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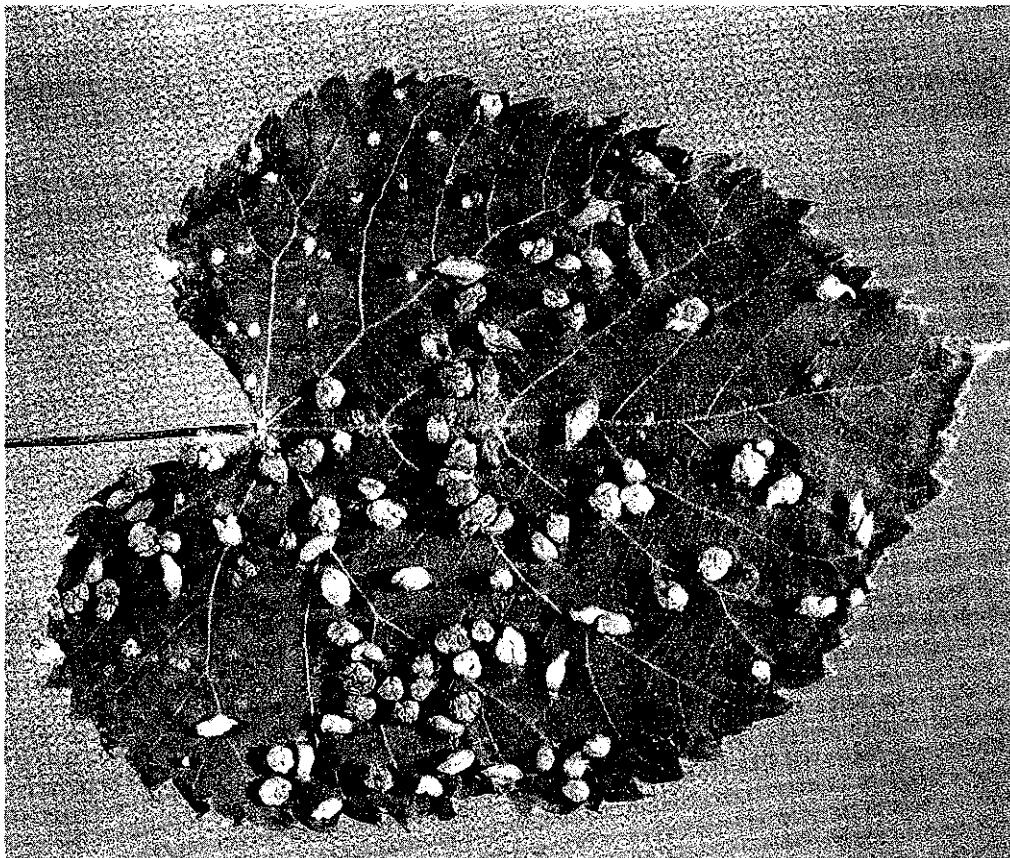
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196

Common insect and mite galls of the Canadian Prairies



H.R. Wong, J.C.E. Melvin, and A.M. Harper

COMMON INSECT AND MITE GALLS

OF THE CANADIAN PRAIRIES

BY

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ABSTRACT

Photographs of the more common galls and abnormal plant growths of the Canadian Prairies caused by insects and mites are presented. Galls are grouped according to plant hosts; dichotomous keys and references are supplied to enable the reader to obtain additional biological information on the species treated.

RESUME

Le lecteur trouvera dans ce rapport des photographies des galles et des excroissances anormales les plus communes observées sur les plantes des Prairies canadiennes et causées par les insectes et les mites. Les galles sont groupées selon la plante hôte; des clés dichotomiques et des références sont à la disposition du lecteur pour lui permettre d'obtenir plus de renseignements sur les espèces traitées.

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INTRODUCTION

Unsightly plant galls are of common occurrence in the Canadian Prairies. Some, such as the poplar bud gall mite, woolly elm aphid, and boxelder twig borer, are of considerable economic importance. They not only impair growth and vigor of trees and shrubs, but also mar their aesthetic value. Galls may be found on buds, stems, flowers, leaves, petioles, and even roots. Although these deformities may be caused by insects, mites, bacteria, fungi, and nematodes, we deal here only with those caused by insects and mites in the Canadian Prairies. The insect or mite stimulates the host plant to abnormally increase the number or size of the cells and thus provide it with both nutritious food and shelter. The ability to alter plant growth for their own benefit is shared by several widely different groups of insects such as wasps, sawflies, midges, beetles, moths, aphids, and scales. The different species of these insects show a preference for a specific host and a certain part of the host. They stimulate the host to produce a type and shape of gall that is characteristic of the insect or mite species.

There have been few attempts to identify the many galls and abnormal plant growths caused by insects and mites in the Canadian Prairies. The major works (Darlington 1968, Felt 1940, Hutchins 1969, Barnes 1948 and 1951) and minor works (Fisher 1964, Jacobs 1964) deal mainly with galls outside of this area; papers on prairie galls (Kolach 1968, Shorthouse 1973, and Harper 1975) indicate only a very limited number. Studies of galls on some hosts such as poplar (Harper 1959, 1966;

Alleyne and Morrison 1977) and rose (Olson 1964, Shorthouse 1973b) have been published, but these deal only with one group of insects and not others that also cause deformities on the same hosts.

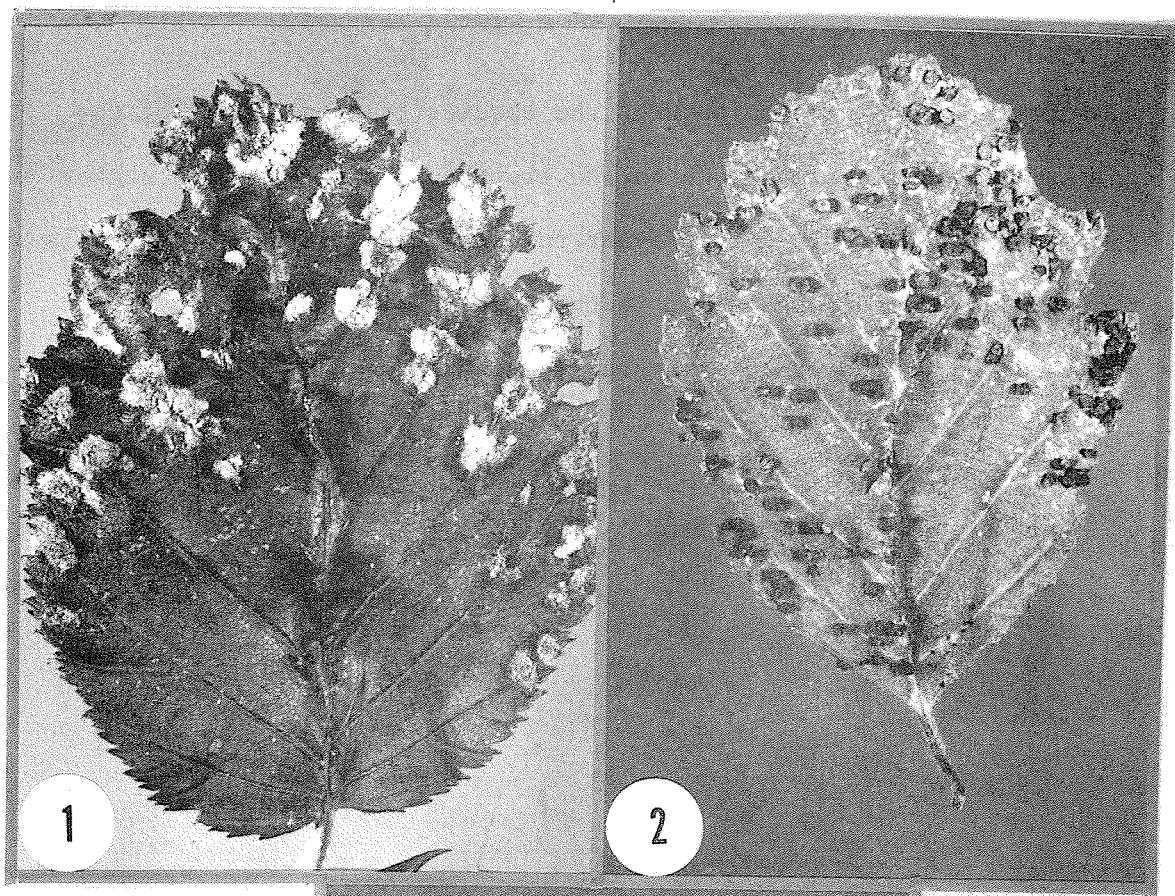
This is a pictorial attempt to assist in identifying some of the more common galls or abnormal plant growths in this area. It is based on laboratory rearings conducted during the last 10 years. The insect or mite causing the abnormal growth was reared in the Winnipeg, Edmonton, or Lethbridge laboratories, and the adults were sent to specialists for determination. The damage associated with each species was photographed and grouped according to host. The host, if unknown, can be identified in the case of trees by consulting Hosie (1969) and for wild plants, Budd and Best (1964).

Dichotomous keys to galls of the different hosts are presented to assist in their determination. These keys consist of couplets of opposing alternatives, one of which should lead to the identification of the gall. Each alternative gives either a number leading to the next couplet or the common and scientific name of the insect or mite causing the gall. The alternative leading to identification will also give a figure number of a photograph that shows the damage and list references to biological information on the species causing the gall.

This is an expanded and revised version of an earlier study (Wong *et al.* 1970). As in the earlier report, the objective is to aid in the recognition of the more common gall-makers in the Canadian Prairies and to supply references that will enable the reader to obtain

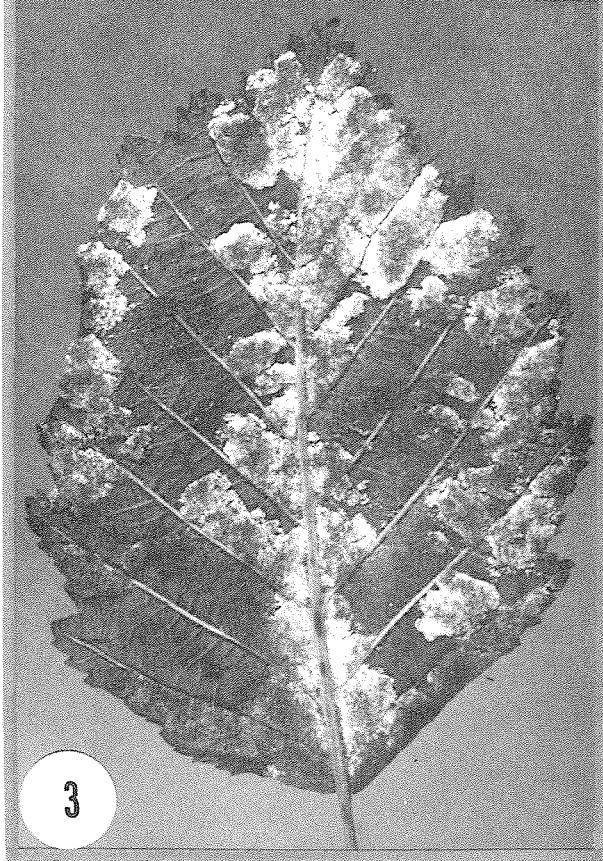
additional information on each of the species treated. Most of the galls cause negligible damage to the trees and if only few in number can be pruned and burned to prevent further infestation. Those galls that cause more serious damage to the host or are too numerous to prune can be controlled by a systemic insecticide.

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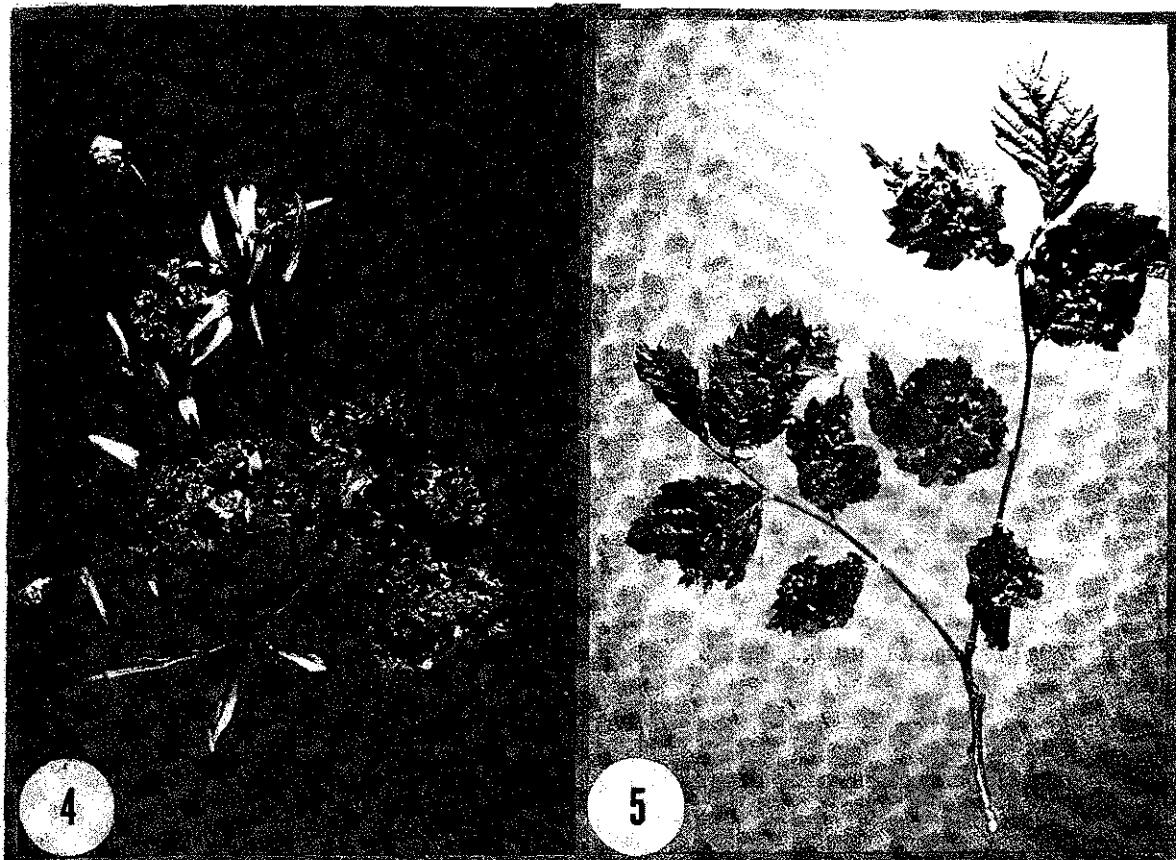
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Galls of Alder, *Alnus* spp.

1. Galls small subglobular, reddish brown in color on underside of leaf, mite (Fig. 2) (Reference 20) *Eriophyes* sp.
Galls patches of pile (Figs. 1, 3) 2
2. Galls small irregular patches of white to brownish pile on upper side of leaf, mite (Fig. 1) possibly *Tarsonemus* sp.
Galls larger irregular patches of yellowish to brownish pile on underside of leaf, mite (Fig. 3) (Reference 33)
..... *Phytoptus laevis* (Nalepa)

FIGS. 1-3. 1, Gall of a mite, possibly *Tarsonemus* sp. on alder leaf.
2, Gall of a mite, *Eriophyes* sp. on alder leaf. 3, Gall
of the mite, *Phytoptus laevis* on alder leaf.

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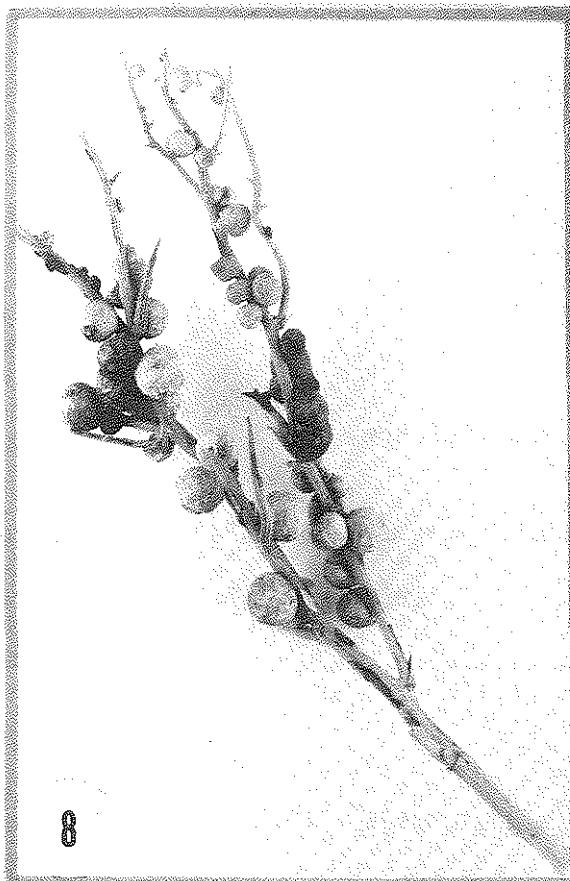
Galls of Ash, *Fraxinus* spp.

