tarsi darker; rather densely hairy; tarsal claws strong, toothed. WINGS: Slightly tinged yellow, most so in the radial and

cubital cells; anterior margins rather short-ciliate; veins brown; areolet moderately large; cubitus not reaching the basalis; radial cell moderately short, open; the second abscissa of the radius somewhat curved, the tip parallel with the margin for a short distance; first abscissa sharply angulate at almost 90°, with hardly any projection. LENGTH: 3.0-5.0 mm.

GALL.—Large, globose to reniform, smooth, twig gall. Monothalamous, or polythalamous, containing from one to a dozen larval cells. Irregularly rounded, ovate, ellipsoid to reniform, all sizes, up to 65. mm. in diameter by 113. mm. long; the surface smooth, sparingly, shallowly roughened; reddish to yellow and brown. Internally more or less filled with compacted, soft, crystalline, brown, yellow, or white material, woody from the point of attachment to above the center of the gall; the larval cells oval, averaging 4.-5. mm. long by 3. mm. wide, more or less radiantly in the woody tissue, toward the center of the gall. Laterally, on twigs of several white oaks.

RANGE.—From the Mexican border of California to Washington.

The most apparent differences between the varieties of this species are those of color and size. That we may have underestimated the constancy of these characters with some species is indicated by the absolute correlation of these differences with the physiologic differences and geographic distribution.

An astounding structural characteristic of one of the varieties is the complete parapsidal groove; the other varieties have the groove terminating very distinctly midlength of the thorax.

The occurrence of variety *californicus* upon two hosts without consequent variation, and the possible occurrence of *fructiformis* upon two more distinct hosts (as discussed under that variety), offer data concerning the non-influence of hosts upon the insect, and further confirm the idea that the gall is specific for the insect producer, without evidence of direct host influence.

The most important problem which this species may illuminate is that of the nature of alternation of generations. As discussed for each of the varieties, the northern forms quite certainly have alternate generations, but in the southern form the close concurrence of emergence dates and the appearance of fresh galls make it seem possible that there is no alternation of generations in the perpetually warm climate of southern California. If this is demonstrated it will confirm my opinion previously expressed (1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 372) that alternation of generations

is an extreme development of seasonal dimorphism. With such large adults, and monstrous and abundant galls as this species has, it should not be a difficult matter for some one on the field to experimentally discover this life history.

Andricus californicus variety **californicus** (Bassett)

Cynips Q. Californica Bassett, 1881, Can. Ent., XIII, p. 51. Riley, 1881, Amer. Nat., XV, pp. 402, 403.

Andricus californicus Mayr, 1881, Gen. gallenbew. Cynip., p. 28. Ashmead, 1885, Trans. Amer. Ent. Soc., XII, pp. 295, 304. Ashmead in Packard, 1890, 5th Rpt. U.S. Ent. Comm., p. 110. Dalla Torre, 1893, Cat. Hymen. Cynip., II, p. 81. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 62. Kellogg, 1914, Amer. Ins., p. 472, fig. 665. Thompson, 1915, Amer. Ins. Galls, p. 8. Felt, 1918, N.Y. Mus. Bull., 200, p. 62.

Andricus (Callirhytis) californicus Ashmead, 1885, Trans. Amer. Ent. Soc., XII, p. 294. Ashmead in Packard, 1890, 5th Rpt. U.S. Ent. Comm., p. 105.

Callirhytis californica Ashmead, 1887, Trans. Amer. Ent. Soc., XIV, p. 132.

Callirhytis californicus Beutenmuller, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 25.

Andricus quercus-californicus Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 531, 803. Trotter, 1910, Boll. Lab. Portici, V, p. 111. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 346; 1912, Journ. N.Y. Ent. Soc., XX, pp. 275, 280.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color almost entirely light brownish rufous; antennæ slightly darker than the head, darkest midlength, rather short, distinctly enlarged terminally, with only 14 segments; parapsidal grooves moderately broad at the scutellum, becoming finer anteriorly, not extending much more than half the length of the mesothorax; median groove lacking; scutellum with the anterior depression rugose, smoother laterally, but hardly forming distinct foveæ; length 4.0-5.0 mm.

GALL.—Differs from the galls of other varieties of the species as follows: Color light brownish tinged slightly reddish, to light straw yellow, usually yellow, weathering dark brown to black; usually more completely filled with the crystalline material than in other varieties. Very young galls cause a lateral swelling of the stem which often becomes 4. mm. or more high before the bark breaks; young galls are very succulent, red when first breaking thru; old galls persist on the trees for years. Maximum length observed, 113. mm. On *Quercus lobata* and *Q. Douglasii.*

RANGE.—Between the ranges of the other varieties. California: Grant (Trotter); Exeter, Three Rivers, Merced Falls, El Portal, Paso Robles, Byron, Oakdale, Gilroy (Redwood School), Palo Alto, Redwood

City, San Francisco; Mt. Diablo (F. B. Leach coll.); Santa Rosa, Napa, Galt, Oroville, Redding. Possibly a distinct variety occurs from San Francisco north.

TYPES.—Adults and galls at the Philadelphia Academy, The American Museum of Natural History, the Museum of Comparative Zoölogy, and in the Beutenmuller collection (?). Redwood City, California; 1878 and 1880; "*Q. Hindsii?*" (=*Q. lobata*); Wm. Sutton collector.

The adult of this variety is morphologically very similar to *spongiolus*, except in color, but it has a very distinct range and (consequently?) distinct hosts. The young galls were just beginning development at Palo Alto on March 13, and further north at Galt on March 29; adults emerge in October. Very probably an alternate generation occurs with a life history of at least five months.

The two oaks on which this variety occurs are distinct but not unrelated species, are confined to the same geographic area, and have about the same distribution, tho one occurs in somewhat different soil and averages a different elevation above sea-level. Under such circumstances it appears possible for a cynipid to inhabit both oaks without consequent variation, for as far as the material I have seen would show there are not apparent differences between insects and galls from *Quercus lobata* and *Q. Douglasii*.

Andricus californicus variety **spongiolus** (Gillette)

Andricus spongiola Gillette, 1894, Can. Ent., XXVI, p. 235. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 65; 1910, Das Tierreich, XXIV, pp. 529, 803, 830. Thompson, 1915, Cat. Amer. Ins. Galls, pp. 8, 34. Felt, 1918, N.Y. Mus. Bull., 200, p. 62.

Andricus quercus-californicus Swezey, 1916, Proc. Haw. Ent. Soc., III, p. 222.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color almost entirely dark rufous brown, blackish in the foveal depression and on the metathorax; antennæ very dark brown or blackish, "15-jointed" (according to Gillette); parapsidal grooves rather fine, even at the scutellum, not extending much more than half the length of the mesonotum, median groove very short or lacking; scutellum with the anterior depression forming more or less smooth, indistinctly bounded foveæ; length "5 mm." (according to Gillette).

GALL.—Differs from the galls of other varieties of the species as follows: Color light straw yellow to a unique, salmon yellow, weathering dark brown to black; occasionally bearing a few, short, blunt, tuberculate projections; internally usually softer than in the other varieties,

more often not completely filled, the tissue whiter; galls more often smaller and in compact clusters, thus becoming greatly compressed and flattened basally; maximum length observed 92. mm. On *Quercus garryana.*

RANGE.—North of the other varieties. California: Yreka. Oregon: Ashland, Grants Pass, Roseburg, Junction City, Canby; Eugene (Swezey). Washington: Olympia (Gillette); White Salmon.

TYPES. C. P. Gillette collection (?).

The adult is distinguishable from the adult of variety *californicus* primarily in color, but this difference is not as insignificant as it might seem for it is constant and is correlated with a physiologic difference shown in the gall, and a very distinct geographic range and (consequently?) distinct host. Swezey reported live adults cut from galls in July; Gillette had adults emerge thru November; I failed to find young galls yet developing on April 15. Very probably an alternate generation occurs with a life period of at least six months.

Andricus californicus variety **fructiformis,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color almost entirely brownish rufous, only slightly darker than in variety *californicus,* sometimes blackish on the anterior parallel and lateral lines and in the foveæ; whole antennæ almost black, distinctly longer than in the other varieties, not particularly enlarged terminally, with 15 distinct segments; parapsidal grooves moderately narrow at the scutellum, finer anteriorly, but distinct to the pronotum (!); scutellum with quite distinct foveæ, wholly smooth laterally, separated anteriorly by a fine ridge; length 3.0-3.7 mm.

GALL.—Differs from the galls of other varieties of the species as follows: Color always red or reddish brown, very brilliant apple red when fresh; internally with large cavities, the little tissue which it contains, other than the woody core, being brittle, dark, resinous, appearing fused; galls usually small and monothalamous, tho the maximum length observed is 90. mm. On *Quercus dumosa.*

RANGE.—South of the other varieties. California: Descanso, Alpine, Fallbrook, Sorrento, El Toro, Upland, Pasadena, Paso Robles.

TYPES.—12 females, 30 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, Stanford University, and with the author. Galls at the Museum of Comparative Zoology, and the Philadelphia Academy. Labelled El Toro, California; February 14, 1920; *Q. dumosa;* Kinsey collector.

Morphologically the insects of this variety are remarkably similar to those of other varieties except in color and

size, and in having a complete parapsidal groove. Inasmuch as the difference between a distinctly incomplete and a distinctly complete parapsidal groove has been considered of generic significance among several groups of Cynipidæ, it is very significant to find both conditions among varieties of a single species, and possibly within this single variety. Insects from Pasadena material agree with El Toro material. Variety *intermedius* comes very close to this variety.

The Descanso record, based on galls alone, may need further investigation, for there is indication from other sources that a distinct faunal area occurs in the very southern part of California. Galls taken on *Quercus lobata,* at the Encino Ranch near Zelzah, appear to be of this variety rather than of *californicus,* which is the variety normally on *lobata.* I do not have insects from these galls, so I cannot be sure of their relations. If further collecting proves they are *fructiformis* we shall have an extremely important case of the same species occurring on quite different oaks without material effect by the host upon the insect. This is an extreme southern station for *Quercus lobata,* and is quite distant from other stations. A very low pass between the Sierra Madre and the Santa Monica Hills connects this part of the San Fernando Valley with southern California.

A few insects had not emerged at Upland on February 3; in the same latitude, a few adults emerged from the Pasadena galls after February 7, tho most of them had emerged previously. Forty miles south of Pasadena, at El Toro, on February 14, many of the galls contained live adults, with some of the insects previously emerged. At the same time young galls were found in several stages of development. At Fallbrook, by February 26 all the adults had emerged, and fresh galls grown almost to full size were abundant. The emergence period then seems to be early February, earlier in the north; the fresh galls soon appear, rapidly attaining a considerable size. It is possible that an alternate generation takes just about one or two years for its life; but it is also possible that the fresh galls of late February are the products of eggs laid by the adults emerging in early February, without an alternate generation's intervening. If the Zelzah material proves of this variety, there will arise the further question of a difference in life history there. Tho the old galls

were very abundant at this place on March 3, no new galls were in evidence.

Undoubtedly this distinct variety, previously undescribed, has been repeatedly observed by numerous entomologists, including collectors of Cynipidæ, but it and its inviting problems of such general biologic import have probably been dismissed with the remark, quoting from the literature: "The familiar 'oak-apple' ".

Andricus californicus variety **intermedius,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color rich rufous brown, mostly dark, darker than in any other variety, blackish on the lateral lines, in the foveæ, on the edges of the mesopleuræ, on the abdomen dorso-basally, and elsewhere; antennæ dark brown, only somewhat enlarged terminally, not very short, with only 14 segments; parapsidal grooves fine at the scutellum, finer anteriorly, extending only two-thirds to the pronotum; median groove lacking; scutellum with the anterior depression partly smooth and shining, forming quite distinct foveæ; areolet of moderate size, distinctly smaller than in *fructiformis;* length 3.7 mm.

GALL.—Practically identical with the galls of variety *fructiformis.* On *Quercus dumosa.*

RANGE.—California: San Bernardino Mountains. Probably confined to this mountain range.

TYPES.—1 female, 7 galls. Holotype female, paratype gall at The American Museum of Natural History; paratype galls at Stanford University, the U.S. National Museum, and with the author. Labelled San Bernardino, California; January 31, 1920; Kinsey collector.

Most of the adults had emerged by January 31, but one live female was still in the gall. The galls were abundantly eaten into, probably by birds.

This variety shows evident relationship to variety *fructiformis,* but is astounding in its distinctness. The galls of the two are remarkably similar. Tho *fructiformis* has complete parapsidal grooves, this closely related variety has distinctly incomplete grooves, further emphasizing the lack of generic value to this character. There is no indication in this variety of a division in the fourteenth segment of the antenna, and *fructiformis* regularly shows fifteen distinct segments.

Intermedius may be largely confined to the San Bernardinos, as are most other varieties of cynipids found in that range, as far as we know. Of all instances of this remarkable distribution, *intermedius* furnishes one of the most distinct.

Andricus dimorphus variety **verifactor,** new variety

Cynips vacciniiformis [gall only!] Beutenmuller, 1913, Trans. Amer. Ent. Soc., XXXIX, p. 247. Felt, 1918, N.Y. Mus. Bull., 200, p. 80.

FEMALE.—Hairy; parapsidal grooves not continuous, smooth at bottom; foveæ distinct; areolet large; most of the wing veins faint. HEAD: Not as wide as the thorax, somewhat enlarged behind the eyes; rufo-piceous, almost black toward the mouth; finely roughened, shallowly and finely rugose on the face; distinctly hairy except on the vertex; without malar groove. Antennæ brownish, darker in places, especially terminally; distinctly but not greatly thickened terminally; with 14 segments, the second slightly elongate, the third half again as long as the fourth, the last not quite twice the length of the preceding. THORAX: Wholly black; mesonotum finely coriaceous and rather closely punctate and hairy; parapsidal grooves moderately broad posteriorly, rather shallow, smooth at bottom, arcuately convergent posteriorly, finer anteriorly, extending only half way to the pronotum; median groove lacking; anterior parallel lines not prominent, slightly divergent posteriorly; lateral lines rather broad, not quite smooth; scutellum longer than wide, moderately rounded posteriorly, finely coriaceous rugose, punctate, and hairy, a slight median ridge indicated posteriorly; foveæ distinct but shallow, quite rounded, smooth at bottom, rather broadly separated; pronotum rugoso-striate laterally; mesopleuræ hairy and punctate about the edges, centrally more smooth and naked, limitedly aciculate in the very center. ABDOMEN: Piceous to black, browner posteriorly, the second segment smooth, with patches of hairs latero-basally, the other segments microscopically punctate and mostly naked; distinctly longer than high, not produced dorsally, the second segment covering two-thirds of the area, its posterior edge almost vertical, rounded ventrally; ventral spine long and slender, ventral valves at about 60°. LEGS: Piceous black, yellow brown at the joints and on the tibiæ and tarsi of the front and middle legs; hairy; tarsal claws of moderate weight, simple. WINGS: Clear; only the hind margins ciliate: long and rather narrow; subcosta and cross-veins light brown, the others fine and faint; areolet of moderate size or larger; cubitus not continuous; radial cell open, moderately long and wide, the second abscissa of the radius rather distinctly curved, the first abscissa distinctly angulate, without a projection. LENGTH: 2.2-3.2 mm., averaging nearer 3.0 mm.

GALL.—Clustered, seed-like leaf galls. Each gall monothalamous, elongate, rather cylindrical, urn-shape, broadest at the middle, less broad apically, flattened at the end, taper-pointed basally, up to 4.0 mm. in diameter by 6.0 mm. in length; colored dark green when young, becoming a dark red or purplish red when old. Mostly solid and fleshy when young, becoming hard, thin-walled, and hollow when old, without a distinct larval cell lining. In compact clusters of up to 30 galls, attached to the midrib, on the under sides of leaves of *Quercus stellata* (and *Q. breviloba*?).

RANGE.—Texas: Buffalo, Hearne, Elgin, (Leander?), Austin.

Probably thruout more eastern Texas and a part of Oklahoma and Louisiana.

TYPES.—36 females, 3 pins of galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls with the author; paratype females at the U.S. National Museum, Stanford University, the Philadelphia Academy, and the Museum of Comparative Zoology. Labelled Austin, Texas; February 12 to March 8, 1922; *Q. stellata;* Patterson collection number 6.

This gall is very common on the post oaks in Texas. Patterson states that the punctures from which the galls will arise may be detected about the first of May, that the galls do not develop from the scars until about the middle of July, that the galls are fully grown in size by the first of October, and in a couple of weeks most of them fall to the ground. I have collected them in late November and December, but the larvæ are then still so small that they do not mature after becoming dry. Evidently they need to be kept moist, as they are when lying on the ground, to allow the insect to develop. Patterson secured over a hundred adults which emerged from February 12, 1922, to March 8. Inasmuch as the breeding of the insect is difficult unless carefully handled on the field, we are considerably indebted to Dr. Patterson for successfully rearing the adult.

I collected the galls, but did not obtain the insects from the other Texas localities listed. It is possible but not probable that other varieties occur at some of those points. The gall occurs on *Q. breviloba* at Leander, and Patterson reports it as occasionally on *breviloba* at Austin. It is not unlikely that the *breviloba* insect is a distinct variety with a range centering about Burnett County, Texas.

This is certainly a variety of *Andricus dimorphus,* described as a *Cynips* (Beutenmuller, 1913, Trans. Amer. Ent. Soc., XXXIX, p. 245) from galls taken by Weld at Evanston, Illinois, on *Q. macrocarpa.* Similar galls have been recorded and are common on white oaks of many species from the whole of eastern United States. Unfortunately I cannot examine the types of *dimorphus,* and cannot furnish a comparative description. Probably several different varieties occur in several faunal areas, and possibly different varieties on different hosts. This variety appears to differ from *dimorphus* in having the thorax less roughly rugose, the parapsidal grooves and lateral lines smooth, and the first abscissa of the

radius not infuscated. Probably an examination of the *dimorphus* type would modify this comparison and disclose other points of difference.

Cynips vacciniiformis was described from *Q. stellata* galls which are undoubtedly those of *verifactor*, and from Austin. But the description of the single insect obtained is far from correct for the true producer of this gall, and apparently applies to a different species mistakenly supposed to have come from *verifactor* galls. *Vacciniiformis* was described in 1913. Of course insects bred from galls collected in 1917 and now labelled cotypes in at least a couple of collections, cannot have any standing as type material.

Andricus lasius (Ashmead)

FEMALE.—Mostly rufous, head and thorax moderately hairy, antennæ with 14 or 15 segments; median groove almost lacking; cubitus very faint, short; length under 2.5 mm. HEAD: Not quite as wide as the thorax, distinctly enlarged behind the eyes; lighter or darker rufous, darker on tips of mandibles; finely rugose, scatteringly hairy, front almost naked. Antennæ brown, lighter basally; hairy; with 14 or 15 segments, the first not especially long, the second globose, the third not much longer than the fourth, the last more than twice the length of the preceding or incompletely divided. THORAX: Entirely yellow rufous; moderately hairy; mesonotum punctate, parapsidal grooves distinct, gradually convergent posteriorly, only gradually divergent anteriorly; median groove almost lacking, brokenly indicated at the scutellum; anterior parallel lines barely indicated, lateral lines distinct, long, smooth, and naked; scutellum elongate, broadest almost at the posterior end, shallowly punctate to rugoso-punctate; the basal foveæ narrow, smooth at bottom, divergent, widely separated; pronotum laterally finely rugoso-punctate; mesopleuræ smooth, punctate, finely rugose beneath the tegulæ, less densely hairy. ABDOMEN: Lighter or darker rufous, darkest dorsally, smooth, hairy latero-basally, on the ventral spine, and on the ventral valves; edges of segments almost vertical, the ventral edges only slightly rounded, ventral spine short, blunt. LEGS: Yellow rufous, middle and posterior tibiæ and all tarsi darker; quite hairy; tarsal claws moderately heavy, toothed. WINGS: Clear, hairy, the margins ciliate; cross veins and subcosta brown; areolet of moderate size; cubitus very faint, not extending half way to the basalis; radial cell open, rather long, second abscissa of the radius distinctly curved; first abscissa arcuate-angulate. LENGTH: 2.0-2.5 mm.

GALL.—A more or less globular, wool-covered, leaf gall. Polythalamous, with a half dozen or fewer cells. Roughly globular, flattened basally, 10. mm. in diameter, covered with short, dense wool about 2. mm. thick, the wool at first bright golden brown, weathering light gray or black. Internally hard, woody, solid except for the larval cells, which

average 2.5 x 1.5 mm., and which are arranged rather radiantly about the mid-point of the base. Attached by a slight projection of the woody gall to the mid-vein or often to the petiole, occasionally two together, on either surface, usually on the under surfaces of leaves of *Quercus chrysolepis*.

RANGE.—California: El Toro to Ukiah and Dunsmuir.

I cannot fix characters which will distinguish the galls of the varieties, for they are very similar. Here is an instance of the physiologic measure of the insect varying less than does the morphologic. Morphologically the varieties are also very similar. What differences do exist are correlated with the occurrence of the faunal areas.

Andricus lasius variety **lasius** (Ashmead)

Callirhytis lasius Ashmead, 1896, Proc. U.S. Nat. Mus., XIX, p. 132. Thompson, 1915, Amer. Ins. Galls, pp. 20, 29. Felt, 1918, N.Y. Mus. Bull., 200, p. 115.

Callirhytis lasia Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 66; Das Tierreich, XXIV, pp. 567, 815, 829. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 356.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Almost entirely yellow rufous, antennæ light brown, rufous basally; parapsidal grooves rather less closely convergent at the scutellum; abdomen yellow to brownish rufous, darkest dorsally, about as wide as long, the second segment covering more than half the area; middle and posterior tibiæ and all tarsi brownish; wing veins light brown, first abscissa of the radius bent very close to the subcosta; areolet moderately large.

GALL.—Does not differ particularly from galls of the other varieties.

RANGE.—California: Dunsmuir(?), Auburn, Placerville. Probably occurs in the central Sierras, north of El Portal, wherever *Q. chrysolepis* occurs.

TYPES.—Females and galls; in the U.S. National Museum; labelled No. 3091. Placer County, California; December 19, 1885; Albert Koebele collector.

The above descriptions are made from types of this variety and from my material. Ashmead bred adults December 19, and January 2; in the Museum of Comparative Zoölogy is material bred December 15, by Dr. I. McCracken. All but a very few of the adults had emerged before my collecting in March and April; these very few other adults died without emerging. The most northern record, Dunsmuir, is for galls only; adults from that locality may prove to be of still another variety.

Andricus lasius variety sublasius new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Almost entirely rufous brown, antennæ dark brown, almost black, brownish rufous basally; parapsidal grooves rather more closely convergent at the scutellum than in either other variety; abdomen dark rufous brown, darker dorsally, more elongate, longer than high, second segment not covering half the abdomen; tibiæ very dark brown; wing veins darker brown, the first abscissa of the radius bent nearly midway between the subcosta and areolet; areolet moderately large.

GALL.—Does not differ particularly from galls of the other varieties.

RANGE.—California: San Bernardino. Probably confined to this range of mountains.

TYPES.—7 females, 11 galls. Holotype female, paratype female, and galls in The American Museum of Natural History; paratype females and galls in Stanford University, the U.S. National Museum, and with the author. Labelled San Bernardino, California; January 31, 1920; Kinsey collector. All the adults were cut from the galls.

Andricus lasius variety areolaris, new variety

Acraspis n. sp. Trotter, 1910, Boll. Lab. Portici, V, p. 106, pl. 1, figs. 16, 19, 20.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Almost entirely rufous brown; antennæ dark brown, almost black; parapsidal grooves not as closely convergent at the scutellum as in *sublasius;* abdomen dark rufous-brown, longer than high, the second segment covering about half the area; tarsi brownish rufous; wing veins about as heavy as those of *sublasius;* the first abscissa of the radius bent about midway between the subcosta and areolet; areolet somewhat smaller than in other varieties.

GALL.—Does not differ particularly from galls of the other varieties.

RANGE.—California: Yosemite, Pasadena (Trotter); El Portal, San Jacinto Mountain, El Toro. Probably occurs thruout the southern Sierras and their extensions, from El Portal south, except in the San Bernardino and Cuyamaca mountains.

TYPES.—1 female, 10 galls. Holotype female, paratype galls in The American Museum of Natural History; paratype galls at Stanford University, the U.S. National Museum, and with the author. Labelled El Portal, California; March 26, 1920; Kinsey collector.

This insect shows a curious combination of the characters of the other two varieties. The records for all localities except El Portal are for galls alone, and their determinations are based on our knowledge of faunal areas indicated by other species.

Andricus operator (Osten Sacken)

FEMALE.—Generally rufous; antennæ with 12 segments; median groove almost lacking; many of the wing veins very faint; areolet about closed. HEAD: Fully as wide as the thorax, distinctly enlarged behind the eyes; rufous, the tips of the mandibles piceous; finely granulose, almost naked of hairs except about the mouth. Antennæ yellowish, slender in the bisexual female, stouter in the agamic female, of moderate length, slightly thicker terminally, with 12 (13) segments, the second shortest but quite elongate, the third only slightly longer than the fourth, the last more than twice the length of the preceding or obscurely divided. THORAX: Of a uniform rufous; mesonotum very finely rugulose rugose, almost naked but with a few, very short hairs; parapsidal grooves widest posteriorly, continuous, rather abruptly divergent anteriorly; median groove almost absent or just discernible at the scutellum; anterior parallel lines barely indicated in the bisexual female; lateral lines fine, smooth; scutellum small, rather longer than wide in the bisexual female, wider than long in the agamic female, rugose, with the two foveæ distinctly separated by a fine ridge; pronotum laterally very finely rugose; mesopleuræ wholly, very finely rugose, aciculated centrally, naked. ABDOMEN: Wholly rufous brown, darkest more posteriorly especially dorsally; smooth, naked, edges of segments finely, faintly punctate; quite a little longer than wide, hardly produced dorsally, and the edges of the segments not far from vertical in the bisexual female; somewhat produced dorsally, the edges of the segments strongly oblique in the agamic female; segment two covering two-thirds of the area; ventral spine fine, rather short; ventral valves toward the vertical. LEGS: Rufous, including the coxæ; tarsal claws rather fine, simple. WINGS: Clear; edges not ciliate; subcosta and cross veins a medium brown, the other veins very fine and faint, the terminal part of the subcosta very faint or lacking; areolet closed; cubitus very short and faint; radial cell of moderate length, slender, open, the second abscissa of the radius almost straight; the first abscissa weakly angulate. LENGTH: Of the bisexual female, 1.7-2.7 mm.; of the agamic female, 3.2-3.5 mm.

MALE.—Differs from the female of the species as follows: Face yellowish; antennæ yellowish, decidedly thicker than in the female, with 14 segments, the third clavate, incised basally, the last not as long as the preceding; abdomen elongate, slender, the second segment covering three-quarters or more of the area; legs yellowish; length averaging less than in the female.

GALL.—An oval larval cell, mostly inseparable from and occupying most of a thin-walled, seed-like capsule. These capsules woolly, clustered in the bisexual generation, naked in the agamic generation, producing the following forms of galls; on eastern American black oaks.

Bisexual Generation: Large, compact masses of wool, irregular in shape, often oval, up to 40. by 55. mm. in dimensions; the hairs at first crisp, succulent; greenish, white, or rose-tinged, sometimes deep red; becoming straw color or golden brown upon aging, finally weathering bluish gray or black, shrivelling considerably. Within the wool,

scattered or in small clusters, mostly toward the center of the gall, are the seed-like capsules with the closely imbedded larval cells, each capsule hard, oval, about 1.5 by 3.0 mm., sometimes 150 or more cells in a gall. On or involving young stems, new clusters of leaves, and especially the flower clusters.

Agamic Generation: The larval cell occupying most of a triangulate or obconical capsule, somewhat compressed, up to 5. by 4. mm. in dimensions, one to six, usually one, between the nut and the cup of the acorn; on all of the black oaks which bear the bisexual generation.

RANGE.—Ottawa to Virginia, Texas, and Illinois. Probably thruout more eastern North America wherever black oaks occur.

The varieties I treat for this species are on a whole more nearly related than are the varieties of most Cynipidæ. There is enough individual variation to make it difficult to definitely determine every individual. Nevertheless series of each variety average rather differently, and material of any variety from separated localities agrees well in its characters.

My first examinations happened to involve material from several oaks, each oak from a different locality. I should have believed the variation in the insects was due to their isolation upon distinct hosts. But three different hosts at Rosslyn, Virginia, give the same insect. The objections to believing each variety restricted to a distinct faunal area are that I have two varieties from Rosslyn, and that the ranges as far as known are intricately connected, at least for three of the varieties. However I rather expect to find that each variety is restricted to a geologically distinct area. Our records are still so few that it is quite possible my present interpretations of this species will need revision, but I hope that the facts have been so distinguished from my hypotheses that others may be able to build on my work.

This species is famous as the first for which an alternation of generations was proved. One generation occurs in large, woolly galls, is bisexual, appears early in the spring, and matures within a couple of months or less. The sexes are probably produced in about equal numbers; of 898 insects of all varieties which we have bred, 447, or just about 50 per cent, are males. These data are not wholly significant, however, because sometimes only a single sex is produced in each gall. Patterson found this for a gall of *austrior*, and collections of other varieties in several museums usually present only one sex. Unless a considerable number of galls are used for breeding, the sexes may be obtained in unequal num-

bers. From 44 galls of variety *consobrinus* I obtained 70 per cent males; and Patterson obtained 90 per cent males for *austrior*! This bisexual generation lays fertilized eggs in year-old acorns, the next generation produces a naked, seed-like, acorn gall, is agamic, and takes two or more years to develop. Superficially the insects and galls of the two generations are so different that this has appeared as extreme a case of heterogeny as we knew. The differences, I now realize, are largely superficial. Upon making the comparative descriptions of the insects I find that they differ in only a relatively few respects; it has been simple to make a description which would cover either generation of the species. Upon further examination, especially of younger stages of the galls, I find that they are much the same except for one being naked and on the acorn, while the other has a woolly covering and occurs on young stems, leaves, or flowers, but both have at center similar seed-like capsules enclosing nearly as large larval cells. I have suggested (1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 373) that heterogeny in Cynipidæ is an extreme development of seasonal dimorphism. At that time I questioned whether one could ascribe the differences in the galls of the two generations of *operator* primarily to the differences in the plant tissues attacked; but now I am ready to believe such may be the case. If, as Cosens has shown (1912, Trans. Can. Inst., IX, p. 374), no new plant structures are developed in the formation of a gall, one should not expect the normally hairless acorn to produce as woolly a gall as the normally pubescent or hairy young stem, leaf, or flower tissues.

The agamic generation has been bred for only one variety, *operator*, but I have acorn galls which probably represent the agamic generations of every one of the varieties here described. The following references are to the bisexual forms of possibly undescribed varieties:

Cynips q. operator Walsh, 1864, Proc. Ent. Soc. Phila., II, p. 494. Thompson, 1915 (Walsh record), Amer. Ins. Galls, pp. 11, 30.

This species has further been recorded (Beutenmuller, 1913, Bull. Brook. Ent. Soc., VIII, p. 103) from Ottawa, and Pennsylvania. I do not know what varieties occur in these locali-

ties. I have material representing some further varieties, but it is not sufficient to warrant description now. Probably several other varieties remain to be described, particularly from more southern regions of North America.

Operator does not belong to the genus *Andricus* in its true limitations. *Operator* has unique generic characters which I have not yet recognized in any other species. Until a complete revision of cynipid genera can be given, it is not desirable to introduce a new genus for this species.

Andricus operator variety **operator** form **operator** (Osten Sacken)

Cynips quercus operator Osten Sacken, 1862, Proc. Ent. Soc. Phila., I, p. 256.

Cynips q. operator Bassett, 1863, Proc. Ent. Soc. Phila., II, p. 332; 1864, Proc. Ent. Soc. Phila., III, pp. 197, 198; 1873, Can. Ent., V, pp. 91, 93, 94; 1877, Can. Ent., IX, p. 121. Riley, 1873, Amer. Nat., VII, p. 519. Howard, 1882, Psyche, III, p. 329. Packard, 1890, 5th Rpt. U.S. Ent. Comm., p. 11.

Cynips operator Osten Sacken, 1865, Proc. Ent. Soc. Phila., IV, pp. 341, 346, 350, 357.

[No name] Bassett, 1880, Can. Ent., XII, p. 170.

Andricus (Callirhytis) operator Mayr, 1881, Gen. Gallenbew. Cynip., p. 28. Bassett, 1882, Amer. Nat., XVI, p. 246. Ashmead, 1885, Trans. Amer. Ent. Soc., XII, p. 294. Ashmead (in Packard), 1890, 5th Rpt. U.S. Ent. Comm., p. 105. Viereck, 1916, Hymen. Conn., p. 429.

Callirhytis operator Ashmead, 1885, Trans. Amer. Ent. Soc., XII, p. 304; 1887, Trans. Amer. Ent. Soc., XIV, p. 131. Ashmead (in Packard), 1890, 5th Rpt. U.S. Ent. Comm., p. 110. Riley, 1895, Sci., I, p. 463. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 66. Thompson, 1915 (O. S. record), Amer. Ins. Galls, pp. 11, 30. Felt, 1918, N.Y. Mus. Bull., 200, p. 72.

Andricus operator Dalla Torre, 1893, Cat. Hymen., II, p. 92. Bassett, 1900, Trans. Amer. Ent. Soc., XXVI, p. 315. Felt, 1906, Ins. Aff. Pk. and Woodl. Trees, II, pp. 618, 622, 713. Britton, 1920, Conn. Geol. and Nat. Hist. Surv. Bull., 31, p. 321.

Callirhytis quercus-operator Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 582, 798, 830.

FEMALE.—Differs from the bisexual females of the other varieties of the species as follows: Head and thorax bright brownish rufous, face yellow rufous, antennæ mostly yellow rufous, slightly darker terminally, parapsidal grooves distinctly wide posteriorly, not quite smooth at bottom, convergent posteriorly; foveæ quite broad, entirely rugose at bottom; mesopleuræ distinctly aciculate centrally; abdomen usually bright rufous basally; length 1.5-2.7 mm.

MALE.—Shows the secondary sexual characteristics of the species but further agrees with the female of this variety.

GALL.—Similar to galls of the bisexual generations of the other varieties. On *Quercus marylandica, Q. coccinea,* and possibly other black oaks.

RANGE.—Virginia: Rosslyn. D.C.: Washington (Osten Sacken). New York; Sullivan County (Beutenmuller collector). Connecticut: Waterbury (Bassett). Possibly thruout a more northern area of eastern United States except in more northern New England and on the Atlantic Coastal Plain.

TYPES.—Females, males, and galls in the Museum of Comparative Zoology; a male in my collection. Washington, D.C.; *Q. marylandica;* Osten Sacken collector.

This variety is closely related to varieties *falsus* and *consobrinus,* from which this insect is to be distinguished by the distinctly broadened parapsidal grooves, the sculptured foveæ, and the distinctly larger size.

Osten Sacken originally described *operator* from *Q. marylandica* (=*Q. nigra* Gray, Ed. 6, not Linnæus). I have it from *marylandica* at Rosslyn, Virginia, altho most of the insects from that host are *consobrinus.* Insects I bred from galls of *Q. coccinea* at Rosslyn, material from an unidentified host in Sullivan County, New York, and Bassett material purporting to be from *Q. ilicifolia* near Waterbury, Connecticut, are quite uniformly of this variety. Apparently it occurs on several of the black oaks, without coincident, constant variations. In regard to coloration, material from each host may average rather differently, but I cannot discover good structural characters to separate host varieties. The distribution appears to be broad, over a part of eastern United States, but we need more data to determine the exact range. I have not seen it from more northern New England, from the Atlantic Coastal Plain, nor from Texas, altho other varieties occur in those places. Its occurrence at Rosslyn, Virginia, in the same locality with *consobrinus,* may indicate a limit of its range. The British Columbia record of Dalla Torre and Kieffer originated in their customary, mistaken interpretation of "D.C." The Bassett material, unfortunately, is not of certain locality or host, for Bassett did not definitely label most of his material and sometimes put into a single box unmounted material from several sources. Whether the *operator* material I have seen is the same as Bassett had when

he recorded *Q. ilicifolia* and *Q. palustris* as the hosts, and when he solved the life history, identifying *operatola* as the agamic generation, I cannot be certain until I can see material certainly collected at Waterbury.

Andricus operator variety **operator** form **operatola** (Bassett)

Cynips q. operatola Riley, 1873, Amer. Nat., VII, p. 519.

Callirhytis operatola Riley, 1895, Sci., I, p. 463. Thompson, 1915, Amer. Ins. Galls, pp. 21, 30 (not the fig.).

Andricus operatola Bassett, 1900, Trans. Amer. Ent. Soc., XXVI, p. 315 [Adult first described!]. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 64; 1910, Das Tierreich, XXIV, pp. 550, 823, 831. Beutenmuller, 1913 (in large part), Brooklyn Ent. Soc. Bull., VIII, p. 103, fig. 8. Viereck, 1916, Hymen. Conn., p. 418. Britton, 1920, Conn. Geol. and Nat. Hist. Surv. Bull., 31, p. 321.

Andricus operator form *operatola* Felt, 1906, Ins. Aff. Pk. and Woodl. Trees, II, p. 709. Kinsey, 1920 (except the figs.), Bull. Amer. Mus. Nat. Hist., XLII, pp. 347, 380.

Andricus operator Felt, 1918, N.Y. Mus. Bull., 200, p. 118 (not the fig.).

FEMALE.—Differs from the female of the bisexual generation of this variety as follows: Head and thorax rich brownish rufous, darker in part; antennæ thicker, uniformly rich brownish rufous; anterior parallel lines more evident, in part because of a darker coloring; scutellum not as long as wide; foveæ moderately broad, not rounded, sparingly sculptured at bottom; abdomen rich rufous to piceous dorsally and posteriorly, smooth, the edges of the segments finely punctate, the second segment rather hairy latero-basally, the abdomen much longer than high, rather produced dorsally, the edges of the segments strongly oblique; legs golden rufous, the tibiæ, especially the hind tibiæ, brown; areolet small or closed, indistinct; length, 3.2-3.5 mm.

GALL.—Similar to the seed-like acorn gall of the other agamic forms. Probably on all of the black oaks on which the bisexual generation occurs.

RANGE.—As given for the bisexual form of this variety. Probably thruout a more northern part of the eastern United States except in more northern New England and on the Atlantic Coastal Plain.

In an earlier paper (1920), I have given an account of this form; as explained under *operator* there may be a question whether this is the agamic form of *operator* or of *falsus*. The insect matures in the second or third spring, emerging in early May in Connecticut, and oviposits in the young buds to produce the bisexual generation.

Andricus operator variety **consobrinus,** new variety
form **consobrinus,** new form

FEMALE.—Differs from the bisexual female of variety *operator* as follows: Parapsidal grooves very slightly widened posteriorly, almost smooth at bottom; foveæ rather large, round, sparingly roughened at bottom; mesopleuræ finely aciculate centrally; abdomen yellow rufous basally; length 1.2-2.0 mm.

MALE.—Shows the secondary sexual characteristics of the species, and further agrees with the female of this variety except in having most of the abdomen a brownish piceous, and in being smaller, 1.2-1.7 mm.

GALL.—Similar to the woolly gall of the other varieties. The types are small, averaging 20. mm. in diameter, the hairs rather brittle and light brown; but more mature galls may differ. On the young stems and aments of *Quercus velutina, Q. marylandica,* and *Q. coccinea.*

RANGE.—Virginia: Rosslyn. Probably thruout a more southern range in eastern United States.

TYPES.—59 females, 140 males, 44 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females, males, and galls at the U.S. National Museum, Stanford University, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Roslyn, Virginia; May 16, 1920; *Q. marylandica;* Kinsey collector.

The insects emerged at some time after collecting on May 16, 1920. The galls appeared immature at the time of collecting. This variety comes nearest *austrior*; the galls are similar; the males differ more than the females.

The types of *operator* were collected on *marylandica* in the District of Columbia, which is very near Rosslyn, Virginia. Nevertheless only 3 of the 202 insects I secured from *marylandica* at Rosslyn are *operator.* The others, representing *consobrinus,* have the parapsidal grooves much more narrow posteriorly, smoother foveæ, and are much smaller in size. It may prove that two varieties occur in two distinct faunal areas which meet near Washington. One of the 48 insects I obtained from *Q. coccinea,* and all of the 12 I bred from *Q. velutina* from Rosslyn are *consobrinus.* I cannot discover any constant differences between this material from the several oaks.

Andricus operator variety **austrior,** new variety
form **austrior,** new form

FEMALE.—Differs from the bisexual female of variety *operator* as follows: Parapsidal grooves fine, fine posteriorly, smooth at bottom; foveæ narrow, shallow, sparingly sculptured at bottom; mesopleuræ

finely, faintly aciculate centrally; abdomen yellow rufous basally; the hind tibiæ dark brown to almost black; length 1.7-2.2 mm., averaging smaller than in *operator*.

MALE.—Shows the secondary sexual characteristics of the species, and further differs from the female of this variety as follows: Face dull yellow, antennæ dull yellow, only the basal segment brownish; the third segment almost half again as long as the fourth; thorax dull yellowish rufous; legs dull yellowish, the hind femora and tibiae sometimes brownish; length 1.2-2.0 mm., averaging less than in the female.

GALL.—Similar to the woolly galls of the other varieties; white, weathering light brown in part; 15.-25. mm. in diameter, usually irregular in shape. On young twigs (from the bud) of *Quercus Schneckii*.

RANGE.—Texas: Austin. Possibly confined to an area including eastern Texas, on black oaks.

TYPES.—18 females, 125 males, 3 galls. Holotype female, paratype females, males, and gall at The American Museum of Natural History; paratype females, males, and galls with the author; paratype females and males at the U.S. National Museum and Stanford University; paratype males at the Museum of Comparative Zoology and the Philadelphia Academy. Labelled Austin, Texas; April 24, 1921; *Q. Schneckii;* Patterson collection number 64.

Patterson first found this gall on April 1, 1921; it had not been observed before that date, but pupæ were forming in the galls at the time. This indicates a very rapid development of the young gall. Adults began emerging April 24. From a single gall Patterson bred 128 males and no females; a single gall sometimes produces only a single sex.

This insect is more closely related to variety *consobrinus* than to the other varieties. Thus far we have obtained it only from *Q. Schneckii*; other black oaks in the same region may support this variety, or may have isolated still other varieties. We have galls of an agamic form of this species from Austin on *Q. marylandica* (Patterson collection 144) ; whether these represent the alternate generation of *austrior* I cannot say until we can obtain insects.

Andricus operator variety **falsus,** new variety
form **falsus,** new form

Callirhytis operator Beutenmuller (in Smith), 1910, Ins. N.J., p. 601. Thompson, 1915 (R.I. record), Amer. Ins. Galls, pp. 11, 30, pl. 2, fig. 169.

Andricus operator form *operator* Kinsey, 1920 (in small part), Bull. Amer. Mus. Nat. Hist., XLII, p. 345, pl. XXXI, fig. 32.

FEMALE.—Differs from the bisexual female of variety *operator* as follows: Parapsidal grooves moderately wide posteriorly, smooth at bot-

tom, more convergent posteriorly than in *illustrans;* foveæ quite broad, rounded, almost wholly smooth at bottom; mesopleuræ quite finely aciculate centrally; abdomen reddish rufous basally; length 1.7-2.2 mm., less than in *operator.*

MALE.—Shows the secondary sexual characteristics of the species, and further agrees with the female of this variety; length 1.5-2.0 mm.

