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BIOLOGICAL AND MEDICAL SCIENCES

PLANT GALLS OF THE VICINITY OF SEWARD, NEBRASKA

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This report is based on twenty years of collecting and culturing insects from galls in the vicinity of Seward, Nebraska. It includes a listing of gall insects, inquilines, and parasites discovered in this study. Some forty-seven gall makers, forty-nine parasites, and fourteen inquilines are listed.

† † †

INTRODUCTION

One of the most interesting areas of study for the novice in biology is that of the plant-insect relationships evident in plant galls. In order to offer a challenge to the biology student in his contacts with college biology and to assure him that biology is the study of living things rather than, as so many have been led to believe, the consideration of the dead and embalmed, the author has been sending his students into nature in the vicinity of Seward, Nebraska to see for themselves and to collect and to culture insects from galls which they find.

Since the literature on galls is often not available to the student, this paper is designed to make available much of the information needed to identify the galls which he will probably encounter. This paper represents the efforts of the author in collecting through the years from 1938 through 1959, while carrying out other research projects. Daily trips were made to the field during the summers of 1952, 1955, 1957, and 1959. Galls discovered were taken to the laboratory and placed in glass jars or in shoe boxes in the ends of which holes had been made to receive small vials. Since these holes were the only source of light, the emerging insects were attracted to them and soon appeared in the vials.

Most of the insects involved in this study were cultured by the author and identified by the specialists indicated. A few of the insects have not been successfully reared by the author, and in such cases, the literature has been carefully checked; but it is believed that the identifications are quite accurate. However, some uncertainty still prevails with regard to some of the insects. Even in the literature there remain many questions as is indicated by Kinsey and Ayres (1922): "The association of insects with the wrong galls is liable to

occur with our most precautionous methods, and that it has occurred abundantly with many published species is being repeatedly shown." The fact that many parasites, hyperparasites, and guests inhabit the same gall with the gall maker makes it extremely difficult to be sure of the identity of the real gall maker. Also, if clusters of galls are cultured, the fact that at times several different galls are found in one cluster makes it difficult to determine which insect emerged from which gall. The author has some doubts as to the exactness of the identities, especially of some of the wasps listed in the study of *Rosa pratincola* Greene.

GALLS ENCOUNTERED IN THE VICINITY OF SEWARD, NEBRASKA

AMORPHA

Amorpha canescens Pursh. (Lead Plant). (Fig. 1, d, and e.)

"Chimney" gall, 6 mm. tall, on leaflets, petioles or stems, color reddish to green.

Maker: A midge, *Diarthronomyia* sp.

Parasite: A chalcid, *Zatropis nigroaeneus* (Ashmead).

Location: Meadows east of Seward.

Note: This is the first record of this relationship of *Z. nigroaeneus* (Ashmead) with *Diarthronomyia*.

Rachis gall, 15 mm. long, 3 mm. diameter, fusiform thickening of rachis of inflorescence. This gall seems not to have been described nor is the causative insect known. (Fig. 1, e.)

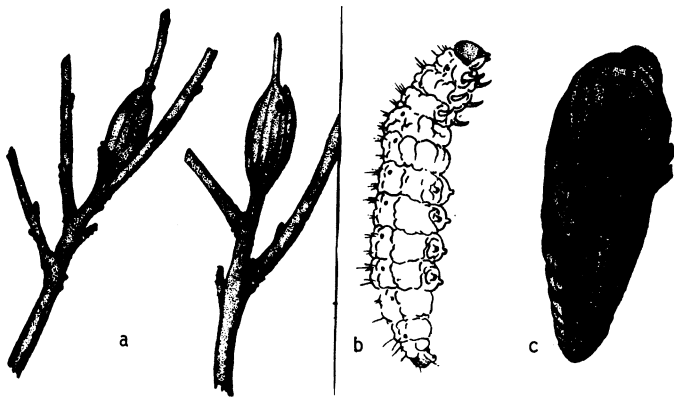
Amorpha fruticosa Linnaeus (False Indigo). (Figure 1, a, b, and c.)

Oval to fusiform stem gall, 8 mm. diameter, 24 mm. long, near tips of stems.

Maker: Lepidopteron, *Walshia amorphella* Clemens.

Parasites: *Phaeogenes walshiae walshiae* Ashm. pupates inside the pupa of *W. amorphella*. *Microgaster ecdytoplophae* Muesebeck spins silken cocoon inside gall after devouring *W. amorphella*. *Eupelmus* sp.