1. Galls lobulate flower masses, ash flower mite (Fig. 4) (References 20, 41, 43, 57) *Eriophyes fraxiniflora* Felt
- Galls of leaves (Figs. 6, 7) 2

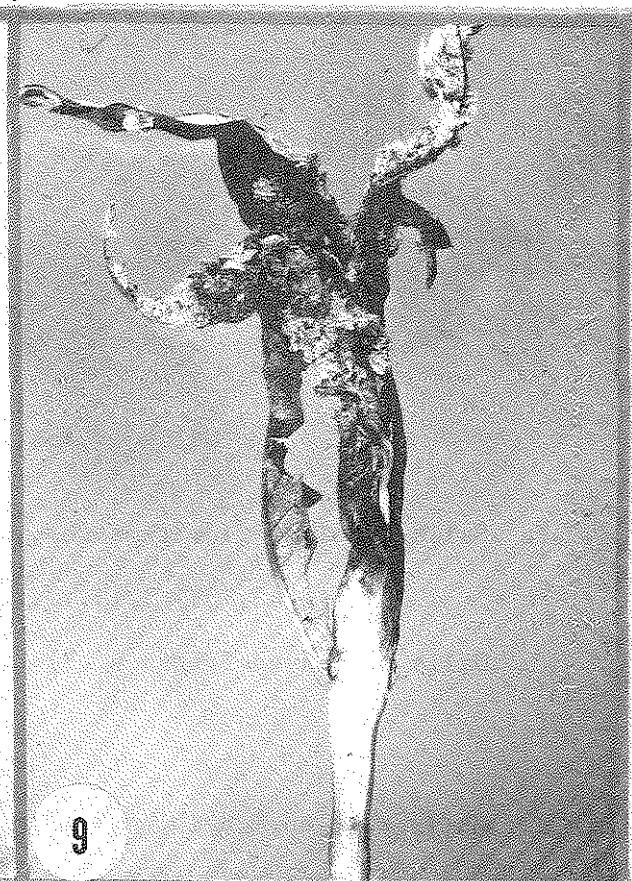
2. Galls swollen midrib, ash midrib gall, midge (Fig. 6) (References 20, 57) *Contarinia canadensis* Felt
- Galls small yellowish blisters on upper side of leaf, mite (Fig. 7)
(Reference 20) *Eriophyes* sp.

FIGS. 4-7. 4, Gall of the ash flower mite, *Eriophyes fraxiniflora* on ash flowers. 5, Gall of a mite, *Eriophyes* sp. on elm leaves. 6, Gall of the ash midrib gall, *Contarinia canadensis* on midrib of ash leaves. 7, Gall of a mite, *Eriophyes* sp. on ash leaves.

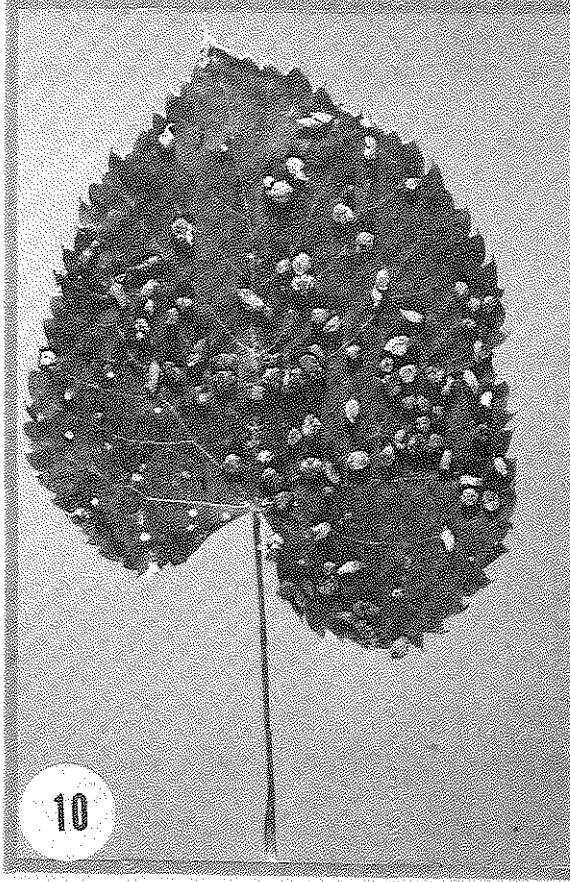
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Gall of Basswood, *Tilia americana* L.

Galls subglobular to elongate on upper surface of leaf, mite (Figs. 10, 11) (Reference 20) .. *Phytocoptella* possibly *abnormis* (Garman).

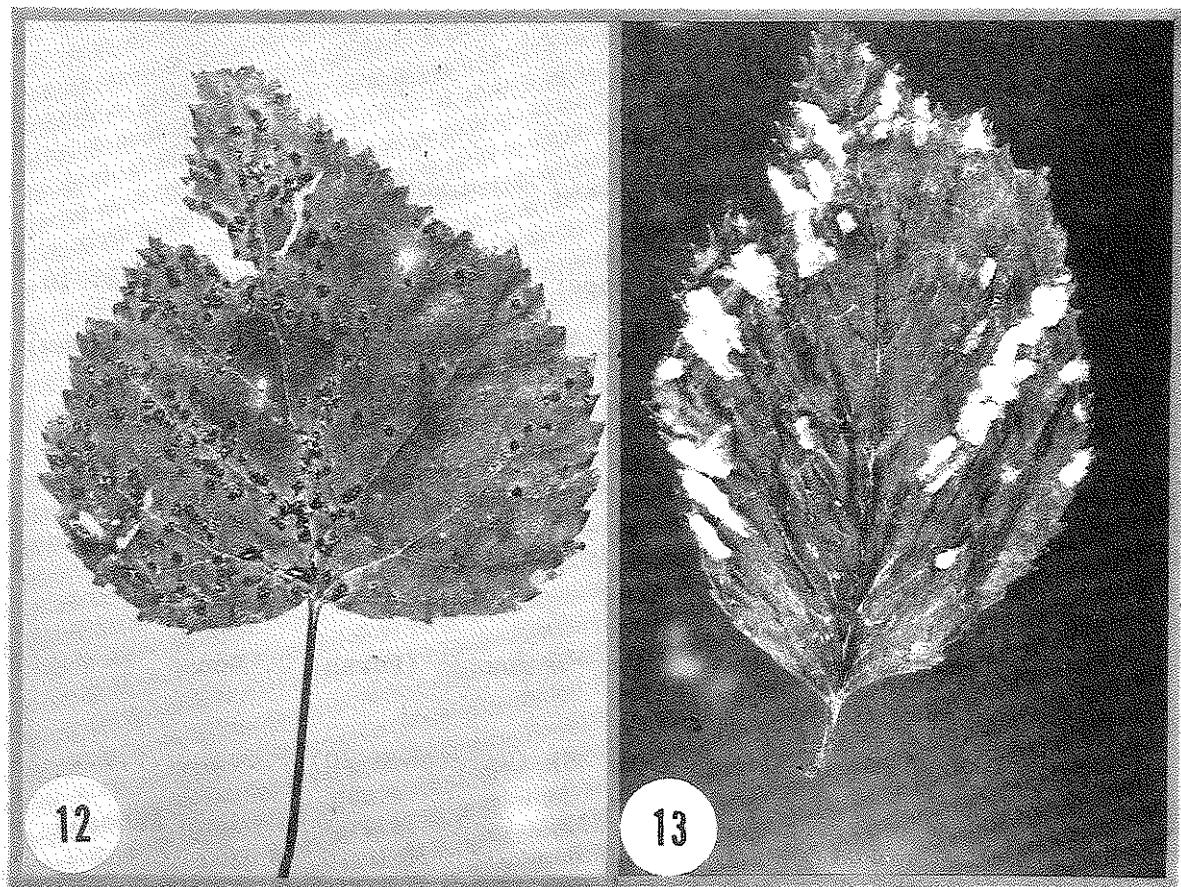
Gall of Skeletonweed, *Lygodesmia juncea* (Pursh) D. Don

Galls oval on stem, gall wasp (Fig. 8) (Reference 20)
..... *Antistrophus pisum* Ashmead

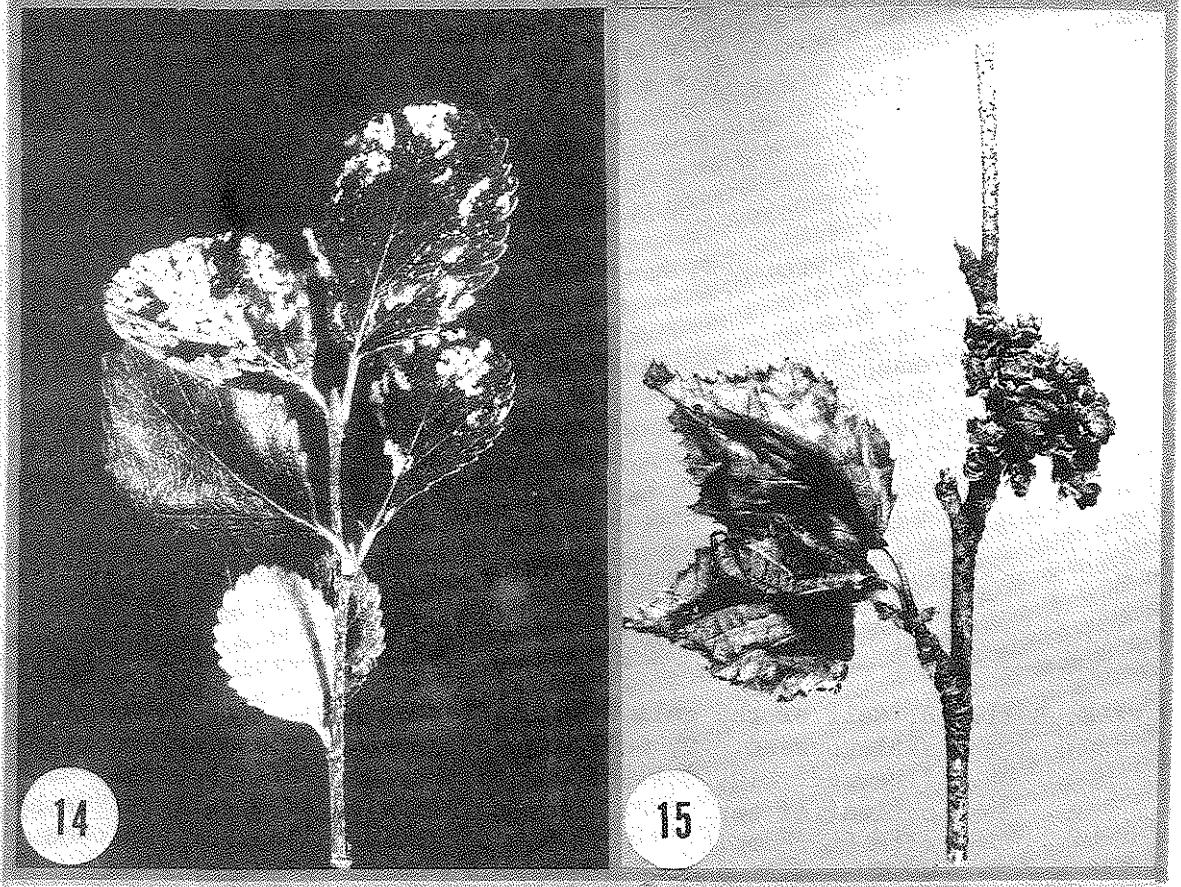
Gall of Fireweed, *Epilobium angustifolium* L.

Galls spindle-shaped on stem, midge (Fig. 9) (Reference 20)
..... *Lasioptera* sp.

FIGS. 8-11. 8, Gall of the gall wasp, *Antistrophus pisum* on stems of skeletonweed. 9, Gall of a midge, *Lasioptera* sp. on stem of fireweed. 10, Gall of a mite, *Phytocoptella* possibly *abnormis* on leaf of basswood. 11, Another view of a gall caused by a mite *Phytocoptella* possibly *abnormis* on leaf of basswood.



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Galls of Birch, *Betula* spp.

1. Galls formed by aborted buds or leaves, mite (Fig. 15) (Reference 20) *Eriophyes* sp.

Galls on fully developed leaves 2

2. Galls small brownish blisters, mite (Fig. 12) (Reference 33)

..... *Tyrophagus putrescentiae* (Schrank)

Galls irregular patches of pale yellowish pile on upper surface,
mite (Fig. 14) (Reference 20) *Eriophyes* sp.

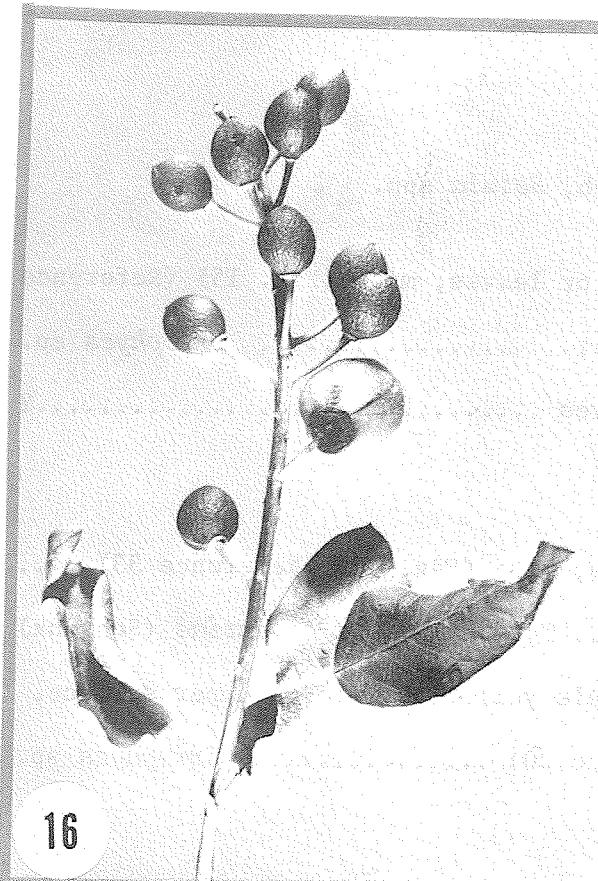
Gall of Hazel-nut, *Corylus cornuta* Marsh.

1. Galls irregular patches of pale yellowish pile on upper surface
of leaves, mite (Fig. 13) (Reference 20)

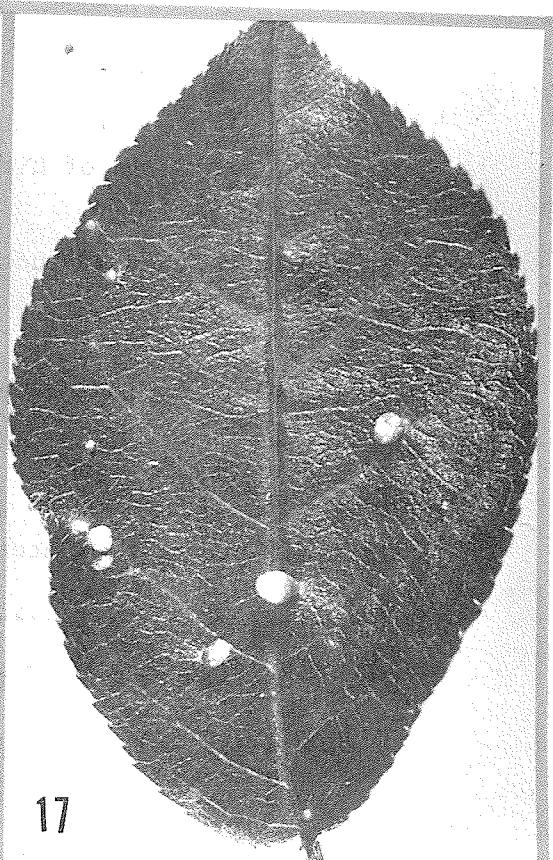
..... *Eriophyes* sp.