GALL.—Similar to the galls of the bisexual forms of the other varieties; large, up to 55. mm. in diameter, becoming golden brown on aging; on *Quercus ilicifolia.*

RANGE.—Rhode Island: Providence (Thompson). New York: Staten Island (Beutenmuller and W. T. Davis). New Jersey: Plainfield, New Brunswick, Milltown, Hornerstown (in Amer. Mus. Nat. Hist.). Possibly confined to a northern part of the Atlantic Coastal Plain.

TYPES.—14 females, 1 male, 4 galls. Holotype female, paratype females, males, and galls at The American Museum of Natural History; paratype females and gall with the author. Labelled Staten Island, New York; June, 1893; *Q. ilicifolia;* Beutenmuller collector.

Falsus is to be recognized by the only moderately widened parapsidal grooves, the smooth, rounded foveæ, and the small size. On the whole this variety more nearly agrees with the other southern varieties than it does with *illustrans,* the more northern form on *Q. ilicifolia.* I have examined insects of *falsus* from the localities listed, and find them quite uniform. The Bassett material purporting to be from *ilicifolia* at Waterbury, Connecticut, belongs to variety *operator.* Certainly two varieties, *falsus* and *illustrans,* occur on this one oak, and possibly the third, *operator.* The geologic histories of the distinct areas occupied by each variety may be responsible for the development of the distinct insects. I do not know whether other black oaks in the same part of the Coastal Plain have this same variety.

The galls which I figured (1920, Bull. Amer. Mus. Nat. Hist., XLII, pl. XXXI, figs. 30, 31), are from *ilicifolia* near Providence, Rhode Island, and probably represent the underscribed, agamic form of *falsus.*

Andricus operator variety **illustrans,** new variety
form **illustrans,** new form

Calliryhtis operator Stebbins, 1910, Springfield (Mass.) Mus. Bull., II, p. 25, fig. 47. Thompson, 1915 (Mass. record), Amer. Ins. Galls, pp. 11, 30.

Andricus operator form *operator* Kinsey, 1920 (in large part), Bull. Amer. Mus. Nat. Hist., XLII, pp. 345, 380.

FEMALE.—Differs from the bisexual females of the other varieties of the species as follows: Head and thorax rather dark rufous brown, antennæ entirely light brownish rufous; parapsidal grooves rather wide posteriorly, averaging distinctly finer than in *operator*, almost smooth at bottom, averaging less convergent at the scutellum than in any of the other varieties; median groove short but often more evident than in other varieties; foveæ rather broad, distinctly sculptured at bottom; abdomen red rufous basally; legs light brownish rufous, darker basally, the posterior tibiæ dark brown to black; length 2.0-2.5 mm., smaller than *operator*.

MALE.—Shows the secondary sexual characteristics of the species, and further agrees with the female of this variety.

GALL.—Similar to the galls of the other bisexual forms; large, weathering a golden brown. On *Quercus ilicifolia*.

RANGE.—New Hampshire: West Ossipee. Massachusetts: Springfield (Stebbins); Worcester? (Thompson); Boston (Clarke); Sharon, Blue Hills. Probably only in more northern New England.

TYPES.—About 150 females, 100 males, 2 galls. Holotype female, paratype females, and males at The American Museum of Natural History; paratype females and males at the U.S. National Museum, Stanford University, the Museum of Comparative Zoology, the Philadelphia Academy, and the Boston Society of Natural History; adults and galls with the author. Labelled Blue Hills, Massachusetts; June 9 to 30, 1918; *Q. ilicifolia;* Kinsey collector.

The galls of this form are very abundant on the scrub oaks in eastern Massachusetts, early in the spring as soon as the flowers begin to appear. They are very succulent, drying quickly unless gathered after the first of June. Insects emerge thruout June and early in July.

Following the previous practice which overlooked varietal differences, I described this insect in 1920 as the bisexual form of *operator*. The insect up to date is known only from *ilicifolia*; it may occur also on other black oaks in the same region. *Ilicifolia* is also one of the hosts of variety *operator* in another faunal area, and of *falsus* in still another area. I have seen insects only from Sharon and the Blue Hills, but the variety may range thruout northern New England, at least wherever *ilicifolia* occurs. This variety is rather distinct from any of the other described varieties of the species, which emphasizes the fact that we have been overlooking data when they occur too near the centers of our more extensive work with Cynipidæ, the northeastern parts of the United States!

The acorn gall of the agamic generation is abundant on *ilicifolia* in the range of this variety, but I have not yet obtained the adult. I have collected this acorn gall as far north

as West Ossipee, New Hampshire. The gall figured by Stebbins (1910, Springfield Mus. Bull. II, p. 26, fig. 48), may belong to this undescribed form.

Andricus ovatus (Weld)

FEMALE.—A mostly uniform shade of rufous; mesothoracic grooves and lines not wholly straight; second abdominal segment small; length averaging 4.0 mm. HEAD: Slightly broader than the thorax, distinctly enlarged behind the eyes; rufous or darker, the mouth parts still darker; very irregularly roughened, rugose and hairy on the face and cheeks. Antennæ short, rather thick; with 14 segments, second segment distinctly elongate, the third not much longer than the fourth, the last rather longer than the preceding. THORAX: Rufous or darker; mesonotum shagreened, very irregularly roughened antero-laterally; parapsidal grooves distinct but not deep, continuous to the pronotum, very narrow and somewhat obscured by the sculpturing anteriorly, almost smooth at bottom, gradually converging posteriorly, sharply diverging at the very anterior end; median groove distinct for two-thirds or more of the distance to the pronotum, widest posteriorly, shallow, not wholly straight, not quite smooth at bottom; anterior parallel lines shallow grooves, distinct, not wholly straight; lateral lines shallow grooves, smoother, long, not straight; scutellum longer than wide, somewhat squared posteriorly, slightly depressed medio-posteriorly; rugose, hairy, with the two large, broad foveæ broader laterally, smooth, slightly ridged at bottom; pronotum laterally rugose; mesopleuræ smoothest beneath the tegulæ, elsewhere very closely rugoso-aciculate. ABDOMEN: Rufous or darker, smooth, microscopically punctate except on the base of the second segment, naked except for a very few hairs latero-basally; not much longer than high, not produced dorsally, the edges of the segments only slightly oblique but well rounded ventrally, the second segment covering about half the abdomen; ventral spine rather short, rather slender and pointed. LEGS: Irregularly roughened, hairy; the tarsal claws rather weak, simple. WINGS: Mostly clear, tinged brownish in part, especially in the radial, discoideal, and cubital cells; not ciliate on any of the margins except on the hind margins of the hind wings; veins brown, only the subcosta and cross veins heavy; areolet of moderate size or small; cubitus discontinuous; radial cell rather long and broad, open, the second abscissa of the radius clearly curved; the first abscissa angulate, not sharply so, without a projection, very limitedly infuscated. LENGTH: 2.8-4.8 mm., averaging nearer 4.0 mm.

GALL.—Elliptical, hollow, standing out from the bark of roots. Monothalamous, altho several galls may more or less solidly fuse. Each gall globoid to ovoid or egg-shaped, up to 4. mm. in diameter by 6. mm. long, usually smaller, covered with bark mostly of normal color and texture, somewhat smoother; a direct continuation of the root bark, altho the galls stand out distinctly from the bark; a large, circular exit hole terminally. Internally entirely hollow (in mature galls), the walls moderately thin, a distinct woody lining inside of the bark wall.

On very large roots or on rootlets not 2. mm. in diameter; on black oaks.

RANGE.—Florida to Texas.

This is a very distinct root gall. The insects pupate late in the fall, soon becoming adults, but not emerging until early in the spring.

The three varieties I have seen are distinct as to color, two of them remarkably so. It has been a mistake to completely ignore variation in color as tho occurring without order in any group of individuals. These color differences are correlated with very definite morphologic characters, and with host and geographic distribution. It is too much to expect one variety to become the next if transplanted from one oak to another or one locality to another. But host and geographic isolation have separated distinct forms in this species. The galls of all of the varieties are very similar.

Andricus ovatus variety ovatus (Weld)

Callirhytis ovata Weld, 1921, Proc. U.S. Nat. Mus., LIX, p. 222, pl. 34, fig. 23.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color of head, thorax, and abdomen bright brownish rufous; antennæ light brownish rufous, the last seven or eight segments browner; parapsidal grooves of moderate width at the scutellum, not as broad nor as rugose at bottom as in *melanicus*, not converging as closely posteriorly; anterior parallel lines rather close together anteriorly for almost half the length, almost twice as wide apart posteriorly; the scutellum relatively shorter, the foveæ large, broad, broader laterally, mostly smooth at bottom, separated by a fine, simple ridge; mesopleuræ beneath the tegulæ smoother, irregularly roughened; legs entirely brownish rufous, including the coxæ; areolet rather small.

GALL.—Quite the same as those of the other varieties; on *Quercus Catesbæi.*

RANGE.—Florida: Marianna, Ocala, Madison, Jacksonville (Weld).

TYPES.—Holotype and paratype adults and galls at the U.S. National Museum; paratype adults in my collection. U.S. National Museum number 22569; from Marianna, Florida; *Q. Catesbæi;* Weld collector.

Weld recorded having collected the type galls on October 11, 1919, when they contained pupæ; living adults were cut out of these galls on December 3. Empty galls were found at Ocala on April 15, 1914. Probably emergence occurs late in January or in February, as with *melanicus*. Weld further

suggests that inasmuch as the December galls contained larvæ as well as pupæ emergence may be distributed over two years. Altho Patterson cut into a great many of the galls of *melanicus* he found no indication there of differences in emergence.

This variety is readily distinguished from *melanicus* by the lighter color and the distinctly narrower parapsidal grooves; from the variety on *myrtifolia* it is best distinguished by the anterior parellel lines which diverge posteriorly and the foveæ which are much broader and wholly smooth.

The galls which Weld recorded from Daytona, Florida, occurring on *Quercus myrtifolia*, and which were also included in the paratypes of *ovatus*, belong to a distinct variety.

Andricus ovatus variety **melanicus**, new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color of head, thorax, and abdomen dark chestnut rufous; antennæ almost entirely brown, very dark terminally, the first two segments rich rufous; parapsidal grooves distinctly broader and more rugose at the scutellum than in *ovatus*, converging more closely posteriorly; anterior parallel lines rather close together anteriorly for almost half the length, almost twice as wide apart posteriorly; the scutellum relatively much longer, the foveæ large, broad, broader laterally, mostly smooth but irregularly ridged at bottom, separated by a wider rugose area than in *ovatus;* mesopleuræ beneath the tegulæ very finely puncto-rugose, front and middle pairs of legs rich rufous, tibiæ lighter, hind legs very dark rufo-piceous, sometimes in part black, the tibiæ lighter; areolet of moderate size.

GALL.—Quite the same as those of the other varieties; more often fused to the very tips; on *Quercus Schneckii.*

RANGE.—Texas: Austin.

TYPES.—55 females, 16 galls (in 3 clusters). Holotype female, paratype females, and galls at The American Museum of Natural History; paratype adults and galls with the author; paratype adults at the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and Stanford University. Labelled Austin, Texas; February 7, 1922; *Q. Schneckii;* Patterson collection number 156.

Patterson found adults emerging on February 7, 1922.

This variety is readily distinguished at a glance by its dark color; it is distinguished from both other varieties by the much broader parapsidal grooves which converge more closely posteriorly; and it is further distinct from the variety on *myrtifolia* in having very broad, largely smooth foveæ.

In describing *ovatus* Weld recorded collecting similar galls

on *Quercus texana* at Boerne, Texas. I cannot say what variety these insects may be, especially as they come from an oak different from but closely related to the host of *melanicus*.

Andricus pomiformis (Bassett)

FEMALE.—Head and thorax black, coarsely sculptured; foveæ large, a dark cloud at the base of the radial cell; length over 3.0 mm. HEAD: Fully as wide as the thorax, rather distinctly enlarged behind the eyes; black, the mouthparts rather dark rufo-piceous, tips of mandibles piceous; entire head coarsely, rugosely sculptured, striæ radiating from the mouth; face and cheeks rather densely hairy. Antennæ light brownish rufous, lightest basally, darker terminally; heavily pubescent; with 14 segments, the second globose, the third not much longer than the fourth, the last not half again as long as the preceding, sometimes with an indication of a division near the tip. THORAX: Wholly black, tinged rufo-piceous in old specimens; not densely covered with yellow hairs; mesonotum coarsely sculptured; parapsidal grooves continuous, sometimes in part lost in sculpturing; median groove more or less lost in the sculpturing; anterior parallel lines fine, in some varieties indistinct and discontinuous; lateral lines raised, smooth, of moderate length; scutellum as coarsely sculptured as the mesonotum, sometimes medianly depressed, somewhat as in the genus *Amphibolips;* basal foveæ large, broad, mostly smooth at bottom, rather semicircular in shape, separated by only low sculpturing; pronotum laterally rugoso-aciculate; mesopleuræ rugose, hairy, with a smooth, shining area centrally. ABDOMEN: Rich rufo-piceous to piceous-black, becoming more rufous in old specimens, darkest dorsally, lightest ventro-posteriorly; smooth, shining, finely but closely punctate except on the basal half of the second segment, naked except for rather dense patches of hairs latero-basally; narrow, elongate, protruding dorsally, edges of segments sharply oblique, well rounded ventrally, the second segment covering three quarters or more of the entire area; ventral spine very slender, hairy, of moderate length, ventral valves at least at a 45° angle. LEGS: Light brownish rufous, all the coxæ and the hind trochanters piceous black, the tips of the tarsi dark, the hind femora and tibiæ rich rufous brown; legs punctate and rather densely hairy; tarsal claws of moderate weight, simple, with a bare suggestion of a tooth basally. WINGS: Clear, ciliate on all margins, the veins brown; areolet of different sizes; cubitus fine, not reaching the basalis; radial cell entirely open, moderately wide, the second abscissa of the radius only slightly curved; the first abscissa rather angulate, heavy, with a heavy, moderately large, brown patch between the first abscissa of the radius and the terminal portion of the subcosta. LENGTH: 3.0-4.0 mm.

GALL.—Spherical, smooth, compact, in section suggesting an apple with seeds about the core. Polythalamous, often with fifty or more larval cells. More or less perfectly spherical, rarely flattened, or elongate ovate; of all sizes up to 55. mm., averaging nearer 40. mm. in diameter; the surface sometimes entirely smooth, usually finely, irregularly pitted

and cracked, sometimes set with low, raised lines or irregular rows of low tubercles radiating more or less from the slightly pointed tip of the gall; brilliant, rich apple red when fresh, with some apple green and lighter green, becoming bright brownish yellow on aging, weathering darker. Internally like compacted sawdust, crystalline, spongy only in old and weathered specimens; with a hard, woody core originating from the point of attachment, the core flaring and somewhat branching in the center of the gall, with the larval cells arranged radiantly in the extremities of this core, mostly in a single layer centrally of the gall; each cell averaging 2. x 4. mm., with a distinct and easily separable, thin-walled lining. Laterally, less often terminally, attached by a small point, sessile on twigs of *Quercus agrifolia* and *Q. Wislizenii.*

RANGE.—California: from the Mexican border to Dunsmuir and Ukiah.

This is one of the most prominent of Californian galls, being surpassed in size and abundance only by *Andricus californicus.* Both species are known as oakapples. As with *californicus,* the possibility of more than one variety, each with its own intensely interesting biologic problems, has been heretofore entirely overlooked. The biologist who will learn what these two species should easily disclose in ten years or less work on the field, may contribute as important data as we yet possess on such problems as the nature of alternation of generations, distribution factors, and host effects, for instance.

Adults mature in early spring, earlier at southern localities. The field data indicate that northern varieties (see variety *pomiformis*) complete the life cycle in a year, with the possibility of an alternation of generations; while southern varieties (see *maculipennis*) take two years or more to mature, and may not have an alternate generation. This must be considered a suggestion, to be verified only by experimental work. If this is shown to be the true condition, it confirms my previously expressed opinion (1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 372) that alternation of generations is an extreme development of seasonal dimorphism.

If galls are collected too soon before maturity, the larvæ will develop into adults altho few insects will emerge. One finds this the case with galls in the laboratory more often than with galls in the open. Under adverse conditions in the field, such as a season of drought, there may be a similar destruction of adults before emergence. An experience with this species in the laboratory alone, in connection with some

other similar cases, misled me into an over-statement in a previous paper (1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 383) as to the lack of vitality of Cynipidæ in general.

Some of the most illuminating data I yet have on the effectiveness of the host in isolating varieties is that presented under variety *distinctus*.

Some of the varieties of this species show a median depression of the scutellum much as in the genus *Amphibolips*. Other varieties do not show this. An evolution of a generic character has occurred within this single species.

Callirhytis rossi Kieffer (1903, Marcellia, II, p. 84, figs. 1, 2) is probably the same as one of the varieties described for this species in this paper. The publication was made without a more definite locality than "California", and without a host determination, but with a host description which best fits *Quercus chrysolepis*. I feel certain there must be a mistake here, just as I do not believe Kieffer's *eriophorus* came from *Wislizenii* as published. Until we can see types of *rossi* it will not be possible to determine the variety it represents. I am inclined to expect to find it a synonym of *maculipennis*.

Andricus pomiformis variety pomiformis (Bassett)

Cynips Q. pomiformis Bassett, 1881, Can. Ent. XIII, p. 74.

Andricus pomiformis Ashmead, 1885, Trans. Amer. Ent. Soc., XII, pp. 295, 300, 303; 1887, Trans. Amer. Ent. Soc., XIV, p. 130. Ashmead (in Packard) 1890, 5th Rpt. U.S. Ent. Comm., p. 108. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 64. Beutenmuller, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 24. Thompson, 1915, Amer. Ins. Galls, pp. 8, 33.

Callirhytis pomiformis Mayr, 1902, Verh. Ges. Wien, LII, p. 289. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 82. Felt, 1918, N.Y. Mus. Bull., 200, p. 62. Fullaway, Ann. Ent. Soc. Amer., IV, p. 371.

Callirhytis quercus-pomiformis Dalle Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 568, 803, 825. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 355; 1912, Journ. N.Y. Ent. Soc., XX, p. 275.

FEMALE.—Shows the following characteristics in addition to those common to all varieties of the species: Parapsidal grooves very largely lost in the sculpturing, wholly rugose at bottom; no median depression even indicating a median groove; anterior parallel lines fine, smooth, continuous, fairly distinct; lateral lines rather prominent, distinctly wider than in *maculipennis;* mesopleuræ with the smooth central area wholly smooth and naked; foveæ separated only by a very low rugose area; areolet moderately small to very small; the cloud on the first abscissa of the radius of moderate size, smaller than in *maculipennis*.

GALL.—Very much like that of all other varieties except *distinctus;* the surface smooth. On *Quercus agrifolia* (and *Q. Wislizenii*?).

RANGE.—California: San Francisco? (Bassett); Stanford University (Fullaway); Mt. Diablo (F. A. Leach coll.); Palo Alto, Salinas, Gilroy (Redwood School). Probably restricted to a region in central California.

TYPES.—Adults and galls at the Philadelphia Academy, The American Museum of Natural History, and the Museum of Comparative Zoology. From San Francisco (?), California; H. D. Bassett, collector; on *Quercus agrifolia.*

Bassett recorded this variety as emerging in March. None of the galls which I collected after March 8 contained adults, and fresh galls had not yet appeared in more northerly localities by April 1. The variety may require only a year to mature, in contrast to the history of southern varieties which may take up to three years to mature. An alternate generation is entirely possible for this variety.

The original host was *Quercus agrifolia,* and in the southern part of the range, nearer the coast, *agrifolia* is the only host. In the northern Coast Range, at least in Mendocino County, and in the Sierras north of El Portal, *agrifolia* does not occur, but there *Wislizenii* bears a similar gall. In addition *Wislizenii* bears a shaggy-coated gall similar to the southern variety *distinctus.* I have this latter gall from Placerville, Auburn, Oroville, and Ukiah, but I do not have adults enough of either smooth or shaggy galls from these localities to make definite determinations. As I suggest in the detailed discussion under *distinctus* it is possible that *pomiformis* takes to *Wislizenii* where *agrifolia* is lacking, and meeting a variety representing *distinctus* in the north sometimes interbreeds with it.

Andricus pomiformis variety **maculipennis** (Kieffer)

Callirhytis maculipennis Kieffer, 1904, Bull. Soc. Metz, (2), XI, p. 131; 1904 (in Baker), Invert. Pacif., I, p. 42. Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 587, 808, 825. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 358. Felt, 1918, N.Y. Mus. Bull., 200, p. 76. Johnson and Ledig, 1918, Pomona Coll. Journ. Ent. and Zool., X, p. 26.

?Callirhytis Rossi Trotter, 1910, Boll. Lab. Portici, V, p. 110.

Cynipide, 31, Trotter, 1910, Boll. Lab. Portici, V, p. 112, pl. I, figs. 5, 6.

Andricus pomiformis Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 383.

FEMALE.—Shows the following characteristics in addition to those common to all varieties of the species: Parapsidal grooves distinct but wholly rugose at bottom, most rugose anteriorly; no median depression even indicating the median groove; anterior parallel lines discontinuous, in part lost in the sculpturing; lateral lines fine, distinctly narrower than in variety *pomiformis;* mesopleuræ with the smooth central area scatteringly punctate and hairy; foveæ well separated; median depression of the scutellum only moderately deep; areolet of moderate size; the cloud on the first abscissa of the radius somewhat more extensive than in variety *pomiformis,* prolonged on the subcosta.

GALL.—Quite identical with the galls of all other varieties except *distinctus;* smooth; more often ridged and scatteringly set with short tubercles than in other varieties. On *Quercus agrifolia* (and *Q. Wislizenii*?).

RANGE.—California: Claremont (Baker); Descanso, Alpine, Fallbrook, El Toro, Upland, Pasadena; Los Angeles (Trotter); Santa Barbara, Gaviota, Paso Robles; El Portal (Trotter). Probably confined to more southern California, except in the San Bernardinos and the Cuyamacas, wherever *Q. agrifolia* occurs, and possibly on *Q. Wislizenii.*

TYPES.—Berlin Museum? Cotypes at Pomona College. Material from the same collector (Baker) and the same locality (Claremont) at The American Museum of Natural History and Stanford University.

Collections made thruout February showed galls with the adults completely emerged; at the same time galls contained live larvæ and live adults, while fresh galls, not many days or weeks old, were on the trees. Both adults and live larvæ were found as late as February 1921 in galls which had been mature in February 1920. The insects must take at least two years, possibly longer to mature. Emergence comes early in the spring, and is followed so soon by the appearance of fresh galls that it suggests there is no alternation of generations with this variety, altho this question must be settled by experimental breeding.

This insect is not very abundantly distinct from variety *pomiformis*; it may be distinguished best by the finer lateral lines and the larger areolet. In regions where only *Q. agrifolia* occurs the variety is quite constant. It remains very constant in the Cuyamaca Mountains where it meets variety *descansonis* at Descanso. Where *maculipennis* meets *distinctus,* on *Wislizenii,* there is to be found a considerable amount of intergrading between the two insects. A gall from Santa Barbara gave adults with as large an areolet as in *distinctus*; this gall was recorded from *agrifolia,* but may have been on *Wislizenii* instead. A further discussion of these host considerations is given under *distinctus.*

Andricus pomiformis variety **distinctus,** new variety

FEMALE.—Shows the following characteristics in addition to those common to all varieties of the species: Parapsidal grooves distinct, rather smooth at bottom posteriorly, anteriorly wholly rugose; a distinct median depression, extending almost the length of the mesonotum, indicating the median groove; anterior parallel lines rather distinct, only in part discontinuous; lateral lines moderately fine; mesopleuræ with the smooth area wholly naked with almost no punctures; foveæ well separated by a rather higher rugose area; median depression of the scutellum rather distinct, not as deep as in *provincialis;* areolet large to very large, prolonged on the cubitus; the cloud on the first abscissa of the radius very large, larger than in any other variety, extending the full length of the terminal portion of the subcosta.

GALL.—Surface very much roughened, densely covered with projections, each ending in a short filament, making the gall appear very rough or even somewhat mossy; this shaggy coat largely breaks off of old galls. On *Quercus Wislizenii.*

RANGE.—California: El Portal, Merced Falls, Three Rivers, Pasadena, San Jacinto Mountains. This probably outlines the limits of the range.

TYPES.—8 females, 22 galls. Holotype female, paratype female, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author; galls at the Museum of Comparative Zoology and the Philadelphia Academy. Labelled Three Rivers, California; March 23, 1920; *Q. Wislizenii;* Kinsey Collector.

Very young galls were found at Three Rivers on March 23; at the same time galls possibly a year old had larvæ in them; some of these galls still contained live larvæ almost two years later, on February 11, 1922. However, some of the insects from these same galls had matured meanwhile. It may be that all of the larvæ would have transformed sooner if the galls had remained in the open, but it is not improbable that some individuals take longer than others to mature, remaining as larvæ for two or three years or even longer.

This variety is in all respects the most distinct in the species. The large areolet and the median depression of the scutellum define the variety in the region of the southern Sierras; there the shaggy-coated gall is also very characteristic. But in the Sierra Madre and other more southern parts of the range of the variety the galls are as smooth as in any other variety of the species, and altho some of the insects show all of the characteristics of the more northern material, others will show only a part of them, varying directly toward *maculipennis. Maculipennis* occurs largely in the same

region, in the same faunal area, but on another host, *Quercus agrifolia*. This variation in these cynipids exactly parallels the variations of the two oaks which are the hosts. As to the status of these two oaks Jepson states: (1910, Mem. Univ. Calif., II, pp. 230, 231), "While the two species are thus very distinct [in the north], frontier stragglers are not always readily separated. The leaves of the Coast Live Oak [*Q. agrifolia*] are sometimes quite flat [as is normal in *Wislizenii*] and the terminal winter buds on fruiting shoots of Interior Live Oak [*Q. Wislizenii*] may remain dormant so that full grown acorns may appear to be on 'one-year-old' wood [as is normal in *agrifolia*]. Acorns removed from the branch or picked from the ground are sometimes not determinable, so much do certain deep-cupped forms in the two species resemble each other. Nuts short and thick or as slender as a quill are not uncommon variants in *Quercus Wislizenii* acorns. These variations, which are to a large extent a matter of nutrition, are closely matched by similar variations in *Quercus agrifolia*. While the Interior Live Oak [*Wislizenii*] in tree form [as in the north] trespasses little if at all upon the Coast Live Oak or Encina [*agrifolia*] territory, it is found throughout the same region, overtopping it, as it were, on the summits of the mountains as a low shrub [as in the south]."

One explanation that may be offered is that *distinctus* has been segregated from other varieties by isolation upon a distinct host, much as geographic isolation would allow the development of distinct forms. In the Sierras where the hosts of the two are distinct, the two varieties do not interbreed, but at more southern points the two hosts, being more closely related, sometimes fail to effect the requisite isolation, and some degree of interbreeding may occur. A single gall from the many I collected near Santa Barbara gave adults which have an areolet fully as large as in any specimen of *distinctus*, tho in many respects the characters are those of *maculipennis*. I recorded this material as from *agrifolia*, but it is not impossible that I misdetermined a single tree of *Wislizenii*, since dwarfed specimens of the two oaks are so similar in the region.

In the northern Sierras, north of El Portal, in another faunal area, galls of this species occur on *Q. Wislizenii* which are sometimes shaggy as in variety *distinctus* and sometimes entirely smooth. Sometimes both forms occur in close prox-

imity on a single tree. I do not yet have insects enough to determine what varieties are represented here. Variety *pomiformis* occurs in the same faunal area, but was originally described from *agrifolia*. This oak is restricted to the coast country in the north, and does not occur in the northern Sierras. It is not improbable that variety *pomiformis* takes itself to *Wislizenii* where *agrifolia* is absent, that in so doing it comes into contact with a northern variety matching *distinctus*, and that the two may interbreed where they occur on the same host.

The San Bernardino variety on *Wislizenii* is separate from *distinctus*, and shows relations to *maculipennis* as much as to *distinctus*. In this range again *agrifolia* is not to be found.

Andricus pomiformis variety **provincialis**, new variety

FEMALE.—Shows the following characteristics in addition to those common to all varieties of the species: Parapsidal grooves wider than in any other variety, but shallow and largely rugose; no trace of a median groove; anterior parallel lines discontinuous, in part lost in the sculpturing; lateral lines very fine; mesopleuræ with the smooth area wholly naked, with almost no punctures; foveæ larger, more elongate than in other varieties, not wholly smooth at bottom, separated by a shallow, rugose area; median depression of the scutellum deeper than in other varieties; areolet of moderate size to very small; the cloud on the first abscissa of the radius only moderately large.

GALL.—With a smooth surface; quite identical with that of all other varieties except *distinctus*. On *Quercus Wislizenii*.

RANGE.—California: San Bernardino mountains. Probably confined to the neighborhood of this range.

TYPES.—32 females, 14 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, and with the author. Labelled San Bernardino, California; January 31, 1920; *Q. Wislizenii;* Kinsey collector.

On January 31, 1920, galls showed that adults had emerged previously, but also contained live larvæ and adults.

The best characters for distinguishing this variety are the more elongate foveæ and the deeper median depression of the scutellum. Altho the variety occurs on *Wislizenii* it does not show closer relationship to the other varieties on that host than it does to the varieties on *agrifolia*. Of thirty-six individuals from the San Bernardino mountains, four are closer to *maculipennis* than to this variety. Many of the

others, however, vary toward *maculipennis,* and probably variety *provincialis* is not yet wholly separated from the other varieties, but there is a strong indication that a distinct type has been or is being isolated in the San Bernardino range.

Andricus pomiformis variety **descansonis,** new variety

FEMALE.—Shows the following characteristics in addition to those common to all varieties of the species: Parapsidal grooves apparent but rugose at the bottom and largely lost in the mesothoracic sculpture; a very short but rather distinct indication of a median groove at the scutellum; anterior parallel lines fine, smooth, more or less continuous, but not as distinct as in variety *pomiformis;* lateral lines of moderate weight, finer than in variety *pomiformis,* heavier than in *maculipennis;* mesopleuræ with the smooth central area largely but not entirely free of punctures and hairs; foveæ separated by a very low rugose area, bottoms of foveæ somewhat rugose, at least in part; areolet very small or closed; the cloud on the first abscissa of the radius very limited, smaller than in any other variety.

GALL.—Similar to the galls of all other varieties except *distinctus;* smooth. On *Quercus agrifolia.*

RANGE: California. Descanso. Probably confined to a higher elevation of the Cuyamacas, extending into Lower California.

TYPES.—45 females, 4 galls. Holotype female, paratype females, and gall at The American Museum of Natural History; paratype females and galls with the author; paratype females at Stanford University, the Museum of Comparative Zoology, and the U.S. National Museum. Labelled Descanso, California; February 23, 1920; *Q. agrifolia;* Kinsey collector.

On February 23, 1920, galls contained large larvæ, while many insects had emerged previously.

This variety is readily distinguished by the very limited amount of shading on the first abscissa of the radius; the very small or closed areolet is a fairly constant character. Both this variety and *maculipennis* occur at Descanso, but none of the many adults which I have show intermediate or differently combined characters! Unfortunately I did not keep distinct the galls from Descanso, and those from higher elevations a few miles from Descanso; for I did not realize at the time that I was at the meeting point of two faunal areas. It may be that the two varieties are confined to different elevations. *Maculipennis* rather than *descansonis* is the variety at Alpine, not ten miles from Descanso, and over fifteen hundred feet lower in elevation. *Descansonis* is probably confined to higher elevations of the Cuyamaca Mountains

and their extensions into Lower California. This is another instructive instance of the nature of variation where two different faunal areas meet.

Andricus ribes, new species

FEMALE.—Almost wholly black; mesonotum regularly shagreened; parapsides the only thoracic grooves; depression at base of scutellum undivided; abdomen about triagulate; a brownish cloud in the cubital cell. HEAD: Not as wide as the thorax; eyes protruding beyond the cheeks; black, the mandibles yellowish rufous; finely rugose, rougher on the face, with a few, scattering, short hairs. Antennæ brown, the basal four or five segments yellow-rufous, brightest basally; pubescent; with at least 14 segments (material broken), first segment short, second globose, third almost half again as long as the fourth. THORAX: Mesonotum black; regularly shagreened, almost naked of hairs; parapsidal grooves deep, continuous, gradually approaching closely at the scutellum, widely divergent only finally at the pronotum; median groove lacking; anterior parallel lines and lateral lines hardly indicated by smoother areas; scutellum black, distinctly longer than wide, moderately roughly rugose, a broad, smoother but not wholly smooth, slightly arcuate depression anteriorly not divided into foveæ; pronotum laterally finely rugose, irregularly aciculate posteriorly, hairy, usually black, sometimes with a rufo-piceous area; mesopleuræ usually black, very irregularly aciculate, hairy, a central area smoother, naked, sometimes colored rufo-piceous. ABDOMEN: Almost wholly black, sometimes tinged with dark piceous, ventral valves light rufo-piceous; almost naked, a few hairs latero-basally, and hairs on the ventral spine; abdomen about triangulate, slightly produced dorsally, the second segment covering two-thirds of abdomen. LEGS: Yellowish rufous, parts of hind coxæ may be piceous black, tarsi brownish apically; pubescent, tarsal claws fine, toothed. WINGS: Clear, ciliate on edge, veins heavy, deep brown; areolet of moderate size or smaller; cubitus not as heavy as the other veins, continuous to the basalis; radial cell open, the bounding veins not quite reaching the margin; second abscissa of the radius slightly curved, tip somewhat enlarged; first abscissa angulate, the angle about 135°, with a distinct infuscation; a limited, light brown cloud in the cubital cell, prolonged into a more or less discontinuous band parallel to the second abscissa of the radius. LENGTH: 2.2-2.8 mm.

MALE.—Very similar to the female, differing as follows: eyes somewhat larger; antennæ wholly brown; abdomen very slender, smaller, rather long-pedicellate.

GALL.—Spherical, berry-like, very succulent, green and more or less translucent when fresh, bright red when very young; the surface pebbled, with a few, small, projecting points. Shrivelling greatly upon drying, becoming blackened, 4.-6. mm. in diameter; when drying upon the twig, the galls become rather obconical in shape, remaining lighter in color. Monothalamous, the cavity filling the whole gall, the wall of tissue moderately thin, thinnest furthest from the point of attachment.

Attached by only a slight point to twigs (bud galls) of *Quercus Douglasii*.

RANGE.—California: Oroville, Three Rivers.

TYPES.—16 females, 10 males, and 48 galls; adults all imperfect. Holotype female, paratype adults, and galls in The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, and with the author. Labelled Oroville, California; April 1, 1920; Kinsey collector.

Some of the galls at Oroville contained pupæ on April 1, while an equal number showed adults or exit holes thru which adults had already emerged. The whole life of this generation must be a month or so, with an alternate, probably agamic generation in the rest of the year. Of 40 adults I have, 14 are males. The species is not entirely unlike *Dryophanta pulchella* Beutenmuller, of which the male and gall are unknown, but the two species are distinct enough.

Andricus spectabilis Kinsey

FEMALE.—Head and thorax black, densely hairy; abdomen rufous; areolet very large; cubitus not continuous; average length 4.5 mm. HEAD: Dark piceous to black, mandibles rufous; about as broad as the thorax, broadened behind the eyes; very finely coriaceous, punctate and hairy, dense with long hairs on the face, naked just lateral to the eyes; face with rugose striæ radiating from the mouth. Antennæ rufous brown to piceous; first segments and apical segments darker; hairy; with 14 (or 15) segments. THORAX: Black, piceous to black on the sides; mesonotum very finely coriaceous, closely punctate and densely hairy, with long hairs; parapsidal grooves distinct, punctate, slightly convergent at the scutellum, slightly divergent at the pronotum; median groove distinct and smooth for a short distance from the scutellum, obsolete forward; anterior parallel lines raised, smooth, extending from the scutellum about half the mesonotal length; scutellum black, longer than wide, deeply rugose, depressed on the median lines, with two large, shining, smooth or rugose, laterally-spreading foveæ at the base separated by a fine ridge; mesopleuræ piceous or black, in part coriaceous, almost naked of hairs. ABDOMEN: Rufous to piceous, brightest at the very base and apically, especially ventrally; practically smooth, the posterior segments, the ventral spine, and the valves with long hairs; only a few, scattering, long hairs at the base of the second segment laterally; longer than wide, the second segment covering less than one-third of the total area, the third segment fully as long as the second, the hypopygium projecting slightly posteriorly; ventral spine very short, heavy, and blunt. LEGS: Yellow brown to rufous, the coxæ and sometimes trochanters black; hairy, hairs densest and longest on the tarsi and on the hind tibiæ; claws prominently toothed. WINGS: Hyaline, tinged with yellowish, covered with fine, brown hairs, edges ciliate; veins brown, heavy, cross veins heaviest; areolet very large,

sometimes spectacularly so; cubitus usually not reaching the basalis, the tip curved downward toward a point below the mid-point of the basalis; radial cell closed; first abscissa of the radius arcuate-angulate, heavily but limitedly infuscated, usually without much of a projection. LENGTH: 3.7-4.7 mm.

GALL.—Elongate stem swelling. Polythalamous. Large, elongate, oval to spindle-shaped, averaging 25. mm. wide by 50. mm. long; large specimens scarcely greater in diameter will reach 110. mm. in length; covered with bark of natural color. Internally hard and woody, only the peripheral tissue being less compact than the normal stem wood; larval cells toward the center of the gall, oval, 3. by 5. mm., tissue almost not at all distinct from the rest of the wood; exit holes upon aging show a distinct, smoother area on the bark. On smaller stems of *Quercus chrysolepis*.

RANGE.—California: San Jacinto Mountains to Auburn and Ukiah. Probably wherever *Quercus chrysolepis* occurs.

This species was published very recently. The manuscript had been prepared a year previously, and at the time I did not recognize the several varieties represented by my material. In presenting these varieties it seems desirable to republish the specific description in order that it may be more available for comparisons. At the same time some corrections have been introduced, notably the consideration of the radial cell as closed, and of the second segment of the abdomen as short, with the third segment fully as long as the second, instead of taking the second to be long with a more or less definite division.

The variation shown by the species is not great, and is so confused by an unusual amount of individual variation that it has been difficult to define varietal differences. I have not yet been able to separate the San Bernardino material as the distinct thing we might expect it to be. This may be due to the fact that I collected all of my material of this species at the lower elevations in the San Bernardinos, instead of at the higher elevations which have given the more characteristic things from this range. It is interesting to find the Ukiah material belonging to the best defined variety. The galls of all varieties are much alike.

The wing venation in many individuals of this species shows the most unusual abnormalities I have ever seen in Cynipidæ. Specimens show the first abscissa of the radius out of line with the second intercubitus; or a vein between the second abscissa of the radius and the cubitus parallels the second intercubitus, or joins the second intercubitus; in sev-

eral a cross vein arises from the cubitus midway between the areolet and the basalis; the areolet may be closed; and other abnormalities occur. These should in all cases be preserved for a study on the homologies of cynipid venation.

Andricus spectabilis variety **spectabilis** (Kinsey)

Andricus spectabilis Kinsey, 1922, Bull. Amer. Mus. Nat. Hist., XLVI, p. 289, figs. 11, 12.

FEMALE.—Differs from other varieties of the species as follows: Parapsidal and median grooves not especially broadened at the scutellum; median groove usually longer than in *ukiahensis;* anterior parallel lines prominent, distinctly broad; basal foveæ of the scutellum in part smooth, only moderately and in part rugose; mesopleuræ wholly but very finely coriaceous, in no place wholly smooth, less finely coriaceous, but still coriaceous centrally.

GALL.—Does not differ from the galls of the other varieties.

RANGE.—California: San Jacinto Mountains, San Bernardino(?), Upland, Pasadena, El Portal. Probably thruout the southern Sierras and their extensions.

TYPES.—76 females, 19 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, the Berlin Museum, and with the author. Labelled Pasadena, California; February 7, 1920; Kinsey collector.

On March 26, 1920, galls at El Portal contained large larvæ and mature adults, and showed some adults to have emerged previously. The majority of the adults had emerged from these galls by April 3. Emergence is probably earlier at more southern points.

Andricus spectabilis variety **incisus,** new variety

FEMALE.—Differs from the females of other varieties as follows: Parapsidal grooves and median groove distinctly broader at the scutellum than in variety *spectabilis;* median groove moderately long; anterior parallel lines almost but not as wide as in variety *spectabilis;* foveæ about as smooth as in *spectabilis;* mesopleuræ almost wholly smooth beneath the tegulæ, very coarsely coriaceous in other places, not especially coriaceous-aciculate centrally as in *ukiahensis;* areolet large but averaging distinctly smaller than in other varieties; first abscissa of the radius heavy, but not as heavy as in other varieties.

GALL.—Does not differ from galls of other varieties.

RANGE.—California: Placerville, Auburn. Probably confined to the central Sierras from El Portal north.

TYPES.—8 females, 22 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype females and galls

at Stanford University, the U.S. National Museum, and with the author. Labelled Placerville, California; March 30, 1920; Kinsey collector.

Adults were emerging from these galls at Placerville on March 30, 1920.

Andricus spectabilis variety **ukiahensis,** new variety

FEMALE.—Differs from the females of other varieties of the species as follows: Parapsidal and median grooves not especially broadened at the scutellum; median groove distinct, but usually shorter than in variety *spectabilis;* anterior parallel lines very fine, basal foveæ of the scutellum very largely rugose, more so than in variety *spectabilis;* mesopleuræ entirely smooth beneath the tegulæ, coarsely coriaceous, even somewhat aciculate centrally.

GALL.—Does not differ from the galls of the other varieties.

RANGE.—California: Ukiah. Probably confined to a small region of the north Coast Range country.

TYPES.—13 females, 8 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author. Labelled Ukiah, California; March 17, 1920; Kinsey collector.

The insects did not emerge until some time after collecting at Ukiah on March 17, 1920.

The very distinct nature of the anterior parallel lines would separate this variety even if other characters were lacking.

Compsodryoxenus brunneus Ashmead

FEMALE.—Head wider than thorax; antennæ with 13 segments; mesonotum rather transversely rugose. HEAD: Wider than the thorax, distinctly enlarged behind the eyes; brownish rufous, finely coriaceous, finely rugose toward the mouth, naked except near the mouth. Antennæ brown, the first four or five segments golden yellow; with 13 segments, the second short but more elongate than globose, the third not much longer than the fourth, the last half again as long as the preceding. THORAX: Wholly brownish rufous, darker on the scutellum and on the sides; mesonotum finely rugose, rather transversely so, naked; parapsidal grooves fine, shallow, lost in rugose areas before reaching the pronotum; median groove lacking; anterior parallel lines very fine; not prominent; lateral lines fine, shallow; scutellum decidedly longer than wide, well rounded posteriorly, wholly, rather finely rugose, with two shallow depressions anteriorly indicating small, shallow, rugose foveæ; pronotum roughened laterally, hardly rugose; mesopleuræ mostly coriaceous, suggesting an aciculation in places, smooth on the posterior and ventral margins. ABDOMEN: Brownish rufous, lighter basally, much darker posteriorly especially dorsally; entirely smooth and naked; not longer than high, protruding somewhat ventrally, the hypopygium well developed, plow-shaped, the spine not long, fine, and slender; ventral

valves approaching the vertical; second segment covering not more than half the total area; edges of segments not very oblique, but well rounded ventrally. LEGS: Yellow to brown black, tips of tarsi darker; tarsal claws fine, simple. WINGS: Clear, not ciliate on the anterior margins, cross veins and subcosta rich brown, other veins fine; areolet of moderate size; cubitus not reaching the basalis; radial cell open, fairly wide, the second abscissa of the radius somewhat curved; first abscissa slightly angulate, without a projection; a brown cloud about the base of the radial cell, and between the areolet, the basalis, and the discoideus. LENGTH: 1.7-3.0 mm., averaging nearer 2.0 mm.