Note: Old galls are used by many other insects and spiders.



Terminal bud gall, heart-shaped, pubescent, 6 mm. diameter, 8 mm. long.

Maker: A midge, *Itonididae* sp.

Parasites: *Pseudotorymus* sp., *Amblymerus* sp., *Platygaster* sp.

Note: This gall has been found on other asters also.
Location: Roadsides north and east of Seward.

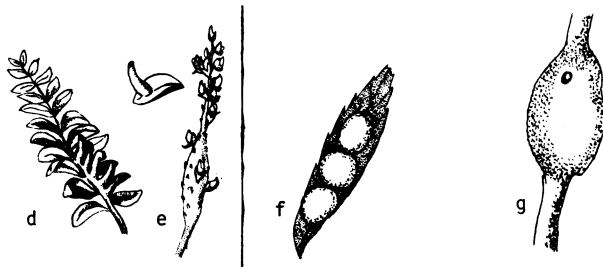


Figure 1. a) *Amorpha fruticosa*—Galls of *Walshia amorphella* Clemens.

b) Larva of *Walshia amorphella*.

c) Pupa of parasite, with *Phaeogenes walshiae* Ashmead inside pupa of *Walshia amorphella*.

d) *Amorpha canescens*, Gall of *Diarthromyia* sp.

e) Rachis gall on *Amorpha canescens* (unidentified).

f) *Solidago canadensis*, Gall of *Asteromyia flavoanulata* Felt.

g) *Solidago canadensis*, Gall of *Gnorimoschema gallaesolidagenis* (Riley).

Location: Second street of Seward, 1 mi. south, along the Blue River.

Watch for galls with a cellophane-like cover over the emergence hole. This is produced by the bee, *Hylaeus cressoni* (Cockerell) (= *Prosopis cressoni* Cockerell, 1907) (Colletidae) which uses the gall as a nesting site.

ASH

Fraxinus campestris Britton (Green ash). (Figure 2, e.) Flowers in deformed masses remain on tree.

Maker: A mite, *Eriophyes fraxiniflora* Felt.

Location: Many on the campus of Concordia Teachers College.

ASTER

Aster multiflorus Aiton (Many-flowered aster). (Figure 2, b.)

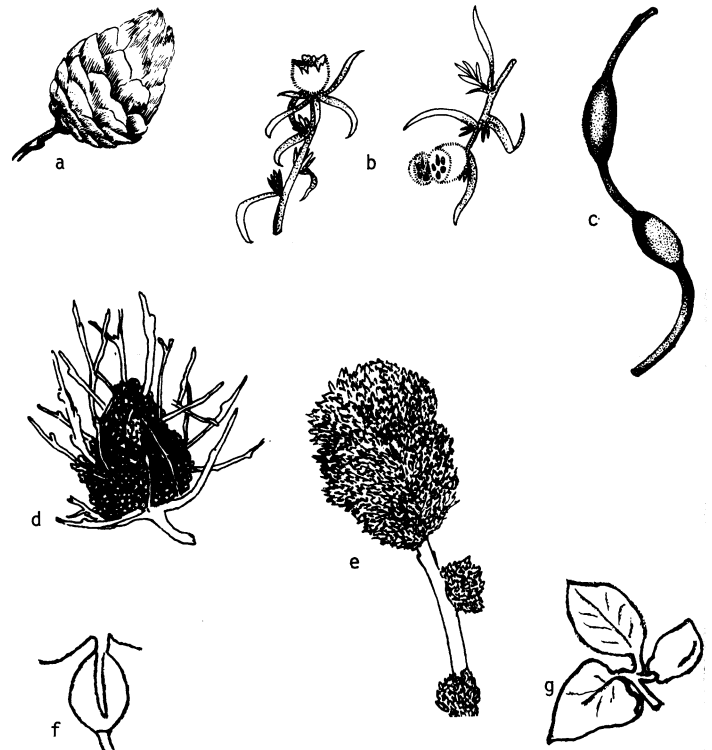


Figure 2. a) Pine cone gall of *Rhabdophaga strobiloides* on *Salix*.

b) Galls of a midge, probably *Rhopalomyia lateriflora* Felt (*Itonididae*).

c) Galls of *Lasioptera convolvuli* Felt on *Convolvulus sepium*.

d) Gall of *Sphaerotheca phytophila* Felt on *Celtis occidentalis*, Linneus.

e) Gall of *Eriophyes fraxiniflora* on *Fraxinus campestris* Britton.

f) Gall of *Pemphigus populitransversus* Riley on *Populus occidentalis* Rhydborg.

g) Gall of *Contarinia virginianiae* Felt on *Prunus virginiana* Linnaeus.