FIGS. 12-15. 12, Gall of the mite, *Tyrophagus putrescentiae* on leaf of birch. 13, Gall of a mite, *Eriophyes* sp. on leaf of hazel-nut. 14, Gall of a mite, *Eriophyes* sp. on leaf of birch. 15, Gall of a mite, *Eriophyes* sp. causing aborted buds on leaves of birch.

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Galls of Chokecherry, *Prunus virginiana* L.

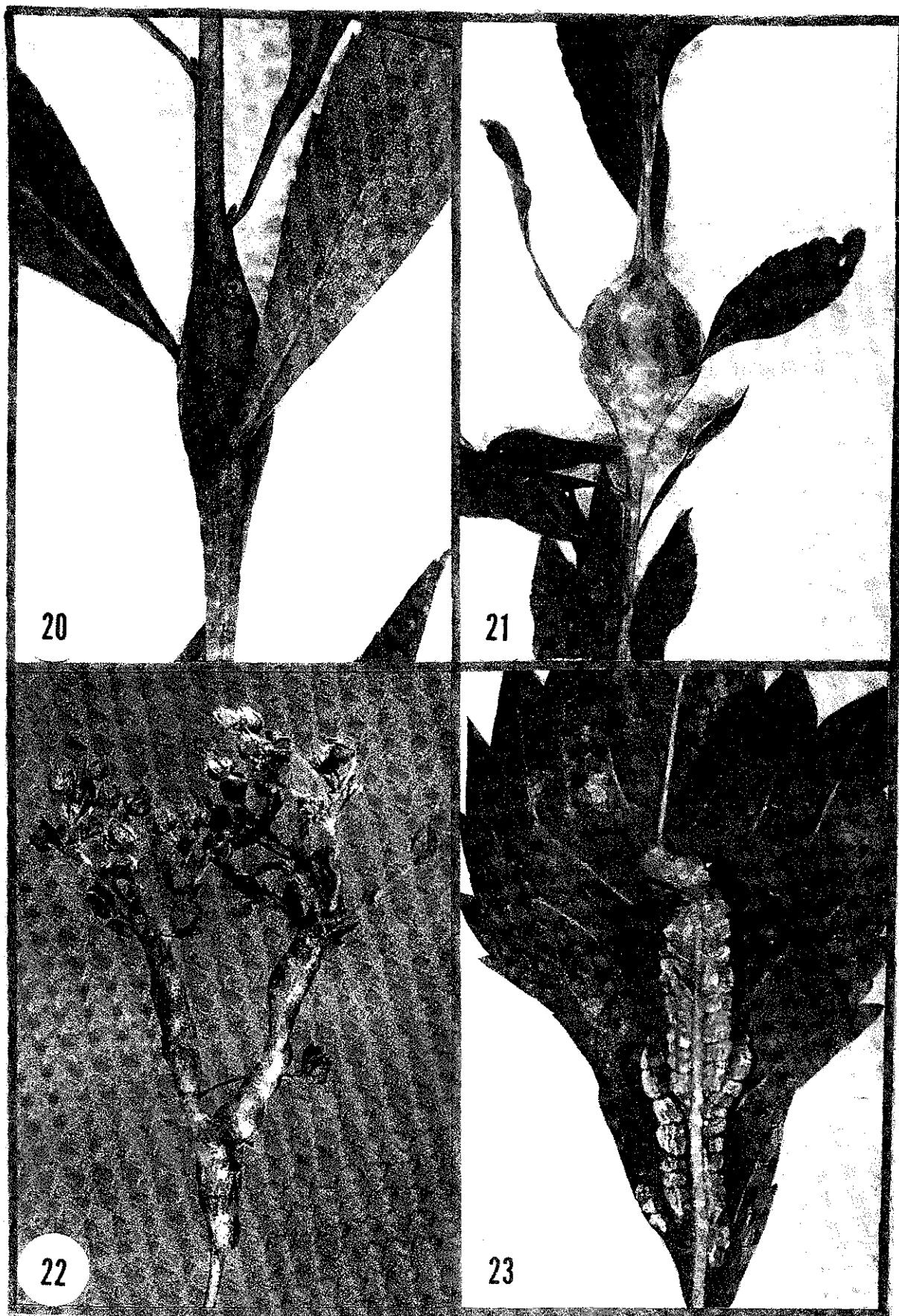
1. Galls formed by swollen deformed fruit, chokecherry midge (Fig. 16)
 - (References 2, 11, 20, 57)
 - *Contarinia virginianiae* (Felt)
- Galls of leaves and not fruit (Figs. 17, 18)

2. Galls spherical, jumping plant lice (Fig. 17) *Pachypsylla* sp.
 - Galls spindle- or fingerlike, mite (Fig. 18) (References 33, 57) ...
 - *Phytoptus emarginatae* (Keifer)

Gall of Hawthorn, *Crataegus* sp.

- Galls thickened elongate areas on leaf, midge (Fig. 19)
- *Lestodiplosis* sp.

FIGS. 16-19. 16, Gall of the chokecherry midge, *Contarinia virginianiae* causing deformed fruit of chokecherry. 17, Gall of a jumping plant lice, *Pachypsylla* sp. on leaf of chokecherry. 18, Gall of the mite, *Phytoptus emarginatae* on leaves of chokecherry. 19, Gall of a midge, *Lestodiplosis* sp. on leaf of hawthorn.



Galls of Goldenrod, *Solidago* spp.

Galls spindle-shaped on stem, elliptical goldenrod gall caterpillar

(Fig. 20) (Reference 20) *Gnorimoschema gallaesolidaginis*

Riley

Galls globose on stem, goldenrod ball gall fly (Fig. 21) (Reference 20)..

..... *Eurosta solidaginis* (Fitch)

Gall of White Cinquefoil, *Potentilla arguta* Pursh

Galls long and spindle-shaped on stem, gall wasp (Fig. 22) (Reference

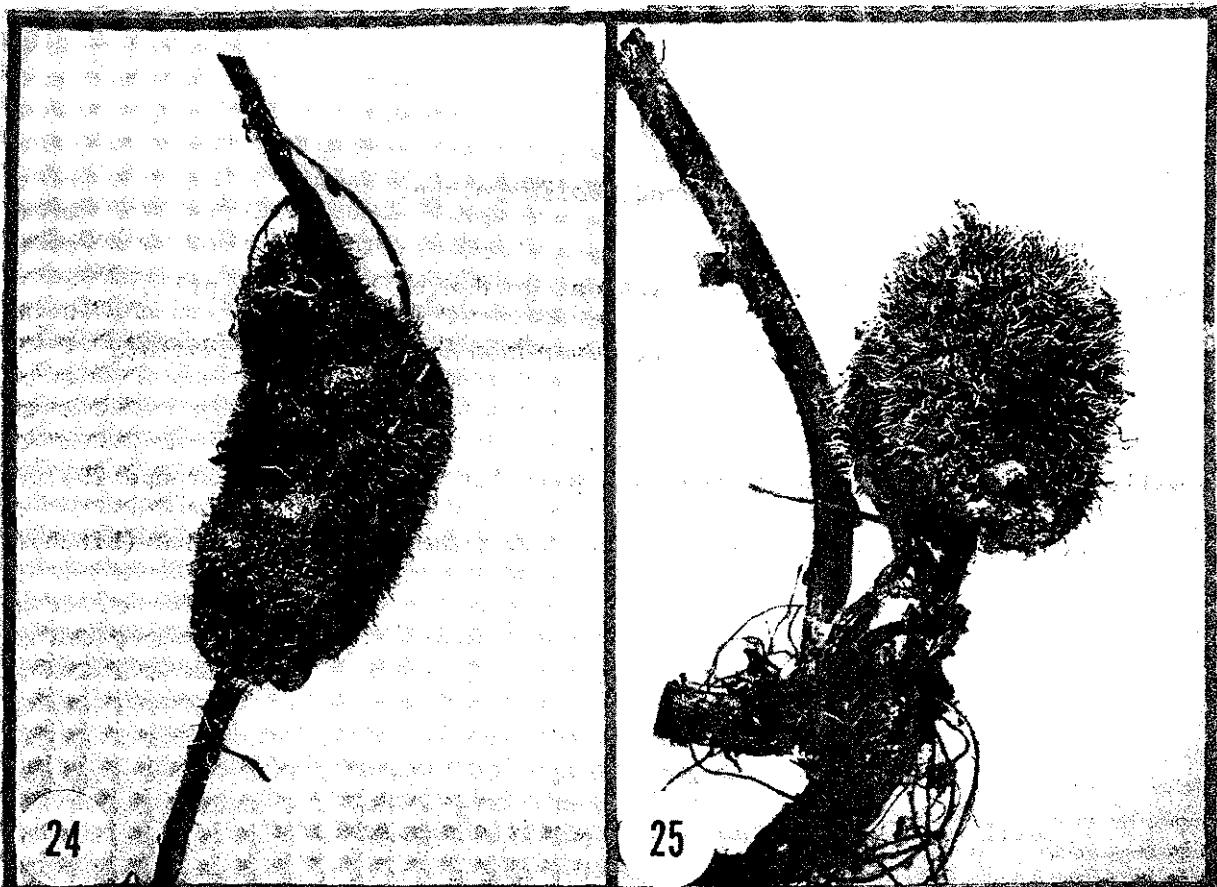
20) *Diastrophus* sp.

Gall of Virginia Creeper, *Parthenocissus* sp.

Galls swollen midrib of leaf, woodbine vein gall midge (Fig. 23) (References

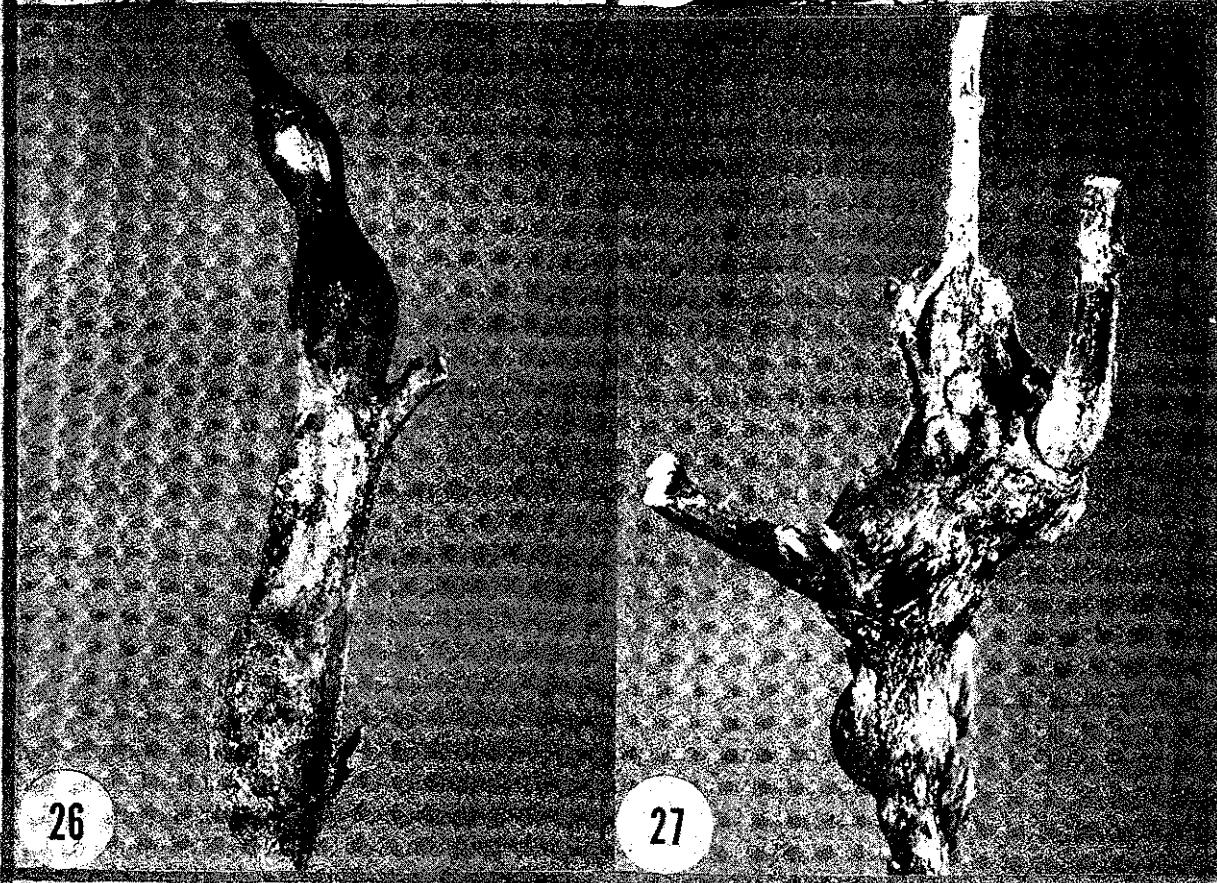
20, 56) *Dasineura parthenocissi* (Stebbins)

FIGS. 20-23. 20, Gall of the elliptical goldenrod caterpillar, *Gnorimoschema gallaesolidaginis* on stem of goldenrod. 21, Gall of the goldenrod ball gall fly, *Eurosta solidaginis* on stem of goldenrod. 22, Gall of a gall wasp, *Diastrophus* sp. on stem of cinquefoil. 23, Gall of the woodbine vein gall midge, *Dasineura parthenocissi* on midrib of leaf of virginia creeper.



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Galls of Raspberry, *Rubus* spp.

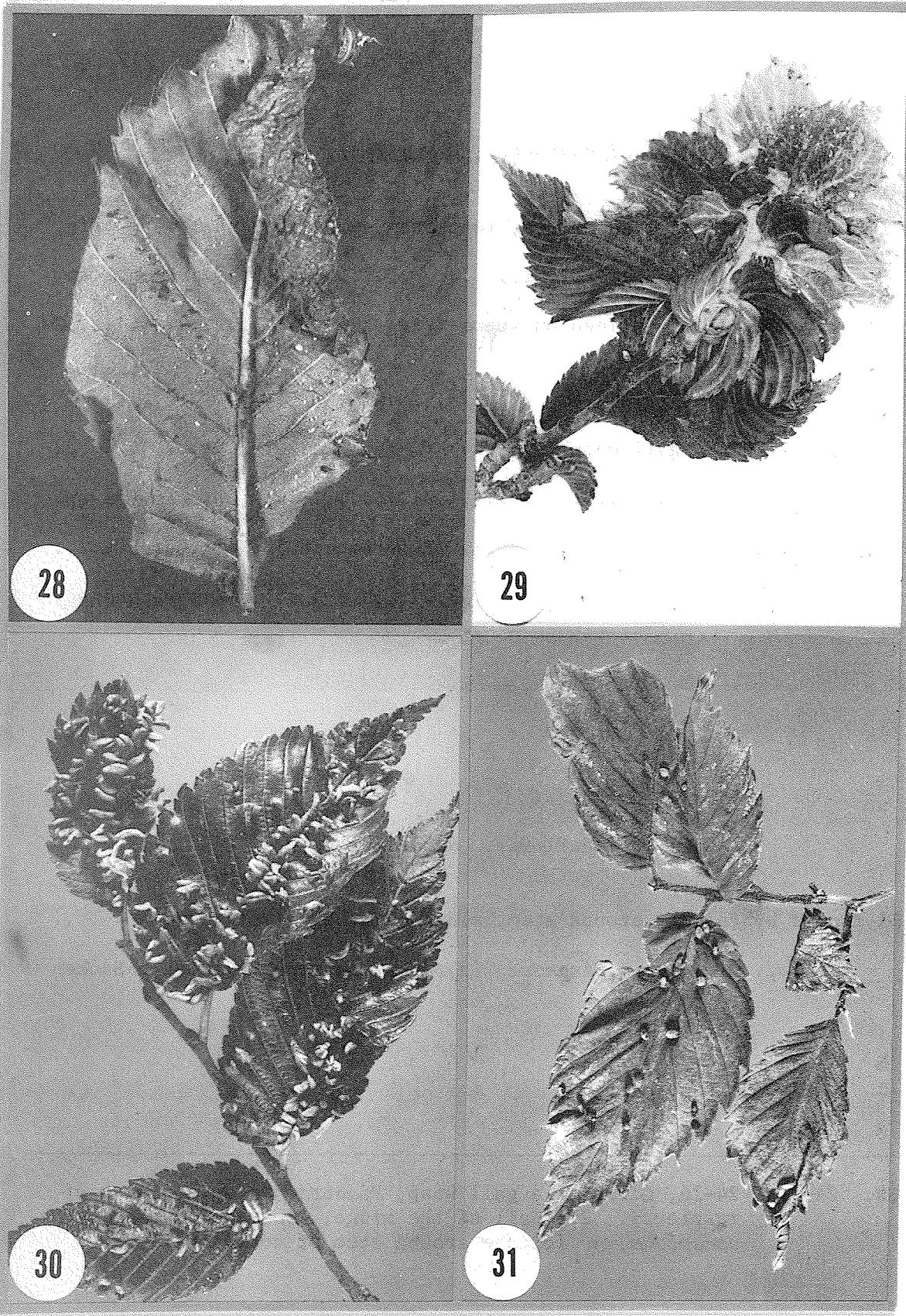
1. Galls not covered with spines, long stem swellings, gall wasp (Fig. 26) (Reference 20) *Diastrophus* sp.
- Galls covered with spines on stems (Figs. 24, 25) 2

2. Galls elongate, gall wasp (Fig. 24) (Reference 20)
- *Diastrophus* sp.
- Galls globose, gall wasp (Fig. 25) (Reference 20)
- *Diastrophus* sp.