GALL.—None, or only a very slight swelling of the stem. The larval cells are elongate, averaging 2.5 mm. long by hardly 1.0 mm. wide, embedded in the wood, with the lining hardly distinct, and not at all separable. Mostly on young twigs of white oaks.

RANGE.—California.

The adults of the two varieties differ mainly in color, but the differences are so marked and constant in series of the two that there can be no question of their distinct nature.

These differences are correlated with the distribution of each variety in two faunal areas and on two different hosts. Both occur at much the same latitude; the two type localities are only about twelve miles apart, but at elevations differing by about thirty-five hundred feet. *Quercus chrysolepis,* the host of variety *brunneus,* belongs to a northern Sierran zone, which is limited to higher elevations. *Q. lobata,* the host of variety *atrior,* is confined to the Californian zone, which is always at a lower elevation. When I first discovered the distinct varieties, some time ago, I was ready to credit the differences in the two to their different hosts. Since then I have found some evidence that host differences are not always important unless two distinct faunal areas are involved. In this case it appears reasonable to ascribe the differences in the varieties primarily or in part to the same distributional factors which have delimited the parallel distributions of the hosts. Where geologic, geographic, and host isolation mark out the same bounds, very distinct forms may well be developed.

Compsodryoxenus brunneus variety **brunneus** (Ashmead)

Compsodryoxenus brunneus Ashmead, 1896, Proc. U.S. Nat. Mus., XIX, p. 129. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 78; 1910, Das Tierreich, XXIV, p. 704. Beutenmuller, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 281. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 376. Thompson, 1915, Amer. Ins. Galls, pp. 10,

37. Felt, 1918, N.Y. Mus. Bull., 200, p. 71 (in part). Weld, 1921, Proc. U.S. Nat. Mus., LIX, p. 234.
The gall described and figured in these references is not the gall of this species.

FEMALE.—Differs from the female of the other variety as follows: Head lighter brownish rufous; thorax bright brownish rufous, slightly darker on the scutellum and the sides; anterior parallel lines very fine, not prominent but distinct; abdomen brownish rufous, brown black posteriorly; legs brownish yellow, the middle and the hind tibiæ darker brown; shading on wings moderately heavy, largely confined closely to the veins.

GALL.—None, or a slight stem swelling; the larval cells embedded in the wood, quite as in the other variety. On *Quercus chrysolepis.*

RANGE.—California: Mt. Diablo (Ashmead); Placerville. Probably confined to more northerly localities where *Q. chrysolepis* occurs.

TYPES.—Females and galls at the U. S. National Museum; labelled number 3085. From California, probably Mt. Diablo, rather than Martinez, for *chrysolepis* is not likely to be found at Martinez.

The redescription of the insect is made from adults collected at Placerville. I am not certain that Mt. Diablo and Placerville belong to one faunal area, but I do not now perceive differences between Ashmead types and my Placerville material.

In the original description Ashmead stated that "The gall of this species was likewise confused in the collection with a similar gall (*Andricus chrysolepidis*), occurring on *Q. chrysolepis* in California, but I can distinguish two kinds of galls, although both bear the same number (2972). Both are very much alike externally, but one is polythalamous, the other monothalamous, and I believe the latter is the one producing the present gallfly." He then records having received galls from Mount Diablo and Martinez, but does not state which he thought gave the *Compsodryoxenus,* or whether both lots appeared to be involved. I have seen a paratype gall, and find it a globular, woody, monothalamous gall entirely unlike the gall of any of the six other forms now known from this genus. Its monothalamous nature especially rules it out of this genus. I have cut adults of both varieties of the species from cells buried in twigs which showed little if any deformation, and have obtained a goodly number of insects from such cells collected at two separated localities. Undoubtedly Ashmead's insects came from cells hidden in the twigs of stems which bore galls of some other species.

Adults emerged from the Placerville material at some date after March 30, 1920.

Compsodryoxenus brunneus variety **atrior,** new variety

FEMALE.—Differs from the female of the other variety as follows: Head darker brownish rufous; thorax dark brownish rufous, very dark laterally; anterior parallel lines very fine, in part not evident; abdomen dark brownish rufous basally, largely very dark brown black; legs almost wholly brown, front legs lighter, all tarsi yellow brown, middle and hind tibiæ very dark brown black; shading on wings darker brown, much more extensive, extending well beyond the veins.

GALL.—None, or a slight swelling; the larval cells embedded in the wood; quite as in the other variety. On *Quercus lobata.*

RANGE.—California: Byron. Probably occurs thruout the range of *Quercus lobata* (and not improbably *Q. Douglasii*).

TYPES.—23 females, 2 infested stems. Holotype females, paratype females, at The American Museum of Natural History; paratype females and galls with the author; paratype females at Stanford University, the Museum of Comparative Zoology, the Philadelphia Academy, and the U.S. National Museum. Labelled Byron, California; March 19, 1920; *Q. lobata;* Kinsey collector.

The adults emerged at some time after collecting near Byron on March 19, 1920. The infestation is not to be discovered except by widespread, haphazard cutting into young twigs.

Compsodryoxenus pattersoni, new species

FEMALE.—Head and thorax yellow rufous, abdomen largely black; antennæ with 13 segments; thorax shagreened, rugose on the scutellum; parapsidal grooves not continuous to the pronotum; length about 1.5 mm. HEAD: As wide or wider than the thorax, distinctly widened behind the eyes; yellow rufous, the tips of the mandibles darker; finely rugoso-punctate to coriaceous on the front, finely rugose on the lower part of the face, practically naked of hairs. Antennæ brownish black, the first four or five segments yellow rufous; pubescent; with 13 segments, the third segment hardly at all longer than the fourth, the last almost twice as long as the preceding. THORAX: Mostly bright yellow or brownish rufous; mesonotum regularly shagreened, practically naked of hairs; parapsidal grooves distinct posteriorly, less so anteriorly, hardly reaching the pronotum, not diverging greatly anteriorly; median groove absent; anterior parallel lines barely indicated for half the mesonotal length; lateral lines fine, but distinct, smooth, diverging posteriorly; scutellum darker rufous, sometimes almost black on the edges, rather finely but deeply rugose, naked of hairs, with two foveæ indicated in the longitudinally furrowed depression at the base; pronotum rufous, rough and shagreened at the sides; mesopleuræ darker rufous to black, roughly shagreened, with some shallow, irregular furrows. ABDOMEN: Black, rufo-piceous ventrally and on the hypopygium; entirely naked of hairs;

closely and distinctly punctate; not produced dorsally, the second segment not covering one-third the abdomen, its edge only slightly oblique. LEGS: Brownish, the tarsi yellowish with dark tips, the middle tibiæ and the hind tibiæ and femora almost black; hairy; tarsal claws weak, simple. WINGS: Very clear, set with only minute hairs; edges only very short ciliate; veins brownish black, cross veins heaviest; areolet of moderate size or smaller; cubitus fine, reaching only half way to the basalis; radial cell moderately short, open, the second abscissa of the radius somewhat curved; the first abscissa arcuate, deeply and widely infuscated; with a light brown cloud extending over the areolet and a similarly colored, large spot below the areolet. LENGTH: 1.5-1.7 mm.

GALL.—A slight but distinct swelling of small roots. Polythalamous. Galls gradual enlargements from the stems, elongate, averaging 20. mm. long by 4. mm. wide, often larger, covered with natural or slightly roughened bark. Internally woody, but the tissue irregular, with the larval cells closely clustered, the lining not separable nor hardly distinct, each cell spherical, about 1.0 mm. in diameter. On roots of *Quercus virginiana.*

RANGE.—Texas: Austin (Patterson).

TYPES.—149 females and 4 galls. Holotype female, paratype females, and gall in The American Museum of Natural History; paratype females and galls in the U.S. National Museum and with the author; paratype females at the Museum of Comparative Zoology, the Philadelphia Academy, and Stanford University. Labelled Austin, Texas; *Q. virginiana;* Patterson collection numbers 18a and 18b.

One of the galls is constricted into two parts, the parts bent at an angle; the other galls are straight, undivided; the two types of galls give the same kinds of adults. These galls contained live adults in December; insects emerged on February 9. It is not impossible that adults are mature in the galls over the winter, not emerging until early in the following spring. Similar but much smaller swellings at the bases of the petioles (Patterson collection number 155) had adults emerge on Dec. 27 which appear exactly identical with those from the root galls. Some sort of alternation of generations may be involved here, but it is not unlikely that the species will produce galls on various parts of the plant, not being confined to the roots only.

Cynips mirabilis, new species

Holcaspis maculipennis Beutenmuller (in part), 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 43, pl. IX, figs. 2, 3.

Cynips maculipennis Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 344. Felt (in part), 1918, N.Y. Mus. Bull., 200, p. 100, fig. 63 (2, 3).

Amphibolips quercus-inanis Trotter (error), 1910, Boll. Lab. Portici, V, p. 101.

(Not (!) *Holcaspis maculipennis* Gillette, 1894, Can. Ent., XXVI, p. 236.)

FEMALE.—Median groove evident in part; parapsidal grooves continuous; abdomen hairy on the sides of all the segments; almost a score of spots in the cubital cell; length about 4.5 mm. HEAD: Not as broad as the thorax, considerably widened behind the eyes; brownish rufous, darker on the median elevation and piceous on the mandibles; finely rugose, mostly hairy, dense with long, yellowish hairs on the face, naked on the front. Antennæ deep brown, tinged with rufous on the first two segments; hairy; with 14 segments, the first segment almost as long as the fourth, the second segment globose, the third considerably longer than the fourth, the last distinctly longer than the preceding. THORAX: Bright rufous, black between the parapsides except posteriorly, and black about the lateral lines; mesonotum smooth, finely punctate, not heavily covered with long, yellow hairs; parapsidal grooves continuous, distinct to the pronotum, rather well convergent posteriorly, only gradually divergent anteriorly; median groove discernible for almost half the length of the mesonotum, quite distinct posteriorly; anterior parallel lines fine but evident, most distinct and smooth and divergent posteriorly, extending half way to the scutellum; lateral lines very prominent, broad, elevated, smooth, and naked; scutellum wide, but considerably longer than wide, rounded posteriorly, rich rufous, finely rugose, sparsely hairy, dense with yellow hairs at the sides, with a slight indication of a longitudinal, median depression as in the genus *Amphibolips;* basally with two very large foveæ, black, shining, deeply grooved, indistinctly separated by irregular ridges; pronotum at the sides rich rufous, smooth, finely punctate, sparsely hairy; mesopleuræ rufous with some black, punctate, hairy, densely so ventrally. ABDOMEN: Longer than wide, the segments only slightly produced dorsally, rufous to rufo-piceous and black, darkest dorsally and ventrally, practically smooth tho very microscopically punctate, more distinctly punctate where hairy, a heavy coating of yellowish hairs on the sides of *all* the segments, a tuft of long, yellow hairs on the tip of the ventral spine. LEGS: Femora rufous, coxæ yellow rufous, tarsi and tibiæ rufous brown; punctate, dense with yellow hairs, hairs only sparse on the femora; tarsal claws heavy, toothed. WINGS: Tinged with yellow, veins yellowish brown, cross-veins darker; areolet large; radial cell open, the second abscissa of the radius not reaching the margin, curved, thickened, and peculiarly knobbed terminally; the first abscissa sharply angulate but without a projection, infuscated, as is also the subcosta terminally; light brown clouds in the cubital and discoideal cells, about a score of distinct, brown spots in the cubital cell. LENGTH: 4.5-5.0 mm.

GALL.—Globular leaf gall; monothalamous; 15.-35. mm. in diameter, thin-shelled, smooth, yellowish brown, rather closely marked with irregular, purplish brown spots. Internally with a hard-shelled larval cell, 3. x 5. mm., held centrally by a moderately dense mass of silky, sparingly branched fibers. On leaves of *Quercus garryana.*

RANGE.—Washington: White Salmon. Oregon: Ashland, Junction City, Grants Pass, Roseburg, Canby; Portland (E. O. Hovey); Albany (Trotter). California: Ukiah(?), Yreka; McConaughy, Siskiyou Co. (Fullaway); Elsies Creek, Amador Co. (G. Hansen, in Gray

Herb.). Probably found thruout northern California, Oregon, Washington, and British Columbia, wherever *Q. garryana* occurs.

TYPES.—5 females, 10 galls. Holotype female, paratype females, and galls in The American Museum of Natural History; paratype females and galls with the author. Labelled Portland, Oregon; October, 1905; E. O. Hovey collector.

By a mistake in identification of this Hovey material, this species has gone thru the literature as Gillette's *maculipennis*. The two are generically related, but are very distinct species. *Maculipennis* was described from New Mexico, and is restricted as far as I know to a southern Rocky Mountain area; *mirabilis* is confined to the Vancouveran zone of the Pacific Coast, at present recorded only from *Quercus garryana*, or some of its varieties, on which oak it is very abundant. Apparently adults emerge late in the fall or early in the spring, for by early March the galls are all vacated. This species belongs to *Cynips* Hartig; and not to *Cynips* of most American authors; the species shows also some characteristics of *Amphibolips*, with which genus the physiology reflected by gall characters would connect the insect.

Diastrophus kincaidii Gillette

FEMALE.—Wholly black except on legs and mouthparts; median groove short; foveæ not sharply defined; first abscissa of the radius almost straight. HEAD: Broader than the thorax, somewhat enlarged behind the eyes; black, mouthparts yellow to rufo-piceous; vertex smooth and naked, a few scattered hairs behind the eyes, face puncto-rugose, hairy; rugose, radiating striations from the mouth to the eyes. Antennæ brownish black to black, browner basally; pubescent; with 13 segments, the second not quite globose, the third half again as long as the fourth, the last almost twice the length of the preceding. THORAX: Entirely black; mesonotum smooth, shining, and naked; parapsidal grooves rather fine but distinct, continuous to the pronotum where they are widely divergent, gradually and closely convergent at the scutellum; median groove distinct in some irregular sculpturing between the parapsides at the scutellum, usually short, sometimes discernible for a third or more of the mesonotal length; anterior parallel and lateral lines practically absent, barely indicated sometimes; scutellum elongate, narrow, rather finely rugose, depressed anteriorly, the depression divided by a rugose, raised area into smaller or larger foveæ; pronotum moderately broad dorsally, puncto-rugose and scatteringly hairy; mesopleuræ mostly smooth and naked, finely rugose dorsally, finely aciculate centrally and scatteringly elsewhere. ABDOMEN: Black, piceous basally and ventro-posteriorly, entirely naked and smooth, extending ventrally as far as or farther than dorsally, segments produced somewhat dorsally, edges oblique and very much rounded ventrally; second segment small,

not covering a quarter of the abdomen; ventral spine practically lacking. LEGS: Wholly bright rufous brown even on the coxæ, hairy; tarsal claws fine, weak, toothed. WINGS: Clear; hardly ciliate on the anterior margins; veins rich brown, rather heavy; areolet usually present; cubitus reaches the basalis at the midpoint; radial cell rather short and broad, open, the second abscissa of the radius hardly curved, failing considerably to reach the edge; first abscissa of the radius almost straight with hardly a suggestion of a curve; radial cell entirely clear, a brownish infuscation about the terminal part of the subcosta, extending into the subcostal cell. LENGTH: 1.5-2.5 mm.

MALE.—Differs from the female as follows: Antennæ with 14 segments; abdomen much smaller; areolet smaller, terminal part of subcosta practically without infuscation; length 1.2-1.8 mm.

GALL.—Large, irregular stem swelling. Polythalamous, with a great many cells. Swelling rather abrupt, elongate, up to 60. mm. in length by 20. mm. in diameter; somewhat irregular, smoothed, covered with bark of normal color. Internally filled with mostly loose tissue in which the larval cells are densely crowded, the cells not separate, but almost separable, broadly oval, averaging 2. x 2.5 mm. On stems of *Rubus parviflorus* (acc. B. G. Thompson in Mus. Comp. Zool.), and *R. nutkanus.*

RANGE.—From Alameda Co., California, to Washington and Idaho.

These two varieties are about as similar as any two forms which I should call distinct. Both insects and galls share the similarity. The best single distinction between the insects is the nature of the foveæ of the scutellum; other characters are distinct mostly in their averages. The two have distinct ranges. This species is not so very different from *Diastrophus nebulosus* and *D. turgidus* of the eastern parts of the United States, and I am not entirely certain that all of these should not be considered varieties of one species.

Diastrophus kincaidii variety **kincaidii** (Gillette)

Diastrophus kincaidii Gillette, 1893, Can. Ent., XXV, p. 110. Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 662, 841. Thompson, 1915, Amer. Ins. Galls, pp. 24, 44.

Diastrophus Kincaidi Kieffer, 1902, Bull. Soc. Metz, X, p. 92. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 73.

Diastrophus kincaidi Beutenmuller, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 138, pl. XXVII, figs. 2, 3. Felt, 1918, N.Y. Mus. Bull., 200, p. 142, fig. 141 (2, 3). Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 371.

FEMALE.—Differs from the female of the other variety as follows: Antennæ rather short and thickened, somewhat thicker apically; anterior parallel and lateral lines only indicated, but perhaps less distinctly than in *austrior;* scutellum with foveæ indefinite, mostly rugose

at bottom, with small, smoother areas laterally; areolet of moderate size to very small or closed; radial cell entirely clear, a limited, brown infuscation about the terminal part of the subcosta extending into the subcostal cell only.

MALE.—Differs from the male of *austrior* in having the areolet small or very small, averaging smaller.

GALL.—Quite similar to that of *austrior*.

RANGE.—Washington: Seattle (in Amer. Mus. Nat. Hist.); Olympia (Gillette); White Salmon. Oregon: Corvallis (B. G. Thompson in Mus. Comp. Zool.). Idaho: Cedar Mts. (Beutenmuller det.).

TYPES.—C. P. Gillette collection?.

I have not seen the Idaho material. The B. G. Thompson material in the Museum of Comparative Zoology was bred January 24 and 27. Gillette bred his adults in March. Material which I collected at White Salmon, Washington, April 11, had most of the adults already emerged, tho a few emerged after that date. I am inclined to believe late March is the average time of emergence. Of 64 adults of which I have record, 21 are males. I have collected galls which were widely broken into, possibly by birds, more probably by mice in search of the ready mess of larvæ or pupæ.

Diastrophus kincaidii variety **austrior** new variety

Diastrophus kincaidi Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 375.

FEMALE.—Differs from the other variety as follows: Antennæ distinctly slender, not as short as in the other variety; anterior parallel and lateral lines only indicated but perhaps more distinctly than in variety *kincaidii;* scutellum with two very distinct, good-sized foveæ which are smooth at bottom; areolet of moderate size to large, rarely small; radial cell mostly clear, a light brown infuscation about the terminal part of the subcosta more often extending equally into both radial and subcostal cells.

MALE.—Differs from the male of variety *kincaidii* in having the areolet of moderate size or small, averaging larger.

GALL.—Quite similar to that of variety *kincaidii*.

RANGE.—California: Point Arena (Fullaway); Alameda Co. (thru Riley); Mt. Tamalpais.

TYPES.—32 females, 13 males, 26 galls. Holotype female, paratype adults, and galls in The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, and with the author. Labelled Mount Tamalpais, California; March 14, 1920; Kinsey collector.

Some of the insects had emerged before March 14, but all of the types emerged after that date.

Diplolepis bassetti (Beutenmuller)

FEMALE.—Mostly black, legs largely rufous; parapsidal grooves very distinct, continuous; mesonotum distinctly coriaceous, punctate, and hairy; scutellum without foveæ; radial and part of cubital cells smoky. HEAD: About as broad as or somewhat broader than the thorax; black, mandibles dark rufous, piceous on the tips; front coriaceous, smooth in part, naked; face puncto-rugose, hairy. Antennæ almost wholly black, sometimes the two basal segments tinged piceous; finely pubescent; with 14 segments, the second globose, the third almost twice the length of the fourth, the last almost twice the length of the preceding, an incomplete division indicated. THORAX: Wholly black; mesonotum shining, smoothed, coriaceous in places, especially between the parapsides posteriorly, scatteringly punctate and hairy; parapsidal grooves very distinct, continuous to the pronotum, tho obscured in sculpturing anteriorly, only gradually divergent anteriorly, gradually but not very closely convergent posteriorly; median groove distinct at the scutellum, indicated a third of the mesonotal length; anterior parallel lines fine and faint, indicated more than half the mesonotal length; lateral lines practically absent; pronotum laterally rugose; mesopleuræ rugose dorsally, mostly smooth and shining, crossed by a moderately broad, rugose, horizontal line; scutellum quite elongate, well rounded posteriorly, closely rugose, depressed anteriorly only laterally, without foveæ, a broad, elevated ridge extending from the mid-point of the scutellum to the mesonotum. ABDOMEN: Entirely black, entirely smooth, shining, naked; distinctly elongate, more than half again as long as high, segments produced somewhat dorsally, only moderately rounded ventrally, the second segment covering only about one third of the total area; ventral sheath produced, plow-shaped, the spine short. LEGS: Brownish rufous with more or less piceous, tarsi less bright, the tips dark; covered with hairs; tarsal claws weak, simple. WINGS: Finely ciliate on the margins, yellowish, entirely smoky, most so in the radial cell and nearby in the cubital cell; veins heavy, dark brown; areolet distinct; cubitus becoming fine, but reaching the basalis below the midpoint; radial cell open (!), tho somewhat darkened on the margin, very short and broad; second abscissa of radius not greatly curved; first abscissa of the radius angulate at about 75°, with a short but very distinct projection. LENGTH: 2.0-3.2 mm.

MALE.—Differs from the female as follows: Eyes protruding as far as or farther than the cheeks; mandibles brighter in color; antennæ with 15 segments; the abdomen small and slender; the wings less smoky; areolet somewhat smaller, radial cell somewhat less open; length 1.7-2.7 mm.

GALL.—Mossy, containing a compact or agglomerated cluster of woody cells. Filamentous covering 4.0-8.0 mm. thick, probably green and reddish when young, becoming brown and blackened with age; filaments attached to a more or less compacted cluster of larval cells, each cell sub-spherical, 2.0-4.0 mm. in diameter, with woody but not thick walls, entirely hollow within. On the twigs, usually terminally, of *Rosa nutkana.*

RANGE.—Oregon, Idaho, and Utah. Probably elsewhere in the northwest.

Morphologically the insects of this species are decidedly related to *Diplolepis rosæ*, and less closely to *D. bicolor*. Significantly, the galls of variety *bassetti* show striking similarity to those of *rosæ*. The galls of the other variety, tho superficially similar to *rosæ*, are in all respects merely a compact cluster of galls of the *D. bicolor* type, differing mainly in possessing the filamentous covering. The evolutionary transition from the galls *bicolor* to *rosæ*, or the reverse procedure, cannot have been more profound than the evolution of the two types of galls in this one species.

There will be no question that this is a single species, for the characters separating the two varieties are very few. But if one has any doubt of the validity of the varieties he should examine a large series of individuals, when he should be impressed with the constancy of the distinctions within these few characters. Geographic isolation has probably contributed materially to the separation of two forms, for as far as the ranges of the two are known at present they are separated by the high altitudes of the barren lava-bed country of western Oregon. The type localities of the two are two hundred and fifty miles apart. Moreover, variety *bassetti* occurs in a region of excessive precipitation and tempered seasons, while the other variety occurs in the very arid deserts of the northern Rocky Mountains, a country of extreme climate.

I should not consider this a variety of *Diplolepis rosæ*, tho the two are very close. *Rosæ* seems to be a native of Europe, but has more or less of a world-wide distribution, being readily imported into new regions; and apparently the species reached the eastern part of the United States as an importation from Europe. *Rosæ* has not been recorded from west of the Rockies. No species native to America is very closely related to *rosæ* except this Pacific Coast species, *bassetti*. There may be considerable significance in this situation.

Diplolepis bassetti variety **bassetti** (Beutenmuller)

Rhodites bassetti Beutenmuller, 1918, Can. Ent., L, p. 307, pl. IX, figs. 13, 14.

FEMALE.—Differs from the female of the other variety as follows: Eyes not protruding beyond cheeks; scutellum closely rugose,

uniformly so even on the elevated central portion and on the elevated ridge to the mesonotum; legs mostly bright brownish rufous, coxæ touched with piceous; areolet of moderate size.

MALE.—Differs from the male of the other variety as follows: Mandibles dark rufous brown; legs mostly bright rufous, with the tarsi darker and the coxæ wholly piceous; wings distinctly smoky in the radial cell but less so than in the female; areolet small.

GALL.—Superficially resembles the gall of the other variety, but is distinct as follows: Filaments finer, more dense and curled; often a hundred or more larval cells in a cluster, the cells thoroly fused together, forming a perfectly solid, woody mass; galls averaging large, often up to 45. mm. in diameter.

RANGE.—Oregon: Corvallis (Beutenmuller); Ashland.

TYPES.—In the Beutenmuller collection(?), and at the Museum of Comparative Zoology. From Corvallis, Oregon; B. G. Thompson, collector.

The above descriptions were made from material I collected at Ashland. Of 85 adults, 39 are males. Beutenmuller states that galls collected in December gave adults from late February to the middle of March, indoors. Most of the adults had not yet emerged from the galls collected at Ashland on April 6.

Diplolepis bassetti variety **lucida,** new variety

FEMALE.—Differs from the female of the other variety as follows: Eyes distinctly protruding beyond the cheeks; scutellum closely rugose, only finely rugose and distinctly shining on the elevated central portion and on the elevated ridge to the mesonotum; legs bright brownish rufous, the coxæ, trochanters, and a small part of the femora piceous; areolet very large.

MALE.—Differs from the male of the other variety as follows: Mandibles light yellow rufous; the scutellum almost without the smoothher area of the female of this variety; the legs generally darker, the coxæ, trochanters, and a large part of the femora piceous; wings almost clear, almost entirely clear in the radial cell; areolet large but not as large as in the female of this variety.

GALL.—Superficially resembles the gall of the other variety, but is distinct as follows: Filaments heavier, broader, straighter; usually only 30 or fewer larval cells in a cluster, each cell more or less entirely separate, with a proximate origin from the stem, the cells compacted into an insecure mass more by the intertwining filaments than by a fusion of the wood of each cell; the whole mass averaging smaller than in the other variety, 25. mm. the maximum diameter noted.

RANGE.—Oregon: La Grande. Idaho: Mountain Home.

TYPES.—115 females, 83 males, 36 galls. Holotype female, paratype adults, and galls in The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy,

and with the author. Labelled La Grande, Oregon; April 12, 1920; Kinsey collector.

Few of the adults had emerged on April 12 at La Grande, and on April 20 at Mountain Home Of 267 adults, 100 are males.

The collection at Mountain Home, Idaho, has peculiar interest because that locality is in the heart of the Snake River desert. This is an alkaline, dust desert, barren of most vegetation except sage brush, with an excessively low precipitation; because of its elevation of about 3500 feet, and its great, level sweep, the region is exposed to severe storms and extreme temperatures in winter, and to a surprisingly hot summer. Repeated searchings at several localities across this desert failed to disclose any plant which might bear *Cynipidæ*. The oaks, mainly eastern species, planted as wind breaks in the towns, failed to disclose galls. Some distance outside of the town of Mountain Home, a few roses were growing beside an irrigation ditch, and there were two galls of this species and variety. I do not know whether the roses were native species or escapes from cultivation; they bore a native cynipid. How far it may have been to the next colony of roses it would be hard to determine; I am inclined to believe it might have been a considerable distance. Insects and galls of this material agree in minute detail with material from La Grande, two hundred miles away, mostly across the desert. The desert does possess a system of streams, but roses are few at most along these streams, for I failed to find them at any of a half dozen other points at which I tried to collect.

I collected galls of this type at Brigham, Utah, but did not obtain insects, so I cannot say whether yet another variety will be found for this species.

Diplolepis fusiformans (Ashmead)

FEMALE.—Head and thorax black, abdomen in part rufous; mesonotal grooves and lines shallow or obscure; mesopleuræ smooth, crossed by a wide, rugose band; abdomen entirely smooth; areolet small. HEAD: Wider than the thorax, not enlarged behind the eyes; black, the mouthparts colored lighter; finely coriaceous, more coarsely so on the face; vertex naked, face hairy. Antennæ slender, black, the first two segments colored lighter; with 14 segments, the second globose, the third at least half again as long as the fourth, the last somewhat longer than the preceding. THORAX: Wholly black; mesonotum irregularly, rather finely coriaceous or shagreened, punctate, finely hairy; parap-

sidal grooves rather fine and shallow, continuous to the pronotum, slightly obscured in a more rugose area anteriorly; median groove indicated for a quarter the length of the mesonotum; anterior parallel lines barely indicated; lateral lines more or less distinct; scutellum elongate, well rounded posteriorly, rugose, depressed anteriorly, most so laterally, not forming distinct foveæ; pronotum laterally rugose; mesopleuræ smooth, only obscurely coriaceous, shining, naked, edges rugose, transversely crossed below the middle with a rugose band which is very rugose posteriorly. ABDOMEN: Brighter basally, darker posteriorly and ventrally; entirely smooth, naked except for a very few hairs basally; of moderate length, somewhat produced dorsally, the second segment covering a half to two-thirds or more of the area; edges of segments somewhat oblique; hypopygium broad, pointed, the spine short, fine. LEGS: In part rufous, in part brown; tarsal claws fine, simple. WINGS: Narrow; only finely ciliate on the margins; tinged yellowish especially on the radial cell; veins not heavy, of a medium brown; areolet small to closed; cubitus hardly continuous, faint at the basalis; radial cell closed but the marginal vein rather faint, of moderate length, the second abscissa of the radius only slightly curved; first abscissa well curved, arcuate with only a slight suggestion of an angle. LENGTH: 1.5-2.2 mm.

MALE.—Differs from the female as follows: First two segments of the antennæ darker, third segment relatively longer; abdomen piceous black, very small, somewhat pedicellate, sometimes elongate triangulate; legs darker; wings almost clear, the radial cell more distinctly closed; length 1.2-2.0 mm.

GALL.—Small, elongate stem swelling. Polythalamous, with rather few cells. Irregular, usually longer than wide, sometimes rather globose, more or less abrupt, usually but not always symmetrical about the stem, covered with brown bark somewhat different from the normal bark; up to 30. mm. long by 8. mm. in diameter, usually smaller, sometimes several more or less fused. Internally woody, rather solid, the normal stem tissue more evident centrally; the larval cells more or less elongate oval, the lining rather distinct but inseparable. On stems of *Rosa* species.

RANGE.—Canada: Toronto (Cosens). Illinois (Weld). Colorado. California. Probably occurs thruout North America, wherever roses occur.

This is one of the primitive species of the genus, as indicated by the closed radial cell, the small second abdominal segment, the equal numbers of the two sexes, and the slight development of the gall. It is not the same species as *Diplolepis verna* (Osten Sacken), altho both species are primitive. This species should be discovered wherever roses occur in North America, and many other varieties will need to be described.

Of 236 insects I have bred, only 89, or 38 per cent, are

males. But material of one variety gave over 50 per cent males, suggesting that the sexes are probably equal if the collections are adequate. The insects emerge in spring, from February further south to April (or later?) further north. It is unlikely that an alternation of generations occurs.

Diplolepis fusiformans variety **fusiformans** (Ashmead)

Rhodites fusiformans Ashmead, 1890, Bull. Colo. Biol. Assoc., I, pp. 14, 38. Cockerell, 1890, Ent., XXIII, p. 75; 1900, Ent. Student, I, p. 10. Gillette, 1892, Ent. News, III, p. 246. Dalla Torre, 1893, Cat. Hymen. Cynip., II, p. 127. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 78; 1910, Das Tierreich, XXIV, pp. 717, 840. Beutenmuller, 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 643, pl. XLVI, figs. 10-12. Thompson, 1915, Amer. Ins. Galls, pp. 22, 45. Felt, 1918, N.Y. Mus. Bull., 200, p. 146, fig. 150 (10-12). Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 393.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Mouthparts yellow or brown rufous, the mandibles tipped piceous; first two segments of the antennæ bright rufous brown; lateral lines fine, smooth, distinct; abdomen bright yellow rufous, dark brownish rufous posteriorly and ventrally; second segment covering fully two-thirds or more of the abdomen; hypopygium relatively smaller than in *minuta;* legs almost entirely bright yellow rufous, coxæ somewhat darker basally, the hind tibiæ and tarsi brown; areolet moderately small; length 1.7-2.2 mm.

MALE.—Differs from the males of the other varieties as follows: Lateral lines somewhat smooth; second segment covering three-quarters of the abdomen; legs dark brown on the coxæ and femora and hind tibiæ; areolet moderately small; length 1.5-2.0 mm.

GALL.—Differs from the galls of other varieties in having the swelling rather abrupt, distinct, sometimes globose; up to 17. mm. in length and 8. mm. in diameter; usually with only six or eight larval cells.

RANGE.—Colorado: West Cliff, Colorado Springs (Cockerell); Manitou. Probably confined to an area in Colorado in the foothills on the eastern side of the Continental Divide.

TYPES.—Females, males, and galls at the U.S. National Museum. From West Cliff, Colorado; T. D. A. Cockerell collector.

The redescriptions are made from material I collected at Manitou on April 24, 1920; I have compared it with the Ashmead types.

Of 86 insects I bred from the galls collected at Manitou, 17, or only 20 per cent, are males. Probably the sexes are more nearly equal in number, some of the males having emerged before collection.

This insect has also been recorded from Illinois and

Toronto (Beutenmuller, 1914, Bull. Brooklyn Ent. Soc., IX, p. 88, pl. V, figs. 6-8); I have not seen this material, but feel certain it must represent at least distinct varieties, for the faunal area in which true *fusiformans* occurs is limited to a small part of Colorado.

Diplolepis fusiformans variety **minuta,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Mouthparts dark rufous to black, darker than in *mendocinensis;* first two segments of the antennæ very dark brown, averaging darker than in *mendocinensis;* lateral lines not smooth, not very evident; abdomen dark brown rufous, almost black posteriorly and ventrally; second segment covering a half or somewhat more of the abdomen; hypopygium relatively larger than in *fusiformans;* legs yellow rufous, the coxæ basally, parts of femora, and the hind tibiæ dark brown; areolet very small or closed; length 1.0-1.5 mm.

MALE.—Differs from the males of other varieties as follows: Lateral lines not smooth, barely evident; second segment covering only about half of the abdomen; legs almost black on the coxæ and femora and the hind tibiæ; areolet almost closed; length 1.5 mm.

GALL.—Differs from the galls of other varieties in having the swelling only slightly larger than the stem, not over 20. mm. in length and 3.5 mm. in diameter, hardly noticeable except by the distorted bark; larval cells few, usually not over four in a gall.

RANGE.—California: San Bernardino Mountains (Little Bear Lake). Probably confined to the neighborhood of this range.

TYPES.—11 females, 2 males, 60 galls. Holotype female, paratype female, and galls at The American Museum of Natural History; paratype females and galls at Stanford University and the U.S. National Museum; paratype galls at the Museum of Comparative Zoology and the Philadelphia Academy; paratype females, males, and galls with the author. Labelled San Bernardino, California; January 31, 1920; Kinsey collector.

This is the smallest cynipid I know inhabiting roses. The insect is quite distinct from variety *fusiformans,* but closely resembles *mendocinensis.* It is reasonable that the two California varieties should be more closely related to each other than to the Colorado variety. The galls of the two California varieties also more closely resemble each other than they do the Colorado variety, but are very definitely different.

Minuta galls are almost unnoticeable, so little do they distort the stems. They are located usually toward the tips of the stems, and sometimes kill the stem beyond. Large larvæ were in the galls on January 31, 1920, and emerged at some later date.

Diplolepis fusiformans variety **mendocinensis,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Mouthparts rich brownish rufous; first two segments of the antennæ medium rufo-piceous to very dark brown, sometimes lighter than in *minuta;* lateral lines not smooth, not very evident; abdomen dark brown rufous, dark brown posteriorly and ventrally, not as black as in *minuta;* second segment covering a half or somewhat more of the abdomen; hypopygium relatively larger than in *fusiformans;* legs yellow rufous, the coxæ basally, parts of the femora, and the hind tibiæ dark brown; areolet very small or closed; length 1.7-2.2 mm., averaging about as large as *fusiformans.*

MALE.—Almost identical with the male of *minuta,* the legs averaging lighter, especially not as dark on the coxæ and femora; the areolet more often of moderate size, larger than in the female; length 1.5-2.0 mm.

GALL.—Differs from the galls of other varieties in having the swelling of moderate size, up to 30. mm. in length and 5.0 mm. in diameter, sometimes with several galls fused together; the larval cells clustered, with sometimes about 30 in a gall.

RANGE.—California: Ukiah. Probably confined to a region in Mendocino and northern Sonoma counties.

TYPES.—67 females, 70 males, 80 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Ukiah, California; March 17, 1920; Kinsey collector.

On March 17, 1920, the galls at Ukiah contained mature larvæ, with evidence that some of the insects had already emerged. Of the 137 adults bred, 70, or just about 50 per cent, are males. The galls are usually located near the tips of the twigs, and altho they are only slight swellings of the stem are rather noticeable, because in many cases the bark covering of the cluster of cells is to some extent lost. Whether this is due to the weathering away of the thin bark, or to attacks of birds or mice I cannot determine.

The insect very closely resembles the insect of *minuta,* from which it is distinguished mainly by minor color differences and the very distinct size. This size difference is too great and too constant to be ignored. Moreover the galls of the two are distinct, altho they are more similar to each other than to *fusiformans.* This correlation of similarities between the morphological and physiological characters of the insect is worth attention.

Diplolepis radicum (Osten Sacken)

FEMALE.—Mesonotum rather smooth; parapsidal grooves lost in rugose areas anteriorly; scutellum without foveæ; abdomen wholly smooth; wings largely yellow. HEAD: Somewhat wider than the thorax, hardly enlarged behind the eyes; black, the mouthparts deep rufous, the tips of the mandibles piceous; finely granulose rugose and naked on the vertex and cheeks, roughly rugose and hairy on the face. Antennæ short, thick, hairy, black, the first two segments rufous to piceous; with 14 segments, the second segment about globose, the third twice the length of the fourth, the last not half again as long as the preceding. THORAX: Wholly black; mesonotum mostly smoother, shining, sparsely set with short hairs, especially anteriorly, and irregularly roughened, in part coriaceous, deeply rugose at the anterior ends of the parapsidal grooves; parapsidal grooves deep, rugose at bottom, almost continuous, lost in the rugose area anteriorly; median groove lacking, short, or discontinuous; anterior parallel lines fine or absent; lateral lines long, fine, and shallow, more or less distinct; scutellum much longer than wide, roundly pointed posteriorly, very rugose, depressed and more rugose anteriorly with a more or less elevated, slightly smoother area extending from the middle of the scutellum anteriorly to divide the anterior depression; pronotum laterally very rugose; mesopleuræ largely smooth and shining, the surface slightly uneven, rugose on the dorsal edge anteriorly, and crossed below the center by a deep, rugose, transverse band. ABDOMEN: Piceous black, more brownish or rufo-piceous basally; entirely smooth and shining, entirely naked except for a very few hairs basally; small, short, considerably produced dorsally, the second segment covering one-half to three-quarters of the area, the edges of the segments oblique, the hypopygium broad, pointed, the spine short. LEGS: Brownish rufous, the tarsi brighter, the coxæ darker basally; tarsal claws moderately heavy, simple. WINGS: Yellowish, especially about the radial cell; margins only short ciliate; veins rather fine, of a medium brown; the areolet of a moderate size or large; the cubitus very faint, short, not continuous; radial cell short, broad, open, the second abscissa of the radius sharply bent near the base; the first abscissa arcuate, only suggesting an angle. LENGTH: 3.0-4.0 mm.

MALE.—Differs from the female as follows: Third segment of the antenna slightly curved; median groove not distinct but discontinuously indicated for some distance; abdomen black, slender, elongate, the second segment covering hardly two-thirds of the area, edges of segments about vertical; yellow shading on wings not as heavy.

GALL.—A large, massive, pithy root gall. Polythalamous, larger galls with a hundred or more larval cells. Very irregular in shape, but generally rounded, globular, depressed at the points of attachment, irregularly folded, gnarled, sometimes as an unopened bud; variable in size, up to 105. mm. in length by 70. mm. in diameter; reddish brown, darkening with age. Internally soft, rather pithy, with only a small amount of woody fiber; the larval cells large, nearly round, often 4. mm. in diameter, with a smooth but hardly distinct, inseparable lining. On

stems and roots, under ground, or under debris close to the ground; sessil or nearly so, laterally or terminally, on roses.

RANGE.—Canada and Maine to North Carolina and Washington. Probably everywhere in North America where roses occur.

The insects emerge rather late in the spring, in April or May or later, depending on the development of the season. Immature galls may be found in July or August. The species is bisexual, with the sexes about equal in numbers, and probably takes only a single year to mature, without an alternation of generations. The number of parasites bred is not great, altho they do occur. W. M. Davis (1908) records finding galls broken into by mice.

Two varieties, *radicum* and *utahensis*, of this species have been previously described. They have been considered distinct species, the adults on the basis of trivial characters which cannot be counted more than varietal, and the galls on the basis of the original description of *utahensis*, which states that the gall is deeply incised like a bud, and that it does not occur entirely below the ground. Large collections however indicate that there are absolutely no constant differences in the galls of the two, unless the eastern galls average smaller. It has been the custom to assign all material from eastern localities to *radicum*, from western localities to *utahensis*. As a matter of fact, true *utahensis* and true *radicum* resemble each other as closely as *radicum*, from the Atlantic Coastal Plain up to Cape Cod, resembles *johnsoni* from the northern Massachusetts coast. I hope anyone who may object to recognition of my varieties, my "creations" in Cynipidæ, will bear in mind this *radicum-utahensis* case!

My material of this species is limited except from Utah. There are undoubtedly many varieties to be described. In addition to material which I can assign to definite varieties the species has been recorded from Ottawa (Provancher), Ontario (Jarvis), Maine, Ohio (Beutenmuller), Indiana (Cook), Illinois (Weld), Colorado (Ashmead, Gillette, and Cockerell). The following are the references for these localities:

Rhodites radicum Provancher, 1889, Add. et Corr., p. 162. Ashmead, 1890, Colo. Biol. Assoc. Bull., I, p. 38. Gillette, 1892, Ent. News, III, p. 247. Webster, 1892, Ohio Agr. Exp. Sta. Bull., 45, p. 156. Cockerell, 1900, Ent. Student, I, p. 10. Cook, 1904, Proc. Ind. Acad. Sci., p. 225; 1904, Ohio Nat., V, figs. 98a, 98b; 1905, 29th Rpt. Ind. Dpt. Geol. and Nat. Res., p. 817, fig. 11. Jarvis, 1907, Rpt. Ent. Soc. Ont., XXXVII, p. 70; 1909, Rpt. Ent. Soc. Ont., XXXIX, p. 90.