BINDWEED

Convolvulus sepium Linnaeus (Hedge bindweed). (Figure 2, c.)

A fusiform stem gall 14 mm. long, 7 mm. diameter.

Maker: A midge, *Lasioptera convolvuli* Felt.

Note: This can be most easily seen after a frost.

Location: Along Plum Creek.

CEDAR APPLE

Juniperus virginiana Linnaeus. (Red cedar)

Irregular enlargement on twigs, gelatinous in spring rains.

This gall is caused by a fungus: *Gymnosporangium globosum* Farlow.

Several insects may be found in the dry galls.

Location: Common on cedar trees in various areas of the county.

Note: This fungus also causes a blight on apple and pear trees.

CHOKE-CHERRY

Prunus virginiana Linnaeus (Choke-cherry). (Figure 2, g.)

Fruit gall 6 mm. diameter, 14 mm. long, open at one end.

Maker: A midge, *Contarinia virginianiae* Felt.

Inquiline: *Itonida canadensis*, Felt, *Rhizomyia absorbina* Felt, *Dasyneura pregandei* Felt, *Cecidomyia cerasiphila* Felt, *Arthrocnodax apiphila* Felt.

Note: These inquiline are listed by Felt. Several other insects may be found in the old galls.

Location: Concordia Teachers College campus, Seward.

COTTONWOOD

Populus occidentalis (Rhydberg) Britton (Cottonwood). (Figure 2, f.)

Bulbous hollow petiole gall, 15 mm. diameter.

Maker: An aphid, *Pemphigus populitransversus* Riley.

Location: Cottonwoods are common along Plum Creek.

Similar gall at base of leaf, 13 mm. diameter.

Maker: Another aphid, *Pemphigus populicaulis* Fitch.

DOGWOOD

Cornus asperifolia Michaux (rough-leaved dogwood). Club-shaped gall on twigs, 10 mm. diameter, 17 mm. long.

Maker: A midge, *Mycodiplosis alternata* Felt.

Location: Along Clarke Creek (Middle Creek area).

GOLDENROD

Solidago canadensis Linnaeus (Canada goldenrod, State flower). (Figure 1, f, and g.)

Circular blister leaf gall, 8 mm. diameter.

Maker: A midge, *Asteromyia flavoanulata* Felt.

Note: Felt lists *S. squarrosa* as the host for a similar gall with a black border. Such a gall appears also on *S. canadensis* Linnaeus. The insect producing it may be a midge, *Asteromyia squarrosa* Felt, but this is uncertain.

Parasite: *Platygaster solidaginis* (Ashmead).

Apical rosette gall, 65 mm. diameter.

Maker: A midge, *Rhopalomyia solidaginis* Lw.

Inquiline: Numerous, a curculionid beetle; Felt lists also the following which have not been recovered here: *Rhopalomyia albipennis* Felt and *Oligotrophus inquilinus* Felt.

An oval stem gall, 15 mm. diameter, 25 mm. long. (Fig. 1, g.)

Maker: Leptidopteron, *Gnorimoschema gallaesolidaginis* Riley. (Recommended as fish bait)

Parasites: *Zatropis nigroaenus* Ashmead, *Aprostocoetus americanus* Ashmead.

Note: Several additional galls are listed in the literature, but these have not yet been found here.

Location: Roadsides north and south of Seward.

GRAPE

Vitis vulpina Linnaeus (Wild grape).

Leaf gall, wort-like, tuberculate, 4 mm. diameter.

Maker: An aphid *Phylloxera vitifoliae* Fitch.

Location: Plum Creek, Blue River, Clarke Creek.

Note: Destroyed 2,500,000 acres of vineyard in France.

HACKBERRY

Celtis occidentalis Linnaeus (Hackberry).

Nipple-like gall on underside of leaf, 6 mm. diameter, 8 mm. long.

Maker: Psyllid, *Pachypsylla mamma* Riley.

Predator: A neuropteran.

Large sub-globose to reniform petiole gall 12 mm. to 20 mm. diameter. (Fig. 2, f.)

Maker: Psyllid, *Pachypsylla venusta* Osten Sacken.

“Witches’ broom” gall, a mass of twigs 30 mm. in diameter, 60 mm. long or more. (Fig. 2, d.)

Maker: *Sphaerotheca phytophila* Felt.