Gall of Coneflower, *Rudbeckia* sp.

- Gall formed by foliage around stem, midge (Fig. 27) (Reference 46)
- *Asphondylia rudbeckiaeconspicua* Osten Sacken

FIGS. 24-27. 24-26, Galls of a gall wasp, *Diastrophus* sp. on stem of raspberry. 27, Gall of the midge, *Asphondylia rudbeckiaeconspicua* on foliage around stem of coneflower.



Galls of White Elm, *Ulmus americana* L.

1. Galls formed by the curling of the edges of a single leaf, woolly elm aphid (Fig. 28) (References 2, 11, 28)
..... *Eriosoma americanum* (Riley)

- Galls not formed by the curling of the edges of a leaf (Figs. 29-31) 2

2. Galls forming a rosette on terminal leaves, woolly apple aphid (Fig. 29) (References 2, 11, 28)
..... *Eriosoma lanigerum* (Hausmann)

- Galls not forming a rosette on terminal leaves (Figs. 30-31)..
..... 3

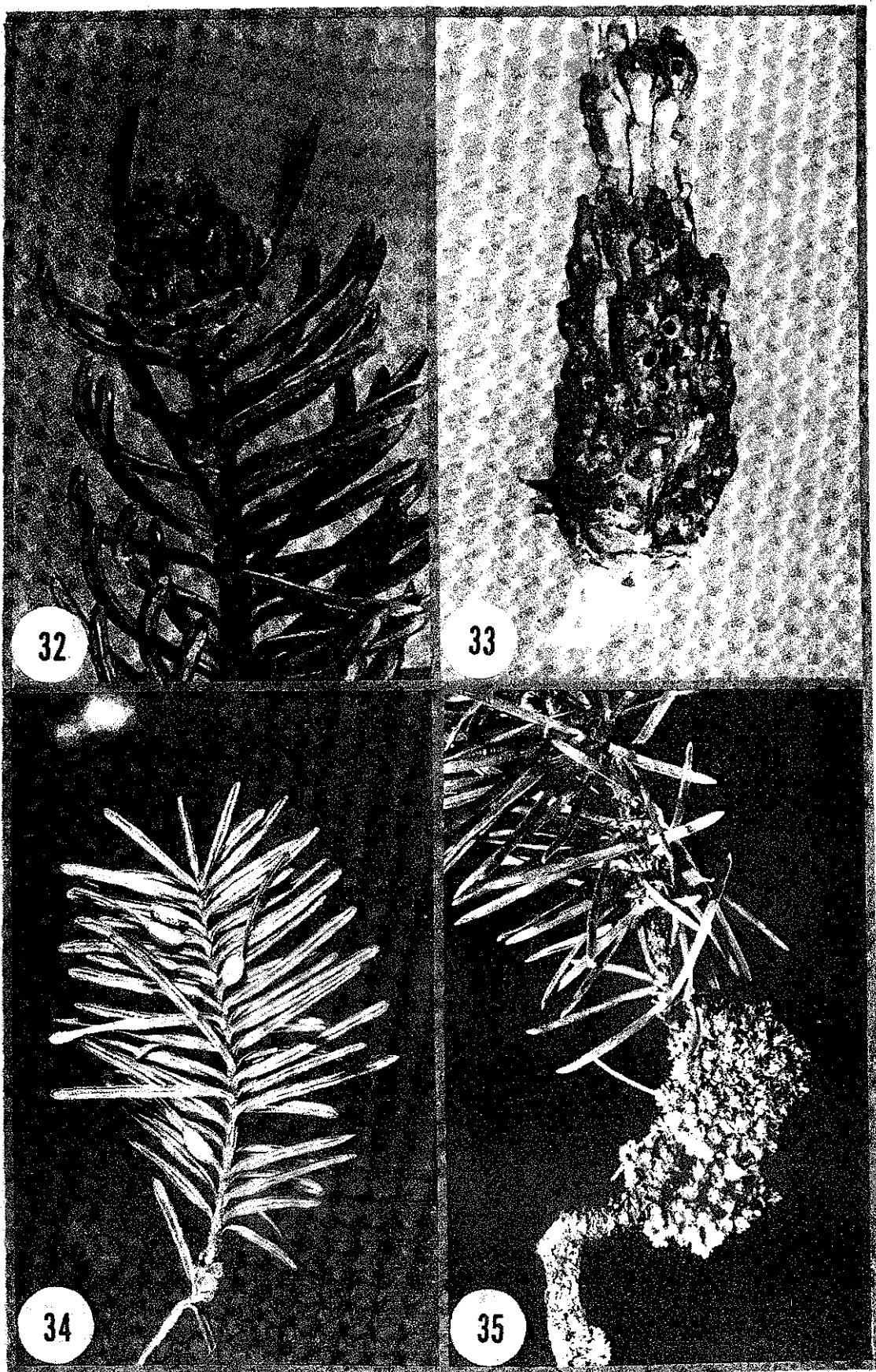
3. Galls spindle-shaped on upper side of leaf, elm leaf gall mite (Fig. 30) (Reference 57) *Aceria ulmicola* (Nalepa)

- Galls roughly globose on upper side of leaf, mite (Fig. 31) ..
..... *Eriophyes* sp.

Gall of an Elm, *Ulmus* sp.

- Galls pouchlike on upper surface of leaf, mite (Fig. 5) (References 20, 33) *Eriophyes* sp.

FIGS. 28-31. 28, Gall of the woolly elm aphid, *Eriosoma americanum* on leaf of elm. 29, Gall of the woolly apple aphid, *Eriosoma lanigerum* on leaves of elm. 30, Gall of the elm leaf gall mite, *Aceria ulmicola* on leaf of elm. 31, Gall of a mite, *Eriophyes* sp. on leaves of elm.



Gall of Balsam Fir, *Abies balsamea* (L.) Mill.

Galls elongate swelling near base of needle, balsam gall midge

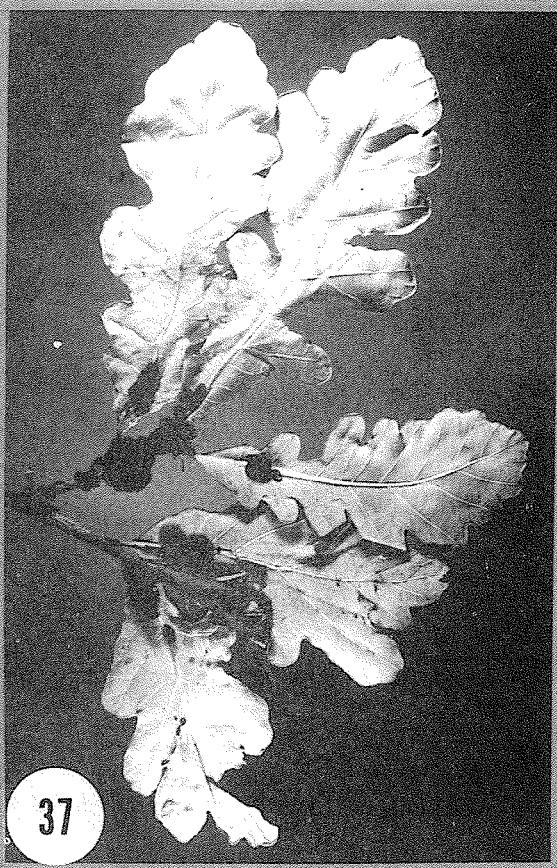
(Fig. 34) (References 2, 11, 20, 22, 58)

..... *Dasineura balsamicola* (Lintner)

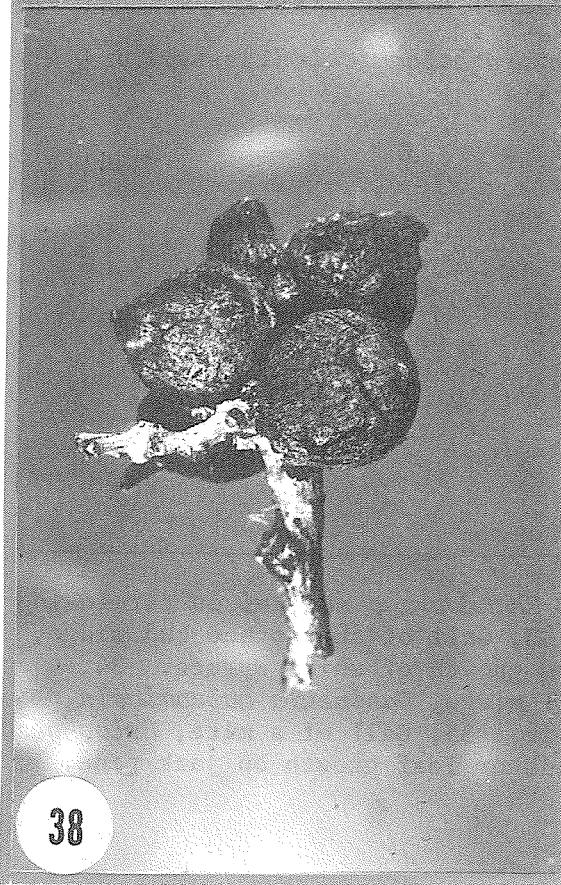
FIGS. 32-35. 32, Gall of the midge, *Rhabdophaga swainei* on terminal bud of white spruce. 33, Gall of the spruce bud midge, *Mayetiola piceae* on new growth of white spruce. 34, Gall of the balsam gall midge, *Dasineura balsamicola* on needles of balsam fir. 35, Gall of a mite, *Eriophyes* sp. causing aborted buds or leaf growth on jack pine.



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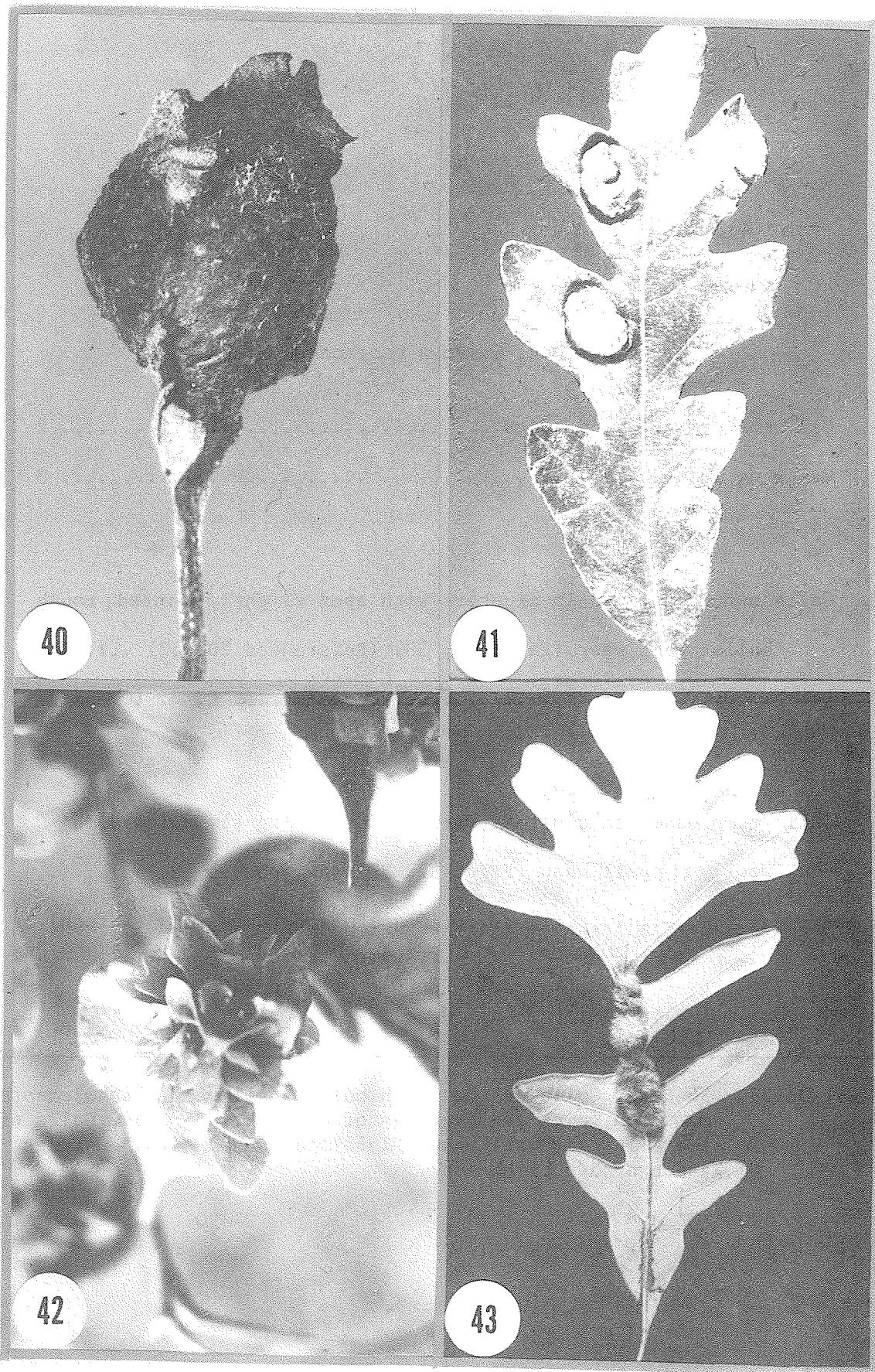
Galls of Bur Oak, *Quercus macrocarpa* Michx.