Patch, 1907, Me. Agr. Exp. Sta. Bull., 148, p. 279; Stebbins, 1910, Springfield Mus. Bull., II, p. 38.

The Ashmead, Gillette, and Cockerell records for Colorado are certainly for an undescribed variety. Stebbins' record may apply to variety *johnsoni*. Considering the geographic source of these other references, it is possible that none of them apply to variety *radicum*, which is probably confined to the Atlantic Coastal Plain. Britton (1902, Conn. Exp. Sta. Rpt., I, p. 237), records this species from *Rubus*. This is a mistake, and the reference applies probably to *Diastrophus nebulosus* (Osten Sacken). According to Beutenmuller (1909), Bull. Amer. Mus. Nat. Hist., XXVI, p. 137), the following references to this species apply to *Diastrophus turgidus* (Bassett):

Rhodites radicum Riley, 1870, Amer. Ent., II, p. 181, fig. 110. Saunders, 1874, Rpt. Ent. Soc. Ont., for 1873, p. 7, fig. 1; 1883 and 1889, Ins. Inj. Fruits, p. 304, fig. 314. Gillette, 1888, 27th Rpt. Agr. Mich., p. 467.

In the same paper (1909) Beutenmuller applies the following references to *Diastrophus radicum* Bassett:

Rhodites radicum Gillette, 1888, 27th Rpt. Agr. Mich., p. 467. Gibson, 1906, Rpt. Ent. Soc. Ont., for 1905, p. 122.

The next references apply to some, probably an undescribed, variety of this species:

Tribalia batatorum Walsh, 1864, Proc. Ent. Soc. Phila., II, p. 471. Ashmead, 1885, Trans. Amer. Ent. Soc., XII, pp. 294, 304; 1887, Trans. Amer. Ent. Soc., XIV, p. 134; 1903, Psyche, X, p. 210; 1903, Proc. Ent. Soc. Wash., V, p. 222. Kieffer, 1902, Bull. Soc. Metz, (2), X, p. 96. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 77; 1910, Das Tierreich, XXIV, pp. 697, 842. Thompson, 1915, Amer. Ins. Galls, pp. 21, 44.

Walsh published this name with a poor description of an immature insect, without a definite locality altho it was probably Illinois, and with the statement that the gall was "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." This astounding host record was fortunately questioned by Beutenmuller (1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 649), who stated that "Dr. William H. Ashmead informed me some time ago that he had investigated this matter and was in possession of con-

clusive evidence that Walsh's galls were the same as those of *Rhodites radicum* and that Walsh received his specimen from a farmer, who found them while plowing his potato-patch and sent them to the 'State Entomologist' as being 'potato-galls' owing to their resemblance to a potato". The Walsh types were lost in the Chicago fire. I quite believe that *batatorum* never came from a potato, and represents a rose root gall.

Diplolepis semipicea (Harris, 1841, Ins. Mass., p. 400), was described from a rose root gall. Osten Sacken took the insect to be an inquiline of the genus *Periclistus* and the name applied to the gall has been taken to be a synonym of *radicum* in most of the literature. Beutenmuller (1908, Psyche, XV, p. 9) states that the remnants of the type *semipicea* show it to be "the same as *Rhodites fulgens* Gillette". This interpretation appeared correct to me when I examined the type of *semipicea* several years ago, but my examination then was not very critical. If so, *fulgens* must be a distinct variety of *semipicea*. Altho both *radicum* and *semipicea* produce somewhat similar root galls on roses, the insects of the two species are very distinct.

Diplolepis radicum variety **radicum** (Osten Sacken)

Rhodites radicum Osten Sacken, 1863, Proc. Ent. Soc. Phila., II, pp. 42, 45, 46. Walsh, 1866, Pract. Ent., I, p. 114. Mayr, 1881, 20 Jahrb. Communal Oberealsch., I, p. 18. Ashmead, 1885, Trans. Amer. Ent. Soc., XII, pp. 293, 304; 1887, Trans. Amer. Ent. Soc., XIV, p. 134. Bassett, 1890, Trans. Amer. Ent. Soc., XVII, p. 62. Beutenmuller, 1892, Bull. Amer. Mus. Nat. Hist., IV, p. 246, pl. 9, fig. 3; 1904. Bull. Amer. Mus. Nat. Hist., XX, p. 27; 1904, Amer. Mus. Nat. Hist. Guide Leaflet, 16, p. 6, fig.; 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 648, pl. XLVII, figs. 7, 8. Dalla Torre, 1893, Cat. Hymen. Cynip., II, p. 127. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 716, 839. W. T. Davis, 1908, Journ. N.Y. Ent. Soc., XVI, p. 55. Beutenmuller (in Smith), 1910, Ins. N.J., p. 603. Thompson, 1915, Amer. Ins. Galls, pp. 21, 45. Viereck, 1916, Conn. Geol. Nat. Hist. Surv. Bull., 22, p. 441. Felt, 1918, N.Y. Mus. Bull., 200, p. 144, fig. 148 (7, 8). Lutz, 1918, Fieldbook Ins., p. 468, pl. C, fig. 2.

Diplolepis radicum Britton, 1920, Conn. Geol. and Nat. Hist. Surv. Bull., 31, p. 322.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Face not radiantly striate as in *johnsoni;* first two segments of the antennæ very dark piceous; mesonotum distinctly more coriaceous, rougher, more hairy than in other varieties; parapsidal grooves somewhat broader and more rugose than in

other varieties, only gradually convergent posteriorly, but approaching so closely at the scutellum as to almost touch the median groove; median groove fine, quite distinct for half the length of the mesonotum; anterior parallel lines indicated for a short distance; lateral lines less distinct than in other varieties; scutellum narrow, the median elevation distinct and so narrow as almost to form a ridge; abdomen of moderate length, the second segment covering hardly more than half the area; legs almost uniformly bright brownish rufous; areolet tending to be small.

MALE.—Differs from the males of other varieties as follows: Face not radiantly striate; first two segments of the antennæ almost black; mesonotum distinctly more coriaceous; parapsidal grooves approaching so closely at the scutellum as to almost touch the median groove; median groove distinct for a third or more of the mesonotal length; anterior parallel lines only indicated; second segment covering two-thirds of the abdomen; areolet moderately small.

GALL.—Does not differ particularly from the galls of other varieties; averaging smaller.

RANGE.—D.C.: Washington (Osten Sacken). North Carolina (Beutenmuller). Pennsylvania? (Beutenmuller). New Jersey: Ft. Lee (Beutenmuller). New York: Staten Island (Beutenmuller); Nyack (Zabriskie in Amer. Mus.).

TYPES.—Females, males, and galls at the Museum of Comparative Zoology; adults at the Philadelphia Academy of Natural Sciences, and in my collection; gall at The American Museum of Natural History. Osten Sacken collector; from Washington, D.C.

The insect of this variety is very distinct from any other in the species. I have examined type material, and material from Nyack and Staten Island, but the other localities listed are published records from the Atlantic Coastal Plain, to which region the variety may be confined. It probably occurs only on the main body of the Coastal Plain which reaches its main northern limit on Cape Cod, but also extends as reduced remnants at river mouths further east on the Atlantic Coast into Nova Scotia.

Diplolepis radicum variety **johnsoni,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Face rugoso-striate, more radiantly so about the mouth than in other varieties; first two segments of the antennæ with more piceous than in other varieties; mesonotum less distinctly coriaceous, quite smooth and polished; parapsidal grooves quite broad, only gradually convergent at the scutellum; median groove long but very discontinuous; anterior parallel lines practically absent; median anterior elevation of the scutellum less evident; second segment covering one-half to two-thirds of the abdomen; abdomen very elongate; legs bright brownish rufous, the femora and coxæ deep rufous brown;

areolet of only moderate size; first abscissa of the radius slightly more angulate than in other varieties.

MALE.—Differs from the males of other varieties as follows: Face somewhat radiantly striate about the mouth; first two antennal segments often more piceous; parapsidal grooves rather close together at the scutellum; median groove discontinuous; anterior parallel lines practically absent; areolet of only moderate size.

GALL.—Does not differ particularly from the galls of other varieties, averaging smaller.

RANGE.—Massachusetts: Gloucester. Not improbably occurs thruout more northern New England.

TYPES.—24 females, 7 males, 1 gall. Holotype female, paratype adults, and gall at the Boston Society of Natural History; paratype adults at The American Museum of Natural History, the U.S. National Museum, and with the author. Labelled Gloucester, Massachusetts; May 30; C. W. Johnson collector.

I am indebted to Mr. C. W. Johnson, of the Boston Society of Natural History, for permission to describe this variety from material of his collection.

Insects emerged from a gall collected at Gloucester, Massachusetts, on May 30.

Probably no two localities in the United States have been more thoroly collected for Cynipidæ than eastern Massachusetts and the neighborhood of New York City. It is no credit to the taxonomy we have been doing to have ignored the evident differences between material from the two regions. No two adjacent varieties of this species are more distinct than *radicum* and *johnsoni*. I have not yet worked out the extent of the cynipid fauna of eastern Massachusetts; it is probably the same as the fauna of most of more northern New England; variety *radicum* is very probably confined to the remnants of the old Atlantic Coastal Plain.

Diplolepis radicum variety **utahensis** (Bassett)

Rhodites Utahensis Bassett, 1890, Trans. Amer. Ent. Soc., XVII, p. 62. *Rhodites utahensis* Cockerell, 1900, Ent. Student, I, p. 10. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 715, 841. Beutenmuller, 1907 (in small part only), Bull. Amer. Mus. Nat. Hist., XXIII, p. 649, pl. XLVII, fig. 6. Thompson, 1915, Amer. Ins. Galls, pp. 21, 46. Felt, 1918, N.Y. Mus. Bull., 200, p. 144, fig. 148 (6).

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: First two segments of the antennæ bright piceo-rufous; mesonotum obscurely punctate; parapsidal grooves quite broad, quite suddenly curving inward and consequently

close together at the scutellum; median groove lacking, or very short and deep and distinct at the scutullum; anterior parallel lines fine, raised, distinct, especially posteriorly; scutellum more narrow than in *plana*, median raised region not as broad anteriorly; second segment of the abdomen covering about three quarters of the area; abdomen rather short; legs, especially the femora, lighter brownish rufous than in *plana;* areolet large or very large; first abscissa of the radius less heavy than in *plana.*

MALE.—Differs from the males of other varieties as follows: Parapsidal grooves posteriorly suddenly curving inward, and consequently close together at the scutellum; median groove short or discontinuous, areolet large or very large.

GALL.—Does not differ particularly from the galls of other varieties; averages larger.

RANGE.—Utah: Thistle (Weld collector); Provo, Price.

TYPES.—Lost.

Bassett described *utahensis* from several males cut from old galls sent by Mr. Siler "from Utah". The original description was a brief comparison of the males with *"radicum"*, but such a comparison as would cover several of the western varieties, especially since it cannot be entirely certain which of the eastern varieties Bassett had in mind. As with other Cynipidæ, there are probably several varieties of this species to be found in Utah, and I have no other reason for taking my Provo and Price material to represent Bassett's name than that this is the common variety in a large part of the more accessible regions of that state. This material does not disagree with anything in the original description. Altho the types are lost it may be as well to retain the Bassett name, restricting it as I have.

Of 4077 insects I have bred of this material, 2554, or about 63 per cent, are males. This high percentage is evidently due to the premature collecting of the galls which appears to prevent a larger number of the less mature females from emerging. Of the first 2948 Provo insects emerging 69.5 per cent were males; of the last 765 Provo insects emerging only 49 per cent were males. More mature galls collected at Price gave only 38 per cent males. These factors in obtaining ratios of the sexes of Cynipidæ must be borne in mind if we are to avoid wrong conclusions. It is safe, however, to estimate that the males are about equal in number to the females in this species. The adults emerged after collecting on April 18 and April 20, 1920. As with other species in this genus this insect probably has no alternation of generations.

A part of the material from Pullman, Washington, matches this Utah material very closely, but until I can examine further collections I should hesitate to state that the range extends into Washington. Beutenmuller's 1907 description of *utahensis* was made from this Washington material, which is at least in part another variety, *divergens*.

Diplolepis radicum variety **plana,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: First two segments of the antennæ bright piceo-rufous; mesonotum obscurely punctate; parapsidal grooves not as broad posteriorly as in *utahensis*, only gradually convergent posteriorly, wide apart at the scutellum; median groove discontinuously evident for half the mesonotal length; anterior parallel lines fine, raised, distinct, especially posteriorly; scutellum broader than in *utahensis*, median raised region broader anteriorly; second segment of the abdomen covering hardly more than one half the area (at least in the available material); abdomen somewhat more elongate than in *utahensis;* legs, especially the femora, much darker piceo-brown than in *utahensis;* areolet large or very large; first abscissa of the radius slightly heavier than in *utahensis*.

MALE.—Not available for description.

GALL.—Does not differ particularly from the galls of other varieties; averaging large.

RANGE.—Oregon: La Grande. Probably confined to an area in Oregon and Idaho east of the highest elevations in Oregon.

TYPES.—3 females, 3 galls. Holotype female, paratype gall at The American Museum of Natural History; paratype adults and galls with the author. Laballed La Grande, Oregon; April 12, 1920; Kinsey collector.

Except for three females, the insects had all emerged before collection on April 12, 1920.

This insect is closely related to *utahensis* and *divergens*; it ranges between those two varieties but is the most distinct of the three.

Diplolepis radicum variety **divergens,** new variety

Rhodites utahensis Beutenmuller, 1907 (in large part), Bull. Amer. Mus. Nat. Hist., XXIII, p. 649 (and pl. XLVII, fig. 6?).

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: First two segments of the antennæ bright piceo-rufous; mesonotum relatively smooth; parapsidal grooves rather broad posteriorly, hardly more than gradually convergent posteriorly, wider apart at the scutellum than in *utahensis*, not as wide as in *plana;* median groove rather long, more continuous posteriorly;

anterior parallel lines fine, raised, distinct, especially posteriorly; scutellum rather narrow, median raised area about as in *utahensis*, or more depressed anteriorly; abdomen of moderate length, the second segment covering one-half to two-thirds of the area; legs almost uniformly rufous brown; areolet of moderate size or smaller, smaller than in *utahensis* or *plana;* first abscissa of the radius slightly heavier than in either *utahensis* or *plana.*

MALE.—Differs from the males of other varieties as follows: Parapsidal grooves hardly more than gradually convergent posteriorly; median groove rather long and continuous posteriorly; areolet of moderate size or smaller.

GALL.—Does not differ particularly from the galls of other varieties.

RANGE.—Washington: Pullman. Probably confined to a small region about the Cœur D'Alene and Moscow Mountains of the Idaho and Washington boundary.

TYPES.—6 females, 2 males. Holotype female, paratype females, and males at The American Museum of Natural History; paratype female with the author. From Pullman, Washington; Melander collector; parts of American Museum numbers 24633, 24660, 24661.

The smaller areolet and less convergent parapsidal grooves will distinguish the types of this variety from *utahensis*, which it closely resembles. But material from the same collection appears to include typical *utahensis* and several grades of intermediates with *divergens*. This variation cannot be dismissed as liable to occur in any locality or between any two localities. I have 4077 insects of *utahensis*, from two localities sixty miles apart. No individual of the lot varies toward the typical *divergens* from Pullman. Either the Pullman material represents both varieties, with interbreeding where the ranges meet; or *utahensis* at Pullman is tending toward the development of another variety not yet completely isolated. In either case the distinct thing should be recognized. More material from the region may illuminate the question.

Beutenmuller's 1907 description of *utahensis* fits *divergens*, and was probably based on this same Melander material. Contrary to the statement made there, the gall of this or of any other variety is not distinctive, unless in average size.

Diplolepis variabilis (Bassett)

FEMALE.—Mesonotum sculptured posteriorly between the parapsides; scutellum without foveæ; second segment of abdomen very large, produced dorsally; radial area heavily shaded, clear centrally. HEAD: Fully as wide as or slightly wider than the thorax, hardly enlarged behind the eyes; black, the mouth parts brighter; coriaceous to finely

puncto-rugose, naked except for a short pubescence on the face. Antennæ black, the two or three basal segments brighter; with 13 (or 14) segments, the second globose, only slightly elongate, the third distinctly longer than the fourth (or more than twice the length of the fourth if there are only 13 segments), the last only slightly longer than the preceding. THORAX: Entirely black; mesonotum rather irregularly rugose, most rugose posteriorly between the parapsidal grooves and antero-laterally; parapsidal grooves distinct for two thirds the mesonotal length, anteriorly entirely lost in the rugose areas; median groove almost lacking; anterior parallel lines evident but not prominent, rather narrow; lateral lines fine, in a smoother area; scutellum longer than wide, well rounded posteriorly, rugose, anteriorly depressed especially laterally but without foveæ; pronotum rugoso-striate laterally; mesopleuræ rugose, with a large, smoother, shining, coriaceous area, smoothest ventrally, crossed by a broad, transverse, rugose area. ABDOMEN: Darker posteriorly, practically entirely smooth, shining, and naked; elongate, much further produced dorsally, edges of segments very oblique, the second segment covering three quarters or more of the whole area; hypopygium plow-shaped, without a further spine. LEGS: Punctate, scatteringly hairy; tarsal claws fine, with a bare suggestion of a tooth. WINGS: With the margins short ciliate; largely smoky; veins heavy; the areolet of moderate size to large; the cubitus not quite reaching the basalis; the radial cell open, or closed by a thickening which is not a continuation of the subcostal or radial veins, cell short, broad, the second abscissa of the radius strongly curved; the first abscissa arcuate-angulate; radial cell especially smoky on the bounding veins, clearer centrally. LENGTH: 2.5-3.7 mm.

MALE.—Differs from the female as follows: Antennæ wholly black; abdomen black, small, elongate; cloud on veins of radial cell almost or wholly lacking; radial cell more or less closed.

GALL.—Irregularly ovate, smooth, solid, leaf gall. Polythalamous, each gall with usually three or four larval cells. Very irregular in shape, globular, to ovate, elliptical, or massive, all edges rounded; averaging 10. by 20. mm., observed to 25. mm. in diameter; smoothed, naked of bloom or scurf, light to rich brown (in mature galls). Internally solid, compact, soft, like compacted sawdust; the larval cells large, 2.0-3.5 mm. in diameter, more round than usual, with a distinct but thin and inseparable lining. On roses, attached to leaves, or replacing leaflets, or replacing the whole leaf and attached directly to stems.

RANGE.—From Texas and Wyoming to Washington. A very closely related species, *Diplolepis ignota* (O. S.), extends over the eastern half of the United States.

I have not seen the insects of this species which have been recorded from Texas (according to Beutenmuller), Wyoming, or Washington, altho I have seen the galls of the Washington material. Undoubtedly these regions as well as others in the western part of the United States have varieties distinct from any yet described. What data have been over-

looked by the approximate taxonomy which fails to distinguish the several varieties concerned!

Important information as to the age of the species and factors in the origin of species are mentioned in connection with variety *lutescens*.

Diplolepis ignota (Osten Sacken) with its varieties occurring thruout the eastern part of the United States is so closely related to *variabilis* that there cannot be found differences in the insects which one could presume are of more than varietal rank. With a single change in regard to the sculpture of the mesopleuræ, the general description of this species will apply to all varieties of *ignota*. On the other hand, the galls of *ignota* varieties are covered with a white scurf which the galls of all varieties of *variabilis* lack, and all of the white-galled varieties occur in the eastern half and all of the brown-galled varieties in the western half of the United States. This indicates closer affinities within each group than between the groups. One must choose between considering the groups as species and over-emphasizing their distinctness; and considering it a single species involved and attempting to express the groupings of the varieties by a system of quadrinomials, which is objectionable. If we will keep in mind the close relations of the two it may prove most convenient to use two specific names.

Of 1622 insects which I have bred, 784, or over 48 per cent, are males. I have a relatively small amount of material of *ignota*, and I had previously believed that the high percentage of males obtained there was abnormal. But it would appear as if these species have a more nearly equal sex ratio than some others of the genus. As with other rose cynipids I have bred, the males appear to emerge earlier than the females, accounting for instance for the 57 per cent males collected at Provo, and the 43 per cent collected at Holly. The insects emerge early in the spring, in late April in the Rocky Mountain country, probably earlier or later in regions of earlier or later seasons. I have recounted the life history of *ignota* (Bull. Amer. Mus. Nat. Hist., XLII, p. 331), and that species in Massachusetts does not have an alternation of generations. The field data for *variabilis* do not disagree, and it is probable that an alternation does not occur for any variety of either group.

Diplolepis variabilis variety variabilis (Bassett)

Rhodites variabilis Bassett 1890, Trans. Amer. Ent. Soc., XVII, p. 61. Cockerell, 1900, Ent. Student, I, p. 10. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 720, 840. Beutenmuller, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 23; 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 635, pl. XLVI, figs. 5-9. Thompson, 1915, Amer. Ins. Galls, pp. 22, 23, 46. Felt, 1918, N.Y. Mus. Bull., 200, p. 146, fig. 150 (5-9).

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Head finely coriaceous rugose; mouthparts rufous, the tips of the mandibles piceous, basal segments of the antennæ yellow rufous; thorax rather finely rugose posteriorly between the parapsidal grooves; parapsidal grooves of moderate width, not as wide or rugose as in *sculpta;* scutellum moderately rugose; abdomen bright rufous, darker rufous posteriorly; legs entirely bright rufous, the coxæ darker basally; wing veins rather light brown; areolet of moderate size, or rather large; cloud on veins of radial cell light brown; length 2.5-2.8 mm., averaging distinctly smaller than in *sculpta.*

MALE.—Differs from the males of other varieties as follows: Thorax only moderately rugose; areolet large; wing veins of moderate weight, light brown; length 1.7-2.5 mm.

GALL.—Does not differ particularly from the galls of other varieties.

RANGE.—Utah: Provo. Idaho: Cedar Mountains.

TYPES.—At the Philadelphia Academy, The American Museum of Natural History, and the Museum of Comparative Zoology. Collected in "Southern Utah".

I secured adults sometime after collecting at Provo on April 18, 1920.

This variety very much resembles variety *sculpta*; the two can be separated by the accompanying descriptions. I have secured both varieties from Provo. Of 563 of these Provo insects only 20 were variety *variabilis.* My work with other rose cynipids indicates that Provo is the meeting point of two distinct but related faunal areas which are not isolated geographically. As with *Diplolepis tuberculatrix* I find that the less abundant variety at this locality is the northern variety. Bassett recorded southern Utah for his material, but I question the interpretation to give to his "southern". Material of this variety in The American Museum is labelled Cedar Mountains, Idaho; I take it these are the mountains near Moscow; some of the mountains in that region contain a distinct, restricted fauna, but as with this variety, the northern Utah insects appear to extend at least as far north as Moscow and Pullman.

The differences between the varieties *variabilis* and *sculpta* are not great, but in all of the nearly six hundred individuals which I have examined only four are not clearly one thing or the other. My *variabilis* material matches all of the Bassett types which I have seen, but Bassett suggested in his original description that he had two things. I define his variety as I do, not only because of the types I have seen, but also because the following points in the original description apply to this rather than to the other variety: "*Head* * finely and evenly punctate on the vertex**. *Thorax* * finely rugose *** radial area faintly clouded on the second transverse vein in the male **. Length: body male .10, female .11 inch." As an appendix to this description he states that "The description of the female does not apply to all the specimens of this sex reared from these galls, as in some the radial area has no cloud, but a simple broadening of the veins bounding it", which might be one way of stating that the cloud in the other variety, *sculpta,* is as heavy as the veins.

Diplolepis variabilis variety **sculpta,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Head finely puncto-rugose, much more rugose than in variety *variabilis;* mouthparts rufous, the tips of the mandibles piceous; thorax coarsely, rugosely sculptured posteriorly between the parapsidal grooves; parapsidal grooves wider, more rugose than in variety *variabilis;* scutellum rather more rugose and more depressed anteriorly than in *variabilis;* abdomen bright rufous, darker rufous posteriorly; legs a peculiar, rich brownish rufous, the coxæ darker basally; wing veins dark brown, heavier than in *variabilis* or *rufopicea;* areolet rather large; cloud on veins of radial cell dark brown, almost as heavy in places as the veins; length 2.7-3.5 mm., averaging distinctly larger than in *variabilis.*

MALE.—Differs from the males of other varieties as follows: Thorax more rugose, and the parapsidal grooves wider than in *variabilis;* wing veins dark brown, decidedly heavier and more decidedly clouded than in the male of *variabilis;* areolet rather large; length 2.5-3.5 mm., averaging decidedly larger than the male of *variabilis.*

GALL.—Does not differ particularly from the galls of other varieties.

RANGE.—Utah: Provo.

TYPES.—150 females, 150 males, 30 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Provo, Utah; April 18, 1920; Kinsey collector.

Of 545 insects bred, 312, or over 57 per cent, are males. These insects emerged at some date after collecting on April 18, 1920.

This variety is very closely related to variety *variabilis*. A discussion of the characters and ranges of the two is given under *variabilis*.

Diplolepis variabilis variety **rufopicea,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Mouthparts dark rufo-piceous; basal segments of the antennæ rufo-piceous; mesonotum very rugose posteriorly between the parapsidal grooves; parapsidal grooves of moderate width; scutellum very rugose, rather more depressed anteriorly than in variety *variabilis;* abdomen mostly piceous black, rich brown rufous basally; legs dark rufous brown, coxæ and hind femora and tibiæ piceous black; wing veins dark brown; areolet of moderate size, elongate on the cubitus; cloud on veins of radial cell dark brown, almost as heavy in places as the veins; length 3.2-3.7 mm.

MALE.—Differs from the males of other varieties as follows: Thorax more rugose; areolet of moderate size, elongate on the cubitus; wing veins heavier, dark brown; length 2.7-3.5 mm.

GALL.—Does not differ particularly from the galls of other varieties.

RANGE.—Colorado: Manitou.

TYPES.—4 females, 8 males, 18 galls. Holotype female, paratype males, and galls at The American Museum of Natural History; paratype adults and galls with the author; paratype males and galls at Stanford University and the U.S. National Museum. Labelled Manitou, Colorado; April 24, 1920; Kinsey collector.

Most of the insects had emerged before collecting on April 24, 1920, but some large larvæ were still in the galls and did not mature until later.

The insect of this variety is very distinct, to be recognized with the naked eye as differing from the Utah varieties. The gall is common in the Garden of the Gods at Manitou, and must have been observed before this by entomologists. How large an area of Colorado is covered by this variety I cannot say definitely. Probably it is confined to a limited area east of the Continental Divide. The Utah varieties and the variety of the High Plains country of eastern Colorado are very closely related, while *rufopicea,* occupying an intermediate geographic position is remarkably distinct. This is strikingly in accord with the geologic histories of the areas involved.

Diplolepis variabilis variety **lutescens,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Head moderately coriaceous rugose; mouthparts rufous, the tips of the mandibles piceous; thorax rather finely rugose posteriorly between the parapsidal grooves; parapsidal grooves of moderate width; scutellum moderately rugose, not greatly depressed anteriorly; abdomen bright rufous, darker rufous posteriorly; legs entirely bright rufous, the coxæ hardly darker basally; wing veins dark brown, rather heavy, not as dark as in *sculpta;* areolet moderately small; cloud on veins of radial cell not as dark as the veins; length 2.3-3.0 mm., averaging distinctly smaller than any other variety except *variabilis.*

MALE.—Differs from the males of other varieties as follows: Thorax only moderately rugose; areolet of moderate size to small or even closed; wing veins heavy, the first abscissa of the radius usually very broad; length 2.0-3.0 mm.

GALL.—Differs from the galls of other varieties only in averaging distinctly smaller.

RANGE.—Colorado: Holly. Probably restricted to an area of the High Plains country east of the Rocky Mountains.

TYPES.—194 females, 168 males, 38 clusters of galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Holly, Colorado; April 25, 1920; Kinsey collector.

Mature larvæ were in the galls and a few adults had begun to emerge on April 25, 1920; the majority of the insects probably emerged soon after that date. Of 1,048 individuals bred, 453, or about 43 per cent, are males.

The closest relative of this insect is variety *variabilis.* This is the more striking because at least one other variety of the species, *rufopicea,* ranges between *variabilis* and *lutescens,* but *rufopicea* is in all respects the most distinct variety of the species. Holly, the type locality of *lutescens,* is in Colorado, very near the Kansas line, in the flat, barren, and largely treeless High Plains country which is very distinct geologically and geographically from the neighboring Rocky Mountains at the base of which *rufopicea* occurs. This region is of a geologic formation which also occurs in parts of Utah, and the close relations of the Utah and eastern Colorado varieties may date from a time when they were one, in a continuous area, before the Rocky Mountains intervened and allowed two distinct forms to become isolated. These two varieties

appear to be older than the Rocky Mountains, having changed only slightly since they were isolated.

Lutescens is separated from *variabilis* by the smaller areolet and the darker cloud on the radial cell in the female, and by the peculiarly heavier first abscissa of the radius in the male.

Disholcaspis pattersoni, new species

FEMALE.—Mostly bright brown rufous and darker; abdomen naked with large patches of hairs latero-basally; areolet large; length about 3.5 mm. HEAD: Not quite as wide as the thorax, greatly enlarged behind the eyes; dark brownish rufous, almost black below the insertions of the antennæ, around the mouth, and on the tips of the mandibles; finely rugoso-punctate, more rugose on the face; moderately dense with long hairs, hairs fewest on vertex and cheeks. Antennæ wholly black, or basal segments either rufous or dark rufo-piceous; with 13 (or 14) segments, the third distinctly longer than the fourth, the last more than twice the length of the preceding (or incompletely divided). THORAX: Mesonotum rich brownish rufous, black on the anterior parallel and lateral lines, sometimes black antero-medianly; distinctly rugoso-punctate, not densely covered with long hairs; parapsidal grooves deep, moderately broad posteriorly, extending half the length of the mesonotum; median groove lacking; anterior parallel lines rather smoother, reaching half way to the scutellum; lateral lines broad, smooth, naked; scutellum brownish rufous, blackish toward the base, rugose, hairy, about as broad as long, elevated, the depression at base more finely rugose, without distinct foveæ; pronotum brownish rufous, shallowly punctate and hairy laterally; mesopleuræ wholly brownish rufous, irregularly punctate and hairy. ABDOMEN: Bright to dark rufous, brightest and lightest basally, smooth and shining, only very microscopically punctate, entirely naked except for large patches of hairs latero-basally, and the hairs on the ventral spine; as high or higher than long, the second segment not covering half the abdomen, not produced dorsally but with the ventral edges of all the segments well rounded. LEGS: Rufous, also rufous on the coxæ, tarsi dark, tips darkest, rugoso-punctate, hairy; claws strong, toothed. WINGS: Clear, ciliate, veins deep brown; areolet large; cubitus extending only a little more than half way to the basalis; radial cell open, wide, the second abscissa of the radius strongly curved distally, neither radius nor subcosta reaching the edge; first abscissa of the radius strongly angulate, with a short but distinct projection. LENGTH: 3.0-3.7 mm.

GALL.—Large, bluntly conical, bullet gall, in compacted clusters about the twig. Each gall primarily a true cone, but distorted by pressure of surrounding galls, a slight projection basally extending into the twig, and a slight overlapping of the primarily circular base about the twig; dark purple when fresh, becoming rich brown, darker at the tips; smooth; averaging 8. mm. in diameter by 12. mm. high. Internally solid, the larval cell oval, 2. x 4. mm., with a distinct, shell-like wall, not

at all separable; cell located below the mid-point of the gall but not at the very base. On twigs of *Quercus breviloba.*

RANGE.—Texas: Austin (Patterson); Round Rock, Leander.

TYPES.—18 females, 19 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author. Labelled Austin, Texas; *Q. breviloba;* Patterson collector.

The gall of this cynipid has been known to me for several years, but previously I have not had the adult. I am glad to be able to name this for Dr. Patterson who successfully reared the insect. In 1921 Dr. Patterson found young galls on July 28, mature galls on August 29, pupæ by October 21, mature adults in the galls by November 5, and emerging adults on December 12. I collected galls in abundance on December 6 and 8, 1919, at Round Rock and Leander, not far north of Austin, but all of the adults had emerged previously. Emergence dates must vary considerably with the development of the seasons in different years.

This is probably a variety of *Disholcaspis bassetti* Gillette, but until I can see the types and more material of *bassetti* I cannot be certain of the relationships of *pattersoni.*

Disholcaspis simulata, new species

FEMALE.—Rufous to black; parapsidal grooves, anterior parallel, and lateral lines distinct; thorax hairy, abdomen mostly naked; areolet large. HEAD: Much narrower than the thorax, widened behind the eyes; rufous brown or darker to black; roughly granulose, or finely but roughly rugose, all but the vertex hairy with long hairs. Antennæ bright rufous brown to rufous black; entirely hairy; (13-) 14-jointed, the second segment almost globose, the third longest but hardly longer than the fourth, the last approaching twice the length of the preceding. THORAX: Broad, rufous to black, mesonotum practically smooth, closely punctate, rather densely covered with long hairs; parapsidal grooves distinct, deep, smooth, naked, fairly broad at the scutellum, narrowing and continuous anteriorly for half the length of the mesonotum; median groove absent; anterior parallel lines distinct, smooth, naked. extending half way to the scutellum; lateral lines distinct, smooth, naked, half the length of the mesonotum; scutellum cushion-shaped, rugoso-punctate, densely hairy, depressed anteriorly, with two oblique, shallow foveæ: pronotum finely punctate, hairy; mesopleuræ entirely punctate and hairy. ABDOMEN: Rufous to piceous black; smooth, shining, naked, except for distinct patches of hairs latero-basally and the hair on the ventral spine; as high as long, not produced dorsally; hypopygium produced, ventral spine prominent but not long, ventral valves at an

angle greater than 60°; segments two to four with the ventral edges well rounded. LEGS: Rufous brown or rufo-piceous, darker on the tarsi; claws prominently toothed. WINGS: Clear, hairy, ciliate, veins heavy; areolet large or very large; cubitus fading out just at or short of the basalis; radial area open, the subcosta and radius not stopping far short of the margin; second abscissa of the radius well curved; the first abscissa slightly infuscated at the subcosta, strongly angulate but with hardly a projection. LENGTH: 3.2-4.0 mm.

GALL.—Rounded bullet gall with a nipple tip. Monothalamous. Fairly globular, averaging 12.-15. mm. in diameter, some specimens larger or smaller, bearing at the summit a short, blunt point; colored light brick red or yellowish brown, weathering dark; the surface is very rough, but finely so. Internally densely but not compactly woody, likely solid when young, becoming hollow when mature, but with the walls still thick; containing a thin-walled, hard-shelled, entirely loose larval cell averaging 3. mm. in diameter by 4.2 mm. long. Galls attached by a tongue in the concave base; laterally on twigs of white oaks.

RANGE.—Oregon, California. Probably wherever oaks occur on the Pacific Coast.

Disholcaspis simulata variety **simulata,** new variety

FEMALE.—Is distinguished from other varieties of the species as follows: Head bright rufous brown, darker only on the tips of the mandibles; antennæ bright rufous brown, dark brown apically; thorax entirely bright rufous brown, sometimes darker on the thoracic grooves and lines; lateral lines only moderately broader; foveæ of the scutellum of moderate size, almost but not quite smooth; abdomen bright rufous, rather rufo-piceous dorsally, ventrally, and posteriorly; legs bright rufous brown, darker on the tarsi especially toward the tips; wing veins heavy, deep and rich brown.

GALL.—Mostly colored light brick red to a darker purplish red, becoming lighter and browner on aging, or weathering dark; on twigs of *Quercus dumosa.*

RANGE.—California: Fallbrook, Sorrento, San Jacinto Mountains, Upland, Pasadena, Santa Barbara, Paso Robles. Probably occurs thruout the southern Sierras and their extensions, from El Portal south.

TYPES.—4 females and 29 galls. Holotype female, paratype female, and galls in The American Museum of Natural History; paratype females and galls with the author; paratype galls at Stanford University, the Museum of Comparative Zoology, the Philadelphia Academy, and the U.S. National Museum. Labelled Upland, California; February 3, 1920; Kinsey collector.

Galls collected in February and March, 1920, contained live adults in November and December 1920 and in March 1921; several adults had emerged before March 1921. It is not unlikely that it is a year and a half or more after hatching before the adult emerges from the gall. Externally some specimens,

duller-colored, of this gall will be confused with less distinctly colored specimens of *Disholcaspis plumbella* Kinsey; both species occur in enormous abundance on the same host, *Quercus dumosa*; the adults of the two are very distinct.

Disholcaspis simulata variety **vancouverensis,** new variety

FEMALE.—Is distinguished from other varieties of the species as follows: Head dark rufous, black medianly on vertex and face; antennæ rufous black, dark rufous basally; thorax rufous black, dark rufous on the parapsidal grooves and forward, and on the mesonotum basally, and dark rufous on the sides; lateral lines quite broad, broader than in variety *simulata;* foveæ of the scutellum more narrow, quite rugose at base; abdomen piceous black, piceous rufous ventro-posteriorly; legs rufo-piceous, darkest on the tarsi; wings with veins piceous black, heavier.

GALL.—Mostly colored light buff to yellowish brown, in part tinged rose red (not brick red!) when younger, weathering darker; on twigs of *Quercus garryana.*

RANGE.—Oregon: Roseburg, Grants Pass, Ashland. California: Yreka. North of the other varieties.

TYPES.—2 females and 6 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype female and galls with the author; paratype galls in Stanford University and the U.S. National Museum. Labelled Ashland, Oregon; April 6, 1920; Kinsey collector.

Tho structurally the two varieties are very much alike, their distinct color, correllated with the distinct hosts and ranges makes it important to distinguish two separated tendencies in evolution. This variety is likely confined to the geographic area of the more northern Pacific coast called "Vancouveran" by Van Dyke (1919, Ann. Ent. Soc. Amer., XII, p. 4). Another variety occurs on *Q. Douglasii* in central California, and still another distinct variety in the San Bernardino Mountains, but I have not seen adults from galls of these.

Heterœcus, new genus

FEMALE.—Generally brownish rufous; antennæ with 14 segments, darker apically; parapsidal grooves not continuous; foveæ large, more or less rugose at base; second segment covering a large part of the abdomen; tarsal claws strong, simple. HEAD: Not quite as wide as the thorax, only slightly enlarged behind the eyes; rufous to dark brown, dark about the mouth; finely rugoso-punctate, scatteringly hairy, most so about the mouth. Antennæ fairly stout, long, finely pubescent, often darker on the seven or eight terminal segments, and lighter

basally; with 14 segments, the first not twice the length of the second, the second somewhat elongate but short, the third only slightly longer than the fourth, the last only one third longer than the preceding. THORAX: Broad, brownish rufous to very dark brown, sometimes in part blackish, scatteringly hairy, most densely hairy on the sides; mesonotum finely, closely puncto-rugose, shagreened in places; parapsidal grooves fairly deep, more or less rugose at bottom, convergent posteriorly, moderately close together at the scutellum, not extending to the pronotum; median groove distinct and shortened, or lacking; anterior parallel lines rather fine to scarcely evident, extending more than half way to the scutellum; lateral lines distinct, long, almost parallel to the parapsides, somewhat curved inward anteriorly; scutellum rugose, the basal depression broad, deep, smooth and more or less rugose at bottom, separated by a very fine ridge into two, large foveæ; pronotum laterally rugoso-punctate, rather dense with long hairs; mesopleuræ densely, closely, irregularly aciculate, naked over most of the area. ABDOMEN: Darker or lighter rufous; smooth, very microscopically punctate on the ventral margins of the segments; naked except for a very few hairs latero-basally, on the edges of the posterior segments, on the ventral spine and valves; somewhat longer than wide, produced only slightly dorsally, the second segment covering most of the abdomen; posterior edges of segments at a 75° angle, the ventral edges only slightly rounded; ventral spine rather long, slender. LEGS: Almost wholly yellow rufous, tips of tarsi darker, the tarsal claws moderately strong, simple. WINGS: Clear, faintly hairy, edges hardly ciliate, veins brownish; areolet closed to large, cubitus very faint, not reaching the basalis; radial cell open, neither vein reaching the margin, second abscissa of the radius distinctly curved, first abscissa of the radius arcuate to distinctly angulate. LENGTH: 1.7-3.7 mm. These characters are common to all of the following species and varieties.

GALL.—Monothalamous bud gall, cylindrical, more or less elongate, two-parted in one species; slender tipped, the tip more or less curved; smooth, with or without scurf or wool covering. Internally with an elongate cavity usually extending most of the length of the gall, the larval cell usually nearer the apical end of the cavity; the adults emerge from near the base of the gall. Sessil, laterally, or terminally, on twigs of *Quercus chrysolepis*.

RANGE.—California, (Arizona?).

TYPE.—*Andricus dasydactyli* Ashmead.

The species included in this genus are remarkably similar in the morphology of the insects; the large amount of detail in the description of the genus applies to all species, emphasizing their close relationships. More distinct differences in insect structure are shown between the varieties of many species than between the species of the genus. That the differences between the insects of two species are nevertheless real enough was evidenced when one of my freshman students, without

other experience than four months in a course in taxonomy, fully distinguished between undetermined material of *dasydactyli* and *pacificus*, two of the most closely related species.

The galls of each species, however, are very distinct, *Heterœcus*, "many homes", referring to this characteristic. All of the galls conform to a single type. The gall is the best data we have as to the physiology of a gall wasp, as I have shown before (Bull. Amer. Mus. Nat. Hist., XLII, p. 365); and that this measure is sometimes extremely fine is abundantly illustrated with many of the varieties I describe in this paper. Many species also in this paper show that either the morphology or the physiology may exhibit the greater degree of variation, or that in other instances the amount of variation may be equal for the two sorts of characters. There can be no objection, then, to recognizing as a distinct unit a group defined by abundant morphologic and physiologic characters, where the species are best distinguished by physiologic data, and the varieties of a species by morphologic data. It may be objected that the insects should define species and the galls the varieties. If one should attempt such an arrangement he would be completely confounded, I think, by the difficulties in choosing a particular structural character to unite forms; the utilization of several such characters in combination would be impossible, for a large number of combinations exist, with few coincidences. Such a method would combine forms with distinctly different galls, and have to ignore facts of distribution. By utilizing the galls in deciding species lines, the conclusions reached are confirmed by some morphologic characters of the insects, and especially by distribution data.

This genus presents an instructive instance of the need for considering characters of several sorts in taxonomy, in contrast to the practice among too many taxonomists! Without the galls as guides, it is probable that a solution of the situation in this group would not yet have been reached.

Whether to interpret this group as a species or a genus is largely a matter of individual opinion and convenience. Certain it is that we must recognize three sorts of relationships: the unity of the whole group, the divisions marked by the galls, and within each division another division indicated largely by insect characters and confirmed by a reasonable

conception of distribution facts. To designate these as species, subspecies, and varieties is not as convenient a method as to consider the group a genus.

The distribution of the varieties of most of the species is in strict accord with my findings for other Cynipidæ, limiting each variety to one faunal area. In *Heterœcus bakeri* there is considerable variation within the single area, and not a distinct type in the San Bernardino range as would be expected. Altho I have some hundreds of the insects and some thousands of the galls, I do not yet have material enough to recognize all of the varieties which probably exist for any one species. There are at least four, possibly six faunal areas in which *Quercus chrysolepis* occurs, and each species is likely to have as many varieties if it occurs over the entire range of its host. Geographic isolation appears to have been a factor in preserving these variations.