Location: Four blocks south of Concordia College campus on Columbia Avenue, Seward.

HORSEWEED

Leptilon canadensis (Linnaeus) Britton (Muletail or horseweed).

Apical bud gall 6 mm. to 12 mm. diameter. Rare.

Maker: A midge, *Rhopalomyia erigerontis* Felt.

Fusiform stem gall or thickening of stem 20 mm. long.

Maker: A midge *Neolasioptera erigerontis* Felt.

Location: Plum Creek, Concordia Teachers College campus, Seward.

IRONWEED

Vernonia baldwinii Torrey (Ironweed).

Fusiform stem gall. 8 mm. diameter, 16 mm. long.

Maker: Dipteron, *Lasioptera* sp. or closely related.

Parasites: Braconidae: *Apanteles plathypenae* Muesebeck, *Schizoprymnus* sp. Platygasteridae: *Platygaster vernoniae* Ashmead. Eulophidae: *Tetrastichus* sp. Torymidae: *Torymus* sp., *Torymus* sp.

Pedicle gall, 2 mm. diameter, 6 mm. long.

Maker: Cecidomyia, *Lasioptera* sp. probably *vernoniae* Beutenmueller.

Location: Ironweed may be found abundantly in pasture four miles north of Seward, Highway 15, and other locations.

KNOTWEED

Polygonum lepathifolium Linnaeus (Knotweed—Ladyfinger).

Spindle-shaped to oval stem gall 12 mm. diameter, 20 mm. long.

Maker: Curculionid, *Lixus* sp. (Sp. nov.)

Location: South side of C.B.&Q. R.R. tracks south of Seward.

Polygonum aviculare Linnaeus (Doorweed).

Gall similar to above but about half the size.

Maker: Curculionid, probably *Lixus musculus* Say.

Locations: Concordia Teachers College Campus—very common throughout the area.

LETTUCE

Lactuca ludoviciana (Nuttall) DeCandolle (Wild lettuce).

Bulbous stem gall up to 35 mm. diameter.

Maker: A wasp, *Aulacidea tumida* Bass.

Similar apical gall, often larger.

Maker: A wasp, *Aulacidea annulata* Kinsey.

Location: Roadsides around Seward.

MOSSYCUP OAK

Quercus macrocarpus Michaux (Mossycup).

Spherical, occasionally pointed, gall 14 mm. diameter.

Maker: A wasp, *Disholcaspis mamma* Walsh.

Bulbous petiole gall, 18 mm. diameter.

Maker: *Andricus concolorans* Kinsey.

“Hedgehog” leaf gall, 5 mm. diameter, reddish.

Maker: *Acraspis prinoides* Beutenmueller.

Location: Along creeks and Blue River.

Note: Several additional galls are found on our oaks, but as yet they have not been definitely identified.

Bullet gall similar to first. Spherical or flattened on one or more sides. 12 mm. diameter.

Maker: A wasp, *Disholcaspis globosa* Weld.

Spherical to conical leaf gall 3 mm. diameter, 4 to 5 mm. high.

Maker: A fly, *Cecidomyia* sp.

Midrib cluster gall 7 mm. wide, 12 mm. long, individual cell spherical 2 mm. diameter.

Maker: A wasp, *Cynips dimorphus* Beutenmueller.

PLUM

Prunus americana Marsh (Wild plum).

Irregular terminal bud gall 12 mm. diameter.

Maker: *Cecidomyia* sp. probably *serotina* Osten Sacken.

Location: Plum Creek, Clarke Creek.

PRAIRIE CONEFLOWER

Ratibida columnaris (Sims) Don (Prairie coneflower).

Swelling of torus 2 mm. diameter, 8 mm. long.

This gall has not been described nor have we been able to culture the maker to maturity.

Location: Middle Creek area.

RAGWEED

Ambrosia trifida Linnaeus (Giant ragweed).

Stem gall, oval 14 mm. diameter.

Maker: A midge, *Neolasioptera ambrosiae* Felt.

REDROOT

Ceanothus ovatus Desfontaines (Redroot).

Irregular swelling of stem 6 mm. diameter.

Maker: Lepidopteron, *Stagmatophora ceanothiella* Cosens.

Parasite: A wasp, *Eurytoma* sp.

Location: The gall is found only in an area north of Garland, Nebraska. The plant is found in many meadows near Seward.

ROSE

Rosa pratincola Greene (Prairie rose). (Figures 3 and 4, b.)

Lenticular leaf gall 4 mm. diameter.