1. Galls on branches and twigs 2
Galls on leaf 3

2. Galls not compressed in clusters with apex slightly pointed, rough
bullet gall wasp (Figs. 36, 38) (References 20, 62)
..... *Disholcaspis mamma* (Cresson)

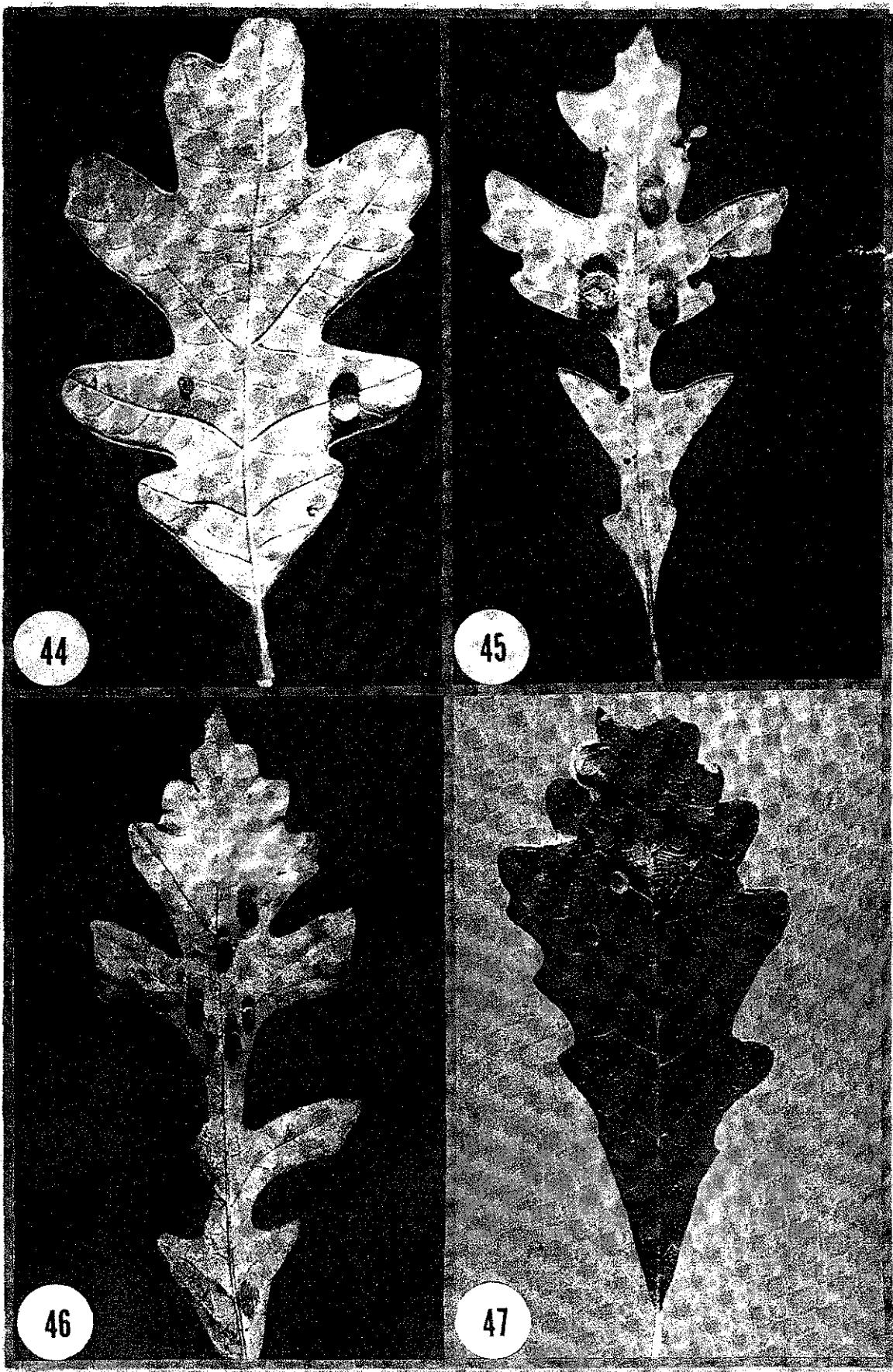
- Galls compressed in clusters with apex not slightly pointed,
woolly fig gall wasp (Figs. 37, 39) (References 20, 62)
..... *Disholcaspis spongiosa* (Karsch)

FIGS. 36-39. 36 & 38, Galls of the rough bullet gall wasp, *Disholcaspis mamma* on twigs and branches of bur oak. 37 & 39, Galls of the woolly fig gall wasp, *Disholcaspis spongiosa* on twigs and branches of bur oak.



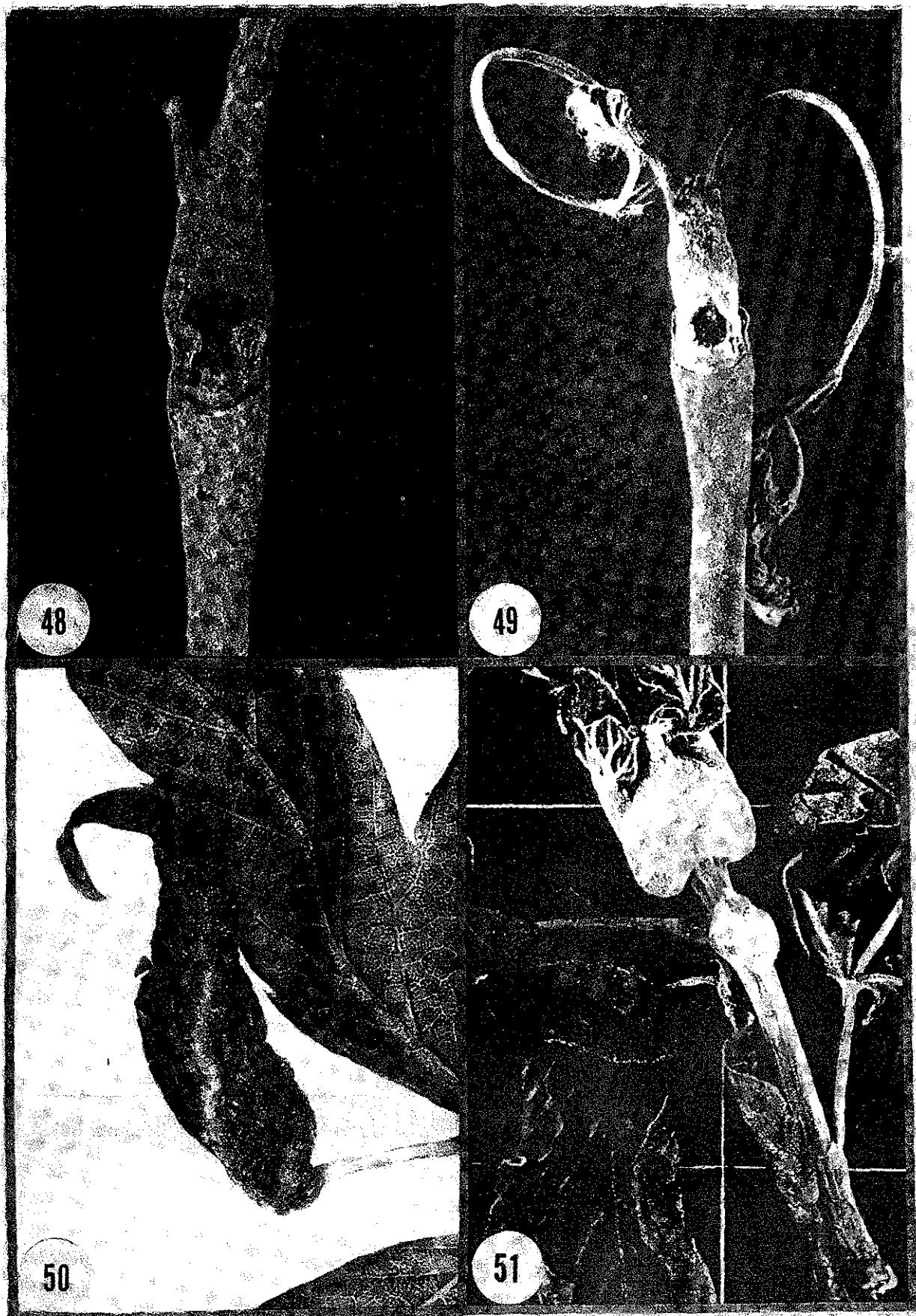
3. Galls on leaf stem or petiole, gall wasp (Fig. 40) (References 20, 62) *Andricus petiolicola* (Osten Sacken)
- Galls on leaf blade or lamina 4
4. Galls on midrib of leaf 5
- Galls not on midrib of leaf 6
5. Galls with rosette of leaflike rudiments on upper side of leaf, gall wasp (Fig. 42) (References 20, 62)
- *Andricus foliosus* Weld
- Galls densely covered with long bristlelike hairs on underside of leaf, hairy oak gall wasp (Fig. 43) (References 20, 62) ...
- *Acraspis villosa* Gillette
6. Galls oval, blisterlike swellings on upper side of leaf with dense brownish pubescence on underside of gall, mites (Fig. 41) (Reference 20) *Eriophyes* sp.
- Galls not blisterlike but globose or oval in shape 7

FIGS. 40-43. 40, Gall of the gall wasp, *Andricus petiolicola* on leaf stem of bur oak. 41, Gall of a mite, *Eriophyes* sp. on leaf of bur oak. 42, Gall of the gall wasp, *Andricus foliosus* on leaf of bur oak. 43, Gall of the hairy oak gall wasp, *Acraspis villosa* on leaf of bur oak.



7. Galls oval, flattened on top on upper side of leaf, gall wasp (Fig. 47) (References 20, 62) *Neuroterus* sp.
- Galls globose in shape on underside of leaf 8
8. Galls smooth and covered with woolly fibers, gall wasp (Fig. 45) (References 20, 62) *Neuroterus* sp.
- Galls rough with surface faceted, gall wasp (Figs. 44, 46) (References 20, 62) *Neuroterus* sp.

FIGS. 44-47. Galls of gall wasps, *Neuroterus* spp. on leaves of bur oak.



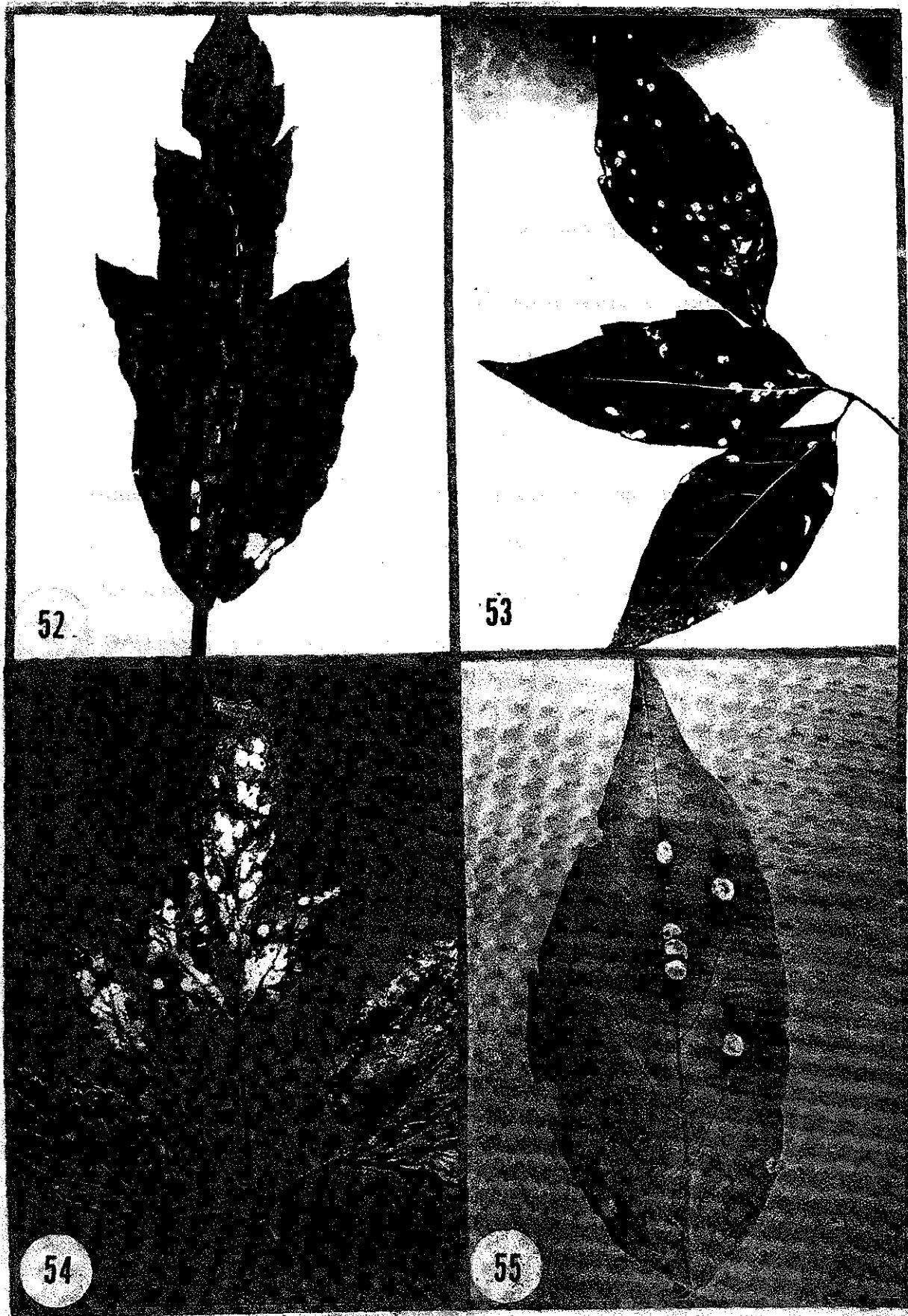
Galls of Manitoba Maple, *Acer negundo* L.

1. Galls swollen terminal buds, box elder bud gall midge, (Fig. 51)
 (Reference 20) *Cecidomyia negundinis* Gillette
 Galls of twig and leaves 2

2. Galls spindle-shaped swelling of new twig, box elder twig borer
 (Figs. 48, 49) (References 2, 11, 48)
 *Proteoteras willingana* (Kearfott)
 Galls of leaves 3

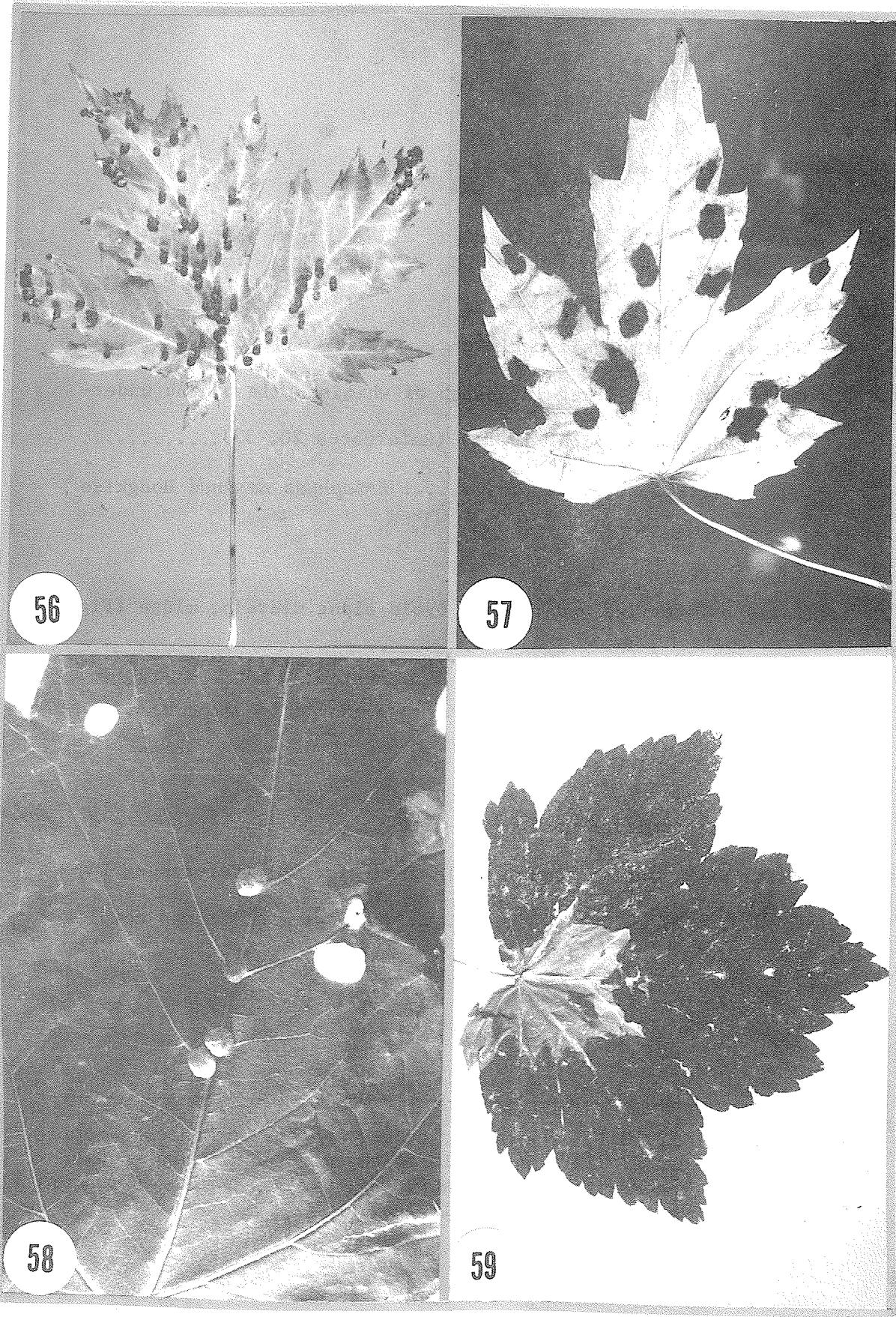
3. Galls swollen long fleshy leaves, box elder leaf gall midge (Fig. 50)
 (References 2, 11, 28, 63) *Contarinia negundifolia* Felt
 Galls not swollen fleshy leaves 4

FIGS. 48-51. 48 & 49, Galls of the box elder twig borer, *Proteoteras willingana* on new twig of Manitoba maple. 50, Gall of the box elder leaf gall midge, *Contarinia negundifolia* on Manitoba maple leaf. 51, Gall of the box elder bud gall midge, *Cecidomyia negundinis* on Manitoba maple leaf.