The confinement of the genus in California to the single host, *Q. chrysolepis,* suggests that isolation upon distinct hosts has had nothing to do with the origin or preservation of the species. Often several species occur on a single tree. Whether species interbreed, whether each type will breed true in successive generations, cannot be stated without experimental data. Intermediates however do not exist in my collection (except in *bakeri,* as noted), and each type of adult is definitely connected with a particular type of gall. Exactly the same and parallel conditions have held in the past, as earlier collections show, collections made in some instances (*pacificus* and *dasydactyli*) thirty-five years previously. I am inclined to expect to find that each species remains distinct.

It is to be noted that this amount of variation occurs in an agamic group. Field data would suggest that an alternate, bisexual generation does not exist. Whether bisexual reproduction ever occurs is a matter of some importance genetically, and one which some student on the field should determine as soon as possible.

I have attempted a key to the forms described, but cannot effect an arrangement which is not very artificial, nor one which would be intelligible without considerable series of several species at hand. The following conspectus may prove more satisfactory, and not too inconvenient for this number of forms.

1. Thorax with considerable black; parapsidal grooves wide; median groove short or lacking; areolet moderate or large. Gall naked, robust, ovate, abruptly tipped. *H. bakeri*
2. Thorax without black unless in the foveæ; veins only moderately heavy; areolet always of moderate size. Galls covered with long-threaded wool. *H. dasydactyli*
   a. Parapsidal grooves rugose at bottom; median groove short, distinct; foveæ rugose at bottom; length over 2.7 mm. Galls long and slender, straight, occurring singly. Northern Sierras. var. *dasydactyli*
   b. Parapsidal grooves at bottom; median groove about lacking; foveæ rugose at bottom; length over 2.5 mm. Galls moderately short, almost straight, singly or in small clusters. Southern Sierras. var. *eriophorus*
   c. Parapsidal grooves at bottom; median groove short, distinct; foveæ smooth at bottom; length under 2.5 mm. Galls very short, curved, in large, compact clusters. San Bernardinos. var. *pygmæus*
3. Thorax without black; wing veins only moderately heavy; the areolet quite small. Galls globose, with a fine scurf. Northern Sierras. *H. chrysolepidis*
4. Thorax with some black; parapsidal grooves only moderately wide; median groove distinct; wing veins moderately heavy; areolet small or lacking. Gall naked, globular, hardly with a tip. Southern Sierras (only?). *H. malus*
5. Thorax very dark brown with black; parapsidal grooves very broad; median groove distinct; wing veins moderately heavy; areolet rather large; length over 3.5 mm. Galls "date seeds", with small scurf. *H. melanoderma*
6. Thorax without black; parapsidal grooves wide; wing veins darker brown; areolet moderate or large. Gall naked, elongate spindle-shaped. *H. pacificus*
   a. Parapsidal grooves rugose at bottom; median groove short or lacking; areolet large, equilateral; length over 3.2 mm. Gall large, slender, straight. Northern Sierras. var. *pacificus*
   b. Parapsidal grooves rugose at bottom; median groove short or lacking; areolet moderate, equilateral; length over 3.0 mm. Gall shorter, robust, tip often curved. Southern Sierras. var. *subpacificus*

c. Parapsidal grooves smooth at bottom; median groove longer; areolet elongate on cubitus; length under 3.2 mm. Gall small, with a longer point. Northern California coast. var. *gracilis*

7. Thorax with some black; parapsidal grooves moderately wide, median groove present, short; wing veins moderate or heavy. Gall turban-like, two-parted. *H. sanctæ-claræ*

a. Foveæ smooth; mesopleuræ heavily aciculate, little black on edges; second segment covering two thirds the abdomen. Northerly California. var. *sanctæ-claræ*

b. Foveæ rugose; mesopleuræ finely aciculate, heavily edged black; second segment covering more than three quarters the abdomen; areolet smaller. Southern Sierras. var. *fuscior*

c. Foveæ smooth; mesopleuræ finely aciculate, more heavily edged black; second segment covering two thirds the abdomen. San Bernardino mountains. var. *aliud*

Heterœcus bakeri (Kieffer)

Callirhytis bakeri Kieffer, 1904, Bull. Soc. Metz, (2), XI, p. 132; 1904 (in Baker), Invert. Pacif., p. 44. Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 586, 807, 830. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 360. Felt, 1918, N.Y. Mus. Bull., 200, p. 76.

Callirhytis Bakeri Trotter, 1910, Boll. Lab. Portici, V, p. 110, pl. 1, fig. 18.

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color of head and thorax rich brownish rufous, black on the anterior parallel and lateral lines and in the foveæ; parapsidal grooves quite wide, often very wide at the scutellum; median groove very short or lacking; anterior parallel lines very distinct; foveæ of the scutellum rather deep, more or less smooth and black at bottom; abdomen rufous brown, deep brown in part; wing veins yellow brown, not as dark as in *H. pacificus*, but darker than in *H. dasydactyli;* areolet of moderate size or moderately large; first abscissa of the radius arcuate-angulate, distinctly but not strongly angulate, without a projection; length 2.2-3.0 mm., averaging nearer 3.0 mm.

GALL.—A naked, robust, ovate gall with a slender tip. Monothalamous. Body of gall spherical to more elongate-ovate, more abruptly flattened apically, 9.-13. mm. in diameter, more or less constricted basally; bearing a slender point apically, arising more or less abruptly from the body of the gall, averaging 1.5 mm. in diameter by 5. mm. long; entirely smooth or with a few tubercles, or with part of the surface roughly rugose, or the whole surface granulose; when fresh, bright to dark green, speckled red, or reddish or purplish brown with buff yellow or light green speckling; on aging becoming more uniformly

yellowish brown. Internally similar to compacted sawdust, with a cylindrical central cavity extending from the base almost to the tip. Scattered, on twigs of *Quercus chrysolepis*.

RANGE.—California: Yosemite (Trotter); El Portal, Pasadena, Upland, San Bernardino, San Jacinto Mountain.

TYPES.—Berlin Museum? Cotypes at Pomona College. Material from the same collector (Baker), and the same locality (Claremont), in The American Museum of Natural History, and in Stanford University.

I have seen the Pomona College cotypes, and the Baker material in The American Museum of Natural History, and they agree with my Upland material. Indeed, my locality, Upland, and Baker's Claremont, are nearby towns neither of which have *Quercus chrysolepis*, but these are post office names for very probably the same region in the nearby mountains.

Most of the adults were emerged in the San Bernardino mountains on January 31, 1920, and at Upland on February 3; most of the insects were not yet emerged at Pasadena on February 7, and adults were still alive in the galls at El Portal on March 21. As usual, emergence is later in more northerly localities.

Both the galls and adults of this species show considerable variation. The above description applies to an average of the material from Upland, that is, near the type locality. The areolet varies from small to large, the foveæ are smooth or sparingly rugose or completely, closely rugose; the parapsidal grooves extend further in some individuals than in others. The galls vary from smooth to very rough or tuberculate, the tip arises very abruptly or only gradually from the body of the gall, the greatest diameter comes at the middle or nearer the apex of the gall. All of these variations occur at each of the localities: San Bernardino mountains, San Jacinto mountains, Upland, Pasadena, El Portal. I cannot perceive any regularity in the concurrence of characters, and have not yet discovered any tendency for a single type to occur in the San Bernardino range, contrary to the usual situation. Galls from Placerville, and part of the material from El Portal, may belong to a northern variety of this species. Some adults from Placerville may belong to a northern variety of *bakeri*, but unfortunately these galls and adults were not definitely connected in the breeding, and I shall need to see more material before deciding the point.

Heterœcus chrysolepidis (Ashmead)

Andricus chrysolepidis Ashmead, 1896, Proc. U.S. Nat. Mus., XIX, p. 119. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen, Cynip., p. 62; 1910, Das Tierreich, XXIV, pp. 553, 824, 828. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 346. Thompson, 1915, Amer. Ins. Galls, pp. 9, 31. Felt, 1918, N.Y. Mus. Bull., 200, p. 68.

FEMALE.—Differs from *Heterœcus dasydactyli* variety *dasydactyli* only in having the areolet quite small and the second abscissa of the radius very slightly more angulate.

GALL.—A small, irregularly globular or ovate bud gall. Monothalamous. A slight nipple at the apex; the surface covered with a fine, scurfy pubescence, light brown in color; 7. mm. in diameter by 10. mm. long.

RANGE.—California: Colfax (Koebele coll.); Diablo? (F. A. Leach coll.).

TYPES.—Adults and galls in the U.S. National Museum. Labelled 3066 and 3816.

I have examined a type adult and a type gall. The insect is very close to *dasydactyli,* but Mr. Rohwer reports that the areolet is constant in size in all three of the types. The gall is the most distinctive thing of the species. Galls from Diablo appear to match the type galls, but I do not have insects to check the determination. Unlike the type galls, some of the Diablo specimens are clustered, suggesting *H. malus,* and inasmuch as the insects of the two are rather similar perhaps *malus* should be considered a variety of *chrysolepidis.*

Heterœcus dasydactyli (Ashmead)

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color of head and thorax rich brownish rufous; parapsidal grooves fairly deep, moderately wide posteriorly, less rugose at bottom than in two varieties of *pacificus;* median groove distinct in two varieties, lacking in one; anterior parallel lines very fine; foveæ sparingly rugose in two varieties, almost smooth in one; abdomen rich brownish rufous, darker dorsally; wing veins brownish yellow, only moderately heavy, lighter than in any variety of *pacificus;* areolet of moderate size; first abscissa of the radius arcuate, with a slight suggestion of an angle; length 1.7-3.5 mm.

GALL.—Spindle shaped, covered with long wool. Monothalamous, occasionally bithalamous. Cylindrical, with a constricted base and an apex which is long in one variety, the tip often curved; smooth, sometimes with a few, scattered, blunt tubercles; light green when young, turning light straw brown to darker; completely covered by a thick mass of long-threaded wool, light buff yellow tinged with pink when young, golden brown when older, attached only to the slightly projecting base of the gall; the wool deciduous from older galls. Internally

almost solid; more porous tissue surrounding a cylindrical cavity extending from the base of the gall hardly more than half way to the tip, with the larval cell in the apical part of the cavity. Singly or in clusters, on twigs of *Quercus chrysolepis*.

RANGE.—California: San Jacinto Mountains to Dunsmuir.

Ashmead described the galls of this species as "covered with long, brownish wool", which is correct. But the rest of his description of the gall, type galls which I have seen, and gall material labelled *dasydactyli* in several collections, match the galls from which I bred *Heterœcus melanoderma*. The extent of Ashmead's confusion is indicated by his choice of the name *dasydactyli* for this rather than for the true "date-seed" gall, *melanoderma*. The gall and insect both are most nearly related to *H. pacificus*. One might take *pacificus* galls to be older galls of this variety with the wool worn off, but when the wool drops from *dasydactyli* it leaves the gall smooth (unlike *melanoderma*), and showing the projecting base to which the wool was attached (unlike *pacificus*).

Heterœcus dasydactyli variety **dasydactyli** (Ashmead)

Andricus dasydactyli (adult only!) Ashmead, 1896, Proc. U.S. Nat. Mus., XIX, p. 117. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 62; 1910, Das Tierreich, XXIV, p. 532. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 349. Thompson, 1915, Amer. Ins. Galls, pp. 10, 32. Felt, 1918, N.Y. Mus. Bull., 200, p. 72. Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 371.

FEMALE.—Differs from the female of other varieties of the species as follows: Parapsidal grooves extending half way or more to the pronotum, finely, not heavily rugose at bottom; median groove very distinct tho short at the scutellum; scutellum of uniform color, not darkened in the foveæ, foveæ wholly but sparingly rugose; first abscissa of the radius arcuate with only a slight suggestion of an angle; length 2.7-3.5 mm., averaging distinctly larger than in any other variety of the species.

GALL.—Differs from the galls of other varieties in being more often long, elongate spindle-shaped, averaging 15.-30. mm. long by 7.-12. mm. in diameter, often with a long, slender apex, less often curved than in *pygmæus;* usually singly on the twigs.

RANGE.—California: Yosemite Valley, Placerville, Dunsmuir. Probably occurs in the central Sierras north of El Portal, wherever *Q. chrysolepis* occurs.

TYPES.—Many females, in the U.S. National Museum; labelled number 3063.

Ashmead's adults were bred from January 18 to February 11, probably indoors. I obtained adults at some date after

collecting the galls out-of-doors: March 30 at Placerville, April 3 at Dunsmuir. Galls collected in the Yosemite Valley, at a high elevation, while snow still buried most of the small trees, were quite immature on March 26. These Yosemite Valley insects belong, without doubt, to this variety rather than to *eriophorus*, the variety of the southern Sierras. *Eriophorus* occurs at El Portal, not twelve miles from the Yosemite Valley, but at an elevation which is a thousand feet lower, and in a locality not nearly as exposed to the severe climate of the higher Sierras. The Yosemite Valley belongs to one faunal area, El Portal to another!

Heterœcus dasydactyli variety **eriophorus** (Kieffer)

Callirhytis eriophora Kieffer, 1904, Bull. Soci Metz, (2), XI, p. 132; 1904 (in Baker), Invert. Pacif., I, p. 43. Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 585, 806, 839. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 359. Felt, 1918, N.Y. Mus. Bull., 200, p. 76. Johnson and Ledig, 1918, Pomona Coll. Journ. Ent. and Zool., X, p. 25.

FEMALE.—Differs from the female of other varieties of the species as follows: Parapsidal grooves extending hardly half the length of the mesonotum, almost wholly smooth at bottom; median groove lacking or extremely short; basal foveæ of the scutellum darkened but not black, largely rugose at the bottom, with only small, smooth areas; first abscissa of the radius arcuate, with only a slight suggestion of an angle: length 2.5 mm. (-3.2 mm., acc. Kieffer); averaging distinctly smaller than in variety *dasydactyli*, larger than in *pygmæus*.

GALL.—Very similar to that of variety *pygmæus*. Each gall short, ovoid or less often spindle-shaped, with the tapering point short, not usually curved as in *pygmæus*, more or less smooth. Usually singly, sometimes a few in a cluster, on twigs.

RANGE.—California: El Portal; Claremont (Baker); Upland, Pasadena, San Jacinto Mountains. Probably occurs thruout the southern Sierras and their extensions, south of El Portal, except in the San Bernardino and Cuyamaca mountains.

TYPES.—Berlin Museum? Pomona College? Material from the same collector (Baker) and the same locality (Claremont) at Stanford University.

This variety comes very close to variety *pygmæus*, but the insects can be separated by the darker rufous brown general color, and by the rugose bottoms of the foveæ of *eriophorus*. *Pygmæus* comes from a neighboring but isolated mountain range. I have not seen types of this variety, but Dr. McCracken very kindly compared types of *pygmæus* with Baker

material of *eriophorus* at Stanford University, and independently concluded that the two are distinct. I have insects from Pasadena and the San Jacinto Mountains, but only galls from Upland, which is my locality for the same mountain range from which the Baker material came. All of my material is from *Quercus chrysolepis*. Kieffer records *Q. Wislizenii* as the host. I have never seen such a gall on *Wislizenii*; the only material which I have seen labelled *eriophorus* bore leaves unmistakably those of *chrysolepis;* and I doubt very much whether *Wislizenii* is ever the host for this variety.

Heterœcus dasydactyli variety **pygmæus,** new variety

FEMALE.—Differs from the female of other varieties of the species as follows: Parapsidal grooves extending two-thirds or more of the way to the pronotum, finely, not densely rugose at bottom; median groove distinct for a short distance; basal foveæ of the scutellum darker than in other varieties, occasionally black, almost entirely smooth at bottom; first abscissa of the radius rather sharply angulate, without a projection; length 1.7-2.5 mm., averaging distinctly smaller than in other varieties of the species.

GALL.—Very similar to that of *eriophorus*. Each gall short, ovoid, or more usually spindle-shaped, with the tapering point short and strongly curved; more or less smooth. Singly or up to ten in a compact cluster on the twigs.

RANGE.—California: San Bernardino Mountains; Pasadena (?). Probably confined to the neighborhood of the San Bernardino Mountains.

TYPES.—38 females, 20 clusters of galls. Holotype female, paratype females, and galls in The American Museum of Natural History; paratype females and galls at the Museum of Comparative Zoology, the Philadelphia Academy, Stanford University, the U.S. National Museum, and with the author. Labelled San Bernardino, California; January 31, 1920; Kinsey collector.

The gall of this variety closely resembles that of variety *eriophorus*, but the two can be separated very definitely. Dr. McCracken has compared one of my types with Baker material of *eriophorus*, and she points out distinct differences as noted under *eriophorus*. The San Bernardino Mountains constitute a "mountain island" area with a very distinct geologic history and separated quite definitely from the neighboring San Gabriels, in which latter range Baker collected Kieffer's *eriophorus*. Six insects from Pasadena and their galls match the San Bernardino material closely, tho most of the Pasadena material belongs to *eriophorus*.

Heterœcus malus, new species

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color of head and thorax rich brownish rufous, darker only in the foveæ; parapsidal grooves only moderately wide at the scutellum; median groove distinct for a short distance, indicated more or less prominently for the whole mesonotal length; anterior parallel lines indicated less distinctly and rather wider apart than in *bakeri;* basal foveæ of the scutellum darker, only occasionally black, almost as smooth at base as in *bakeri;* abdomen bright brownish rufous, much brighter than in *bakeri;* wing veins moderately dark yellow brown, about as dark as in *bakeri;* areolet very small or lacking; second abscissa of the radius distinctly but not strongly angulate, without a projection, about as in *bakeri;* length 2.0-2.7 mm., averaging smaller than in *bakeri.*

GALL.—Ovoid to almost absolutely spherical, 8.-16. mm., in diameter, only very slightly drawn into a point for attachment basally, and with a very fine, very short point apically 1.0 mm. or much less in length; entirely smooth and naked, or the surface slightly roughened, light to dark green when fresh, tinged with rose red, upon aging becoming brown. Internally more or less solid, with a single larval cell centrally, closely embedded, and between the cell and the base only a discontinuous cavity indicating the usually cylindrical cavity of the species. Singly or in compact clusters of a dozen, more or less, laterally or terminally on twigs of *Quercus chrysolepis.*

RANGE.—California; Pasadena, San Bernardino.

TYPES.—38 females, 21 galls. Holotype female, paratype females, and galls in The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author. Labelled San Bernardino, California; January 31, 1920; Kinsey collector.

This variety comes near *bakeri,* but is distinct enough. The manner of oviposition, many eggs being laid in a restricted area, is distinct from *bakeri.* Material from the San Bernardino Mountains is remarkably uniform in respect to both the insect and the gall. Material from outside the San Bernardinos, that is, from another faunal area, shows some considerable variation, a part of the Pasadena material fully matching that from the San Bernardinos. I cannot decide whether there are other varieties of this species until I can examine more material. It is not impossible that this should be considered a variety of *H. chrysolepidis.*

Heterœcus melanoderma, new species

Andricus dasydactyli (gall only!) Ashmead, 1896, Proc. U.S. Nat. Mus., XIX, p. 118. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 62; 1910, Das Tierreich, XXIV, pp. 532, 799, 828. Fulla-

way, 1911, Ann. Ent. Soc. Amer., IV, p. 349. Thompson, 1915, Amer. Insect Galls, pp. 10, 32. Felt, 1918, N.Y. Mus. Bull., 200, p. 72.

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color of head and thorax very dark rufous brown, black in part; parapsidal grooves very broad at the scutellum, pointed anteriorly, hence long-triangulate in shape, extending not much more than half way to the pronotum; median groove distinct tho short, fairly wide at the scutellum; anterior parallel lines very distinct; scutellum rather finely rugose, basal foveæ of scutellum rugose, broader than in other varieties; mesopleuræ irregularly rugoso-aciculate posteriorly; abdomen rufo-piceous, piceous black dorsally; wing veins only moderately heavy; areolet moderately large; first abscissa of the radius strongly angulate, without a projection; length 3.5-3.7 mm., the whole build distinctly larger than in any other variety.

GALL.—Elongate, scurfy, like a date seed in shape. Cylindrical, averaging 6. mm. wide by 20. mm. long, bluntly, short, and conically pointed apically, slightly tapered basally, broadest near the apex; covered with a dense, very short, scurfy pubescence, rich golden brown, weathering dull brown to black. Monothalamous. Internally with a single, cylindrical, central cavity 2. mm. wide extending from the base almost to the tip of the gall; a larval cell, 1.7 x 3.5 mm., lies in the cavity, usually nearer the apical end. Sessil, on twigs of *Quercus chrysolepis*.

RANGE.—California: Cupertino (Fullaway); Los Gatos (McCracken coll.); Redwood Park (in Stanford Univ. coll.); Boulder Creek, Placerville.

TYPES.—2 females, 7 galls. Holotype female, paratype galls in The American Museum of Natural History; paratype female and galls with the author; paratype galls at Stanford University and the U.S. National Museum. Labelled Placerville, California; March 30, 1920; Kinsey collector.

Adults were almost mature in the galls at Placerville, March 30, and emerged some time later.

Material of this species in several museums is labelled *Andricus dasydactyli*, and this gall largely agrees with the gall described for that species by Ashmead. But the insect *dasydactyli* comes from galls covered with long wool, and is very distinct from *melanoderma* adults; the latter species has been heretofore undescribed. Weld sends me galls from the Santa Catalina Mountains of Arizona, occurring on *Quercus oblongifolia*; the galls are similar to those of *melanoderma*, but I have not yet seen the insects.

Heterœcus pacificus (Ashmead)

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color of head and thorax rich

brownish rufous; parapsidal grooves very broad at the scutellum, pointed anteriorly, hence long-triangulate in shape, in two varieties more rugose at bottom than in *dasydactyli*, extending not much more than half way to the pronotum; median groove very short or lacking, often wide at the scutellum; anterior parallel lines fine but more evident, rather finely rugose; scutellum dark to black in the foveæ, foveæ rugose at base; abdomen darker rufous, rufo-piceous in part; wing-veins brown, darker than in *melanoderma* or *dasydactyli;* the areolet of moderate size or large; first abscissa of the radius arcuate-angulate, with a more distinct angle than in *dasydactyli;* length 2.8-3.7 mm.

GALL.—Naked, elongate, spindle-shaped. Cylindrical, with a constricted base and a greatly elongate, slender tip; entirely straight or curved; entirely naked, smooth, bright green splotched with brown to purple brown, becoming dark brown upon aging. Solid, except for the cylindrical cavity extending from the base two-thirds to the tip, the larval cell not always at the very end of the cavity. On twigs of *Quercus chrysolepis.*

RANGE.—California: San Jacinto Mountains to Dunsmuir and Ukiah; probably wherever *Q. chrysolepis* occurs.

This species morphologically is closely related to *dasydactyli*, but altho Ashmead stated that the insects of *pacificus* "cannot be separated from *A. dasydactyli*", his types of the two are distinct, showing differences which agree with those in the material I have bred from the two types of galls. *Pacificus* never bears any of the woolly covering which is characteristic of *dasydactyli.*

Adult insects emerge in the spring, a couple of months earlier in southern than in northern California.

Heterœcus pacificus variety **pacificus** (Ashmead)

Andricus pacificus Ashmead, 1896, Proc. U.S. Nat. Mus., XIX, p. 118. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 64; 1910, Das Tierreich, XXIV, pp. 532, 805, 828. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 348. Thompson, 1915, Amer. Ins. Galls, pp. 9, 33. Felt, 1918, N.Y. Mus. Bull., 200, p. 68.

FEMALE.—Differs from other varieties of the species as follows: Parapsidal grooves rugose at bottom; median groove short or lacking; wing veins somewhat heavier than in the other varieties; areolet quite large, about equilateral; length 3.2-3.7 mm., larger and heavier than in other varieties.

GALL.—Differs from the galls of other varieties in averaging larger, longer, more slender, the tip about as in *subpacificus*, shorter than in *gracilis.*

RANGE.—California: Cupertino (Fullaway); Placerville, Auburn, Dunsmuir. Probably thruout the central Sierras, from El Portal north, wherever *Q. chrysolepis* occurs.

TYPES.—Adults and galls, in the U.S. National Muscum; labelled 3064.

The redescription of adults and galls is made from a considerable quantity of material in my collection, compared with types.

The insects from Auburn and Dunsmuir material agree entirely with those from Placerville. I collected galls from March 26 to April 3; the adults emerged at some later date.

Heterœcus pacificus variety **subpacificus,** new variety

Cynipide, 38, Trotter, 1910, Boll. Lab. Portici, V, p. 114, pl. 1, figs. 22-23.

FEMALE.—Differs from the female of the other varieties of the species only as follows: Parapsidal grooves rugose at bottom; median groove short or lacking; wing veins somewhat finer than in variety *pacificus;* areolet of only moderate size, about equilateral; first abscissa of the radius more arcuate than in either other variety; length 3.0-3.2 mm., distinctly smaller than in variety *pacificus.*

GALL.—Very similar to the galls of other varieties of the species, differing in averaging much shorter, but of as great diameter as in variety *pacificus,* hence more robust; the tip is about as long as in *pacificus,* often curved, even at right angles with the body of the gall.

RANGE.—California: Yosemite (Trotter); El Portal, San Jacinto Mountains. Probably thruout the southern Sierras and their extensions, from El Portal south, except in the San Bernardino and Cuyamaca ranges.

TYPES.—5 females, 40 galls. Holotype female and paratype galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, and with the author. Labelled El Portal, California; March 26, 1920; Kinsey collector.

The insects had mostly emerged in the San Jacinto mountains by February 28. Further north at El Portal a larger proportion of the insects had not yet emerged on March 26. Thus do emergence dates vary with the development of the season.

This variety comes very close to variety *pacificus,* but does show differences in the insect morphology, the galls, and the range. San Jacinto material agrees distinctly with the El Portal material; altho the two localities are about three hundred and fifty miles apart they are in the same faunal area.

Heterœcus pacificus variety **gracilis,** new variety

FEMALE.—Differs from other varieties of the species as follows: Generally of a darker, richer rufous brown; parapsidal grooves almost entirely smooth at bottom; median groove often longer, very wide at

the scutellum; wing veins somewhat finer than in variety *pacificus;* areolet of moderate size or larger, distinctly elongate on the cubitus; length 2.8-3.2 mm.

GALL.—Very similar to the galls of other varieties of the species, differing in averaging smaller, tho individual galls will equal those of the other varieties in size; more slender, with a longer, more slender point.

RANGE.—California: Ukiah. Probably confined to a part of Mendocino and northern Sonoma Counties.

TYPES.—6 females, 23 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, and with the author; paratype galls at the Museum of Comparative Zoology, and the Philadelphia Academy. Labelled Ukiah, California; March 17, 1920; Kinsey collector.

Galls were found in several stages of development at Ukiah on March 17; the insects emerged at some later date.

Both the insects and galls of this variety are more distinct than those of other varieties of the species.

Heterœcus sanctæ-claræ (Fullaway)

FEMALE.—Differs from the females of other species of the genus as follows: Color of head and thorax mostly rich, dark, brownish rufous, blackish in part; parapsidal grooves distinct, moderately wide at the scutellum, rugose at bottom, extending only half the mesonotal length; median groove indicated by a rather wide depression for a short distance from the scutellum; anterior parallel lines fine, distinct; scutellum rather deeply rugose, the basal foveæ smooth or rugose at bottom; mesopleuræ with a small dorsal area rugoso-punctate; abdomen darker or lighter rufous, second segment covering not more than three quarters the whole area; wing veins rich brown or yellowish brown; margins short ciliate; areolet of moderate size or larger; second abscissa of the radius almost straight; first abscissa arcuate-angulate; length 2.5-3.5 mm.

GALL.—A smooth, two-parted gall. The lower portion of the gall is rather cylindrical, narrower apically where it is inserted into the second part, concave basally where it is attached to the twig; the upper portion is low, cylindrical, as wide or more often nearer twice as wide as the lower portion, as high or little higher than the lower portion, drawn more or less abruptly into a long, rather slender, blunt point; gall measuring up to 15. mm. in greatest diameter, and 20. mm. in total length; externally smooth or slightly roughened, covered with a bluish white bloom when fresh, becoming light buff to golden yellow, blackening on weathering. Internally compact, not woody, solid except for a small, irregular cavity in the upper portion; the larval cell about central, divided between the two parts of the gall, or nearer the base. Sessil on twigs of *Quercus chrysolepis.*

RANGE.—California: San Jacinto Mountains to Dunsmuir.

This is not an acorn gall, as stated in the original description, but a bud gall. The insect shows extremely close relationships to other species of the genus. Indeed, the distinctive characters of the species are few. These characters are not as marked as for most varieties of species of the genus, and but for the character of the gall, *sanctæ-claræ* would never have been described when it was. In regard to the gall, the character of the external surface, the compact internal tissues, and the fact that it is a monothalamous bud gall would indicate even a physiology related to that of the other species. It is in general form only that the galls are distinct.

As usual, the varieties are distributed in distinct faunal areas.

Heterœcus sanctæ-claræ variety **sanctæ-claræ** (Fullaway)

Callirhytis sanctæ-claræ Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 363, fig. 5. Felt, 1918, N.Y. Mus. Bull., 200, p. 118.

? Disholcaspis sp. Trotter, 1910, Boll. Lab. Portici, V, p. 109, fig. 9.

FEMALE.—Differs from the other varieties of the species as follows: Antennæ almost wholly brownish rufous, hardly lighter basally; thorax almost wholly rich, dark, brownish rufous, blackish on the anterior parallel and lateral lines; depression at base of scutellum almost smooth at bottom for a wide area; most of mesopleuræ heavily punctoaciculate, almost entirely brown rufous, only finely edged blackish, abdomen rufous, darker dorsally, yellow rufous ventro-posteriorly; second segment covering about two-thirds of the abdominal area; wing veins rich brown, areolet moderately large, larger than in the other varieties; first abscissa of the radius limitedly infuscated; length 3.0-3.5 mm.

GALL.—Does not differ particularly from the galls of the other varieties.

RANGE.—California: Cupertino (Fullaway); Yosemite (Trotter); South Fork of Kings River, Tulare Co. (Weld); Boulder Creek, Dunsmuir, Placerville. Probably confined to the more northern parts of California, where *Q. chrysolepis* occurs.

TYPES.—2 females, 1 gall, at Stanford University; collected at Stevens Creek Canyon, above Cupertino, California, by R. W. Patterson.

I have seen the types of this species, but the above description was made from material I collected at Boulder Creek. I have not seen the insects of the Yosemite and Kings River material, so refer the galls to this variety rather than to the other only because of the geographic distribution. Insects had emerged from galls collected in March and April; dead adults were obtained by cutting into the galls.

Heterœcus sanctæ-claræ variety **fuscior** new variety

FEMALE.—Differs from the other varieties of the species as follows: Antennæ distinctly light yellow rufous basally; thorax rich, dark, brownish rufous, distinctly black on the anterior parallel and lateral lines in the basal depression of the scutellum; depression at base of scutellum more rugose at bottom; most of mesopleuræ finely and more regularly puncto-aciculate, very distinctly edged with black; abdomen dark rufo-piceous, almost black dorsally, yellow-rufous ventro-posteriorly; second segment covering more than three quarters the abdominal area; wing veins light yellowish brown; areolet of moderate size, smaller than in the other varieties; first abscissa of the radius not infuscated; length 2.5-2.7 mm.

GALL.—Does not differ particularly from the galls of the other varieties.

RANGE.—San Jacinto Mountains, Pasadena. Probably thruout the southern Sierras and their extensions, except in the San Bernardino and Cuyamaca ranges.

TYPES.—2 females and 16 galls. Holotype female, paratype galls in The American Museum of Natural History; paratype female and galls with the author; paratype galls at Stanford University, the Museum of Comparative Zoology, and the U.S. National Museum. Labelled San Jacinto Mountains, California; February 28, 1920; Kinsey collector.

The insects had all emerged before the collecting in January and February.

Heterœcus sanctæ-claræ variety **aliud,** new variety

FEMALE.—Differs from the other varieties of the species as follows: Thorax rich, dark, rufous brown, distinctly black on the anterior parallel and lateral lines, in the basal foveæ of the scutellum, and on the edges of the mesopleuræ; depression at base of scutellum distinctly smooth at the bottom; most of mesopleuræ finely and more regularly puncto-aciculate, similar in this regard to *fuscior*, more heavily edged with black, especially ventrally, than in *fuscior;* abdomen dark rufo-piceous, almost black dorsally, dark brownish rufous ventro-posteriorly; second segment covering about two thirds of the abdominal area, about as in variety *sanctæ-claræ* rather than in *fuscior;* wings with veins light brown, darker than in *fuscior*, distinctly lighter than in *sanctæ-claræ;* areolet of moderate size, rather larger than in *fuscior;* first abscissa of the radius with an indication of a limited infuscation, less so than in *sanctæ-claræ;* length 2.7 mm., intermediate in size and build between the other two varieties.

GALL.—Does not differ particularly from the galls of the other varieties. On *Quercus chrysolepis.*

RANGE.—San Bernardino Mountains. Probably confined to this range.

TYPES.—1 female, 7 galls. Holotype female, paratype galls in The American Museum of Natural History; paratype galls at Stanford University, the U.S. National Museum, and with the author. Labelled San Bernardino, California; January 31, 1920; Kinsey collector.

Adults had all emerged before January 31, tho the galls still possessed a bloom, probably indicating that the insects had emerged not long previously.

This variety again illustrates the remarkably distinct nature of the fauna of the San Bernardinos. There is not the least difficulty in separating this variety from either of the others, but if one will compare the descriptions of the adults word for word he will be struck by the fact that part of the characters of this variety match those of variety *sanctæ-claræ,* and part those of *fuscior.* On a whole the variety comes nearer *fuscior.*

Neuroterus cupulæ, new species

FEMALE.—Almost wholly black, a light ring at base of the third segment of the antennæ; mesopleuræ finely coriaceous; areolet large; length up to 1.7 mm. HEAD: As wide as the thorax, moderately widened behind the eyes; black, mouthparts deep rufous brown; very finely and evenly shagreened, smoother on the face, face scatteringly punctate and pubescent. Antennæ short, black, piceous black basally, apex of the second segment and base of the third usually yellow piceous; with 13 segments, the last segment hardly longer than the preceding. THORAX: Entirely black; mesonotum practically smooth, shining, and naked, very faintly and microscopically shagreened; entirely without grooves; scutellum large, oval, smooth, and shining, very faintly and microscopically shagreened, an arcuate furrow at the base; pronotum very finely, irregularly puncto-shagreened at the sides; mesopleuræ shagreened-coriaceous. ABDOMEN: Piceous black; entirely smooth and shining, and practically naked; large, irregularly triangular, protruding ventrally as far as or further than dorsally; the second segment occupying about half the area; ventral valves at a 60° angle to almost vertical. LEGS: Piceous black, brownish yellow on the joints and on the tarsi, the tips of the tarsi dark; finely pubescent; tarsal claws simple. WINGS: Clear, set with fine hairs, anterior margins scarcely ciliate; veins rich brown; areolet large to very large; cubitus reaches the basalis below the mid-point, distinct for the whole length; radial cell open, second abscissa of the radius somewhat curved, most so toward the tip, not quite reaching the margin of the wing; first abscissa sharply angulate. LENGTH: 1.0-1.7 mm.

GALL.—Only a larval cell buried in the wood of the acorn cup. The cell oval, averaging 1.5 mm. wide by 2.2 mm. long; the walls hard but not thick; entirely hollow. Buried wholly or in part in the wood of the acorn cup, oftenest at the base; part of the cell sometimes visible within

the cup, only rarely producing a slight swelling on the outside of the cup. On *Quercus lobata.*

RANGE.—California: Paso Robles, Gilroy (Redwood School).

TYPES.—50 females and many infested acorns; holotype female, paratype females, and galls in The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Paso Robles, California, March 7, 1920, Kinsey collector.

Adults were emerging at Paso Robles on March 7, after most of the cupules had fallen to the ground. This is clearly an agamic generation, and very probably has an alternate, bisexual generation, probably not occurring on acorn cups. A similar gall occurs on *Q. garryana* on the north Pacific Coast; the insects will probably prove to belong to a distinct variety.

Neuroterus evanescens, new species

Almost wholly black, straw colored on the antennæ and parts of the legs; areolet moderately large; length 1.0 mm. or less.

FEMALE.—HEAD: As broad or broader than the thorax, protruding slightly behind the eyes; wholly black except the straw yellowish mouth-parts; apparently smooth, but microscopically coriaceous, most so toward the mouth. Antennæ light straw yellow; very finely pubescent; with 13 segments, the third the longest but not much longer than the fourth, the last about as long as the preceding. THORAX: Entirely black or piceous black; mesonotum almost entirely smooth, shining, without lines or grooves; scutellum almost smooth, shining, with a very few hairs, the groove at the base only slightly arcuate; pronotum piceous black, very finely roughened; mesopleuræ piceous black, very finely rugoso-aciculate. ABDOMEN: Piceous black or black; smooth, naked; small, about triangular, shrivelling, extending ventrally as far as or further than dorsally. LEGS: Dark brown, light straw brown at the joints and on the tarsi, the tips of the tarsi darker; very finely hairy; tarsal claws simple. WINGS: Very clear, edges ciliate; veins straw brown, distinct; areolet of moderate size; cubitus reaches the basalis; radial cell entirely open, not as long and narrow as usually in the genus; second abscissa of the radius practically straight; first abscissa distinctly angulate but without a projecting tip. LENGTH: 0.7-1.0 mm.

MALE.—Similar to the female, but with 14 segments to the antennæ; legs almost wholly straw brown; abdomen much smaller, with a more distinct but not long pedicel.

GALL.—Very slight swelling of the stem of the ament, causing an abortion of the whole ament into a short, ovoid mass about 5. mm. long, covered closely with clustered but otherwise normal anthers. The larval cells are tiny cavities in the swollen stem, without distinct linings, covered on the outside by only very thin tissue. On aments of *Quercus breviloba.*

RANGE.—Texas: Austin (Patterson).

TYPES.—31 females, 2 males, 3 galls. Holotype female, paratype females, male, and gall in The American Museum of Natural History; paratype adults and galls with the author; paratype females in the U.S. National Museum, the Museum of Comparative Zoology, and the Philadelphia Academy. Labelled Austin, Texas, *Q. breviloba*, Patterson collection number 46.

Only two males were obtained among the fourteen adults, but it is not unlikely that the sexes are usually more nearly equal in number. Patterson reports the galls appearing early in March, and the adults beginning to emerge March 15. With such a short life history for this generation, another form must occur in the remainder of the year. A bisexual generation on such an evanescent part of the host usually produces the alternate, agamic generation on some other part of the same host, and Patterson has observed the females ovipositing on the under sides of the leaves. The gall material of the Patterson collection number 68 occurs on *Q. stellata*; it shows only a slightly greater degree of swelling of the stems, but when the insects are obtained it may prove a distinct variety confined to the single species of host.

Neuroterus floricola, new species

FEMALE.—Generally piceous, legs brownish and piceous; areolet very small; length 1.0 mm. or slightly more. HEAD: Not as wide as the thorax, not widened behind the eyes; black, the mouthparts yellow with some piceous; very finely roughened, practically naked. Antennæ brownish black, hardly lighter basally, the second segment globose, the third hardly longer than the fourth. THORAX: Piceous black, very finely roughened, almost finely coriaceous; parapsidal and median grooves lacking, anterior parallel and lateral lines barely indicated as smoother, slightly raised lines; scutellum about circular, with an arcuate depression basally; mesopleuræ not wholly smooth. ABDOMEN: Piceous black; smooth, naked; somewhat triangulate, produced dorsally about as far as or somewhat farther than ventrally; ventral spine very short, fine. LEGS: Brownish, the femora and hind tibiæ piceous; tarsal claws fine, simple. WINGS: Very long; clear; finely ciliate on the margins; veins brown, mostly rather fine; areolet very small; radial cell long and narrow, open, the second abscissa of the radius slightly curved; the first abscissa distinctly angulate but without a projection. LENGTH: 1.0-1.3 mm.

MALE.—Differs from the female as follows: Head golden yellow, front brownish; antennæ yellow basally; whole thorax light brownish; abdomen brown, small, pedicellate; legs entirely golden yellow; areolet rather small, but larger than in the female.

GALL.—A minute, egg-shaped capsule in the aments. Monothalamous. Each capsule ovate, somewhat elongate, more pointed apically; golden yellow brown, the surface finely pitted like leather; averaging 1.5 mm. long by 0.7 mm. wide; thin-walled, entirely hollow. Singly or two or three completely fused; showing clearly the origin from the anthers, sometimes incompletely furrowed, or with parts of anthers attached; on the aments of *Quercus Douglasii.*

RANGE.—California: Three Rivers. Probably occurs thruout the range of *Quercus Douglasii.*

TYPES.—10 females, 3 males, 27 clusters of galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author. Labelled Three Rivers, California; March 23, 1920; *Q. Douglasii;* Kinsey collector.

A form on the flowers of the oak must have a short life history, with an alternate, probably agamic generation.

This tiny species is of especial interest because the gall so closely resembles that of *Andricus gigas* Kinsey, *gigas* galls differing mainly in being larger, averaging 2.0 mm. in length by 1.0 mm. wide. *Gigas* was obtained from the same oak, in the same faunal area. I also have *gigas* from the same flowers which gave this *Neuroterus.* Of course the two insects are very distinct, belonging to different genera, even if the name *Andricus* does not define a genus. Some other species of Cynipidæ produce similar galls on the aments. Here is one of the few cases I know among cynipids producing distinct galls where the species and genus of the gall maker is not the primary factor in determining the type of the gall. The anther appears to have only certain possibilities for abnormal development; practically identical results are effected when the stimulus is supplied by either *Andricus gigas* or *Neuroterus floricola.* Galls of much the same type, altho clustered differently and of several different shapes, are effected by *Andricus dubiosus* (Fullaway), *Andricus serricornis* Kinsey, *Neuroterus pallidus* Bassett, and some other species. In fact, I do not now recall any species where any other sort of modification of the anther is produced. The diversity of these insects is great; it would appear to be the nature of the anther which restricts the type of modification.

Plagiotrichus Mayr

Plagiotrichus Mayr, 1881, Gen. Gallenbw. Cynip., pp. 8, 12, 32. Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, p. 388.