Maker: A wasp, *Diplolepis rosaefolii* (Cockerell).

Guest: A wasp, *Periclistus* sp.

Parasites: Wasps, *Ormyrus* sp., *Pteromalini* sp., *Chrysocharis* sp., *Ormyrus* sp.

Spiny-leaf gall, globose, 8 mm. diameter. (Figures 3, c and e.)

Maker: A wasp, *Diplolepis pustulatoides* Beutenmueller.

Parasites: Wasps, *Habrocytus* sp., *Ormyrus* sp., *Eupelmus* sp.

Guest: A wasp, *Periclistus* sp.

Mealy gall, irregularly globose, 10 mm. to 20 mm. diameter.

Maker: A wasp, *Diplolepis ignotus* Osten Sacken.

Parasites: Wasps, *Eurytoma* sp., *Tetrastichus rosae* (Ashmead).

Similar to above, but not mealy type.

Maker: A wasp, *Diplolepis variabilis* Bass. (Figure 4, c.)

Parasites: Wasps, *Eurytoma* sp., *Tetrastichus rosae* (Ashmead), *Eupelmus* sp., *Habrocytus* sp., *Torymus bedeguaris* (Linnaeus), *Eupelmella dryorhizonexi* (Ashmead), *Orthopelma mediator* (Thunberg).

Long spined twig gall 7 mm. to 12 mm. diameter. (Figure 4, h.)

Maker: *Diplolepis fusiformans* Ashmead.

Parasites: Wasps, *Habrocytus* sp., *Torymus bedeguaris* (Linnaeus).

Fusiform stem gall 7 mm. diameter, 10 mm. long. (Figure 4, g.)

Maker: A wasp, *Diplolepis verna* (Osten Sacken).

Parasites: Wasps, *Habrocytus rosae* (Girault), *Ormyrus* sp., *Torymus bedeguaris* (Linnaeus), *Zatropis* sp., *Eurytoma* sp., *Polynema* sp. (egg parasite).

Spiny-leaf gall, globose, 6 mm. to 8 mm. diameter, spines longer than in *Diplolepis pustulatoides* Beutenmueller. (Figure 4, d.)

Maker: A wasp, *Diplolepis bicolor* (Harris).

Guest: A wasp, *Periclistus pirata* (Osten Sacken).

Parasites: A wasp, *Chalcididae*, several species.

Note: *Diplolepis bicolor* was also reared from a gall on *Rosa rugosa* Thunb. This gall has long spines consistently bent or hooked. (Figures 4, e, and f.) From this gall there emerged also the parasites: *Torymus bedeguaris* (Linnaeus) and *Habrocytus* sp.

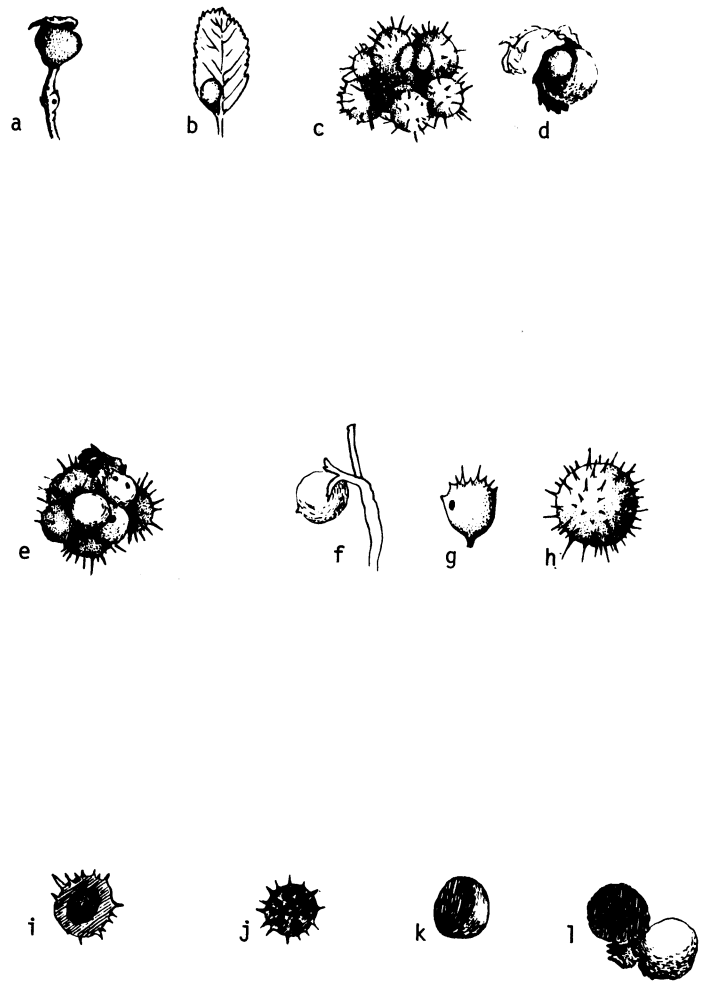


Figure 3. Gall characteristics:

- a) New petiole gall, maker unknown.
- b) Disk gall on leaf.
- c) Disk and spiny galls combined.
- d) Disk and pithy galls combined.
- e) Spiny and pithy galls combined.
- f) Pithy gall.
- g) "Varnished" gall.
- h) Large spiny gall.
- i) Monothalamous spiny gall.
- j) Polythalamous spiny gall.
- k) Polythalamous pithy gall.
- l) Monothalamous pithy gall.

ROSINWEED

Silphium integrifolium Michaux. (Rosinweed)

Ovate flower gall 2 mm. diameter.

Maker: A wasp, *Antistrophus laciniatus* Gillette.

Guest: A wasp, *Eurytoma gigantea* Walsh.

Parasites: Wasps, *Eurytoma* sp., *Tetrastichus* sp.

Location: Blue River, Lincoln Creek, roadsides.

Antistrophus pisum Walsh. The typical gall is pea-shaped; another is a root gall; the third is a stem gall. Parasites: *Antistrophoplex bicoloripes* Crawford, *Eupelmus allynii* French *Tetrastichus bruchophaga* (Gahan)

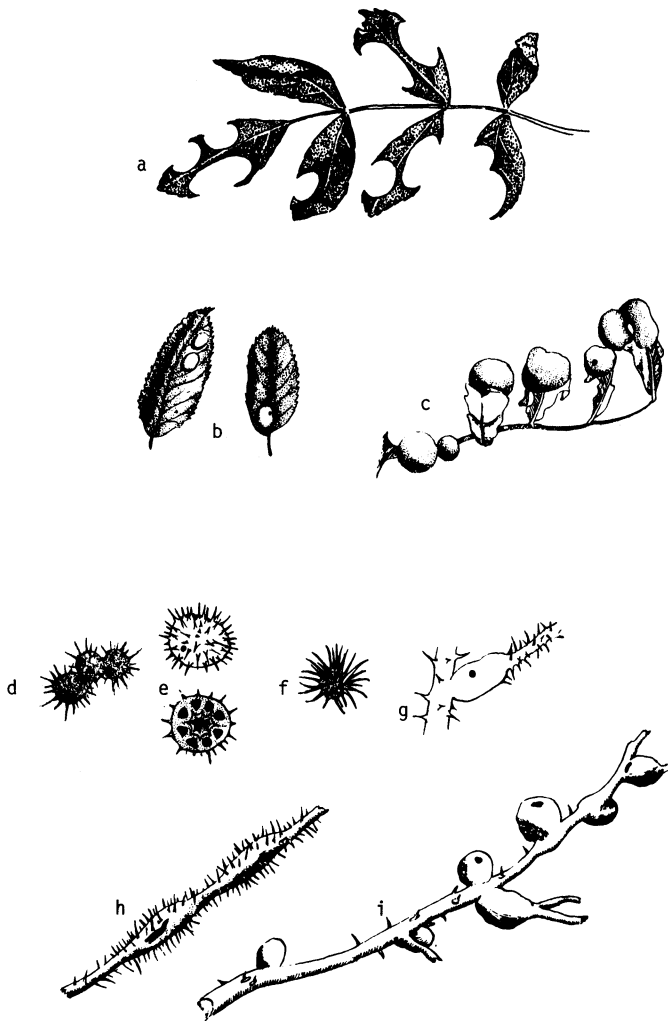


Figure 4. a) Work of the leaf cutter bee, Megachilidae. b) Gall of *Diplolepis, rosaefolii* (Cockerell). c) Gall of *Diplolepis variabilis* Bass. d) Gall of *Diplolepis pustulatoides* Beutenmueller. e) Gall of *Diplolepis bicolor* (Harris). f) Gall of *Diplolepis bicolor* on *Rosa rugosa* Thunberg. g) Gall of *Diplolepis verna* (Osten Sacken). h) Perhaps gall from *Diplolepis fusiformans* Ashmead. No insect recovered. i) Gall of an unknown insect not recovered.