4. Galls globular or blisterlike 5
- Galls formed by irregular patch of whitish pile on the under-
side, mite (Figs. 53, 54) (References 20, 33)
..... *Eriophyes negundi* Hodgkiss
5. Galls blisterlike and roughly ovoid along midvein, midge (Fig.
52) (Reference 20) *Lasioptera* sp.
- Galls globular along veins 6
6. Galls with whitish leaf pile, mite (Fig. 55) ... *Eriophyes* sp.
- Galls pink, maple bladder gall mite (Fig. 58) (References 28,
33, 43) *Vasates quadripedes* complex

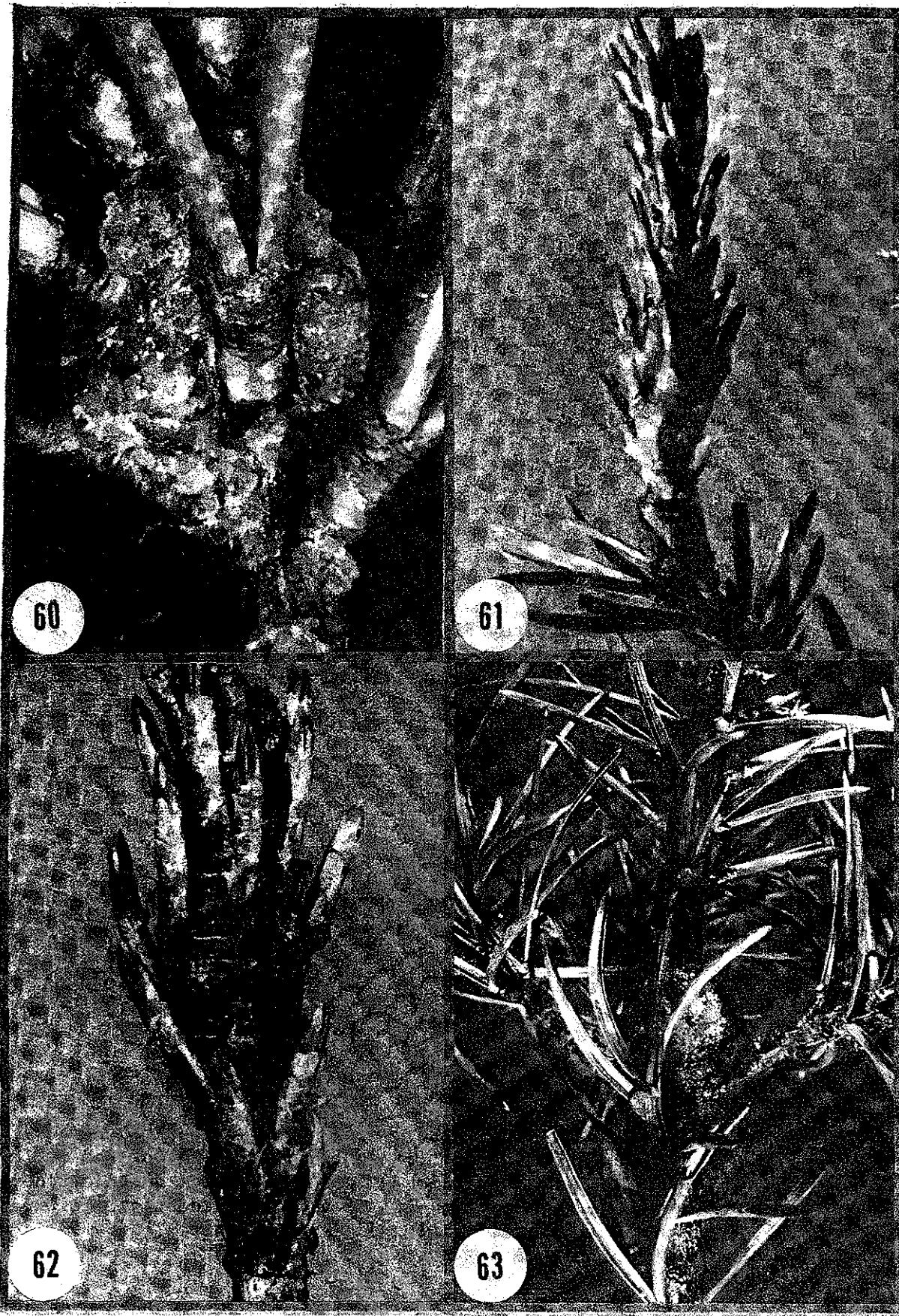
FIGS. 52-55. 52, Gall of a midge, *Lasioptera* sp. on Manitoba maple
leaf. 53 & 54, Galls of the mite, *Eriophyes negundi*
on Manitoba maple leaf. 55, Gall of a mite, *Eriophyes*
sp. on Manitoba maple leaf.



Galls of Other Maples, *Acer* spp.

1. Galls globular, pink or reddish in color on upper side of leaf and in irregular reddish patches of pile on underside of leaf, maple bladder gall mite (Figs. 56, 57) (References 28, 33) ..
..... *Vasates quadripedes* complex
- Galls not globular, reddish pile over most of the upper side of leaf and no galls on the underside of leaf, mite (Fig. 59)
..... *Eriophyes* sp.

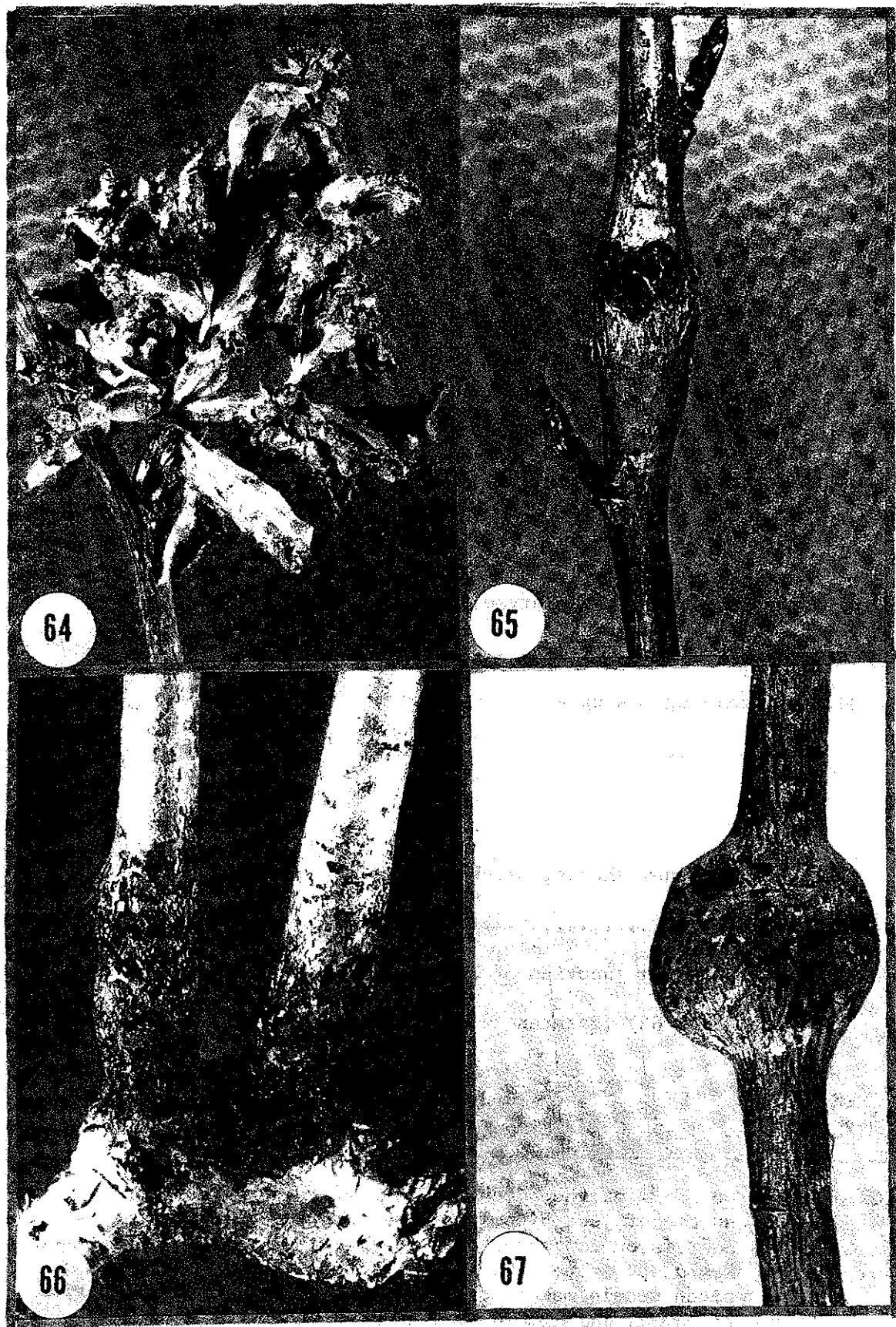
FIGS. 56-59. 56, Gall of a maple bladder gall mite, *Vasates quadripedes* complex on upper side of maple leaf. 57, Gall of the maple bladder gall mite, *Vasates quadripedes* Shimer on underside of red maple leaf. 58, Gall of a maple bladder gall mite, *Vasates quadripedes* complex on Manitoba maple leaf. 59, Gall of a mite, *Eriophyes* sp. on maple leaf.



Galls of Jack Pine, *Pinus banksiana* Lamb.

1. Galls formed by aborted buds or leaf growth, mite (Fig. 35) (Reference 20) *Eriophyes* sp.
- Galls not formed by aborted buds or leaf growth 2
2. Galls formed by swollen new shoots (Figs. 61, 62) 3
 - Galls formed by pitch (Fig. 60, 63) 4
3. Galls containing several larvae, chalcid (Fig. 61) (References 59, 66) *Eurytoma calycis* Bugbee
 - Galls containing a single larva, sawfly (Fig. 62) (Reference 66)...
 - *Xyela* sp.
4. Galls small on new shoots, pitch midge (Fig. 60) (Reference 49) ...
 - *Cecidomyia reeksi* Vockeroth
 - Galls not small, at junction of branches and stem, pitch nodule maker moth (Fig. 63) (Reference 60) *Petrova albicapitana* (Busck)

FIGS. 60-63. 60, Gall of the pitch midge, *Cecidomyia reeksi* on new shoots of jack pine. 61, Gall of the chalcid, *Eurytoma calycis* on new shoot of jack pine. 62, Gall of a sawfly, *Xyela* sp. on new shoot of jack pine. 63, Gall of the pitch nodule maker moth, *Petrova albicapitana* at junction of branch and stem of jack pine.



Galls of Poplar, *Populus* spp.

1. Galls on stem or attached to stem or twig 2
 - Galls on twigs, petioles, or leaves 7

2. Galls on stem 3
 - Galls attached to stem or twig 5

3. Galls at junction of root and stem of regeneration poplars, poplar borer (Fig. 66) (References 17, 67) ... *Saperda calcarata* Say
 - Galls not at junction of root and stem of regeneration poplar .. 4

4. Galls slightly flattened and spindle-shaped, longhorned beetle (Fig. 65) (References 18, 68, 70) ... *Saperda populnea moesta* Le Conte
 - Galls not slightly flattened, oval in shape, fly (Fig. 67) (Reference 20) *Melanagromyza* sp.

FIGS. 64-67. 64, Gall of a mite, *Aceria* sp. nr. *dispar* (Nalepa) at apex of trembling aspen twig. 65, Gall of the longhorned beetle, *Saperda populnea moesta* on balsam poplar stem. 66, Gall of the poplar borer, *Saperda calcarata* at junction of stem and root of trembling aspen. 67, Gall of a fly, *Melanagromyza* sp. on trembling aspen stem.