FEMALE.—Head enlarged behind the eyes; antennæ with 14 or 15 segments; mesonotum never wholly smooth, often puncto-rugose, hairy; foveæ present; tarsal claws simple; anterior margins of wings not ciliate; radial area open. HEAD: About as wide as the thorax, considerably enlarged behind the eyes in the agamic female, usually by a distance equalling the width of the eyes; slightly enlarged behind the eyes in the bisexual form; malar space about one third the length of the compound eyes in the agamic female, less in the bisexual forms, especially the males; face without aciculations; no malar furrow; more or less finely puncto-rugose, largely hairy, most hairy and rugose on the face; rufus to black, the tips of the mandibles piceous. Antennæ golden rufous to black, often the seven or eight terminal segments darker; only finely pubescent, usually rather long, usually not much enlarged terminally; with 14 or 15 (or rarely 16) segments, the second the shortest segment but distinctly elongate, the third only somewhat longer than the fourth, the last hardly longer than the preceding, sometimes longer and with another division. THORAX: Mesonotum mostly finely punctate, puncto-shagreened to puncto-rugose, never roughly rugose, naked or more usually largely hairy; parapsidal grooves often fine, shallow, often discontinuous, indistinct, or faintest anteriorly, gradually converging posteriorly; median groove more or less faint or reduced, or lacking; anterior parallel lines lacking or in part indistinct or distinct; lateral lines smooth; scutellum longer than wide, moderately rounded posteriorly, coriaceous to rugose, hairy; foveæ always present, more or less distinctly separated; pronotum laterally striate rugose; mesopleuræ in part smooth, shining, and naked, in part punctate, puncto-rugose or rugose aciculate, often hairy. ABDOMEN: Mostly smooth and naked, sometimes sparsely hairy, sometimes finely punctate or reticulate, somewhat shorter to slightly longer than high, not produced dorsally, the second segment covering less than a half to two-thirds of the area, its edge more or less slightly oblique and much rounded ventrally; ventral spine not long, slender; ventral valves toward the vertical. LEGS: Brownish rufous, in part darker especially on the hind tibiæ, entirely golden yellow in the bisexual forms; tarsal claws rather fine, simple. WINGS: Entirely clear, pubescent, the anterior margins not ciliate or short ciliate; veins brown, only the subcosta and cross veins ever heavy; areolet very small to very large; cubitus continuous or discontinuous; radial cell open, rather long, the second abscissa of the radius moderately curved; the first abscissa distinctly, sometimes sharply, angulate, with or without, usually without a projection, sometimes very limitedly infuscated. LENGTH: 1.2-3.5 mm.

GALL.—A more or less gradual, woody swelling, on stems, leaves, or flowers. Polythalamous, varying from a very few to a great many cells in a gall. The swelling usually elongate, less often globose, usually arising gradually, surrounding and involving the affected parts; covered with normal epidermis mostly of normal color and texture. Internally woody, the tissue increased but not otherwise greatly modified, the larval cells with only a more or less distinct lining, in some cases solidly imbedded, sometimes with the cells in a more or less continuous cavity in the wood, each cell distinct, adjoining the next, but inseparable; some-

times the larval cell entirely separable at maturity. On both black and white oaks, the agamic generation in larger, more woody stem galls, and the bisexual generation in smaller galls on veins, petioles, flower stems.

RANGE.—Western Asia, Europe, northern Africa, and North America. Probably wherever oaks occur.

TYPE.—*Cynips ilicis* Fabricius. Designated by Ashmead, 1903, Psyche, X, p. 151.

This description largely agrees with the Das Tierreich description, and is somewhat broadened to include both European and American species showing close relationships. I have specimens of *P. ilicis* and some other European species kindly sent me by Prof. A. Trotter, of Portici, Italy, and have compared all other species with *ilicis*. This genus has not been recognized in the North American fauna previously. It is known from western Asia, Europe, and northern Africa from only three or possibly four species. The insects are characterized by the key characters at the beginning of this description. The genus as I recognize it is a very compact group of species, distinguished by insect morphology, very uniform gall characters, and probably uniform life histories. Here is a good instance of the correlation of morphologic and physiologic characters. I repeat that I question the quality of any "genus" where the two sorts of characters are not correlated! All of the American species previously described have been placed in the heterogeneous mixtures called *Andricus* or *Callirhytis*. *Plagiotrichus* is closely related to *Dryocosmus* Giraud, but the two groups should not be united. *Dryocosmus* shows some specialization in structure, particularly of the abdomen, and the galls are more highly specialized, being aggregations of monothalamous stem galls. *Plagiotrichus* is distinctly a more primitive group, probably "ancestral" to *Dryocosmus* and to a group including some of the other North American stem gall producers not yet assigned to exact genera.

The relatively smaller second abdominal segment, the simple tarsal claws, the simple nature of the galls (polythalamous, inseparable, without special structures, the larval cell often inseparable), and the fundamental similarity of the alternate generations are the primitive characters. The open radial cell, the reduced thoracic sculpture, and the occurrence of heterogeny mark some degree of specialization, greater than occurs in the genus *Neuroterus*, for instance.

Kieffer states in Das Tierreich that *Plagiotrichus kiefferianus* is the agamic generation of *P. ilicis.* I have not seen a further account of this life history, and I do not know of any other life history being proved in the genus. But this alternation is entirely probable because the galls of the two generations are fundamentally alike, differing only in connection with their occurrence on different parts of the hosts, and the bisexual and agamic insects clearly belong to the same genus. All of our American bisexual species occur in galls which are typical of *ilicis,* and all of our agamic species occur in galls similar to *kiefferianus.* Probably both generations have been described as separate species for some of our eastern American insects of this genus. On the Pacific Coast apparently only one bisexual form, *P. congregatus,* is described, altho I have the galls of several forms which very probably alternate with varieties of *P. chrysolepidicola, P. suttonii, P. perdens,* or *P. asymmetricus.* Several of these undescribed galls are leaf vein swellings little different from *ilicis* galls. Some are more woody petiole swellings.

A fact to be emphasized is the close similarity of the two generations, except that one is agamic and the other bisexual. My detailed description of the insects and galls fits both the bisexual and agamic forms of all the species yet known. Again we find that alternation of generations is only an extreme development of seasonal dimorphism.

In addition to the species treated in this paper, the following American Cynipidæ should be assigned to *Plagiotrichus*:

Plagiotrichus concolorans (Kinsey) (= *P. cicatriculus* (Bassett) ?). Agamic; eastern; white oaks.

P. congregatus (Ashmead). Described from female only; both sexes among the types; Pacific Coast; on white oaks.

P. cornigerus (Osten Sacken). Agamic; eastern; on black oaks.

P. punctatus (Bassett). Agamic; eastern; on black oaks.

P. quinqueseptum (Ashmead). Agamic; eastern; white oaks.

P. reticulatus (Bassett). Only female described; southwestern; white oaks.

P. scitulus (Bassett). Bisexual; eastern; on black oaks.

P. tumificus (Osten Sacken). Bisexual; eastern; on black oaks.

I shall withhold opinion on the generic position of some other American Cynipidæ from stem and leaf vein galls until further revision of cynipid genera may indicate the several trends of evolution.

With many if not all of the species of this genus, each variety is confined to a single oak. The influences of host isolation have been greater than with some other Cynipidæ, and with some of the insects of the genus host isolation has succeeded in developing more distinct varieties than geographic isolation has effected.

Plagiotrichus asymmetricus, new species

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color light rufous brown and darker to black; widened but not greatly so behind the eyes; antennæ brown, first four or five segments lighter, with 14 segments; mesonotum more or less smooth and shining, but coriaceous in places, more or less distinct, rugous striæ radiating from the midpoint of the posterior margin, anteriorly more coriaceous or rugose; the thorax naked of hairs; parapsidal grooves never traceable for more than a short distance from the scutellum, converging considerably posteriorly; median groove and anterior parallel lines barely indicated as marks, not as grooves or lines; lateral lines short, oval depressions; a smooth, arcuate foveal furrow hardly divided into two by a very fine, median ridge; mesopleuræ brownish rufous or darker, at least in part aciculate; abdomen rich rufous brown or darker, entirely smooth, shining, neither punctate nor reticulate, about as high as long, the second segment occupying hardly half the area; legs largely rufous, hind tibiæ darker centrally; areolet of moderate size to very large; cubitus not reaching the basalis; length 1.7-3.0 mm.

GALL.—Stem swelling containing compact clusters of larval cells. Polythalamous. The swelling covered with bark normal in appearance; a gradual enlargement, often asymmetrical on the stem; up to 30. mm. long, by 20. mm. broad. Internally, the larval cells in compact masses, each cell with a distinct and sometimes separable lining, not very thin walled; the cells usually densely clustered. On young stems of *Quercus chrysolepis.*

RANGE.—California: Pasadena and San Bernardino to Dunsmuir and Ukiah. Probably wherever *Q. chrysolepis* occurs.

The gall of this species does not differ materially in external appearance from the galls of two other Pacific Coast species found on the same host: *Andricus spectabilis* Kinsey and *Plagiotrichus chrysolepidicola* (Ashmead).

The species presents the typical condition of distinct varieties wherever it occurs in a distinct faunal area. Between

the adults of the first two varieties there are few differences, but their galls are very distinctive; between the galls of the second and third varieties there are not appreciable differences, but their adults are very distinct. In the first instance the species varies more physiologically than morphologically, in the second instance the morphology varies more than does the physiology.

Plagiotrichus asymmetricus variety **asymmetricus,** new variety

FEMALE.—Closely resembles the female of the following variety; head light rufous brown, rather coarsely coriaceous, distinctly rugose on the face; antennæ dark brown, yellow rufous basally; mesonotum brownish yellow or light rufous brown, in part dark brown to black, usually dark brown lateral to the parapsidal grooves; mesonotum smoothed and shining, but distinctly uneven and irregularly coriaceous in places, distinct striæ radiating from the midpoint of the posterior margin, anteriorly much more coriaceous or even rugose antero-laterally; parapsidal grooves, median, anterior parallel, and lateral lines more distinct than in *compactus;* scutellum yellow rufous or darker, almost black on the edges, finely rugose but not as finely as in *compactus;* arcuate furrow at base of scutellum rather wide, the division into foveæ hardly evident; pronotum rich rufous, brown black on the edges; mesopleuræ wholly, unevenly coriaceous to aciculate; abdomen rich rufous brown, splotched with brown black; wing veins rather heavy, dark brown; areolet large to very large; length 1.7-2.3 mm.

GALL.—A stem swelling, differing from that of both other varieties in being more asymmetrical, about 20. mm. long by 7. mm. wide, with the larval cells mostly between the modified bark and the wood. On stems of *Quercus chrysolepis.*

RANGE.—California: Ukiah. Probably confined to a limited area in the region of Mendocino and northern Sonoma counties.

TYPES.—14 females, 2 galls. Holotype female, paratype females, and gall in The American Museum of Natural History; paratype females and gall with the author; paratype females at Stanford University and the U.S. National Museum. Labelled Ukiah, California; March 17, 1920; Kinsey collector.

All of the type females were cut from the galls, failing to emerge probably because the galls were collected too early (March 17).

The gall of this variety is rather distinct from that of the other varieties; the insects closely resemble those of variety *annectens.*

Plagiotrichus asymmetricus variety **annectens,** new variety

FEMALE.—Almost identical with the female of variety *asymmetricus* (q. v.), differing as follows: Generally of darker color; scutel-

lum somewhat more elongate, basal furrow rather wider; length 2.5-3.0 mm.

GALL.—Differs from the gall of variety *asymmetricus* in having almost the entire swelling compactly filled with larval cells, the swelling more symmetrical; observed up to 3.0 mm. long, probably often longer; the outer bark often splits and in part breaks away. On stems of *Quercus chrysolepis*.

RANGE.—California: Placerville, Dunsmuir. Probably confined to the central Sierras, north of El Portal, at the elevations at which *Q. chrysolepis* occurs.

TYPES.—8 females, 7 galls. Holotype female, paratype female, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author. Labelled Placerville, California; March 30, 1920; Kinsey collector.

Insects emerged from these galls sometime after the date of collecting at Placerville, March 30.

The adults do not appear to differ from variety *asymmetricus* except in color and size characters. But inasmuch as the galls of the two are distinct, and the varieties occur in distinct tho related faunal areas we are warranted in recognizing the differences.

Plagiotrichus asymmetricus variety **compactus,** new variety

FEMALE.—Differs from the female of the other two varieties as follows: Head still lighter brownish rufous, more finely sculptured; areolet of moderate size, much smaller than in the other two varieties; antennæ light yellow brown, more yellow basally; thorax almost wholly clear brownish rufous; mesonotum very largely smooth and shining, faintly coriaceous anteriorly, with very faint striæ from the midpoint of the posterior margin; parapsidal grooves, median, anterior parallel, and lateral lines hardly at all indicated; scutellum wholly rufous brown, more finely rugose than in other varieties; the arcuate furrow at the base of the scutellum more nearly divided into two than in other varieties; pronotum wholly rufous brown; mesopleuræ largely smooth and shining, in only a small part aciculate; abdomen dark brown or brown black; wing veins of moderate weight, light brown; areolet of moderate size only; length 1.7-2.0 mm., smaller than in other varieties.

GALL.—Practically identical with that of variety *annectens*. On stems of *Quercus chrysolepis*.

RANGE.—California: El Portal, Pasadena. Probably occurs thruout the southern Sierras, from El Portal to the Sierra Madre and San Jacinto mountains, except in the San Bernardino range.

TYPES.—8 females, 14 galls. Holotype female, paratype female, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author.

The adult of this variety is remarkably distinct, considering how similar the insects of the other two varieties are. The gall, however, is quite like that of *annectens*. It is often broken into, apparently by birds or mice in search of the cluster of larvæ, for food. Most of the insects had emerged before collection on March 26 at El Portal.

Plagiotrichus batatoides (Ashmead)

——— [gall only] Osten Sacken, 1862, Proc. Ent. Soc. Phila., I, p. 259.
Cynips q. batatoides Ashmead, 1881, Trans. Amer. Ent. Soc., IX, p. XI.
Cynips batatoides Packard, 1881, U.S. Ent. Comm. Bull., VII, p. 57.
Andricus batatoides Ashmead, 1885, Trans. Amer. Ent. Soc., XII, p. 295; 1887, Trans. Amer. Ent. Soc., XIV, p. 132. Ashmead (in Packard), 1890, 5th Rpt. U.S. Ent. Comm., p. 106. Dalla Torre, 1893, Cat. Hymen. Cynip., II, p. 80. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 61. Beutenmuller, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 24. Thompson, 1915, Amer. Ins. Galls, pp. 6, 31. Felt, 1916, N.Y. Mus. Bull., 186, p. 93; 1918, N.Y. Mus. Bull., 200, p. 58.
Callirhytis batatoides Mayr, 1902, Verh. Ges. Wein, LII, p. 289. Beutenmuller (in Dozier), 1920, Ann. Ent. Soc. Amer., XIII, p. 373.
Callirhytis quercus-batatoides Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 566, 802, 838.

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color largely light brownish rufous, without any black; antennæ with 15 segments; mesonotum entirely, rather closely, rather coarsely puncto-rugose; parapsidal grooves almost continuous, moderately broad and distinct at the scutellum, broader than in any other variety of the genus; median groove somewhat evident for a short distance; mesopleuræ almost wholly puncto-rugose, light brownish rufous; foveæ distinct, broadly separated, of moderate size, largely rugose at bottom, in small part almost smooth; abdomen light brownish rufous, darker posteriorly especially dorsally, smooth, naked except for a few hairs latero-basally, posterior segments finely, definitely reticulated, most faintly so posteriorly, longer than high, the second segment covering fully two-thirds the area; legs largely light brownish rufous, only slightly browner on the coxæ and the tibiæ; cubitus complete but very fine and faint at the basalis; areolet of moderate size or rather large, elongate on the cubitus; length averaging close to 3.0 mm.

GALL.—Quite similar to the galls of the other agamic forms of the genus; generally large, robust, up to 20. mm. in diameter and 28. mm. long; usually more irregular, composed of rather distinct, rounded parts, more or less fused; internally inclined to become partly hollow, the larval cells closely embedded, not very distinctly lined. On twigs of *Quercus virginiana*.

RANGE.—Florida, Georgia, and possibly elsewhere. The typical variety confined to an area including Jacksonville, Florida.

TYPES.—In the U.S. National Museum, The American Museum of Natural History, the Philadelphia Academy of Natural Sciences, the

Museum of Comparative Zoology, and the Beutenmuller collection (?). From the neighborhood of Jacksonville (?), Florida; Ashmead collector.

At this time I can add little to our knowledge of this species because I do not have insects enough to determine how many varieties it may have, and the range and hosts of each. The above descriptions, made from types, will separate this species from others of the genus, and give further details probably characteristic of only the typical variety. I have galls from a number of localities in Florida and Georgia, representing certainly more than one variety. Moreover some of the galls are from *Quercus virginiana*, some from *Q. laurifolia*, and some from *Q. stellata*. Probably each host has a distinct form for each faunal area. The *Q. stellata* galls from Georgia may represent a variety of *Plagiotrichus elongatus*, altho the galls are more like *batatoides* galls.

Dozier states that galls collected early in December gave adults late in January; Weld bred adults on April 12, 1914. All of my galls were collected early in November, and I failed to secure adults probably because the larvæ were still too young when the galls were dried. These galls are pecked into by birds and gnawed by mice, as Ashmead also recorded with the original description. Older galls persist on the trees until many of the live oaks are thickly covered with them. They are the favorite abode of ants which tunnel the soft tissue, further its early decomposition, and establish their colonies inside. Many of the old galls are almost hollow, covered by mostly complete bark, but internally a mass of thinly separated tunnels and decomposing chewings.

The insect shows very distinct relationships to the other white oak species of the genus, rather than to the black oak species, but in many respects it is the most unique of the white oak species. The discovery of other varieties may link it more directly with some other species. *Plagiotrichus elongatus rufopleuræ*, occurring in Texas on *Quercus breviloba*, is in some respects similar to *batatoides*, but more closely related to the other varieties of *elongatus*.

Plagiotrichus chrysolepidicola (Ashmead)

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color largely rufous, sometimes in part shaded to black; apical half of antenna darker than basal half; mesonotum closely, finely puncto-rugose, sometimes in part puncto-

shagreened, entirely and rather closely hairy; foveæ distinct, usually well separated; abdomen smooth, not at all reticulated, finely punctate only on the edge of the last segment, moderately hairy, longer than high in some varieties, not as long as high in others, the second segment not covering more than half the area; cubitus more or less complete, faint or practically lacking at the basalis in some varieties; length 1.5-3.5 mm.

GALL.—Similar to those of most species of the genus. Swelling up to 20. mm. in diameter by 70. mm. long, usually much smaller; the larval cells distinct, more or less imbedded in the wood, usually not completely surrounded by wood, never separable. On white oaks.

RANGE.—California and Oregon. Apparently confined to the Pacific Coast states.

I have grouped the following varieties into one species because they are all so closely related that further subdivision is not logical (as discussed under *diminuens*) ; because they all occur on white oaks in the Pacific Coast region, and are abundantly different from the black oak varieties of the same region. The most closely related varieties I have yet seen are the white oak varieties from the Rocky Mountain region, here treated as species *frequens*. In no case are these varieties as generally dark in color, or the abdomen as naked as in *frequens*. But inasmuch as in most other respects varieties of both groups are so similar, it must be borne in mind that *frequens* and *chrysolepidicola* are closely related, if they should not be considered one species.

The insects emerge very early in the spring, from February 7 in southern California to April 7 in Oregon. New galls were found in some instances at about the same dates, too soon to have been produced by the insects then emerging, suggesting the possibility of the species having an alternate generation which takes a full year for its growth. The galls are abundant wherever white oaks occur, each variety being confined as far as known to a single species of oak, and where that oak ranges over more than one faunal area there will be as many varieties of the insect.

It is unfortunate that the first variety described was named *chrysolepidicola*, which wrongly defines the habits of most of the varieties. If *P. congregatus* (Ashmead) should prove to be the bisexual generation of any of these varieties, that name will take precedence for this species.

Plagiotrichus chrysolepidicola variety **chrysolepidicola** (Ashmead)

Cynips chrysolepidicola Ashmead, 1896, Proc. U.S. Nat. Mus., XIX, p. 124. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 59; 1910, Das Tierreich, XXIV, pp. 439, 802, 829. Thompson, 1915, Amer. Ins. Galls, pp. 7, 26.

Callirhytis chrysolepidicola Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 354. Felt, 1918, N.Y. Mus. Bull., 200, p. 59.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally a rather light rufous brown; antennæ bright rufous, the apical half brown; parapsidal grooves indistinct but traceable for the mesonotal length, broader posteriorly than in *kelloggi;* median groove distinct for the mesonotal length; anterior parallel lines evident, continuous, smooth; mesopleuræ in large part punctate and hairy, only in smaller part smooth; abdomen about as long as high; legs with the coxæ light rufous brown, the tibiæ, especially the hind tibiæ, dark brown; areolet of moderate size; cubitus about continuous; length 2.-3. mm.

GALL.—Quite similar to the galls of other varieties of this species; rather small, elongate-ovate, up to 40. mm. in length by about 15. mm. in diameter. On *Quercus chrysolepis?*

RANGE.—California: "Pine Canyon", Martinez (Ashmead).

TYPES.—Adults and galls at the U.S. National Museum. Labelled January 8, 1883, and February 9, 1884; Martinez (and elsewhere?), California; Koebele collector.

I have seen only type material of this variety. The insect is remarkably like that of variety *alutaceus,* differing mainly in having the parapsidal grooves less convergent at the scutellum and the median groove distinctly continuous; the gall is not inflated and partly hollow as in *alutaceus,* but is solid as in most of the varieties of this species. We must see material of other collections before we can be certain what this name represents. *Quercus chrysolepis* bears similar galls of some other species, *P. asymmetricus* and *Andricus spectabilis,* and possibly I have overlooked *chrysolepidicola* galls for this reason. The hosts of the type galls are not certain, however; the pin label records a live oak as host, and it is not impossible that Ashmead merely surmised *chrysolepis* as the host. The bark of the type galls is certainly not very typical of *chrysolepis.* Finally, the inclusion of at least two distinct collections of galls in the types makes the question of host more uncertain.

Plagiotrichus chrysolepidicola variety **kelloggi** (Fullaway)

Cynips kelloggi Fullaway, 1911, Ann. Ent. Soc. Amer., IV, pp. 345, 370.
Felt, 1918, N.Y. Mus. Bull., 200, p. 56.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally a rather light rufous brown; antennæ bright rufous, the apical half brown; parapsidal grooves entirely indistinct but traceable for most of the mesonotal length; median groove traceable for most of the mesonotal length; anterior parallel lines rather evident, continuous, smooth; mesopleuræ in large part, almost, but not entirely, smooth, shining, more or less naked, a distinctly rugose area medianly, bright rufous brown; foveæ not large, more or less smooth at bottom; abdomen darker only posterodorsally and less so ventrally, longer than high; legs including the coxæ bright rufous brown, hardly darker on the hind tibæ; areolet very small; cubitus faint at the basalis; length 2.0-3.0 mm., averaging smaller.

GALL.—Quite similar to the galls of most of the varieties. More or less rounded, up to 25. mm. in diameter and 40. mm. long, averaging nearer 10. mm. in diameter by 20. mm. long. Internally quite solid, the larval cells more or less closely embedded. On *Quercus Douglasii.*

RANGE.—California: Cupertino, Stanford University, Frohm, Paso Robles, San Jose (Fullaway); Palo Alto, Byron, Oakdale, Three Rivers, El Portal. Probably from Palo Alto and El Portal south wherever *Q. Douglasii* occurs.

TYPES.—Females and gall at Stanford University; females at the U.S. National Museum and in my collection.

The above redescriptions are based on paratype females from Paso Robles, and on galls from the several localities in which I collected this species. I have critically examined insects only from Paso Robles, and all of the other locality records, based on galls only, are therefore open to question.

Galls collected in March and April were empty; young galls (not certainly of this variety) were just beginning growth at El Portal on March 26, 1920. If the insects overwinter in the galls they emerge early in the spring. The variety is probably confined to *Quercus Douglasii*, over the southern part of its range, for in the more northern Sierras, and north of San Francisco, this same oak bears different varieties, *compositus* and *atricinctus,* respectively. Galls were collected which had been broken into by mice or other small mammals in search of the insects as food.

The insect, in its color, size, smoother mesopleuræ, elongate abdomen, and more or less discontinuous cubitus, shows closest relationships to variety *diminuens.* It differs from *diminuens* mainly in having complete parapsidal grooves,

a complete median groove, and a smaller areolet. The larger, more robust gall, of greater diameter, is quite unlike that of *diminuens*. This latter variety, moreover, is confined to *Quercus dumosa*.

The Stanford laboratory records state that the single specimen from Cupertino was collected on *Q. dumosa*, and this specimen is labelled as holotype of *kelloggi*. If *dumosa* is the correct host of this specimen it is unlikely that it agrees with the paratypes which came from *Douglasii* at Paso Robles. The original description, however, agrees with the Paso Robles paratypes, and if it develops that the Cupertino material does not agree with the description it cannot remain as the holotype.

Plagiotrichus chrysolepidicola variety **diminuens**, new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally rather dark rufous brown, in part blackish; antennæ almost entirely brown, the apical half much darker, the first two segments golden rufous; parapsidal grooves distinct for only half or two-thirds of the mesonotal length, moderately convergent posteriorly; median groove practically absent; anterior parallel lines rather distinct; mesopleuræ very largely smooth, shining, naked, only centrally punctate, hairy, and limitedly and finely rugose; foveæ not large, rather smooth, wholly but not closely rugose at bottom; abdomen bright rufous laterally, distinctly dark rufo-piceous postero-dorsally and postero-ventrally, not very hairy laterally, longer than high; legs including the coxæ yellowish rufous, the tibiæ distinctly brown; areolet rather small; cubitus very faint at the basalis or actually discontinuous; length 1.5-2.5 mm., averaging about 2.0 mm., distinctly smaller than in any other variety.

GALL.—Differs from the galls of most of the other varieties in being much more slender and elongate, up to 9. mm. in diameter and 70. mm. long, often less in diameter; with the larval cells clustered in a more or less continuous cavity, the cell walls distinct from but attached to the wood. On *Quercus dumosa*.

RANGE.—California: Palo Alto, Paso Robles, Pasadena, Santa Catalina Island, Fallbrook, Sorrento, Alpine, Descanso.

TYPES.—42 females, 38 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Palo Alto, California; March 13, 1920; *Q. dumosa;* Kinsey collector.

Insects were emerging at Pasadena on February 7, 1920; some emerged after February 23 at Descanso, after February 26 at Fallbrook, and after March 7 at Paso Robles. In the

later collections the galls showed some of the adults to have emerged earlier. The Alpine, Sorrento, and Santa Catalina records are based on galls alone; from all the other localities I have the insects. Galls of this variety were in several instances confused in collecting with galls of variety *alutaceus*, the two growing together on the very same trees and twigs. But a fine series of *diminuens* insects was bred from a pure collection of slender galls from Descanso, and large series of *alutaceus* were bred from pure collections of inflated galls from Upland, San Jacinto, and the Santa Catalina Island; so I do not believe I have connected the insects of these two varieties with the wrong galls.

In its color, size, smoother mesopleuræ, elongate abdomen, and more or less discontinuous cubitus, the insect shows closest relationships to *kelloggi*. It differs from *kelloggi* in having incomplete parapsidal grooves, no median groove, and a somewhat larger areolet. The smaller, more slender gall, regularly of smaller diameter, is quite unlike the gall of any other Pacific Coast variety in the genus, altho individual galls of other varieties will occasionally resemble this gall. As far as known the insect inhabits only *Quercus dumosa*, occurring over a remarkably wide range, at least from Palo Alto to Descanso, a distance of about five hundred miles without apparent variation. I am not at all certain that all of this area should be considered one faunal zone. It may be that only the *Q. dumosa* fauna remains southern as far north. At any rate I do not find variations in material of this variety from this wide range. *Alutaceus*, another variety of this same species, also occurs on the same oak over the same range. In all of my abundant material I do not find gradations between the two. It will be questioned whether these two varieties, not separated by host or geographic isolation, should not be considered distinct species. It is true that the galls are very distinct, *alutaceus* galls being very similar to those of practically all of the other varieties I have included in this species. *Diminuens* galls suggest those of some of the varieties of *Plagiotrichus elongatus* Kinsey, of Texas; but the adult is related to the other California insects rather than to the Texas insects. Altho *alutaceus* is close to *diminuens* in some characters, it nevertheless differs in other important regards, as listed under *alutaceus*, closely resembling the *pugnus-atricinctus* group of varieties. One cannot properly

make an independent group of *kelloggi* and *diminuens* without including *alutaceus*, which in turn would require the inclusion of all of the varieties as I have treated them. Any arbitrary line drawn for species would be so contrary to facts as to mitigate what convenience might be gained. Up to date I know of few other instances of two related forms occurring in the same faunal area on the same host except where the forms can be considered as belonging to distinct species. But nature does not order things to fit man's taxonomic invention. Here she is evolving two distinct forms which will some day become our "species", just how we cannot understand since there are no isolation factors present; and how to adequately express the situation is beyond a convenient taxonomic scheme.

Plagiotrichus chrysolepidicola variety **alutaceus**, new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally a rather light rufous brown; antennæ bright rufous brown, the first two segments golden rufous, the apical segments brown; parapsidal grooves entirely indistinct but traceable for most of the mesonotal length, more closely converging posteriorly than in *kelloggi;* median groove hardly discernible except posteriorly; anterior parallel lines rather evident, continuous, smooth; mesopleuræ entirely but rather finely punctate, hairy, and rugose, most rugose medianly, in no place as smooth as in *kelloggi*, rufous brown; foveæ large, rather finely separated, entirely, sparingly, but rather deeply rugose at bottom; abdomen darker only posterodorsally and less so ventrally, longer than high; legs including the coxæ bright rufous brown, the tibiæ and tarsi, especially of the hind legs, dark brown; areolet of moderate size or moderately large; cubitus distinct to the basalis; length 2.0-2.7 mm., averaging smaller.

GALL.—Similar to the galls of most other varieties of the species; generally robust, up to 20. mm. in diameter by 40. mm. long, somewhat irregular, smoothly gnarled; internally with a considerable cavity (in the mature gall only) broken by irregular crossed bands of hard wood, and more or less completely filled by clustered, somewhat fused larval cells. On twigs of *Quercus dumosa.*

RANGE.—California: Alpine, Sorrento, Fallbrook, El Toro, San Jacinto Mountains, San Bernardino (?), Upland, Pasadena, Santa Catalina Island, Paso Robles, Gilroy (Redwood School), Palo Alto. Probably from El Portal and Palo Alto south, wherever *Q. dumosa* occurs.

TYPES.—16 females, 37 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, Stanford University, and with the author; paratype galls at the Museum of Comparative Zoology and the Philadelphia Academy. Labelled Pasadena, California; February 7, 1920; *Q. dumosa;* Kinsey collector.

Insects were emerging from Pasadena galls on February 7, 1920; they emerged sometime after collecting at Upland on February 3, on the Santa Catalina Island on February 11, at Alpine on February 24, at San Jacinto Mountain on February 28, and at Palo Alto on March 13. Several collections made early in March failed to give any adults at all. Apparently most of the insects emerge in February. Galls gathered even a short time before they were quite mature retained many dead adults later, prevented from emerging by the too early drying of even such a woody gall. Repeatedly galls were found which had been broken into and considerably gnawed by mice or other small mammals in search of the larvæ or pupæ as food.

This insect is distinct from all other varieties of the species in having more closely convergent parapsidal grooves; the more punctate and hairy mesopleuræ, the larger areolet, and the distinctly larger size separate the insect from *kelloggi* or *diminuens*. The robust gall is very different from the slender gall of *diminuens*. In general color and elongate abdomen the insect shows relations to *kelloggi* and *diminuens*, but in its size, more hairy abdomen, and continuous cubitus it is related to the *pugnus-atricinctus* group of varieties. The variety occurs on *Quercus dumosa*, on the very same trees in all the wide range from which I collected *diminuens*. Under *diminuens* I have discussed the possibility of considering these two distinct species.

Plagiotrichus chrysolepidicola variety **atricinctus**, new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally rufous brown, with a distinct darker to black shading; antennæ brown, only the first two segments golden rufous, darker brown terminally; parapsidal grooves rather distinct to the pronotum; median groove more or less traceable to the pronotum; anterior parallel lines and lateral lines more distinct, broader, more smooth than in other varieties; mesopleuræ rufous, largely but sparsely punctate and hairy, with small, smoother, naked areas beneath the tegulæ and on the ventral margin; foveæ shining, but sparingly rugose at bottom; abdomen darker, especially postero-dorsally, sometimes in part approaching black, not as long as high; legs including the coxæ bright rufous brown, brown on the tibiæ and tarsi, distinctly dark brown on the hind tibiæ; areolet of moderate size or only moderately small; cubitus distinctly complete; length 2.0-3.0 mm., averaging larger.

GALL.—Similar to the galls of most other varieties; robust, up to 15. mm. wide by 30. mm. long, usually smaller; internally quite dense,

solid, the larval cells rather completely surrounded by wood. On *Quercus Douglasii.*

RANGE.—California: Napa, Auburn, Redding. Probably confined to the more northern range of *Q. Douglasii.*

TYPES.—28 females, 36 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, Stanford University, and with the author. Labelled Napa, California; March 18, 1920; *Q. Douglasii;* Kinsey collector.

The insects emerged after collecting at Napa on March 18, 1920; galls collected later further north, at Auburn, on March 31, and at Redding on April 2, showed all of the adults to have emerged previously.

The solid, woody gall is quite like those of the two other varieties on *Douglasii,* namely *kelloggi* further south and *compositus* along the Sierras north of the Merced River. It is similar to but definitely distinguished from the varieties on other oaks. The insect is best distinguished by the broad lateral lines; it is entirely different in color as well as in some other characters from *kelloggi* which occurs on the same oak. In color it resembles *compositus, pugnus,* and *pugnoides,* but is distinct from all of these in having a more or less completely traceable median groove; from *garryanæ,* which is of a similar color and possesses a very much fainter median groove, it is distinguished by the more definite median groove and parapsidal grooves anteriorly, the broader lateral lines, more largely smooth foveæ, and complete cubitus. Nevertheless *atricinctus* and *garryanæ* are largely similar, just as their adjacent ranges would lead one to expect. The galls of these two, however, are distinct, as are the hosts and ranges.

Plagiotrichus chrysolepidicola variety **compositus,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally dark rufous and brown to piceous black; first two segments of the antennæ yellow rufous; parapsidal grooves fine, narrow, continuous to the pronotum; median groove absent; anterior parallel lines not wholly smooth; mesopleuræ dark rufous brown, largely smooth, scatteringly punctate, most so medianly, sparsely hairy; foveœ rather small, wholly, not closely rugose; abdomen rufous to brown and piceous, mostly dark, not very hairy, not as long as high; areolet of moderate size; cubitus not continuous; length 2.0 mm.

GALL.—Similar to the galls of other varieties of the species; robust, up to 12. mm. in diameter by 28. mm. long; internally rather solid, the larval cells rather closely embedded. On *Quercus Douglasii.*

RANGE.—California: Merced Falls (Placerville?). Probably ranges from the Merced River northward, at least to the American River, wherever *Q. Douglasii* occurs.

TYPES.—1 female, 30 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype galls at the U.S. National Museum, Stanford University, the Philadelphia Academy, the Museum of Comparative Zoology, and with the author. Labelled Merced Falls, California; March 28, 1920; *Q. Douglasii;* Kinsey collector.

Apparently only a single insect had not emerged at the time of collecting, March 28, at Merced Falls. Fresh galls, only presumably of this variety, were found at Placerville on March 30. Many of the galls had been eaten into, and in some cases so deeply that I am inclined to credit part of the work to birds rather than to mice; probably the galls are softer when still fresh, and more easily broken into.

The insect combines characters of *diminuens, pugnus,* and other varieties. It differs from *diminuens* in having complete parapsidal grooves, the abdomen not as long as high, and the general color darker; it differs from *pugnus* in having complete and finer parapsidal grooves, a less hairy abdomen, and a larger areolet. It is distinct from *kelloggi* in color, absence of median groove, and shape of abdomen; and from *atricinctus* in size, absence of median groove, color of mesopleuræ, and other minor details.

The type localities of the three varieties occurring on *Q. Douglasii* are rather widely separated. *Kelloggi,* from Cupertino and Palo Alto, may be confined to the more southern and western range of *Douglasii; atricinctus,* from Napa, may be the most northern of the varieties; *compositus,* from Merced Falls, may range from the Merced River northward at least to the American River. Unfortunately I do not have many insects of these three varieties, and the galls are all so similar that they are not sufficient for determining distributions. The ranges suggested are based on my experience with other Cynipidæ, but must be verified for these three varieties.

I do not want to make a practice of describing new Cynipidæ from single specimens, but in this instance the insect is distinct, and a study of series of the related varieties shows no variation toward this form; so I may be pardoned for this description. It should draw attention to the existence

of the variety, and invite further data from other workers the sooner.

Plagiotrichus chrysolepidicola variety **pugnus,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally dark rufous or chestnut brown and black; antennæ almost entirely brown, the first two segments rufous, the terminal segments darker brown; parapsidal grooves distinct, narrow, but slightly broader and smoother at bottom than in other varieties, practically obsolete for the anterior half or third of the mesonotum; a short median groove just evident; anterior parallel lines not entirely smooth; mesopleuræ rufous, largely smooth and naked beneath the tegulæ, medianly finely rugoso-punctate and hairy; foveæ of moderate size, smooth and shining, very sparingly rugose at bottom; abdomen in part rufous, banded rufous brown about the edges of the second and third segments, and generally dorsally and ventrally, not as long as high; legs brownish rufous, the bases of the coxæ, the tibiæ, and tarsi brownish, the hind tibiæ dark brown; first abscissa of the radius rather broadly infuscated at the subcosta; areolet of moderate size or moderately small; cubitus about continuous; length 2.2-2.8 mm.

GALL.—Similar to the galls of other varieties of the species; more irregular in shape, knotted, sometimes rather fist-like, up to 25. mm. in diameter by 40. mm. long; internally solid, woody, the larval cells closely embedded; on *Quercus lobata.*

RANGE.—California: Three Rivers, Exeter. Probably confined to the more southern range of *Quercus lobata.*

TYPES.—7 females, 19 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, Stanford University, and with the author. Labelled Exeter, California; March 22, 1920; Kinsey collector.

Most of the insects had emerged before the date of collecting at Exeter on March 22, 1920.

This variety, in both insect and gall characters, much more closely resembles *pugnoides* than any other variety of the species. *Pugnus* is to be distinguished by the rufous mesopleuræ, the smaller areolet, and generally smaller size. Both insects occur on the same oak, *lobata,* but as far as collected *pugnus* appears to be more southern than *pugnoides.* The variety next most closely related to these two is *garryanæ,* occurring still further north on *Quercus garryana.*

Plagiotrichus chrysolepidicola variety **pugnoides,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally dark rufous or chestnut brown and black; antennæ almost entirely brown, the first two segments rufous, the terminal segments darker brown; parapsidal

grooves distinct, smooth at bottom, not quite as wide as in *pugnus*, practically obsolete for the anterior half of the mesonotum; a short median groove just evident; anterior parallel lines not entirely smooth; mesopleuræ piceous black, mostly smooth and naked beneath the tegulæ, medianly finely rugoso-punctate and hairy; foveæ rather larger, mostly smooth and shining but very sparingly rugose at bottom; abdomen in part rufous brown, banded rufo-piceous about the edges of the second and third segments, and generally dorsally and ventrally, not as long as high; legs dark rufous or chestnut, the coxæ basally, the tibiæ, and tarsi brown, the hind tibiæ almost black; first abscissa of the radius broadly infuscated at the subcosta; areolet of moderate size or larger, distinctly larger than in *pugnus;* cubitus about continuous; length 2.5-3.5 mm., averaging larger than in *pugnus.*

GALL.—Very similar to the gall of *pugnus*, irregular, knotted, up to 18. mm. in diameter and 60. mm. long; internally solid, woody, the larval cells closely embedded; on *Quercus lobata.*

RANGE.—California: Santa Rosa. Probably confined to a more northern part of the range of *Quercus lobata.*

TYPES.—10 females, 14 galls. Holotype female, paratype female, and galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, Stanford University, and with the author. Labelled Santa Rosa, California; March 16, 1920; *Q. lobata;* Kinsey collector.

Many of the insects had emerged before collecting on March 16, 1920, at Santa Rosa.

This variety, in both insect and gall characters, much more closely resembles *pugnus* than any other variety of the species. *Pugnoides* is readily distinguished by the darker mesopleuræ, the larger areolet, and the distinctly larger size. The range of this variety appears to be intermediate between *pugnus* and *garryanæ. Garryanæ* shows somewhat close relationships to *pugnoides.*

Plagiotrichus chrysolepidicola variety **garryanæ,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally chestnut brown, with considerable black; antennæ brown, the first two segments brownish rufous, the last eight almost black; parapsidal grooves distinct for half the mesonotal length, barely evident anteriorly; median groove barely indicated for the mesonotal length, but not at all definite; anterior parallel lines distinct; mesopleuræ largely smooth and naked, medianly rugoso-punctate and hairy; foveæ rather small, wholly rugose; abdomen for the most part dark rufous brown to black, lighter rufous only latero-basally, not very hairy laterally, not as long as high; legs including the coxæ bright rufous, the tibiæ and tarsi brown, the hind tibiæ very dark; areolet rather small or distinctly small; cubitus not quite continuous; length 2.2-2.7 mm.

GALL.—Rather similar to galls of the other varieties; elongate, slender, regular, up to 14. mm. in diameter and 40. mm. long, usually more slender; internally woody, with somewhat of a cavity, the larval cells densely clustered and packed so closely sometimes (in one specimen especially) as to exclude wood in much of the gall. On *Quercus garryana.*

RANGE.—Oregon: Ashland, Grants Pass, Junction City. Probably California to British Columbia, wherever *Q. garryana* occurs.

TYPES.—4 females, 4 galls. Holotype female, paratype gall at The American Museum of Natural History; paratype females and galls with the author. Labelled Ashland, Oregon; April 6, 1920; *Q. garryana;* Kinsey collector.

Most of the insects had emerged before collection at Ashland on April 6; all of them had emerged before April 7 at Grants Pass.

This insect is to be distinguished by the darker color, the more or less complete median groove, and small areolet. In its general color and the shape of the abdomen, it resembles *pugnus,* but in the smoother mesopleuræ, less hairy abdomen, and somewhat discontinuous cubitus it tends toward *kelloggi* and *diminuens.* One cannot believe that it is necessarily originated from either group rather than from a more remote, common ancestor. Host isolation in this case is accompanied by geographic isolation, the combined forces offering splendid opportunity for the development of a distinct form.

Plagiotrichus coxii (Bassett)

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color rufous, in large part shaded to black, usually solid black on the abdomen; antenna with 14 segments, with the apical half brown, the basal half brownish rufous; mesonotum relatively smooth, mostly finely reticulated or shagreened, entirely smooth between the anterior parallel lines, very sparsely hairy, most hairy on the scutellum and antero-laterally; parapsidal grooves continuous, narrow; median groove short or lacking; foveæ rather large, distinct, but separated by only a fine ridge; mesopleuræ smooth, shining, naked, a transverse, medial band finely shagreened; abdomen black, smooth, not reticulated, but the posterior segments finely punctate, mostly naked except for a few hairs latero-basally; as long as high, the second segment covering slightly more than half the area; legs rich rufous and brown, the coxæ dark; cubitus complete or just short of being complete; length 2.2-3.0 mm.

GALL.—A globose to elongate, solid twig gall. Polythalamous, averaging twenty or more cells to a gall. Smooth, covered with nearly normal bark, somewhat reddened; up to 20. mm. in diameter and 65. mm. in length. Internally rather solid but not entirely so, the larval cells

with a distinct lining, closely embedded in the less solid part of the tissue. On black oaks.

RANGE.—Arizona. Possibly also in New Mexico, western Texas, and Mexico, wherever *Q. Emoryi*, *Q. hypoleuca*, and related oaks occur.