SKELETON WEED

Lygodesmia juncea Pursh (Skeleton weed). (Figure 5, a-h.)

As shown in Fig. 5, three different galls were produced on *Lygodesmia juncea* Pursh by the gall maker,

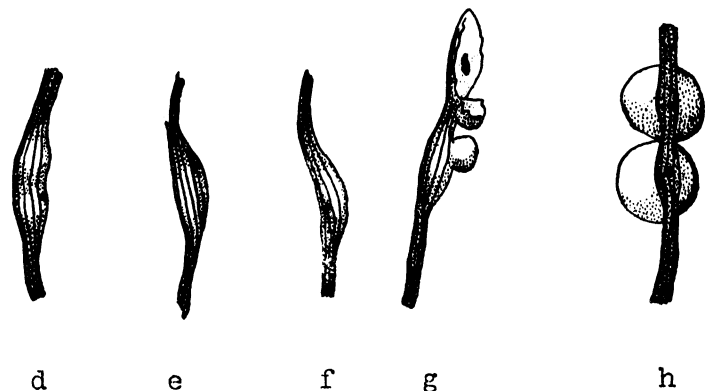
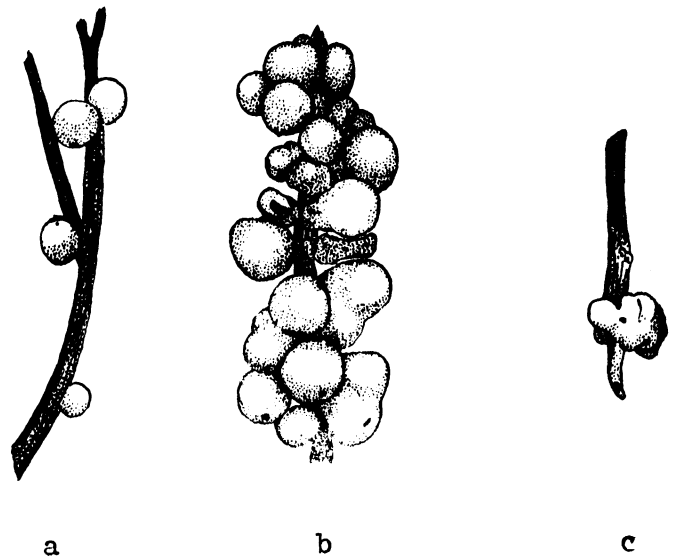


Figure 5. Galls on *Lygodesmia juncea* (Pursh) from which *Antistrophus pisum* Walsh emerged:

- a) Normal condition.
- b) Extreme crowding of galls.
- c) Root gall.
- d) to g) Fusiform galls.
- h) Normal galls with emergence holes through stems.

WILLOW

Salix sp. (willow)

Pine cone gall, 26 mm. diameter, 30 mm. long. (Figure 2, a.)

Maker: A midge, *Rhabdophaga strobiloides* Walsh.

Guest: Several miscellaneous guests live among the "leaves" of the cone-like gall. They have not been successfully cultured, however.

Location: Lincoln Creek near Staplehurst.