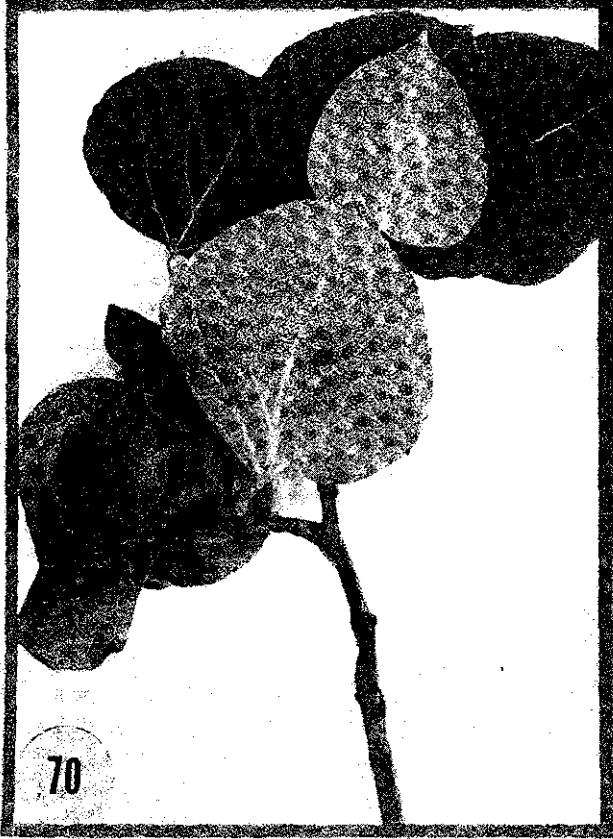
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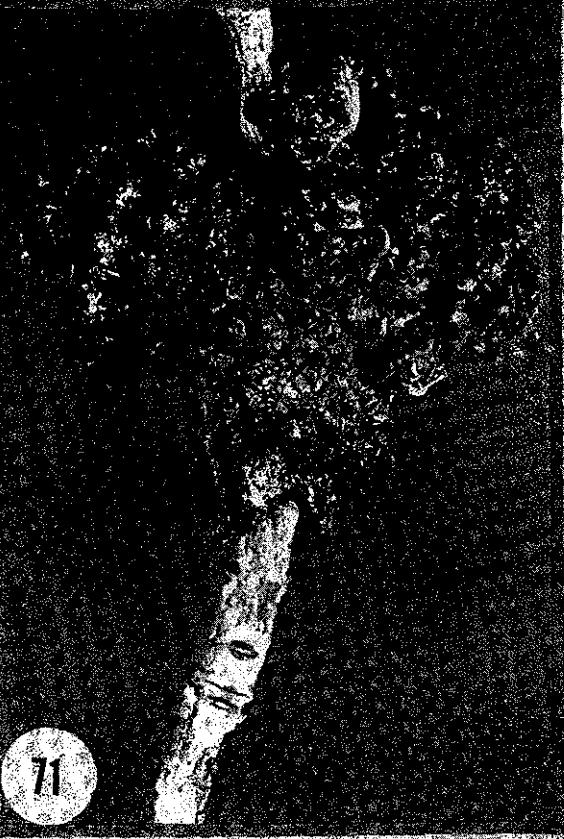
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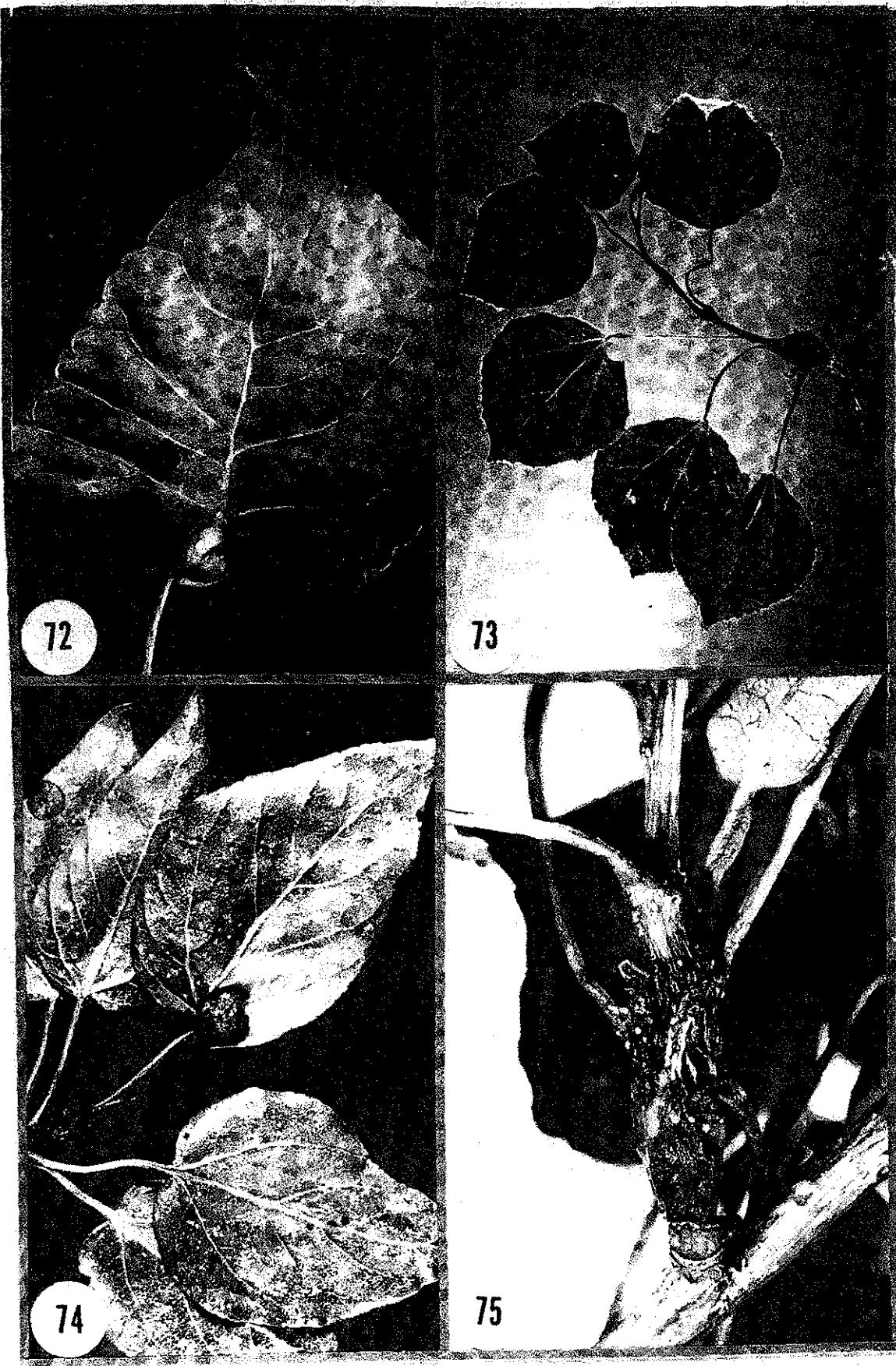
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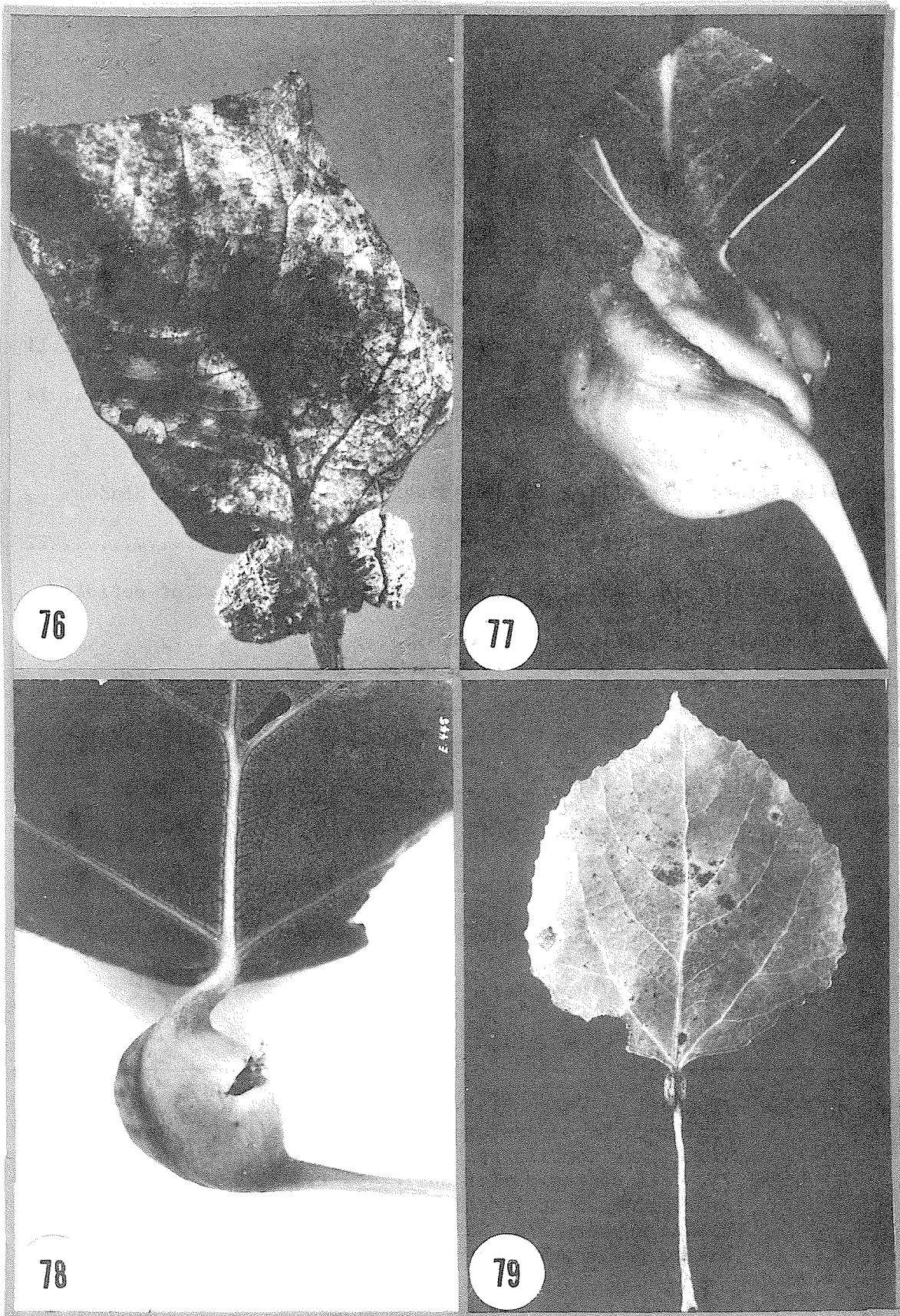
5. Galls with extensive convolutions and ridges at apices of stem,
 poplar vagabond aphid (Fig. 68) (References 24, 30, 31,
 54) *Mordwilkoja vagabunda* (Walsh)
- Galls without extensive convolutions and ridges 6
6. Galls woody in appearance along stem, poplar bud gall mite (Fig.
 71) (References 7, 33, 36) *Aceria parapopuli* Keifer
- Galls of deformed leaves with rolled edges forming ball-like
 clusters at apices of stem or twigs, mite (Fig. 64) (Refer-
 ence 39) *Aceria* sp. nr. *dispar* (Nalepa)
7. Galls on twigs 8
- Galls on petioles and (or) leaves 10
8. Galls round or globular, poplar twig gall aphid (Fig. 69) (Refer-
 ences 24, 47) *Pemphigus populiramulorum* Riley
- Galls elongate or appear tapered 9

FIGS. 68-71. 68, Gall of the poplar vagabond aphid, *Mordwilkoja vagabunda* at apex of eastern cottonwood stem. 69, Gall of the poplar twig gall aphid, *Pemphigus populiramulorum* on plains cottonwood twig. 70, Gall of the aspen leaf-pocket aphid, *Pachypappa sacculi* on trembling aspen leaves. 71, Gall of the poplar bud gall mite, *Aceria parapopuli* on trembling aspen leaves.



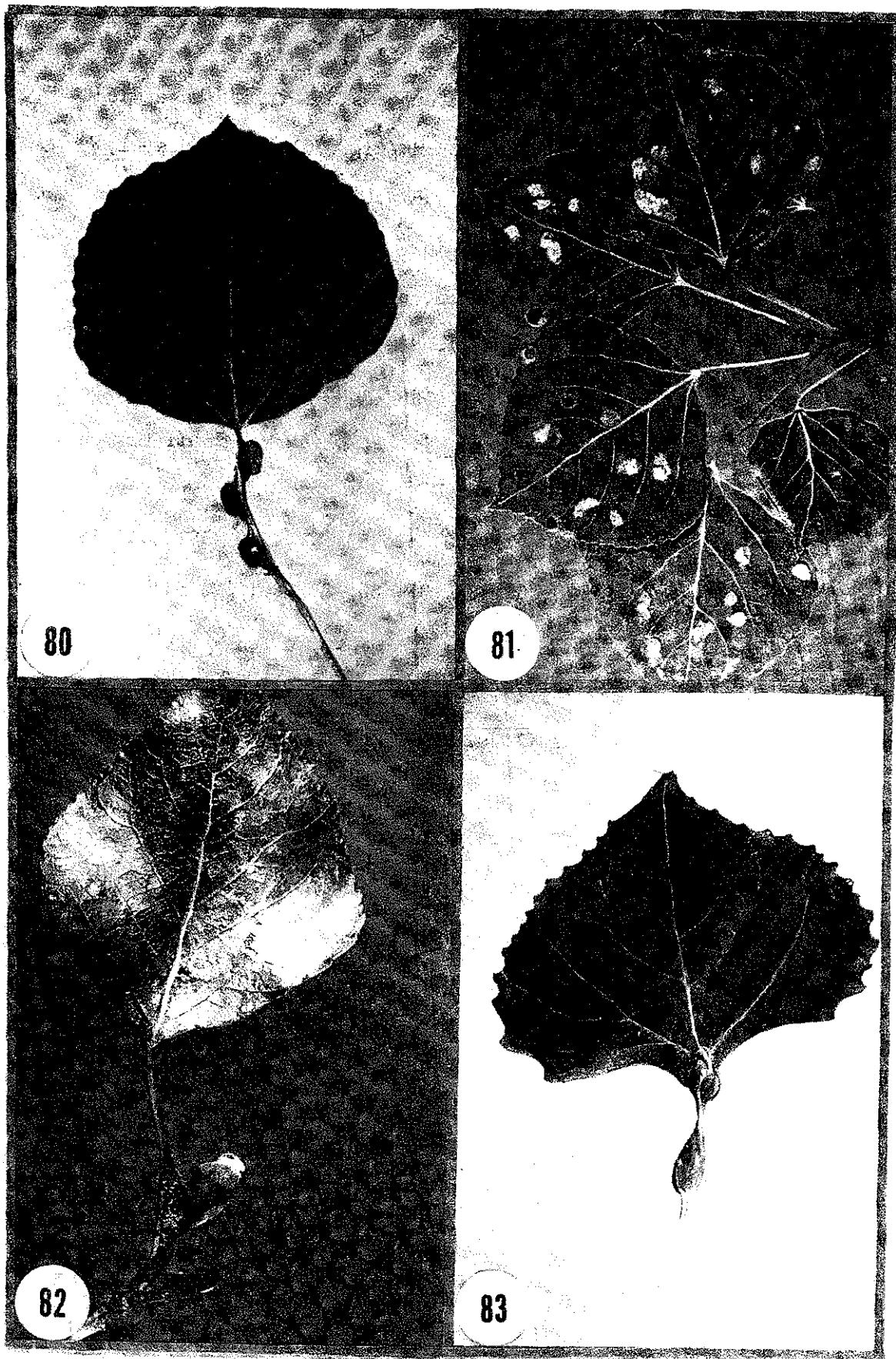
9. Gall at base, midge (Fig. 73) Cecidomyiid sp.
- Gall near center of short shoot, gall wasp (Fig. 75) ... Cynipid sp.
10. Galls formed at junction of leaf blade and petiole 11
- Galls on leaf or petiole 14
11. Galls formed by swelling and twisting of petiole and leaf blade
 (Figs. 72, 74, 83) 12
- Galls formed by swelling of base of leaf blade or apex of petiole
 (Figs. 76, 77) 13
12. Galls with a slit for exit hole, poplar bullet gall aphid, (Fig. 74)
 (References 1, 24, 47) *Pemphigus populiniglobuli* Fitch
- Galls with small round exit hole, poplar leaf-petiole gall aphid
 (Figs. 72, 83) (References 1, 24, 47)
 *Pemphigus populicaulis* Fitch

FIGS. 72-75. 72, Gall of the poplar leaf-petiole gall aphid, *Pemphigus populicaulis* on eastern cottonwood leaf. 73, Gall of a midge, Cecidomyiid sp. at base of trembling aspen twig. 74, Gall of the poplar bullet gall aphid, *Pemphigus populiniglobuli* at junction of leaf blade and petiole of balsam poplar. 75, Gall of a gall wasp, Cynipid sp. on balsam poplar short shoot.



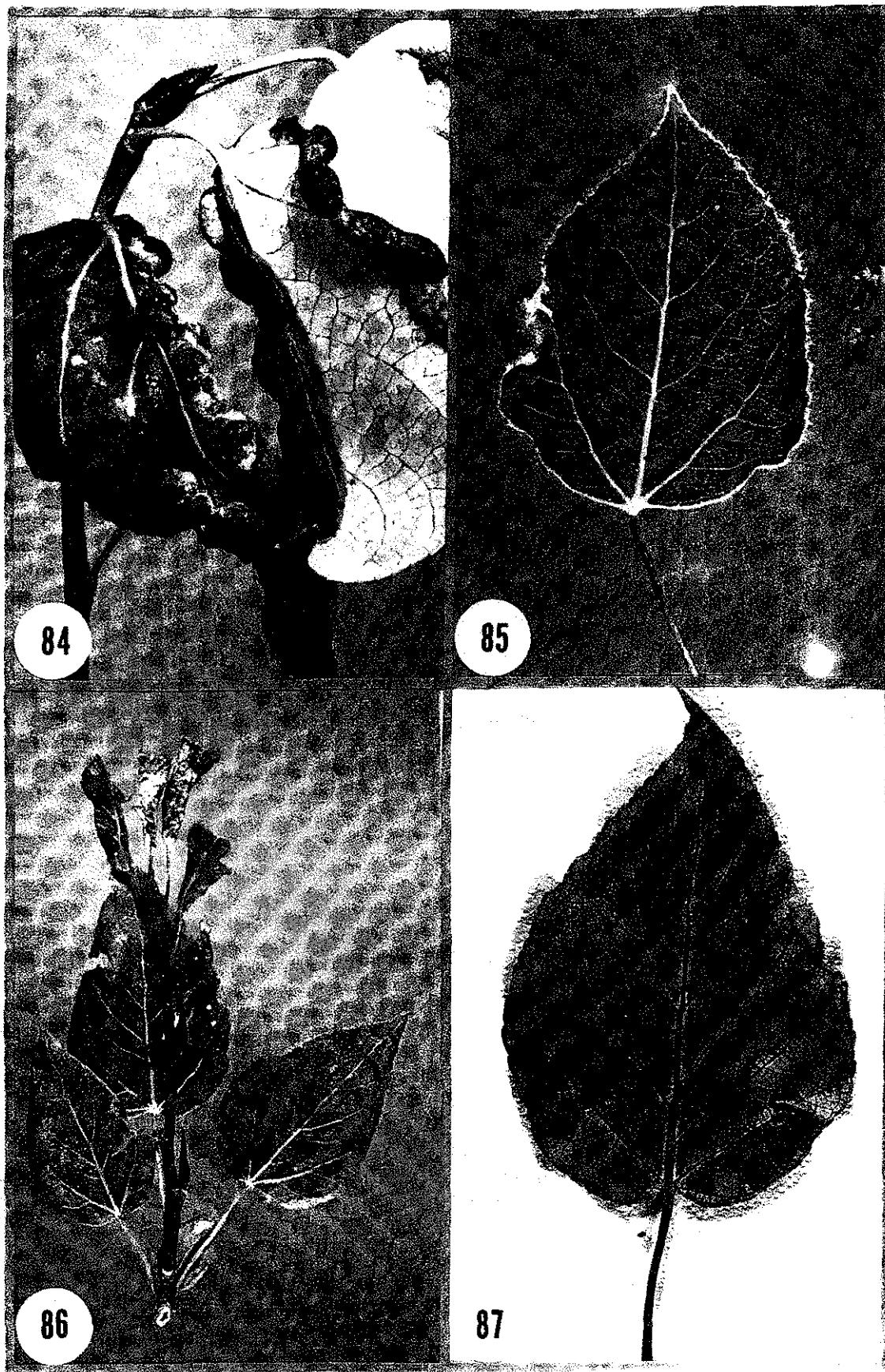
13. Galls formed mostly by swelling on upper side of leaf base with petiole, exit hole a slit, aphid (Fig. 76) (References 1, 47) *Pemphigus monophagus* Maxson
- Galls formed mostly of swollen petiole twisted on broadened leaf base, exit hole a long crevice, poplar petiole-leaf gall aphid (Fig. 77) (References 1, 23, 24, 47)
- *Pemphigus junctisensoriatus* Maxson
- *Pemphigus nortonii* Maxson
14. Galls on petiole (Figs. 78, 79, 80, 82, 83) 15
- Galls on leaves (Figs. 70, 81, 84, 85, 86, 87, 88, 89, 91) .. 18
15. Galls spherical (Figs. 78, 79, 83) 16
- Galls purse- or flasklike (Figs. 80, 82) 17
16. Galls ribbed, ribbed petiole gall caterpillar (Fig. 79) (References 2, 11, 20) *Ectoedemia populella* (Busck)
- Galls not ribbed with a transverse slit, poplar leaf-stem gall aphid (Figs. 78, 83) (References 1, 24, 47)
- *Pemphigus populitransversus* Riley