The insect of this species is in several respects, particularly the almost naked mesonotum and the 14-segmented, short antennæ, extreme for this genus. But species like *P. suttonii* and *P. perdens* of California are intermediate between *coxii* and the white oak species of the genus. This emphasizes the artificial nature of our sharp generic lines. I doubt whether I should consider the species in this genus except for the additional evidence furnished by the gall. It is typically a *Plagiotrichus* gall, related more closely to the other black oak species, as is the insect also, than to any other white oak species.

The insects emerge in midwinter, December and January. The young galls appear immediately, which suggests that they arise from an alternate generation, the whole life cycle taking more than one year.

I have galls from New Mexico which may belong to this species, but rather extensive collecting in both western Texas and New Mexico failed to give me other galls of this species. If the species occurs in those states, it certainly does not there reach the abundance with which it infests the black oaks of southern Arizona.

Plagiotrichus coxii variety **coxii** (Bassett)

Cynips Coxii Bassett, 1881, Can. Ent., XIII, p. 112.

Cynips coxii Packard, 1881, U.S. Ent. Comm. Bull., VII, p. 57.

Andricus Coxii Ashmead, 1885, Trans. Amer. Ent. Soc., XII, pp. 295, 304; 1887, Trans. Amer. Ent. Soc., XIV, p. 132. Ashmead (in Packard), 1890, 5th Rpt. U.S. Ent. Comm., pp. 106, 110.

Andricus coxii Dalla Torre, 1893, Cat. Hymen., Cynip., II, p. 84. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 62; 1910, Das Tierreich, XXIV, pp. 530, 801, 825. Beutenmüller, 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 465. Thompson, 1915, Amer. Ins. Galls, pp. 6, 31. Felt, 1918, N.Y. Mus. Bull., 200, p. 58.

Andricus Coxii Bassett, 1900, Trans. Amer. Ent. Soc., XXVI, p. 320.

Andricus Bassettianus Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 61.

Andricus bassettianus Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 532, 802, 838.

FEMALE.—Differs from the female of variety *translatus* as follows: Two basal segments of the antennæ rather dark brownish rufous,

of the same color as the third and fourth segments; parapsidal grooves converging more closely; areolet averaging moderately small.

GALL.—Very similar to the gall of *translatus*, differing in being more globoid, irregular, up to 20. mm. in diameter and 50. mm. in length, usually smaller. On *Quercus Emoryi*.

RANGE.—Arizona: Santa Catalina Mountains (Sabino Trail, 3000-4000 ft.), Oracle, Santa Rita Mountains, Fort Huachuca, Globe.

TYPES.—At the Philadelphia Academy of Natural Sciences. From near Tuscon, Arizona; on a live oak; E. T. Cox collector.

Galls which I collected in the Santa Catalina Mountains on January 1, 1920, contained mature larvæ; the adults emerged in abundance at some later date. Further south, in the Santa Rita Mountains, on January 6, and at Fort Huachuca on January 14, most of the adults had emerged from the galls, only a few emerging later, and at the same time young galls were to be found. Apparently emergence occurs as early as December. Further north, at Globe, on January 20, all of the adults but one had previously emerged from the galls I collected.

I have not been able to examine the Bassett types; my redescriptions are made from galls and insects I collected in the Santa Catalina Mountains. This is a very characteristic species in the region, and altho the galls are of somewhat the same plan as those of *Andricus rugulosus* the insects are very distinct. There can be no question that my Santa Catalina material, from *Q. Emoryi*, represents the species and variety Bassett "received from Prof. E. T. Cox, who collected them near Tuscon, Arizona, probably from one of the dwarf live oaks of that region." Inasmuch as oaks do not grow nearer to Tuscon than in the Santa Catalina Mountains, and *Q. Emoryi* is the first oak met with along the trail, and the only black oak up to about a five thousand foot elevation, it is probable that Professor Cox's material came from this oak in these mountains. The only other variety I have found occurs at a higher elevation, on *Quercus hypoleuca*, and its large areolet does not fit Bassett's description of *coxii*. The galls I collected at Globe are labelled *Q. arizonica*, but I think I may have made some mistake in the record.

In 1900 Bassett redescribed *coxii* as a new species, using the same name, giving a nearly exact redescription, based on the same material as that used for the first account. Dalla Torre and Kieffer, 1902 and again in 1910, ignoring the obvious, considered the redescription a new species, took *coxii*

to be preoccupied, and substituted *bassettianus*, as Beutenmuller pointed out in 1907. Unfortunately this is not the only instance of the catalog method which has muddled cynipid taxonomy. *Coxii*, for instance, has been mentioned in the literature at least fourteen times. In not a single instance have any data been given beyond that of the original description. Ashmead's guess (1887), copied by Dalla Torre and Kieffer (1910), that the species occurs on the Californian oak, *Quercus agrifolia*, is of course wrong. Some museum material from California is labelled *coxii*; it is *suttonii* instead.

Plagiotrichus coxii variety **translatus**, new variety

FEMALE.—Differs from the female of variety *coxii* as follows: Two basal segments of the antennæ bright rufous, brighter than the third and fourth segments; parapsidal grooves not as closely convergent, sometimes considerably further apart at the scutellum; areolet averaging rather large, sometimes considerably larger.

GALL.—Very similar to the gall of *coxii*, differing in being more regularly cylindrical, elongate, up to 15. mm. in diameter and 65. mm. long. On *Quercus hypoleuca*.

RANGE.—Santa Catalina Mountains (Sabino Trail, 5000-8000 ft.). Probably also occurs on *Q. hypoleuca* in the neighboring mountain ranges.

TYPES.—18 females, 14 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, Stanford University, and with the author. Labelled Santa Catalina Mountains, Arizona; January 1, 1920; *Q. hypoleuca;* Kinsey collector.

The majority but not all of the adults had emerged from the type galls before January 1, 1920; young galls were developing at the same time.

This variety is very closely related to *coxii*, but averages distinct as described; even tho individuals of one variety may vary in regard to a single character toward individuals of the other variety, other characters will be distinct. The host, *hypoleuca*, occurs in a distinct zone above the altitudes occupied by *Emoryi*.

Plagiotrichus elongatus, new species

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color largely rich rufous and black, in large part dark rufous; apical half of antenna darker or not; mesonotum closely, finely puncto-rugose, entirely and rather closely hairy; parapsidal grooves not continuous to the pronotum; median groove very short or wanting; mesopleuræ in part or largely puncto-rugose and

hairy; foveæ distinct or indistinct, smooth or rugose at bottom; abdomen smooth, more or less finely punctate and even indefinitely reticulated, largely naked, very sparsely, rather finely hairy, the second segment covering a full half of the area; cubitus distinctly continuous; length 2.2-3.0 mm.

GALL.—Slight twig swelling, elongate in two varieties, globoid in one. Monothalamous or polythalamous, one to fifty or more cells in a cluster. The swelling slight, two or three times the normal stem diameter, up to 8. mm. in diameter, averaging 60. mm. long in two varieties, 8. mm. long in one; covered with normal bark. Internally solid except for an irregular, more or less continuous cavity completely filled by crowded, distorted, larval cells, each cell separate, with a distinct lining, but not separable. Near the tips of twigs of *Quercus stellata* and *Q. breviloba.*

RANGE.—Texas: Austin. Probably thruout a part of Texas and Louisiana.

Dr. Patterson discovered and bred the insects of all the following varieties.

The insect of variety *elongatus* is very closely related to the varieties of *Plagiotrichus frequens,* differing only in being less black and in having the thorax more hairy. The insect of variety *rufopleuræ* shows some relation to *Plagiotrichus batatoides,* having the antennæ of uniform color and the abdomen very faintly reticulated; but it differs decidedly in many other respects. On a whole, tho, these three Texas insects are more closely related to each other than to the insects of the other species; so it is worth treating them as a distinct species. Beyond exhibiting the same generic characters, the galls are not similar to those of either *frequens* or *batatoides.*

The three insects differ in regard to a few characters only, but these are so differently combined as to make three remarkably distinct varieties. Any one of them might be considered intermediate between the other two. This may be more evident if one thinks of three varieties having nine points in respect to which they vary. Each of these varieties may have three characters which are unique to it, three which are shared with one of the other varieties, three which are shared with the third variety. This may be represented as follows:

Variable characters	1 2 3 4 5 6 7 8 9
Not unique to variety A	1 2 3 4 5 6
Not unique to variety B	4 5 6 7 8 9
Not unique to variety C	1 2 3 7 8 9

In such a case any one of the varieties is midway between the other two. Practically this ideal arrangement often exists in nature, as may be discovered by comparing, word for word, my descriptions of the varieties of many species of Cynipidæ. Unfortunately it is too often the practice to choose one of such a set as the victim and call it a "hybrid", neglecting to see that any one stands in a similar relation to the others! Even when the proportion is not so equal we are not warranted in believing any one the product of the other two, for we really know little about the occurrence or nature of hybrids, and particularly little concerning their occurrence in the field; most of our field hybrids are pure assumptions, recognized by preconceived notions as to how a hybrid should look. I am not inclined to account any of these varieties of *elongatus* hybrids. Large series of each variety are remarkably uniform, even tho all three forms come from one locality, and altho I know little about it I should expect to find hybrids showing several degrees of intermediates, with individuals of one variety varying toward those of another.

The galls of two of these insects are very similar, the gall of the third is very distinct, altho still showing the specific relations.

The most interesting question raised by the species is that of the relation of the varieties to their hosts. Up to date each variety has been taken from only a single species of oak, but *elongatus* and *rufopleuræ* both occur on *Quercus breviloba*. I rather expect to find each variety restricted to a single faunal area, all three areas meeting at Austin, but not until we have further collecting can this be determined finally.

Plagiotrichus elongatus variety **elongatus,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Antennæ brown apically; parapsidal grooves distinct for three quarters or more of the length of the mesonotum; median groove wanting; mesopleuræ puncto-aciculate, in part entirely smooth, less hairy than in the other varieties, usually bright rufous; foveæ small, very narrow, smooth at bottom; abdomen averaging lighter than in *stellatæ*, especially posteriorly; legs brownish rufous, coxæ wholly rufous, the tibiæ and the hind legs in general tending toward a dark brown; wing veins averaging slightly finer than in *stellatæ*, especially the first abscissa of the radius; areolet of moderate size or larger; slightly smaller in build than in *stellatæ*, particularly in the width of the thorax and the size of the abdomen.

GALL.—An elongate, slight swelling; polythalamous, with fifty or more larval cells; differing from the galls of variety *stellatæ* in being more regular, of more uniform diameter up to 6. mm. On twigs of *Quercus breviloba.*

RANGE.—Texas: Austin.

TYPES.—200 females, 3 galls. Holotype female, paratype females, and gall at The American Museum of Natural History; paratype females and galls with the author; paratype females at the U. S. National Museum, Stanford University, and the Museum of Comparative Zoology. Labelled Austin, Texas; March 20, 1922; *Q. breviloba;* Patterson collection number 24.

Patterson states that these galls were first noticed in December, altho they doubtless had formed much earlier. Pupæ were in the galls about the first of January, and adults emerged during the first two weeks of March.

Plagiotrichus elongatus variety **stellatæ,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Antennæ brown apically; parapsidal grooves not evident for more than half the length of the mesonotum; median groove wanting; mesopleuræ almost wholly punctorugose, more hairy than in *elongatus,* in part or wholly dark to black; foveæ not distinct, wholly rugose at bottom; abdomen averaging darker especially posteriorly; legs rufous brown, coxæ darker basally, the hind coxæ almost black, the tibiæ and the hind legs in general tending toward a black; wing veins averaging moderately heavy, especially the first abscissa of the radius, areolet of moderate size only; averaging slightly larger in build than in *elongatus,* particularly in the width of the thorax and the size of the abdomen.

GALL.—An elongate, slight swelling; polythalamous, with a score of larval cells. Differing from the gall of variety *elongatus* in being more irregular, of varying diameter up to 8. mm. On twigs of *Quercus* stellata.

RANGE.—Texas: Austin. Probably thruout a part of Texas and Louisiana.

TYPES.—93 females, 3 galls. Holotype female, paratype females, and gall at The American Museum of Natural History; paratype females and galls with the author; paratype females at the U.S. National Museum, Stanford University, the Philadelphia Academy, and the Museum of Comparative Zoology. Labelled Austin, Texas; March 23, 1922; *Q. stellata;* Patterson collection number 168.

Patterson bred the first adults from March 14 to April 3, 1922; he found insects still emerging on April 2.

Plagiotrichus elongatus variety **rufopleuræ,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally rich rufous and

black; antennæ almost wholly bright yellow rufous; parapsidal grooves distinct for only a little more than half the length of the mesonotum, longer than in *stellatæ*, shorter than in *elongatus;* a short median groove often apparent; mesopleuræ wholly puncto-rugose, more hairy than in *elongatus*, wholly brownish rufous; foveæ large, broad, largely smooth at bottom; abdomen averaging darker than in *elongatus*, especially posteriorly, the second segment covering a full half of the area; legs brownish rufous, coxæ wholly rufous, the tibiæ and the hind legs in general tending toward a dark brown; wing veins averaging slightly heavier especially the first abscissa of the radius; areolet of moderate size only; averaging larger in build than either other variety, particularly in the width of the thorax and the size of the abdomen.

GALL.—Short, globoid stem swelling, diameter up to 8. mm., length not over 12. mm.; rather distinct from galls of the other two varieties, monothalamous or polythalamous, with only four cells at the most. On *Quercus breviloba.*

RANGE.—Texas: Austin.

TYPES.—18 females, 7 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, and with the author. Labelled Austin, Texas; March 30, 1920; *Q. breviloba;* Patterson collection number 167.

Patterson bred insects on March 30, 1920.

The gall of this variety is very distinct from those of the other two varieties, especially in its much reduced number of larval cells. These cells, however, are quite like those of the other galls of the species.

Plagiotrichus frequens (Gillette)

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color largely dark rufous and black, in large part black; antennæ with 14 segments, apical half of antenna darker; mesonotum closely, finely puncto-rugose, entirely but quite sparsely hairy; parapsidal grooves distinct to the pronotum; median groove absent; mesopleuræ largely smooth and naked, irregularly, scatteringly, finely rugoso-aciculate; foveæ distinct; abdomen smooth, not at all reticulated, finely punctate only on the edge of the last segment; almost naked of hairs except for a scatteringly few latero-basally; longer than high, the second segment not covering more than half the area; infuscation on the first abscissa of the radius limited but rather heavy; areolet of moderate size; length 1.7-3.0 mm.

GALL.—Similar to the galls of the other agamic forms of this genus. A stem swelling, up to 25. mm. in diameter and 110. mm. in length, usually smaller; internally rather woody, mostly solid, soft, spongy; the larval cells closely embedded, sometimes somewhat separable. On *Quercus Gambelii*, its varieties, or closely related oaks.

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RANGE.—Colorado, Utah, Arizona, and probably New Mexico. Probably thruout the southern Rocky Mountains and adjacent regions wherever *Q. Gambelii* varieties occur.

The two known varieties occur in distinct faunal areas of the southern Rocky Mountains of Colorado. Inasmuch as that country involves so many other faunal areas, there are probably many other varieties of the species to be described. I have galls from *Q. Gambelii* varieties from several localities in Arizona and Utah that probably belong to this species. *A. rugulosus* Bassett and its varieties produce rather similar galls on evergreen white oaks of parts of the southwest, but those insects are generically distinct from *frequens*. As far as I know, *frequens* occurs only on the deciduous white oaks.

The species is most closely related to *P. chrysolepidicola* of the Pacific Coast, and it is not impossible that we shall consider these one species after other, intermediate varieties become known. *P. elongatus* of Texas is the next most closely related species, but *frequens* does not resemble *elongatus* nearly as closely as it does some of the varieties of *chrysolepidicola*.

Gillette described this species as from *Q. undulata*. I have seen it only from the white oak with large, long, deciduous leaves; this would appear to be *Q. Gambelii*, or one of its varieties or closely related species, according to the more recent treatments of these difficult oaks.

Plagiotrichus frequens variety **frequens** (Gillette)

Andricus frequens Gillette, 1892, Ent. News, III, p. 247. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 63. Thompson, 1915, Amer. Ins. Galls, pp. 6, 32. Felt, 1918, N.Y. Mus. Bull., 200, p. 59.

Callirhytis frequens Mayr, 1902, Verh. Ges. Wien, LII, p. 289. Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 566, 806, 838.

FEMALE.—Differs from the other variety of the species as follows: Color mostly dark rufous to black on the head and thorax, varying to almost solid black; antennæ rufous basally, black terminally; foveæ rather small, distinctly smaller than in the other variety, black; abdomen wholly black; legs including the coxæ rufous, hind tibiæ dark to black; areolet of moderate size; length 1.7-2.5 mm.

GALL.—Quite identical with the gall of the other variety.

RANGE.—Colorado: Manitou. Probably confined to a limited region in Colorado east of the Continental Divide.

TYPES.—31 females, and galls. In the U.S. National Museum and in Gillette's collection. From Manitou, Colorado; May 8, 1892; C. P. Gillette collector.

The above redescription is based on a type female, and upon galls and poor adult material I collected at Manitou.

Gillette recorded the adult emerging on May 10, 1892. My galls were collected on April 24, 1920; they contained mature larvæ at the time, and these even pupated, but not a single adult matured to emerge. This was probably caused by the naturally corky nature of the galls, and their soaked condition after a season of much snow and rain, allowing too much shrivelling after collection. It is notable that the inquiline cynipids from these same galls did complete their metamorphosis. The galls are very abundant on the white oaks of the region. They are often partly destroyed by birds or mice.

This variety is closely related to *piceoderma*. It is different in having more black and in having distinctly smaller foveæ. As with other Cynipidæ, the varieties of Manitou and of Glenwood Springs are not the same.

Plagiotrichus frequens variety **piceoderma,** new variety

FEMALE.—Shows the following characters in addition to those common to the other variety of the species: Color mostly dark rufous on the head and mesonotum, the rest of the body mostly piceous black; antennæ rufous brown, brown terminally, bright rufous basally; mesopleuræ rufo-piceous to piceous or black, less often in small part bright rufous; foveæ rather large, distinct, black, somewhat smooth but more or less sculptured at bottom; abdomen dark rufo-piceous to piceous black, more rufous latero-basally; legs rather dark rufous, coxæ basally and tibiæ and tarsi darker, the middle and hind tibiæ dark brown; length 2.0-3.0 mm.

GALL.—Quite identical with the gall of the other variety.

RANGE.—Colorado: Glenwood Springs. Probably confined to a limited area in Colorado on the west of the Continental Divide.

TYPES.—166 females, 70 galls. Holotype female, paratype females, and galls at The American Museum of Natural History; paratype females and galls at the U.S. National Museum, Stanford University, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Glenwood Springs, Colorado; April 22, 1920; Kinsey collector.

On April 22, 1920, the galls at Glenwood Springs contained large larvæ; the adult insects emerged at some later date. The galls, as with galls of variety *frequens*, were quite soaked, soft, and rubbery, with the inside tissue stained brown

at the time of collecting, affected by the season of snow and rain. In spite of this a great number of insects matured in these galls. After a couple of years of drying the galls are still rather porous and more soft than are most galls of this genus.

This variety is very closely related to variety *frequens*, in both insect and gall characters. It differs rather distinctly from *frequens* in color and in having larger foveæ. In no case have I found the cynipid fauna of Glenwood Springs the same as that of Manitou on the east of the Divide, nor of Green River, Utah, on the west. The Glenwood Springs Cynipidæ are usually closely related to, distinctly intermediate with those from Manitou and Green River. I do not have material from any other locality of this fauna, and cannot guess at the extent of the area other than to believe it is limited.

Plagiotrichus perdens (Kinsey)

FEMALE.—Shows the following characters in addition to those common to all species of the genus: Color largely dark rufous and black; antennæ black, only the two basal segments piceous black; mesonotum quite smooth and shining, finely reticulated, sparsely punctate and hairy, more densely punctate and hairy anteriorly; parapsidal grooves continuous to the pronotum, narrow, distinct; median groove just evident for the length of the mesonotum; anterior parallel lines hardly evident; foveæ broad, deep, shining, smooth; mesopleuræ rugoso-aciculate and hairy at top and bottom, a large, smooth, shining, and naked area centrally; abdomen smooth and shining, naked except for a few hairs latero-basally, posterior segments finely, scatteringly punctate; slightly longer than high, second segment occupying about half the area; legs rufous including the coxæ, most of the hind tarsi and tibiæ black; areolet moderately large; cubitus just continuous to the basalis but faint there; length 2.0-3.0 mm.

GALL.—Stem swelling, raggedly split open, containing flattened, seed-like cells. Polythalamous. Up to 13. mm. in diameter by 200. mm. long, averaging somewhat smaller. Within are large cavities, 4 or 5 arranged more or less radially about the axis of the stem, and a great many in series along the stem, each cavity sector shape, extending to the bark, 10. mm. or less in width at edge. Inserted on the wall of each cavity is a larval cell; each cell is monothalamous, flattened, a somewhat squared oval in outline, 4. mm. high by 3. mm. wide, broadest at the top; concave at the base with a projecting tongue by means of which it is inserted into the twig; cells smooth, shining, buff yellowish; finely streaked, more or less, with purplish brown. The cell walls are shell-like, moderately thick, entirely hollow within. At maturity the bark splits raggedly over each cavity, the larval cell drops to the ground, and the affected twigs die. On terminal twigs of *Quercus Kelloggii*.

RANGE.—California and Oregon. Probably wherever *Quercus Kelloggii* and *Q. Wislizenii* occur.

This species in several respects represents a considerable specialization for this genus. In no other species, as far as I know the genus, does the larval cell drop out of the gall before the insect emerges. The species is directly related to *Plagiotrichus suttonii*, which occurs on Pacific Coast black oaks; the galls of the two are distinct. These galls are very common on *Quercus Kelloggii* and *Q. Wislizenii*, but I am not certain that they occur on the other black oak of the Pacific Coast, *Q. agrifolia*. A couple of galls I collected at Descanso, California, on February 23, 1920, are recorded from *agrifolia*, but I cannot be positive of this determination, especially since the two oaks intergrade regularly in their southern range.

As I noted before, these galls kill the stems beyond the point of infestation, and thus kill the whole tree. Extensive stands of young black oaks are sometimes badly hurt.

I do not know when the insect matures; emergence occurs apparently after the larval cells drop to the ground. I found old galls, with no fresh galls evident, from January in southern California through April in Oregon.

Plagiotrichus perdens variety **perdens** (Kinsey)

Andricus perdens Kinsey, 1922, Bull. Amer. Mus. Nat. Hist., XLVI, p. 286, pl. XXIV, figs. 5-7.

FEMALE.—Differs from the female of the other variety only in having the foveæ less wide, distinctly separate, and in averaging somewhat larger in size, up to 3.0 mm. in length.

GALL.—Differs from the gall of the other variety only in having the bark more roughened, the splitting more ragged. On *Quercus Kelloggii*.

RANGE.—California: Gilroy (Redwood School) (?), Placerville (?), Redding (?), Santa Rosa (?), Ukiah (?). Oregon: Ashland, Grants Pass, Roseburg.

TYPES.—2 females, 12 larval cells, and 26 infested twigs. Holotype female and paratype galls at The American Museum of Natural History; paratype female and galls with the author; paratype galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, and the Philadelphia Academy. Labelled Ashland, Oregon; April 6, 1920; *Q. Kelloggii;* Kinsey collector.

This variety is very similar to the variety on *Wislizenii*, as far as I can see differing only in the two characters described, slight differences in galls, and the different host. *Quercus*

Kelloggii ranges over more than one faunal area, so perhaps only the Oregon records apply to this variety. I have seen the insects only from Ashland, Oregon.

Plagiotrichus perdens variety **destructor,** new variety

FEMALE.—Differs from the female of the other variety only in having the foveæ very much wider, continuous with a smooth area anteriorly, and in averaging somewhat smaller, up to 2.5 mm. in length.

GALL.—Differs from the gall of the other variety only in having the bark smooth, the splitting less ragged, less extensive. On *Quercus Wislizenii.*

RANGE.—California: San Bernardino (?), Three Rivers, Gilroy, (Redwood School), Oakdale, Boulder Creek, Mt. Tamalpais, Placerville, Ukiah. Very probably more than one variety is represented by these localities.

TYPES.—4 females, 40 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype adults and galls with the author; paratype galls at the U.S. National Museum, Stanford University, and the Museum of Comparative Zoology. Labelled Boulder Creek, California; April 11, 1920; *Q. Wislizenii;* Kinsey collector.

At the time of publishing *perdens* it was noted that a "very similar if not specifically identical gall is found on *Quercus Wislizeni*". The insects from *Wislizenii* at Boulder Creek do not agree with the Ashland, Oregon insects from *Q. Kelloggii* in regard to the few characters described. Whether the differences are due to the different hosts, or to differences in distribution, or to both, I cannot say, for I have insects from only the two localities. Probably the varieties are restricted each to a single host, and each to a single faunal area, as is the case with the other California species of this genus.

Plagiotrichus suttonii (Bassett)

FEMALE.—Shows the following characters in addition to those common to all agamic forms of the genus: Color generally bright rufous to brown and black; antennæ with 15 segments, brownish black, only the first two segments lighter; whole mesonotum relatively smooth, not closely punctured, very sparsely hairy; parapsidal grooves rather distinct for half the mesonotal length, hardly discernible anteriorly, not very convergent posteriorly; median groove entirely lacking; anterior parallel lines posteriorly rather broad and distinct; lateral lines in a very broad, smooth, naked area; mesopleuræ in part dorsally smooth and naked, elsewhere sparsely and finely puncto-rugose and at least in part hairy; scutellum quite rugose and hairy; foveæ rather large, broad, separated by only a fine ridge, largely smooth, sparsely rugose at the bottom; abdomen brilliant brownish rufous, solid black dorso-basally;

edges of third to last segments distinctly, closely punctate, the last segment reticulate; sparsely hairy latero-basally; the second segment covering slightly more than half of the area; abdomen about as long as high, or slightly longer or shorter; the tibiæ and tarsi darker, the hind tibiæ almost black; wing veins not heavy, the first abscissa of the radius hardly infuscated; areolet of moderate size to very large; cubitus not continuous, or very faint toward the basalis; length 2.5-4.0 mm., averaging large.

GALL.—Rather large, solid stem swelling. Polythalamous, with a great many cells. The swelling elongate or globose to massive, distinct but only moderately abrupt, solid, covered with normal bark, a somewhat distinct, smoother ring about the exit hole; internally very solid, entirely woody, the larval cell distinctly lined but closely embedded. On stems of all of the Pacific Coast black oaks.

RANGE.—California, Oregon. Probably also Washington and British Columbia, wherever black oaks occur.

The insects of this species emerge early in the spring, in February and March, earlier further south. The galls are hard and solid, and I have not found them eaten into by birds and mice as are the white oak species of *Plagiotrichus*.

The three varieties described here are confined to black oaks, each to a single species, all of the Pacific Coast black oaks being affected. Probably several varieties occur on each oak as it occurs in different faunal areas, but this has been proved only for the *agrifolia* varieties. This species is not so radically different from *Plagiotrichus chrysolepidicola,* but shows characters typical of the other black oak species of the genus. Its intermediate nature may be due to the close relations, probably dating from more remote geologic ages, of the black live oaks and the white live oaks of the Pacific Coast. I have included *coxii* and *asymmetricus* in this genus, even tho they are not closely related to some other species, mainly because *suttonii* nicely connects these more extreme species. The species is very closely related to *Plagiotrichus perdens* which occurs on two of the same oaks over much the same territory.

Plagiotrichus suttonii variety **suttonii** (Bassett)

Cynips Q. Suttonii Bassett, 1881, Can. Ent., XIII, p. 54.

Cynips suttonii Packard, 1881, U.S. Ent. Comm. Bull., VII, p. 57. Riley (in Packard), 1890, 5th Rpt. U.S. Ent. Comm., p. 115.

Andricus (*Callirhytis*) *Suttoni* Mayr, Gen. Gallenbw. Cynip., p. 28. Ashmead, 1885, Trans. Amer. Ent. Soc., XII, p. 294.

Callirhytis Suttonii Ashmead, 1895, Trans. Amer. Ent. Soc., XII, p. 304. Ashmead (in Packard) 1890, 5th Rpt. U.S. Ent. Comm., p. 105.

Callirhytis Suttoni Ashmead, 1887, Trans. Amer. Ent. Soc., XIV, p. 130. Ashmead (in Packard) 1890, 5th Rept. U.S. Ent. Comm., p. 110. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 67.

Callirhytis suttonii Beutenmuller, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 25. Thompson, 1915, Amer. Ins. Galls, pp. 7, 30.

Callirhytis quercus-suttoni Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 564, 801.

Callirhytis suttoni Felt, 1918, N.Y. Mus. Bull., 200, p. 60.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color generally darker rufous; first two segments of the antennæ almost black; mesonotum quite hairy; parapsidal grooves narrow but wider than in other varieties; anterior parallel lines not wholly smooth, extending not half way to the scutellum; mesopleuræ smooth and naked on only a small area beneath the tegulæ; hind coxæ brownish rufous to piceous; areolet very large; first abscissa of the radius sharply angulate, with a short spur; length 3.0-4.0 mm., averaging distinctly larger than in *suttonii*.

GALL.—Differs from the galls of the other varieties in being more robust, not as elongate as in *lustrior*, attaining a larger size, up to 60. mm. in diameter by 90. mm. long, fused galls reaching 115. mm. in diameter, usually much smaller. On *Quercus agrifolia*.

RANGE.—California: near San Francisco (Bassett); Oakland (types); Diablo (F. A. Leach collector); Carmel, Salinas, San Luis Obispo, Paso Robles, Gaviota, Santa Barbara. Restricted to a more northern part of the range of *Q. agrifolia*.

TYPES.—At the Philadelphia Academy of Natural Sciences, The American Museum of Natural History, the Museum of Comparative Zoology; and in the Beutenmuller collection (?). From near San Francisco, California; oak unknown; Wm. Sutton, collector. American Museum types are labelled Oakland.

Insects were emerging from galls I collected at Carmel on March 9, 1920.

The above descriptions are made from types, the coloring described from my material from Carmel. Old specimens, of several collections, are always faded a brighter rufous.

This variety is not very different from the more southern *polythyra* which also occurs on *agrifolia*. It is best distinguished by the larger areolet, the very sharply angulate first abscissa, and the larger size. I am not certain of the extent of the faunal area which includes *agrifolia* about San Francisco. The Santa Barbara insects are nearer this variety than *polythyra*, but do not have the first abscissa so sharply angulate.

Plagiotrichus suttonii variety **polythyra** (Kieffer)

Callirhytis polythyra Kieffer, 1904, Bull. Soc. Metz, (2), XI, p. 132; 1904 (in Baker), Invert. Pacif., I, p. 44. Dalla Torre and Kieffer, 1910, Das Tierreich, XXIV, pp. 586, 802, 825. Johnson and Ledig, 1918, Pomona College Journ. Ent. and Zoo., X, p. 25.

Callirhytis quercus-suttoni Fullaway, 1911 (in part), Ann. Ent. Soc. Amer., IV, p. 357.

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Color darker rufous; first two segments of the antennæ piceous black; mesonotum quite hairy; parapsidal grooves narrower than in *suttonii*, wider than in *lustrior;* anterior parallel lines not wholly smooth, extending not half way to the scutellum; mesopleuræ smooth and naked on only a small area beneath the tegulæ; hind coxæ brownish rufous to piceous; areolet moderately large; first abscissa of the radius very weakly angulate, almost without a spur; length 2.5-3.5 mm., averaging distinctly smaller than in *suttonii.*

GALL.—Differs from the galls of the other varieties in being robust, not as slender as in *lustrior*, reaching 30. mm. in diameter by 40. mm. in length, usually smaller. On *Quercus agrifolia.*

RANGE.—California: Claremont (Baker); Pasadena, El Toro. Restricted to a more southern range of *Q. agrifolia.*

TYPES.—At the Berlin Museum? Cotypes at Pomona College. Material from the same collector (Baker) and the same locality (Claremont) at Stanford University and The American Museum of Natural History.

Insects were already emerging from galls collected at Pasadena on February 22, 1920; some were still emerging on March 2.

Fullaway stated that Beutenmuller *in litt.* had pronounced *polythyra* and *suttonii* synonyms. I do not recall that the synonomy has been otherwise published. The two insects are very closely related, but *polythyra* differs in having a smaller areolet, a weakly angled first abscissa, and in being generally smaller; the ranges of the two are distinct, and the galls differ somewhat, mostly in size. The references to these varieties occurring on *Quercus chrysolepis* undoubtedly apply to *Andricus spectabilis* Kinsey, the gall of which resembles the gall of *suttonii,* altho the insects are generically very distinct.

Plagiotrichus suttonii variety **lustrior,** new variety

FEMALE.—Shows the following characters in addition to those common to all varieties of the species: Generally brighter rufous in color; first two segments of the antennæ distinctly rufous; mesonotum much less hairy than in the other varieties; parapsidal grooves more

narrow than in other varieties; anterior parallel lines posteriorly almost entirely smooth, extending more than half way to the scutellum; whole dorsal third of the mesopleuræ smooth and naked; all coxæ light rufous; areolet moderately large, sometimes smaller than in *polythyra;* first abscissa of the radius sharply angulate, with a short spur; length 2.5-3.2 mm., smaller than in any other variety.

GALL.—Similar to the galls of other varieties, but distinct in being elongate, rather regularly cylindrical, up to 15. mm. in diameter by 65. mm. in length. On *Quercus Wislizenii.*

RANGE.—California: Mt. Tamalpais, Byron.

TYPES.—20 females, 2 galls. Holotype female, paratype females, and gall at The American Museum of Natural History; paratype females and gall with the author; paratype females at the U.S. National Museum and Stanford University. Labelled Mt. Tamalpais, California; March 14, 1920; *Q. Wislizenii;* Kinsey collector.

Insects emerged at some date after collecting the galls on Mt. Tamalpais, on March 14, 1920. Galls collected a little further south, at Byron on March 19, showed all of the insects to have emerged earlier.

This variety clearly belongs to this species, but is very distinct from either of the *Quercus agrifolia* varieties. Host isolation has accomplished more in this instance than the geographic isolation of the *agrifolia* varieties.

I have a similar but shorter, generally smaller gall from *Wislizenii* in the San Bernardinos, and at Three Rivers; these probably represent one or two other varieties related to *lustrior.* A similar, still more elongate gall occurs on *Quercus Kelloggii.* This oak is very closely related to *Wislizenii,* and *lustrior* may sometimes occur on *Kelloggii,* but probably there are other related varieties which extend into northern California, Oregon, and the more northern range of the oak.

Abnormal Galls of **Plagiotrichus suttonii**

GALL.—Very slender, elongate stem swelling, rather irregular, but generally cylindrical, not over 8. mm. in diameter, but reaching 50. mm. in length. Internally quite solid, woody, with a more or less continuous, very irregular central cavity only incompletely divided into chambers; without distinct larval cells. On *Quercus agrifolia, Q. Wislizenii,* and *Q. Kelloggii.*

This gall occurs thruout the range of the varieties of *suttonii.* Nothing but inquilines is ever bred from it, and I take it to be the inquiline-inhabited gall of *suttonii,* just as inquiline-inhabited galls of *Diplolepis tuberculatrix* (Cockerell), of *Diplolepis bicolor* (Harris), and some others are dis-

tinct in structure. I cannot be certain that these are not abnormal galls of *Plagiotrichus perdens* (Kinsey), but I think not, for they never show a trace of the broken bark characteristic of *perdens,* and they occur on *agrifolia* which *perdens* does not appear to inhabit. The galls are very much alike on the three oaks. In general the insects emerge some weeks after the emergence of *suttonii* in the region.

I have these galls from *Quercus agrifolia* at Santa Barbara, Gaviota, Palo Alto, and Mt. Tamalpais; from *Q. Wislizenii* at Oakdale, El Portal, Merced Falls, Auburn, and Oroville; and from *Q. Kelloggii* at Descanso, Placerville, and *Ukiah.*

Trigonaspis ornata, new species

FEMALE.—Almost wholly bright yellow rufous; antennæ distinctly slender; scutellum with a smooth depression at base; all wing veins heavy, including the cubitus. HEAD: Almost as wide as the thorax, eyes extending slightly beyond the cheeks; rufous yellow, tips of mandibles brown; finely rugose, only slightly more so on the face; sparsely hairy. Antennæ long, distinctly slender, light brown, the two basal segments straw yellow; finely pubescent; with 14 segments, the third slightly longer than the fourth, the last almost twice as long as the preceding. THORAX: Entirely bright yellow rufous; mesonotum almost smooth, shining, naked of hairs; parapsidal grooves prominent, deep, continuous to the pronotum, gradually convergent posteriorly, fairly proximate at the scutellum, widely divergent only finally at the pronotum; median groove, anterior parallel, and lateral lines lacking; scutellum somewhat elongate, rugose, hairy, a smooth, arcuate, fairly broad furrow at the base, only incompletely divided into foveæ; pronotum at the sides almost smooth, finely punctate and sparsely hairy; mesopleuræ rugose beneath the tegulæ, otherwise almost smooth, finely punctate and very sparingly hairy. ABDOMEN: Of the same bright yellow rufous as the thorax, darker to almost black ventrally; practically smooth, naked except for a few hairs latero-basally and on the posterior segments; longer than high, second segment not covering quite half the abdomen, not produced dorsally, ventral edges of all the segments well rounded, hind edges oblique. LEGS: Entirely clear yellow, tips of tarsi dark, finely hairy; tarsal claws heavy, toothed. WINGS: slightly yellowish; finely ciliate on the margins, veins heavy, rich, dark brown; areolet of moderate size; cubitus reaches the basalis; radial cell open, bounding veins not quite reaching the edge but extending parallel with it for a very short distance; second abscissa of the radius moderately curved; first abscissa heavy, strongly angulate, infuscated, the brown cloud extending along the subcosta and covering a small part of the base of the radial cell. LENGTH: 3.5 mm.

MALE.—Differs from the female as follows: Eyes larger, protruding distinctly on the sides, head wholly black except the yellow

piceous mandibles which are darker at the tip; antennæ with 15 segments, dark brown, tinged more rufous on the first two segments; thorax mostly piceous black, light piceous spots on the scutellum and mesopleuræ, most of scutellum smoother than in the female; abdomen rufous, very small, pedicellate; legs yellow rufous, the hind tibiæ and proximate segments of the tarsi brown; wings clearer, the infuscation at the base of the radial cell less than in the female; length 2.7-3.0 mm.

GALL.—Spindle-shaped, covered with a golden brown mass of short filaments; 6. mm. wide by 11. mm. long, widest slightly above the middle; distinctly tipped apically. Covered with a densely compacted mass of filaments, each filament short, wholly flattened with a slendor, narrow blade 2. mm. long, the tips purplish when fresh. The central stem is swollen to form a thin-walled, empty larval chamber, apparently monothalamous. A bud gall, or on leaves, attached to the end of the mid-rib; on *Quercus breviloba.*

RANGE.—Texas: Austin (Patterson).

TYPES.—1 female, 5 males, and 3 galls. Holotype female, paratype male, and gall in The American Museum of Natural History; paratype males and galls at the U.S. National Museum and with the author. Labelled Austin, Texas, *Q. breviloba,* Patterson collection number 53.

The galls were collected March 3, and adults emerged April 15. In this country the genus has been known previously only from root galls, tho in Europe it is obtained from leaf and stem galls also.

The galls superficially resemble those of *Neuroterus evanescens* Kinsey, described in this paper, but the anthers in that gall are not particularly modified. The adult of this species closely resembles *Trigonaspis radicola* (Ashmead); the female of *ornata* differs in being more brilliant rufous in color, slightly smaller, the antennæ are distinctly more slender, the scutellum is less rugose with the basal depression smooth (rugose in *radicola*), and the wing veins are much heavier, even the cubitus being heavy (quite faint in *radicola*). A further study of material from more localities and hosts may show that this is a variety of *radicola,* which occurs on *Q. alba,* and was first described from Missouri. *Ornata* will prove a distinct variety at least.

The connection of *ornata* and *radicola* prompts a suggestion concerning the life history of the species, which though resting on circumstantial evidence, may be hazarded if it is taken only as an hypothesis. Brodie (1896, Ann. Rpt. Clerk Board Forestry, Ont., pp. 114-116) records *Biorhiza forticornis* ovipositing on the rootlets of *Q. alba.* In a 1920 paper (Bull. Amer. Mus. Nat. Hist., XLII, p. 374), I recorded the

observation of *Biorhiza forticornis* (which is wingless, agamic, coming from terminal twig galls on *Q. alba*) ovipositing in December at the roots of *Q. alba*. I have observed galls of *Trigonaspis radicola* on the roots of trees which bore old galls of *forticornis*, and recently Weld (Proc. U. S. Nat. Mus., LIX, pp. 203-204) notes thirty-six instances of coincidence of the two galls on trees of *Q. alba*. There is considerable circumstantial evidence, then, of the cyclic alternation of *Biorhiza forticornis* and *Trigonaspis radicola*. In the paper above mentioned I further described a March brood of *forticornis*, obtained from the same galls as the December brood, ovipositing in the terminal buds of the tree; no galls were obtained from these buds in the experiments. Is it possible that the *ornata* gall (or more probably a similar variety on *Q. alba*) is the bud gall from eggs of the March brood of *forticornis*? Are there two interlocking cycles in the life of this species? What is the solution of the heredity questions presented? Such are the alluring problems to be solved only after the cycle has been experimentally investigated.

Varieties of a Rose Gall Wasp (Cynipidæ, Hymenoptera)[1]

By ALFRED C. KINSEY and KENNETH D. AYRES

The following is a study of the varieties of *Diplolepis tuberculatrix* (Cockerell), based largely on material collected by the senior author during the spring of 1920, while he was a Sheldon Travelling Fellow of Harvard University. We have almost exactly four thousand insects of *tuberculatrix,* and some thousands of galls. In spite of which there remains much work to be done, for we do not yet have material from the majority of the more or less distinct faunal areas of the parts of western United States probably covered by the species. Many additional varieties should be disclosed.

The merits of our conception of a single species with many varieties are emphasized by the serious confusion in the bibliographic synonomies of previously described forms. It has never been possible to separate material by means of the scanty descriptions available; always the descriptions ignored the distinctive characters concerned. Considering that distinct species alone were the only concerns, some synonomy was introduced for very similar material, making the utilization of existing data more difficult.

Each variety as far as known is confined to a faunal area stamped as distinct by parallel distributions of other Cynipidæ, of other insects, and of plants to some degree. Within each area individuals vary as do all individual objects, but nevertheless are most remarkably uniform. The limits of the range of each variety are not often crossed by other varieties; at the meeting points of two forms, the two remain distinct, without the occurrence of the traditional intermediates. Witness *xerophila* and *wasatchensis.* Geographic isolation is an accompaniment of the occurrence of distinct varieties in this species, whether or not we care to consider it the cause.

There can be no doubt of the specific unity of this group. The females are separated on relatively few characters, the males are still more difficult to distinguish, if indeed it can

[1]Contributions from the Zoölogical Laboratories of Indiana University No. 194 (Entomological No. 3).

be done in every instance. The galls indicate closely similar physiologies for all varieties, but in most cases can be distinguished. Where the insects show closest relations then the galls are most similar! This is the case with a series comprising varieties *tuberculatrix, similis, arefacta,* and *coloradensis*; similarly with a series leading from *coloradensis* to *tumida* and *wasatchensis*; again with a series including *californica versicolor,* and *melanderi*; and with the distinct and compact series of *rubriderma, sierranensis,* and *descansonis.* These more closely related varieties might be considered in groups as subspecies if we had occasion to use the terminology.