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REFERENCES

- Albertson, Fred W. 1956. Ecology of the mixed prairie in West Central Kansas. *Ecol. Monog.* 7:481-547.
- Aldrich, J.M. 1905. A catalog of North American Diptera. *Smithsonian Misc. Col.* 46:153-652.
- Ashmead, William Harris. 1904. Classification of the chalcid flies or the superfamily Chalcidoidea. *Publ. Carnegie Museum* 1(4).
- Balduf, W.V. 1959. Obligatory and facultative insects in rose hips. *Illinois Biol. Monog.* 26:5-114.
- Bare, Orlando Smith A. 1929. A taxonomic study of Nebraska ants or Formicidae (Hymenoptera). Ph.D. Thesis. Lincoln, Univ. Nebraska Entomology Libr. pp. 1-47.
- Bischoff, Hans. 1927. *Biologie der Hymenopteren*. Berlin, Verlag von Julius Springer, pp. 56-421.
- Blatchley, William Stanley. 1910. Coleoptera known to occur in Indiana. *Nature Publ. Co.* 1386 pp.
- Brandhorst, C.T. 1943. A study of the relationships existing between certain insects and some native western Kansas forbs and weedy plants. *Trans. Kansas Acad. Sc.* 46: 164-175.
- _____. 1961. The microcommunity associated with the gall of *Walshia amorphella* (Lepidoptera: Cosmopterygidae) on *Amorpha fruticosa*. *An. Ent. Soc. of Am.* Vol. 55, No. 4.
- _____. 1963. Notes on *Antistrophus pisum*, (Hymenoptera: Cynipidae) and three types of galls induced by it on *Lygodesmia juncea*. *An. Ent. Soc. of Am.* Vol. 57, No. 1.
- Britton, Nathaniel L. and Addison Brown. 1896. An illustrated flora of the northern United States and Canada. New York, Charles Scribner's Sons. 2:286; 3:276-381.
- Brues, Charles T. and A.L. Melander. 1932. Classification of insects. Cambridge, Harvard Press.
- Clausen, Curtis P. 1940. Entomophagous insects. New York, McGraw Hill Book Co. Inc.
- Comstock, John H. 1933. An introduction to entomology. Ithaca, Comstock Publ. Co.
- Crawford, J.C. 1914. Notes on the chalcidois family Calliomyidae. *Proc. Ent. Soc. Washington.* 16:122-125.
- Creighton, William Steel. 1950. The Ants of North America. *Bull. Mus. Comp. Zool., Harvard College*, pp. 104-515.
- Curran, Charles Howard. 1934. The families and genera of North American Diptera. New York, The Ballou Press. 512 pp.
- Essig, E.O. 1938. Insects of western North America. New York, Macmillan Co.
- Felt, Ephraim Porter. 1940. Plant galls and gall makers. Ithaca, Comstock Publ. Co. Inc.
- Gates, Frank C. 1933. Wild flowers of Kansas. Topeka, Kansas State Printer.
- _____. 1940. Flora of Kansas. Topeka, Kansas State Printer.
- Hicks, Charles H. 1926. Nesting habits and parasites of certain bees of Boulder County, Colorado. *Univ. Colorado Stud.* 15.
- Hoppner, Hans. 1904. Zur Biologie der Rubus-Bewohner. Berlin, *Alg. Zeitschr. Ent.*
- Kinsey, Alfred C., and Kenneth D. Ayres. 1922. Varieites of a rose gall wasp. *Indiana Univ. Stud.* 9(50):142-162.
- Knuth, Paul. 1909. Handbook of flower pollination. Trans. J.R. Ainsworth Davis. Oxford, Clarendon Press. 2:259-305; 3:571.
- Krombein, Karl V. 1958. Hymenoptera of America north of Mexico synoptic catalog. Washington, D.C., Government Printing Office.
- Leng, Charles W. 1920. Catalog of Coleoptera of America north of Mexico. Mount Vernon, N.Y., John D. Sherman.
- Metcalf, C.L. and W.P. Flint. 1939. Destructive and useful insects—their habits and control. New York, McGraw Hill Book Co. Inc.

- Muesebeck, C.F.W., Karl Krombein, Henry Townes, and others. 1951. Hymenoptera of America north of Mexico. Washington, D.C., Government Printing Office.
- Müller, Hermann. 1883. The fertilization of flowers. Trans. D'Arcy W. Thompson. London, Macmillan Co.
- Packard, Clyde Monroe. 1916. Life history and methods of research of rearing Hessian fly parasites. Jour. Agr. Res.
- Peterson, N.F. 1923. Flora of Nebraska. 3rd Ed. Plainview, Nebraska. Pub. by the author. 221 pp.
- Rau, Phillip. 1922. Ecological behavior notes on Missouri insects. Trans. Acad. Sc. St. Louis.
- Riley, Charles V. 1870. Galls made by moths. Jefferson City, Second Annual Report on noxious and beneficial and other insects of the state of Missouri.
- Riley, Charles V., and Benjamin Walsh. 1869. The *Lygodesmia* pea gall. Amer. Entomologist. 2:73-74.
- Stebbins, Fannie A. 1909. Insect galls of Springfield, Massachusetts, and Vicinity. Springfield Mus. Nat. Hist.
- Strand, Embrick. 1914. Ein Nordamerikanisches Eumeniden-nest nebst Discriptiven Bemerkungen über die Gehorigen Wespen. Berlin, Ent. Mittlg.
- Townes, Henry. 1950. The Nearctic species of Gasteruptiidae (Hymenoptera). Proc. U.S. Nat'l. Mus. 100:85-145.
- Van Duzee, Edward P. 1917. Catalog of Hemiptera north of Mexico. Berkeley, Univ. Cal. Press.
- Weaver, John E. and Fred W. Albertson. 1940. Deterioration of midwestern ranges. Ecology 21(2):216-236.