In such series of varieties the developments of characters appear to proceed in a continuous, geographic direction, as is discussed under *sierranensis.* Orthogenesis and other frightful words loom large, but need further investigation.

Two of these series of species present the curious situation of ranges which cross, as we explain further under *sierranensis.*

This species alone will serve to decide the validity of Kieffer's term, *Lytorhodites* Kieffer (1902, Bull. Soc. Metz, (2), X, p. 96). This genus was established to include species of *Dipolepis, "Rhodites",* which show a scutellum without foveæ, the abdomen microscopically reticulate, and the radial cell more or less open. There is certainly no correlation between the occurrence of these characters among species of rose gall makers, and the nature of the radial cell has been the single character used to delimit the genus. *Arefacta,* one of the varieties of the present species, is type of the genus (designated by Rohwer and Fagan, 1918, Proc. U.S. Nat. Mus., LIII, p. 370). In this species, *tuberculatrix,* occur varieties with the radial cell of the female regularly open; in several other varieties, such as *californica,* individuals have the cell either open or closed, usually closed. Sometimes a single individual will present different conditions on the two wings, that is, belonging to one genus on one wing, to another on the other wing! The males of several of the varieties have the radial cell always closed. This, in connection with the entire lack of other correlated characters for the genus, confirms our previous surmise (Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 392) that *Lytorhodites* cannot be maintained as a genus distinct from *Diplolepis.*

Of 4,060 individuals bred, 1,858, or about 46 per cent are

males. It is difficult to obtain complete data on the ratio of the sexes, for the males appear to emerge regularly somewhat earlier than the majority of the females (see *xerophila, wasatchensis, californica, rubriderma*, and *descansonis*). If the galls are collected too early it appears to reduce the number of females emerging, probably by serving to kill the individuals less developed at the time of collecting. All of the galls collected after emergence had proceeded to some degree gave a reduced number of males. It is probably safe to assume that the sexes occur in about equal numbers.

With the sexes so nearly equal, fertilization probably occurs regularly. Whether parthenogenetic development ever occurs would be a matter of interest in connection with the regularly or at least usually parthenogenetic development of some species of the same genus (see Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 393). No species in the genus is known to exhibit an alternation of generations, and the field data for this species would not suggest the occurrence of that phenomenon. The insects overwinter as larvæ, pupating only a very short time before emergence, emerging as adults in early spring, mostly before February 23 on the southern boundary of California, to April 22 and later at the higher elevations in Colorado, and July 27 in southern Montana, (according to Ashmead, for variety *similis*). New galls probably begin development about a month after the emergence and oviposition of the insects. This biologic data is remarkably uniform for all varieties of the species, differing merely in dates of emergence as affected by the earlier or later arrival of spring at more southern or more northern localities.

While red is the normal color of the female, several of the varieties have some of the females black. The heredity problems involved here deserve further study. See our data under variety *coloradensis* form *subcoloradensis*.

Inquiline-inhabited galls of this species present a considerable modification which has resulted in their consideration as distinct species. This is discussed at the end of the paper.

Diplolepis tuberculatrix (Cockerell)

FEMALE.—Rufous or black; thorax finely, irregularly roughened; parapsidal grooves continuous; median groove usually evident; scutellum without foveæ; radial area only slightly shaded. HEAD: As wide as the thorax, not broadened behind the eyes; very finely rugose on the

front, more rugose and punctate on the face; covered with fine hairs. Antennæ with 14 (or 15) segments; second segment globose, the third distinctly longer than the fourth, the last almost twice the length of the preceding, or incompletely divided. THORAX: Finely, irregularly roughened, finely punctate and covered with fine hairs; parapsidal grooves distinct but not deep, rather widely separated at the scutellum, continuous to the pronotum; median groove of variable length; anterior parallel lines smooth, not at all prominent, extending less than one-half the distance from the pronotum to the scutellum; lateral lines fine, smooth; mesopleuræ smooth, with an irregularly rugose area dorsally, and a rugose, transverse band two-thirds toward the ventral edge; scutellum irregularly, finely rugose, covered with fine hairs, a transverse, rugose groove at base not forming foveæ. ABDOMEN: Shining, naked, completely, finely reticulate; distinctly elongate; second segment covering less than one-third the whole abdominal area, the edge somewhat oblique, only moderately rounded ventrally; segments behind the second sparsely fringed with fine hairs; ventral sheath plow-shaped, spine short, blunt. LEGS: Punctate and covered with fine hairs; claws simple. WINGS: Set with fine hairs; very short ciliate; veins dark brown, rather heavy; areolet of variable size; cubitus continuous but fine at the basalis, or discontinuous; radial cell short, open in most varieties, but often with a more or less heavy brown shading along the margin; a slight shading of brown covering the whole radial area and parts bordering it; first abscissa of the radius arcuate to angulate with occasionally a prolonged but more or less detached projection into the radial cell. LENGTH: 2.5 to 4.3 mm.

MALE.—Differs from the female as follows: Head black except the dark rufous mouthparts; antennæ wholly black or with the first three segments rufo-piceous; with 14 or 15 segments, the third twice the length of the fourth, slightly curved, the last longer than the preceding or incompletely divided; thorax black or tinged with rufous in places; abdomen black, very small; legs rufous, the hind coxæ more or less piceous; wings shaded not so heavily as in the female, the radial area open or often closed; length 1.5-3.0 mm.

GALL.—Good-sized, irregularly rounded, more or less spiny twig gall. Polythalamous, with many larval cells. Of variable size, up to 50. mm. in diameter, or of greater length, usually smaller. Very irregular in shape, most often globose or elongate, arising more or less abruptly from the stem; covered with a thin and partly deciduous bark; green, tinged with pink when young, reddish or dull purplish brown when mature, light brown in some varieties, darkening with age; entirely smooth, or covered with a few, stout spines, or with slender, even moss-like, close-set spines. Internally solid, more or less compact with soft, whitish tissue, the larval cells elongate, lying irregularly, more toward the center of the gall. Terminally, laterally (on a lateral twig), or along a continuous stem; on *Rosa* spp.

RANGE.—Illinois and Wisconsin to New Mexico, southern California, and Washington.

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Diplolepis tuberculatrix variety **tuberculatrix** (Cockerell)

Rhodites tuberculator Cockerell, 1888, West Amer. Sci., IV, p. 60; 1890, Ent., XXIII, p. 75; 1900, Ent. Student, I, p. 10. Ashmead, 1890, Colo. Biol. Assoc. Bull., I, p. 38. Gillette, 1892 (in part), Ent. News, III, p. 247. Beutenmuller, 1907 (not the Utah record, not the figs.), Bull. Amer. Mus. Nat. Hist., XXIII, p. 641. Felt, 1918 (not the figs.), N.Y. Mus. Bull., 200, p. 146.

FEMALE.—Differs from the female of other varieties as follows: Color generally dark rufous brown to rufo-piceous; antennæ black with the first three segments rufous; median groove distinct for more than two-thirds the mesonotal length; scutellum rufo-piceous, a brighter rufous area centrally; abdomen rufo-piceous, in part blackish; areolet of moderate size; first abscissa of the radius slightly angulate, sometimes with a very short but distinct projection; radial area open; length 3.0-3.7 mm.

MALE.—Very similar to the males of other varieties; wholly black; median groove distinct for two-thirds the mesonotal length; areolet moderately large; radial area open; length 3.2 mm.

GALL.—Very similar to the galls of the other varieties; relatively small, smooth, more free of spines.

RANGE.—Colorado: West Cliff, Colorado Springs (Cockerell); Manitou (Kinsey). Records from other regions of Colorado, or from other states, very probably do not apply to this variety.

TYPES.—Not located. Type locality is West Cliff, Colorado.

The above description was made from an adult from material collected at Colorado Springs by Prof. Cockerell, and from the insects and galls collected at Manitou. This variety is probably restricted to a region in Colorado on the east of the Continental Divide, but we do not have material enough to determine the limits of the distribution. Utah galls, figured by Beutenmuller, and refigured by Felt, belong to variety *tumida*.

Diplolepis tuberculatrix variety **similis** (Ashmead)

Rhodites similis Ashmead, 1896, Proc. U. S. Nat. Mus., XIX, p. 136. Cockerell, 1900, Ent. Student, p. 10. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 715, 841. Thompson, 1915, Amer. Ins. Galls, pp. 22, 45.

Rhodites arefactus Beutenmuller, 1907 (in part), Bull. Amer. Mus. Nat. Hist., XXIII, p. 641, pl. XLV, figs. 2-4. Felt, 1918 (in part), N.Y. Mus. Bull., 200, fig. 151 (3, 4).

FEMALE.—Is distinguished from other varieties of the species as follows: Head rufous brown with dark shading between the compound eyes and the mouthparts, and dark shading on the vertex and the posterior side of the head; first three segments of the antennæ light

rufous brown, the remaining segments brownish black; thorax rufous brown, finely punctate, sparsely covered with hairs; median groove very distinct, extending to the pronotum; mesopleuræ black with the smooth central area rufous; abdomen rufous; areolet moderately small; cubitus apparently continuous; first abscissa of the radius arcuate-angulate; radial cell open, shaded with brown; length 3.7 mm.

MALE.—From the original description, would appear to be similar to the males of the other varieties except in having the basal segments of the antennæ rufous brown.

GALL.—Very similar to the galls of most other varieties; relatively smooth and spineless, small.

RANGE.—Wyoming (=Montana?): Point of Rocks (Bruner coll.).

TYPES.—Adults (and galls?) at the U.S. National Museum, No. 3098; cotype galls at The American Museum of Natural History. From Point of Rocks, Wyoming; Bruner collector.

Ashmead's material was reared July 27.

These redescriptions are made from type females loaned by the U.S. National Museum, and from type galls in The American Museum of Natural History. The variety is closely related to variety *tuberculatrix*, tho the two are distinct. Beutenmuller considered *similis* a synonym of *arefacta*, which it does closely resemble. But the type localities of the two are about 450 miles apart, in the very discontinuous country of the northern Rocky Mountains, where the quantity of barren areas serves to isolate many distinct varieties. Until we can see an abundance of material from both regions it would be very unwise to bury and confuse data by maintaining the synonomy. These varieties show closest relations to the varieties west of the Continental Divide and in Utah.

Diplolepis tuberculatrix variety **arefacta** (Gillette)

Rhodites arefactus Gillette, 1894, Can. Ent., XXVI, p. 157. Cockerell, 1900, Ent. Student, I, p. 10. Beutenmuller, 1907 (in part), Bull. Amer. Mus. Nat. Hist., XXIII, p. 640, pl. XLV, fig. 1. Thompson, 1915, Amer. Ins. Galls, pp. 22, 45. Felt, 1918, N.Y. Mus. Bull., 200, p. 146, fig. 151 (1). Kinsey, Bull. Amer. Mus. Nat. Hist., XLII, p. 391.

Lytorhodites arefactus Kieffer, 1902, Bull. Soc. Metz, X, p. 97. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 723, 840. Fullaway, 1911, Ann. Ent. Soc. Amer., IV, p. 378.

FEMALE and MALE.—Apparently similar to variety *similis*.

GALL.—Described as small and spineless.

RANGE.—Colorado: Fort Collins (Gillette). Records from other regions of this state and from other states apply to other varieties.

TYPES.—In the C. P. Gillette collection (?), the U.S. National Museum (?), and at The American Museum of Natural History.

Gillette bred adults in late March. We have not yet seen type material of this variety, nor material from the type locality. Our reasons for considering this distinct from *similis* are detailed under that variety.

Diplolepis tuberculatrix variety **multispinosa** (Gillette)

Rhodites spinosissima Gillette, 1889, Iowa Exp. Sta. Bull., VII, p. 244, fig. 28 (name pre-occupied).

Rhodites multispinosa Gillette, 1890, Ent. Amer., VI, p. 25, fig. 2; 1892, Proc. Iowa Acad. Sci., I, p. 110, pl. II. Thompson, 1915, Amer. Ins. Galls, pp. 22, 45.

Rhodites multispinosus Dalla Torre, 1893, Cat. Hymen., p. 127. Beutenmuller, 1907 (except Ontario and Washington records), Bull. Amer. Mus. Nat. Hist., XXIII, p. 642, pl. XLV, figs. 11, 12, pl. XLVI, fig. 1. Washburn, 1918, 17th Rpt. State Ent. Minn., p. 180. Felt, 1918, N.Y. Mus. Bull., 200, p. 146, figs. 150 (1), 151 (11, 12). Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 391.

Lytorhodites multispinosus Kieffer, 1902, Bull. Soc. Metz, X, p. 97. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 722, 839.

(*Rhodites multispinosus* of Jarvis, Cosens, and Stebbins, is *Diplolepis dichlocera* (Harris).)

FEMALE.—Apparently (from the description) differs from other varieties as follows: General color rufous, with some black below the eyes and about the ocelli; median groove extending two thirds to the pronotum; abdomen dark rufous, black on the ventral valve; areolet large; radial cell open; length 4.3 mm.

MALE.—Apparently very similar to the male of other varieties; length 2.5 mm.

GALL.—Similar to the gall of other varieties, more or less densely covered with spines, more so than in other varieties, these breaking off with age and wear.

RANGE.—Illinois: Ft. Sheridan, Evanston (Weld). Wisconsin: Milwaukee (Brues in Beutenmuller). Minnesota: Minneapolis (Potter in Mus. Comp. Zool.); Cass Lake (Washburn). Records except from adjacent parts of the north Middle West apply to other varieties.

TYPES.—1 female at the Philadelphia Academy; the types at the Iowa State College cannot be located. Originally collected in Minnesota.

Insects have been bred in late June (Weld) and early July.

The gall of this variety is distinctive, altho individual galls may not always be characteristic. We have very little of this material in our collection.

Beutenmuller suggested that "*multispinosus* may prove to

be the same as *R. tuberculator* Cockerell" (Bull. Amer. Mus. Nat. Hist., XXIII, p. 643) ; the two are varieties of one species, but distinct.

Diplolepis tuberculatrix variety **coloradensis,** new variety
form **coloradensis** new form

FEMALE.—Is distinguished from the other varieties of the species as follows: General color bright rufous, brighter than in variety *tuberculatrix;* head bright rufous with small dark patches between the compound eyes and the mouth; first three or four segments of the antennæ bright rufous, remaining segments black; thorax light rufous; median groove not deep but extending well toward the pronotum, distinctly longer than in *xerophila;* scutellum almost evenly bright rufous; mesopleuræ rufous, edged black; abdomen bright rufous, darker terminally; first abscissa of the radius angulate; cubitus hardly continuous; radial cell distinctly open; areolet moderately large, larger than in variety *tuberculatrix;* length 2.5-4.0 mm., averaging larger than in variety *tuberculatrix*, but distinctly smaller than in *tumida.*

MALE.—Differs from the male of other varieties as follows: Almost wholly black except on the mouthparts; median groove extending well forward; areolet of moderate size; cubitus not continuous; radial cell mostly open; length 2.0-3.5 mm.

GALL.—Very similar to the galls of other varieties; dark purplish brown, mostly smooth, with a few, scattered, moderately short spines; many of the galls are unusually small, tho some of them measure up to 28. mm. in diameter.

RANGE.—Colorado: Glenwood Springs.

TYPES.—62 females, 90 males, and 33 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Glenwood Springs, Colorado; April 22, 1920; Kinsey collector.

The characters of this variety are intermediate between those of varieties *tuberculatrix* and *tumida,* which range in either direction from Glenwood Springs, but series of individuals do not show variation toward other varieties. The type locality is in a rugged mountain region, with many barren peaks, and desert and alkaline plateaus, lying west of the high elevations of the Continental Divide. In such a country a host of distinct varieties may well be isolated. The most interesting phenomenon shown by the variety is the common occurrence of a black form; this is described in the next paragraphs. Because of the identity of the males of the two forms, we have not been able to assign individuals of that

sex to either form definitely except when they were cut from the galls. Of a total of 185 adults bred from both forms, 94, or just about one-half were males. Most of the adults had not emerged on April 22.

Diplolepis tuberculatrix variety **coloradensis** form **subcoloradensis,** new form

FEMALE.—Differs from form *coloradensis* only in being generally black; sometimes with some rufous, especially from the base of the antennæ to the mouth, and about the ocelli, on the first three segments of the antennæ, on the smooth area of the mesopleuræ, and centrally on the scutellum; abdomen often with a rufous tinge.

MALE.—Quite identical with the male of form *coloradensis.*

GALL.—Quite identical with the gall of form *coloradensis.*

RANGE.—Colorado: Glenwood Springs.

TYPES.—29 females, 4 males, 4 galls. Holotype female, paratype adults, and gall at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, and with the author. Labelled Glenwood Springs, Colorado; April 22, 1920; Kinsey collector.

This black form and the red form of *coloradensis* are identical in structure, and the galls, an indication of the insect physiology, are quite the same. There can be no doubt that the two represent a single variety. Of 91 females obtained from Glenwood Springs, 29 are mostly black. These individuals are usually entirely black altho we obtained several degrees of intermediates between rufous and black. Up to date we have obtained only red or only black insects from a single gall. We have obtained both sexes of the black form, and presumably both sexes of the red form. It is to be noted that black is the color of the males of all varieties of the species, being therefore normally connected with sex inheritance. Reproduction in the genus may be from fertilized eggs or parthenogenetically. These facts may be concerned with the occurrence of the black form. We are instituting further investigations with this material to try to determine what peculiar heredity phenomena may be concerned here. Black females occur occasionally in several other varieties of this species, tho not as abundantly as we have found it in *coloradensis.* We find black individuals in variety *melanderi* and in *californica,* tho all degrees of melanism are to be found with the latter variety, and the normal female there contains much black; *tumida* is a black form of a Utah species.

Diplolepis tuberculatrix variety **tumida** form **tumida** (Bassett)

Rhodites tumidus Bassett, 1890, Trans. Amer. Ent. Soc., XVII, p. 60. Cockerell, 1900, Ent. Student, I, p. 10. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 720, 841. Beutenmuller, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 23; 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 639, pl. XLV, figs. 5-7. Thompson, 1915, Amer. Ins. Galls, pp. 22, 45. Felt, 1918, N.Y. Mus. Bull., 200, p. 146, fig. 151 (5-7).

FEMALE.—Differs from the female of form *xerophila* only in being almost wholly black, the abdomen tinged rufo-piceous.

MALE.—Identical with the male of form *xerophila*.

GALL.—Identical with the gall of form *xerophila*.

RANGE.—Southern Utah (Siler coll.).

TYPES.—Adults and galls, at the Philadelphia Academy and The American Museum of Natural History.

We have examined Bassett types, and find this form identical with the following form except in the color of the female. We have a black form of variety *coloradensis*, and black individuals in *melanderi* and *californica*, but have failed to obtain the black form for this variety, altho we bred almost 3,300 of the insects. It appears that by a curious coincidence Bassett obtained only the abnormal, less common form of the variety. The red form has not previously been described, and since the red is the normal form our notes on this variety are given under *xerophila*.

Diplolepis tuberculatrix variety **tumida** form **xerophila**, new form

Rhodites tuberculator Beutenmuller, 1907, Bull. Amer. Mus. Nat. Hist., XXIII, pl. XLV, figs. 8-10. Felt, 1918, N.Y. Mus. Bull., 200, fig. 151 (8-10).

FEMALE.—Is distinguished from other varieties of the species as follows: Color generally bright rufous with some black; head rufous with small black patches on either side between the mouth and the compound eyes; antennæ with the first three segments rufous, the remaining segments black; thorax rufous, very distinctly more elongate than in *wasatchensis*, without a median depression anteriorly as in *wasatchensis;* parapsidal grooves distinctly broader and more rugose than in *coloradensis*, broader and less rugose than in *wasatchensis;* median groove distinct, extending two-thirds the distance to the pronotum, distinctly shorter than in *coloradensis*, possibly less distinct than in *wasatchensis;* mesopleuræ bright rufous bordered with black; scutellum rufous; abdomen bright rufous, darker terminally; first abscissa of the radius an-

gulate but without a projection into the radial cell; areolet of moderate size, larger than in *coloradensis*, smaller than in *wasatchensis;* radial cell distinctly open; length 3.5-4.5 mm., averaging larger than in *coloradensis.*

MALE.—Differs from the males of other varieties as follows: Wholly black, often tinged dark rufous in spots, especially about the head; parapsidal grooves wider and more distinct than in the male of *wasatchensis;* median groove distinct, extending two thirds to the pronotum; areolet moderately large; radial area entirely open; length 2.7-4.0 mm.

GALL.—More or less similar to the galls of other varieties, decidedly smoother than in any others, with rarely a few short, rather stout spines; more often elongate than in any others; green, touched with rose when young, becoming light olive brown and light brown with age.

RANGE: Utah: Green River, Price, Provo.

TYPES.—99 females, 132 males, 70 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Green River, Utah; April 21, 1920; Kinsey collector.

The galls figured by Beutenmuller as *tuberculator*, refigured by Felt, were collected in Utah by Uhler in the spring of 1881, and are characteristic of this variety.

Of 3,283 individuals bred, 1,535, or about 47 per cent, are males. Material collected on April 18 at Provo, where many adults had already emerged, gave only 28 per cent males; galls collected on April 20, at Price, where a few adults had previously emerged, gave 42 per cent males; galls collected April 21 at Green River, where most of the insects were still larval, gave 55 per cent males. Note that the two later collections were of less mature galls, for these localities are at a much higher elevation! The considerable differences in sex ratios from the different localities were very probably due to the males emerging mostly before the females emerge. The insects live thru the winter as larvæ, pupating only a very short time before emergence in late April. Emergence dates must be affected considerably by the development of the season at the different elevations.

This variety is intermediate between *coloradensis* and *wasatchensis*, just as its geographic position is intermediate. Of the 255 Green River individuals examined in minute detail, none show variation toward any other variety. The Price and Provo material varies more. In regard to the nature of the parapsidal grooves, which is one of the best single characters to distinguish these varieties, we have these data: Of

255 Green River adults all of them have the grooves of *xerophila*; of 674 individuals from Price, fifty miles nearer the *wasatchensis* type locality, 20, or 3 per cent, fail to show the parapsidal grooves characteristic of *xerophila*, but in no case are the grooves those of *wasatchensis*; of 156 individuals from Provo, another sixty miles nearer the *wasatchensis* locality, but still almost one hundred miles removed, 12, or about 8 per cent, do not have *xerophila* grooves, but only 2 of these are distinctly *wasatchensis*. Here is an instance of two varieties having adjacent, not well isolated ranges, being remarkably pure at more extreme localities, remaining remarkably pure even where the ranges of the two overlap. It will be highly profitable to make more elaborate studies of the variations of these varieties at other points.

The galls of the two varieties are quite distinctive; there is no great variation in our material from either of the type localities, tho the Provo and Price material shows more variation. These galls however more closely resemble the *xerophila* galls, again emphasizing the nice measure the gall is of the specific and varietal nature of the insect.

All of these localities are more or less isolated geographically. Green River is located on a very alkaline and barren plateau, about 5,000 feet high, distant from the next locality likely to grow roses. Price is similarly located. Provo lies at a lower elevation, on the edge of the desert, in the fertile territory which lies more or less continuously, depending on the location of the mountain streams which come out onto the desert, along the base of the Wasatch mountains as far north as Brigham, the type locality of *wasatchensis*. Here is an interesting instance of geographic isolation effecting sometimes more but sometimes less absolute segregation of varieties.

Diplolepis tuberculatrix variety **wasatchensis,** new variety

FEMALE.—Is distinguished from other varieties of the species as follows: General color rufous; head rufous with a large black patch between the mouth and the compound eyes, extending to the bases of the antennæ; antennæ with first three segments rufous, remaining segments black: thorax distinctly broader than in *xerophila*, medianly depressed anteriorly between the anterior parallel lines; the parapsidal grooves not as broad but more rugose than in *xerophila;* median groove distinct, extending two-thirds the distance to the pronotum; mesopleuræ bright rufous, edged with black; abdomen dark rufous; first abscissa of

the radius rather heavy, angulate but without a projection or with a very slight projection into the radial cell; areolet very large, larger than in *xerophila;* cubitus distinctly discontinuous; radial cell open; length 3.0-4.0 mm.

MALE.—Very similar to the males of other varieties, differing as follows: Parapsidal grooves very narrow, often indistinct or discontinuous; median groove distinct, extending two-thirds the distance to the pronotum; areolet large; cubitus discontinuous; length 2.5 mm.

GALL.—Very similar to the galls of most varieties; generally smaller, smooth, dark purplish brown, practically spineless.

RANGE.—Utah: Brigham, Provo.

TYPES.—40 females, 11 males, 20 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Brigham, Utah; April 16, 1920; Kinsey collector.

Of 55 individuals bred from galls collected April 16, 1920, only 22, or 20 per cent, are males. This was probably due to the males emerging mostly before the females.

This variety comes very close to *xerophila*, but is distinct in the nature of the parapsidal grooves, the breadth of the thorax, and the nature of the gall, as well as in the means of other characters. A discussion concerning the distinctness of this variety is given under *xerophila*.

Diplolepis tuberculatrix variety **californica** (Beutenmuller)

Rhodites arefactus Cook, 1910, Mich. Geol. and Biol. Surv., I, p. 25 (error, the California record applying probably to this variety).

Rhodites californicus Beutenmuller, 1914, Bull. Brooklyn Ent. Soc., IX, p. 88, pl. V, figs. 11-13. Felt, 1918, N.Y. Mus. Bull., 200, p. 144.

FEMALE.—Is distinguished from other varieties of the species as follows: General color dark rufous with some black, varying to wholly black, usually very dark rufous to black; mouthparts and a small area around the ocelli dark rufous; first and third segments of the antennæ brownish rufous, the second segment brown, remaining segments black; thorax usually dark rufous with the lateral lines and the anterior half of the area between the parapsidal grooves black; median groove not prominent, extending only a very short distance from the scutellum; mesopleuræ edged with black, with a dark rufous central area; scutellum dark rufous; abdomen light rufous anteriorly, approaching black postero-ventrally; wing veins unusually heavy; areolet moderately large or large; radial cell and surrounding area well shaded with brown; radial cell more or less closed; first abscissa of the radius unusually heavy, angulate with an indication of a projection into the radial cell; length 3.0-4.0 mm.

MALE.—Very similar to the males of other varieties, differing as follows: Median groove not distinct but extending about one-half the distance to the pronotum; areolet of medium size; radial cell more or less completely closed; length 2.2-3.2 mm.

GALL.—Of exactly the same type as that of most varieties, large, and when fresh covered with a dense, mossy mass of spines, filaments, and aborted leaves, this covering deciduous with age and wear but leaving the gall thickly studded with the bases of broken spines and filaments.

RANGE.—California: Berkeley (Beutenmuller); Santa Rosa, Palo Alto, Salinas. Probably occurs thruout central California, the "Californian" zone.

TYPES.—In the Beutenmuller collection, the Museum of Comparative Zoology, the Philadelphia Academy, the U.S. National Museum, Stanford University, and the British Museum. Collected at Berkeley, California, by E. C. Van Dyke.

Of 37 adults we have bred, 13, or 35 per cent, are males. Beutenmuller bred adults in February and March. Galls we collected at Salinas on March 8 had had the insects emerge previously, tho some of the galls were still fresh and green, probably indicating that the gall makers had emerged only recently. Galls collected at Palo Alto on March 13 had only a few adults emerge later; from Santa Rosa galls of March 16 a larger number of adults emerged, illustrating again the fact that in regions of later seasons emergence dates are later. The low number of males obtained is very probably due to the fact that the females are the last to emerge, and were in the majority at the dates when we collected.

Beutenmuller's material was sent by Van Dyke from Berkeley, but the rose host had been transplanted from the San Jacinto Mountains in southern California. We have material from the San Jacinto Mountains; it is of another and rather unrelated variety, *sierranensis*. The types of *californica* well match our material collected in localities not so distant from Berkeley. There is no evidence that *sierranensis*, transported to Berkeley, would become *californica*. The type material then represents a variety native to central California. The nearest relative is variety *versicolor* from eastern Oregon, and less directly related is variety *melanderi* from eastern Washington. Altho our Santa Rosa material is distinctly *californica*, it averages generally blacker, with some individuals largely (but never entirely) black, emphasizing local constancy with continual variation between localities.

Diplolepis tuberculatrix variety **versicolor,** new variety

FEMALE.—Is distinguished from the other varieties of the species as follows: General color rufous brown with black, the rufous distinctly darker than in *californica;* head black, with a narrow, rufous brown patch extending from the bases of the antennæ to the mouth and with a rufous brown patch extending from the borders of the eyes upwards and covering the vertex at both sides and behind the ocelli; first three segments of the antennæ brown to black, remaining segments black; thorax rufous brown with the anterior parallel lines and lateral lines rufous to black (generally darker than the remainder of the thorax); median groove evident only a short distance from the scutellum; anterior parallel lines quite distinct; mesopleuræ black with a rufous central area; scutellum dark rufous to brown; abdomen rufous anteriorly, shading into black posteriorly; areolet moderately small; first abscissa of the radius angulate without a projection; cubitus apparently continuous; radial cell distinctly open; length 3.0 to 4.0 mm., but of a distinctly smaller build than *californica.*

MALE.—Not available for description.

GALL.—Closely resembles that of *californica.*

RANGE.—Oregon: La Grande. Probably occurs thruout Oregon east of the lava bed elevations, and in adjacent parts of Idaho.

TYPES.—6 females, 9 galls. Holotype female, paratype galls at The American Museum of Natural History; paratype females and galls at Stanford University, the U.S. National Museum, and with the author. Labelled La Grande, Oregon; April 12, 1920; Kinsey collector.

Collections at La Grande on April 12, 1920, showed all of the males emerged, and only a few of the females were still in the galls. The females, as with other varieties, appear to emerge somewhat later than the males. This variety is most closely related to *californica.* It occurs in a barren country which is entirely separate from western Oregon, and distinct from central California where *californica* occurs.

Diplolepis tuberculatrix variety **melanderi,** new variety

Rhodites multispinosus Beutenmuller, 1907 (error; Washington record only), Bull. Amer. Mus. Nat. Hist., XXIII, p. 642.

FEMALE.—Is distinguished from the other varieties of the species as follows: Head dark rufous to black, sometimes with a darker band between either compound eye and the mouth and with lighter areas between the mouth and the bases of the antennæ and on the vertex; first three segments of the antennæ dark rufous brown, remaining segments black; thorax dark rufous, shading toward black, or almost wholly black; median groove rather distinct for one-half the distance to the pronotum; scutellum dark rufous, darker on the edges; mesopleuræ black, usually with a rufous central area; abdomen dark rufous shading

to dark brown or black at the posterior end; areolet of only moderate size; cubitus apparently continuous; first abscissa of the radius distinctly angulate; radial cell at least in part open; length 3.5-4.2 mm.

MALE.—Very similar to the males of other varieties; median groove extending one-half the distance to the pronotum; abdomen with a decidedly rufous tinge; areolet of only moderate size; radial area closed; length 2.2-3.5 mm.

GALL.—Similar to that of *californica*, but the spines are all rigid, not so dense, often rather sparse, and the filamentous and leafy covering of *californica* is lacking.

RANGE.—Washington: Pullman (Melander). Probably confined to the small and distinct region about the Cœur D'Alene and Moscow mountains of the Idaho and Washington border.

TYPES.—4 females, 8 males, 3 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and gall with the author. Labelled Pullman, Washington; Melander collector; American Museum numbers 24634, 24636, 24645, and 24663.

Structurally this variety is very closely related to *californica* and *versicolor*, but in *melanderi* the median groove is decidedly longer than in either of the others; the more rufous specimens of *melanderi* are much lighter and the more black specimens are much darker than in *californica*, while the intermediates do not show the distribution of rufous and black characteristic of *californica*. The gall shows distinct relations to the gall of *californica*, but is spiny rather than mossy; this spinous gall resembles the gall of *multispinosa*, leading to Beutenmuller's mistake in handling this same material.

Diplolepis tuberculatrix variety **rubriderma,** new variety

FEMALE.—Is distinguished from the other varieties of the species as follows: General color bright rufous without much black; head rufous with black between the compound eyes and the mouth, and with black extending posteriorly and medially from the posterior border of each compound eye; first three segments of the antennæ rufous brown, remaining segments black; thorax wholly bright rufous; median groove distinct for only a short distance from the scutellum, but often discontinuously evident well forward; abdomen bright rufous, shaded darker posteriorly; areolet very large, larger than in any other Pacific Coast variety; radial cell more or less open; first abscissa of the radius angulate, sometimes with a very long projection into the radial cell; radial cell and adjacent areas shaded lightly; cubitus apparently continuous; length 3.5-4.5 mm.

MALE.—Very similar to the males of the other varieties; median groove only discontinuously evident except for a short distance at the scutellum; areolet very large, not as large as in the female; first abscissa

of the radius angulate, sometimes with a long projection into the radial cell; length 2.0-2.5 mm.

GALL.—Resembles the galls of other varieties; purplish brown, bearing short spines or filaments, but these are scattered, the gall is not mossy as in *californica*, and upon aging the gall is often left almost smooth.

RANGE.—California: Ukiah. Probably confined to the region of Mendocino and northern Sonoma counties.

TYPES.—100 females, 64 males, 54 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled Ukiah, California; March 17, 1920; Kinsey collector.

Of 289 adults bred only 64, or 22 per cent, are males, probably due to males having emerged mostly before March 17, the date of our collecting.

This variety is not at all closely related to *californica*, tho the ranges of these two are proximate, but is very closely related to *sierranensis* and *descansonis* of more southern California. Some further discussion of this peculiar distribution is given with *sierranensis*.

Diplolepis tuberculatrix variety **sierranensis**, new variety

FEMALE.—Is distinguished from the other varieties of the species as follows: General color bright rufous, with little black; head rufous with a large black patch between the mouth and the compound eyes, sometimes extending to the bases of the antennæ, leaving an intervening rufous strip; first three segments of the antennæ rufous, remaining segments black; thorax wholly rufous; median groove extremely short or absent, never discontinuously indicated anteriorly as in *rubriderma;* anterior parallel lines not prominent; abdomen rufous, shading darker terminally; areolet of moderate size, or usually small to very small; first abscissa of the radius angulate, rather heavier than in *rubriderma;* radial cell more or less distinctly open; cubitus continuous; length 3.5-4.0 mm.

MALE.—Very similar to the males of the other varieties; median groove absent or barely evident at the posterior border of the mesonotum; areolet very small; radial cell open but with a dark marginal shading; first abscissa of the radius angulate; length 2.2-3.2 mm.

GALL.—Almost exactly like that of *rubriderma*.

RANGE.—California: San Jacinto Mountains. Occurs probably thruout the southern Sierran zone of California, from El Portal to the Sierra Madre and the San Jacinto Mountains, except in the San Bernardino Mountains.

TYPES.—45 females, 48 males, 50 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; para-

type adults and galls at Stanford University, the U.S. National Museum, the Museum of Comparative Zoology, the Philadelphia Academy, and with the author. Labelled San Jacinto Mountains, California; February 28, 1920; Kinsey collector.

Of the 93 adults bred, 48, or about 52 per cent, are males.

Tho we have material from only a single locality, our experience with the distribution of other Cynipidæ would suggest the range described above. This range lies between the ranges of *rubriderma* and *descansonis*, to which variety *sierranensis* is very closely related. The galls of all three are very similar, quite distinct from those of any other variety, altho suggesting *californica* galls; in morphologic characters the adults are intermediate between *rubriderma* and *descansonis*. This is another instance of the remarkable phenomenon of a steadily increasing development of characters along a particular geographic course. But the range of this series of varieties crosses the range of the *californica-versicolor-melanderi* series. To have this occur without consequent crossing of varieties, or mergence of one series into the other, is a matter deserving considerable attention. Differences in geologic histories of the two ranges, geographic and genetic origins of the two series, means of preserving the distinctness of each series, are factors to be investigated.

Diplolepis tuberculatrix variety **descansonis,** new variety

FEMALE.—Is distinguished from other varieties of the species as follows: General color bright rufous with little black; head rufous brown with a very large black patch between the mouth and the compound eyes and extending to the bases of the antennæ, sometimes with two black marks behind the eyes converging toward the pronotum; first three segments of the antennæ rufous brown, the remaining segments black; thorax rufous brown; median groove entirely absent or just barely evident at the posterior border of the mesonotum; anterior parallel lines not prominent; mesopleuræ almost wholly rufous; scutellum wholly rufous; abdomen rufous, rufous to dark brown posteriorly; areolet usually entirely absent; first abscissa of the radius arcuate-angulate, without a projection; radial cell at least in part open; length 2.0-4.0 mm., averaging smaller.

MALE.—Very similar to the males of other varieties; median groove absent or barely evident at the posterior border of the mesonotum; areolet generally absent; first abscissa of the radius arcuate-angulate; radial cell more or less closed; length 2.5-3.5 mm.

GALL.—Quite identical with those of varieties *rubriderma* and *sierranensis*.

RANGE.—California: Descanso. Probably confined to the Cuyamaca Mountains and their extensions into Lower California.

TYPES.—18 females, 32 males, 51 galls. Holotype female, paratype adults, and galls at The American Museum of Natural History; paratype adults and galls at Stanford University, the U.S. National Museum, and with the author. Labelled Descanso, California; February 23, 1920; Kinsey collector.

Of the 50 adults, 64 per cent are males. Some of the adults had emerged before collection on February 23, 1920, but the galls still contained larvæ which matured later. This variety is an extreme development of the *rubridermasierranensis* series, extreme for instance in the reduction of the median groove and of the areolet.

Abnormal Galls of **Diplolepis tuberculatrix**

Rhodites neglecta Gillette, 1894 (gall), Can. Ent., XXVI, p. 158.
Rhodites neglectus Beutenmuller, 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 639, pl. XLIV, figs. 7, 8. Thompson, 1915, Amer. Ins. Galls, pp. 22, 45. Felt, 1918, N.Y. Museum Bull., 200, p. 146, fig. 152 (7, 8). Kinsey, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 391.
Lytorhodites neglectus Kieffer, 1902, Bull. Soc. Metz, (2), X, p. 97. Dalla Torre and Kieffer, 1902, Gen. Ins. Hymen. Cynip., p. 79; 1910, Das Tierreich, XXIV, pp. 722, 840.

GALL.—Smooth, rounded stem enlargement. Polythalamous. Varying in size, usually smaller than the variety of *tuberculatrix* involved; the surface very smooth, only occasionally bearing some thorns and lines as of an unopened bud, light straw yellow in color, spotted darker or with black, becoming silvery gray upon aging. Internally rather more corky than in normal galls of *tuberculatrix*, a dense cluster of many larval cells arranged rather radiantly about the center, each cell small, averaging 2.0 mm. or less in length, fifty or more cells often in a cluster. The abnormal galls vary somewhat among the varieties of *tuberculatrix*, but are more uniform even than the normal galls of the species. On roses of the several species.

Gillette said of this gall: "I have long known what I suppose to be the same gall in Michigan and Iowa, but never before succeeded in getting the gall-makers from them." He described two females and one male, supposedly bred from a single gall taken at Manitou, Colorado. Beutenmuller recorded the gall from Fort Collins, Colorado, and Pullman, Oregon. I have the gall from practically every one of the localities in which I collected normal galls of any variety of *tuberculatrix*, ranging thru California, Oregon, Utah, and Colorado. Often both types of galls grow close together on

the same bush. In some specimens of variety *wasatchensis* from Brigham, Utah, half of a gall is typical *neglecta*, the other half of the gall is normal *tuberculatrix* from which normal gall makers emerged. Abnormal galls of variety *californica*, from Salinas, California, do not show so very much difference from the normal galls. Gillette's description of the adult he called *neglecta* would very well apply to a dark form of variety *tuberculatrix*, tho the question of the synonomy of the insect cannot be adequately decided until we can see the types of *neglecta*. These we have not been able to obtain.

Meanwhile we feel quite certain that *neglecta* galls are only inquiline-inhabited galls of *tuberculatrix*. Even if the Gillette adults do not bear out this conclusion we should maintain it until someone has bred material sustaining Gillette's data. The association of insects with the wrong galls is liable to occur with our most precautious methods, and that it has occurred abundantly with many published species is being shown repeatedly. When the number of insects thus connected is small, the chances of confusion become relatively greater. We have three gall makers bred apparently from *neglecta* galls from La Grande, Oregon. Two of them are *Diplolepis oregonensis*, which has a small bud gall easily liable to have been bagged with the *neglecta* material. The other adult is of a variety of *Diplolepis bicolor*, which has a distinct enough gall, but which in some fashion got into my *neglecta* bag in spite of considerable precaution.

The fact that *neglecta* is one of the commonest of galls, easily obtained by the hundreds, breeding out hundreds or thousands of inquiline Cynipidæ without gall makers among them, should have appeared significant. How a gall maker, as rare as this was supposed to be, could produce galls in abundance would be hard to explain. I have definite reasons for questioning the nature of the producer in several other cases of a supposedly rare gall maker, as with the huckleberry gall, *Solenozopheria vaccinii* Ashmead, and another rose gall, *Rhodites globuloides* Beutenmuller.

Inquiline-inhabited galls of many other species of Cynipidæ have their structure considerably modified. *Diplolepis bicolor* (Harris), the related *D. eglanteriæ* (Hartig), and the species discussed in the next paragraph are examples in the same genus. We do not know exactly in what

way inquilines replace the true gall maker and modify the normal structure, but are instituting further studies.

Rhodites globuloides Beutmuller is an inquiline-inhabited gall very similar to the gall of *neglecta*, but occurring in the eastern part of the United States. In 1892 Beutenmuller described (Bull. Amer. Mus. Nat. Hist., IV, p. 247, pl. IX, fig. 4) an insect from this gall as *Rhodites globulus*. In 1907 he made a correction (Bull. Amer. Mus. Nat. Hist., XXIII, p. 638, pl. XLIV, figs. 2-6) as follows: "The insect described by me as *Rhodites globulus* is a guest-fly, synonymous with *Periclistis pirata* O. S., consequently a new name must be used for the true gall maker. I propose for it *Rhodites globuloides*. * * * The gall of *Rhodites globuloides* occurs on the branches of *Rosa carolina* and is quite common locally in certain localities. I have collected over a hundred specimens of the galls from which I reared hundreds of its guest-fly *Periclistis pirata*, but only a single specimen of the true gall maker."

All of our previous remarks concerning the improbability of a very common gall having such a rare producer apply with even additional force in this case. We have bred many hundreds of the galls, and so have other workers, obtaining thousands of inquilines but not a single gall maker. The holotype female, the only specimen which Beutenmuller had of a gall maker, is in the American Museum. Our notes made three years ago record the date on this holotype as April 25, 1882, which is ten years before the gall was described with an inquiline as the supposed producer, and twenty five years before this true gall maker was described as coming from these galls. This destroys any grounds for the connection of the single specimen with any particular gall.

Until we can find an opportunity to examine this insect further, we cannot give a synonomy with any certainty. Meanwhile it is to be observed that the original description agrees entirely with females of *Diplolepis ignota* (Osten Sacken). We have no data as yet to show what species of rose gall becomes *globuloides* when inhabited by inquilines.

INDICES

Host Index

Distribution Index

Index to Biologic Data

Index of Names

Synonyms or unaccepted combinations are in *italics*, and the page of the principal description in **bold face**; new names are indicated by an asterisk.