FIGS. 76-79. 76, Gall of the aphid, *Pemphigus monophagus* on eastern cottonwood leaf. 77, Gall of the poplar petiole-leaf gall aphid, *Pemphigus junctisensoriatus* on eastern cottonwood leaf. 78, Gall of the poplar leaf-stem gall aphid, *Pemphigus populitransversus* on petiole of plains cottonwood leaf. 79, Gall of the ribbed petiole gall caterpillar, *Ectoedemia populella* on petiole of trembling aspen.



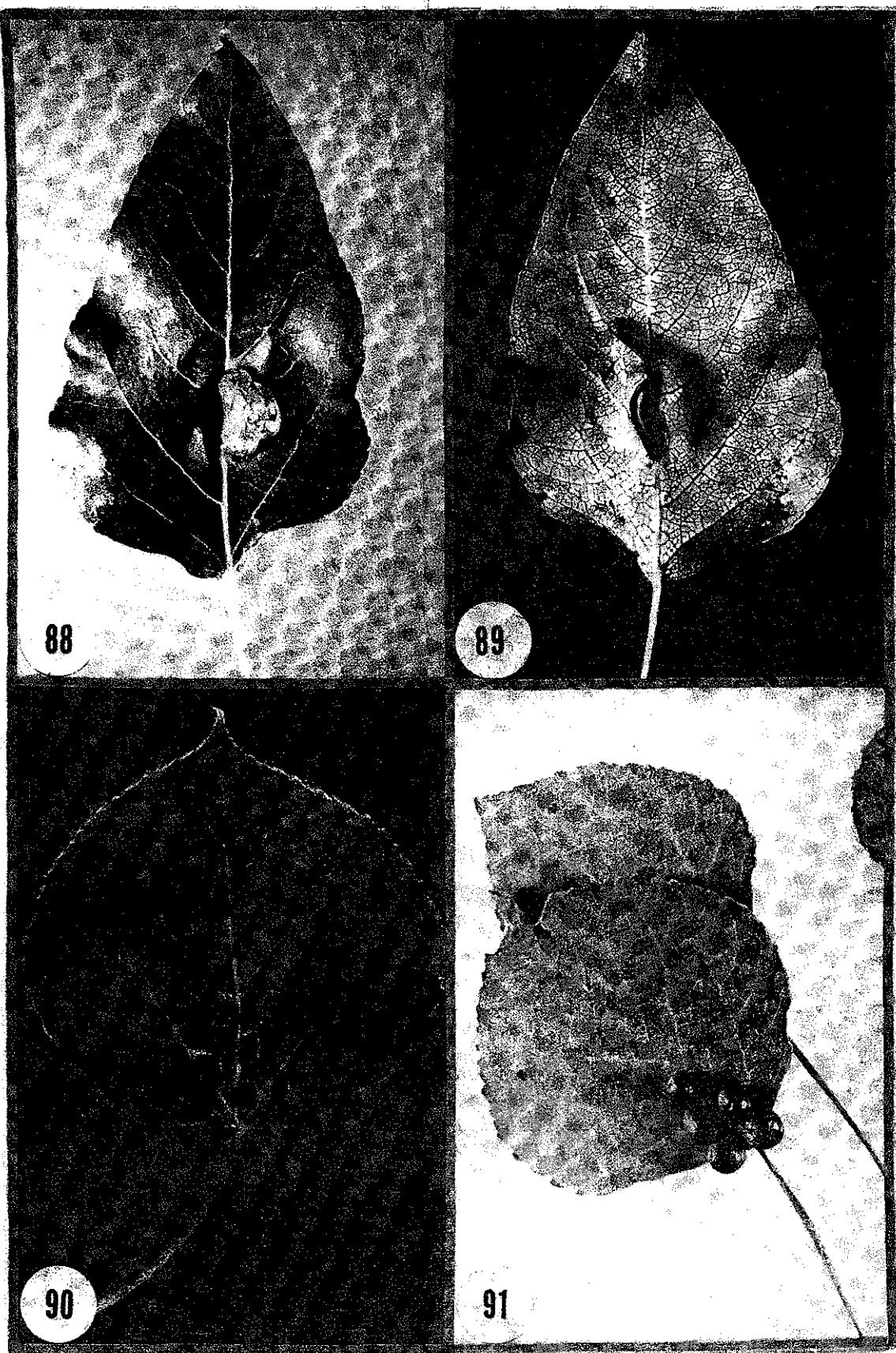
17. Galls large and tapered, wider than long, aphid (Fig. 82) (References
1, 23, 25, 47) *Pemphigus bursarius* Linnaeus
- Galls small and not tapered, longer than wide, midge (Fig. 80)
- Cecidomyiid sp.
18. Pilelike growths on leaf surface, mite (Fig. 81) *Acotyledon* sp.
- Pilelike growths not present on leaf surface 19

FIGS. 80-83. 80, Gall of a midge, Cecidomyiid sp. on petiole of trembling aspen leaf. 81, Gall of a mite, *Acotyledon* sp. on trembling aspen leaves. 82, Gall of the aphid, *Pemphigus bursarius* on petiole of Griffin poplar leaf. 83, Gall of the poplar leaf-stem gall aphid, *Pemphigus populitransversus* (lower gall) and the poplar leaf-petiole gall aphid, *Pemphigus populicaulis* (upper gall) on leaf of plains cottonwood.



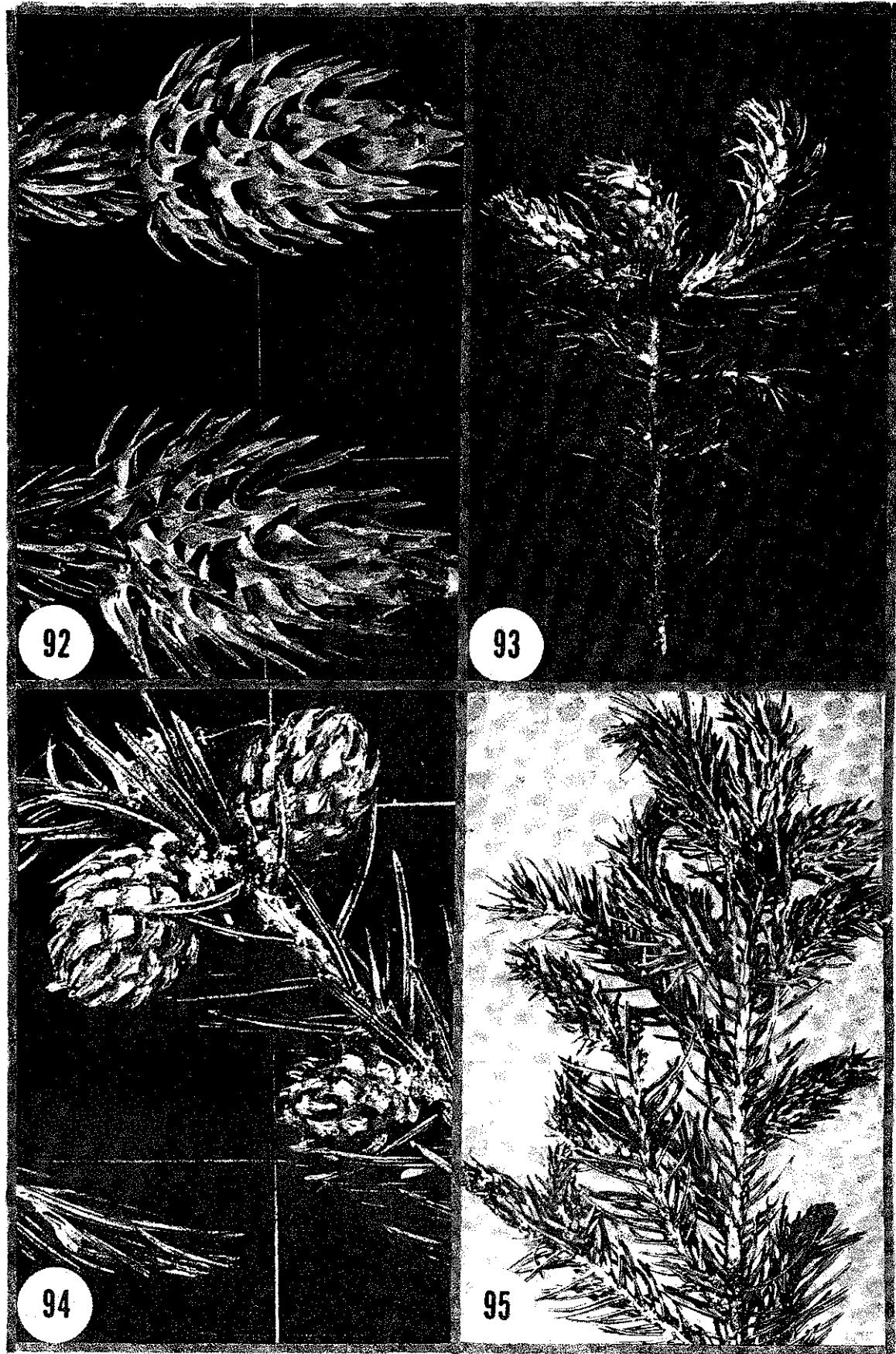
19. Galls near or at leaf margin (Figs. 84, 85, 86) 20
 Galls not near or at leaf margin (Figs. 70, 88, 89, 91) 22
20. Galls in a row, beadlike or pocketlike, beadlike cottonwood gall
 aphid (Fig. 84) (References 24, 47)
 *Parathecabius populinonis* (Riley)
 Galls not in a row, folded leaf margin (Figs. 85, 86) 21
21. Galls not swollen, folded leaf poplar aphid (Figs. 86, 87) (References
 24, 47) *Thecabius affinis* (Kaltenbach)
 Galls swollen, midge (Fig. 85) *Cecidomyiid* sp.

FIGS. 84-87. 84, Gall of the beadlike cottonwood gall, *Parathecabius populinonis* on balsam poplar leaves. 85, Gall of a midge, *Cecidomyiid* sp. on edge of trembling aspen leaf. 86 & 87, Galls of the folded leaf poplar aphid, *Thecabius affinis* on balsam poplar leaves.



22. Galls formed by turned-in edges of leaf, aspen leaf-pocket aphid
(Fig. 70) (References 25, 47)
..... *Pachypappa sacculi* Gillette
- Galls not formed by turned-in edge of leaf (Figs. 88-91) 23
23. Gall elongate, single gall beside midvein, aphid (Figs. 88, 89)
(References 25, 47) *Pemphigus populivae* Fitch
- Galls globular, several galls generally near base of leaf (Figs.
90, 91) Cecidomyiid sp.

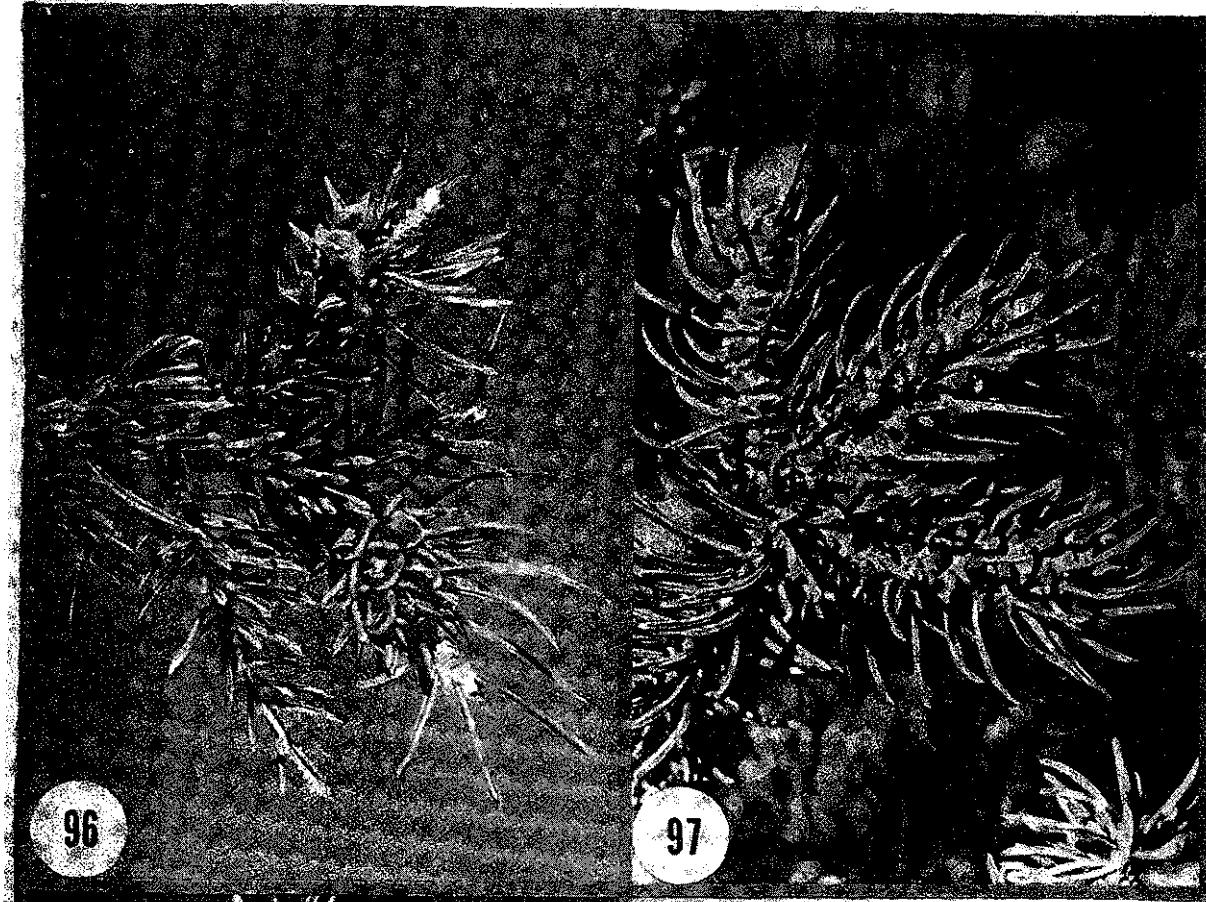
FIGS. 88-91. 88 & 89, Galls of the aphid, *Pemphigus populivae* on
midvein of balsam poplar leaf. 90 & 91, Galls of midges,
Cecidomyiid sp. on trembling aspen leaf.



Galls of Spruce, *Picea* spp.

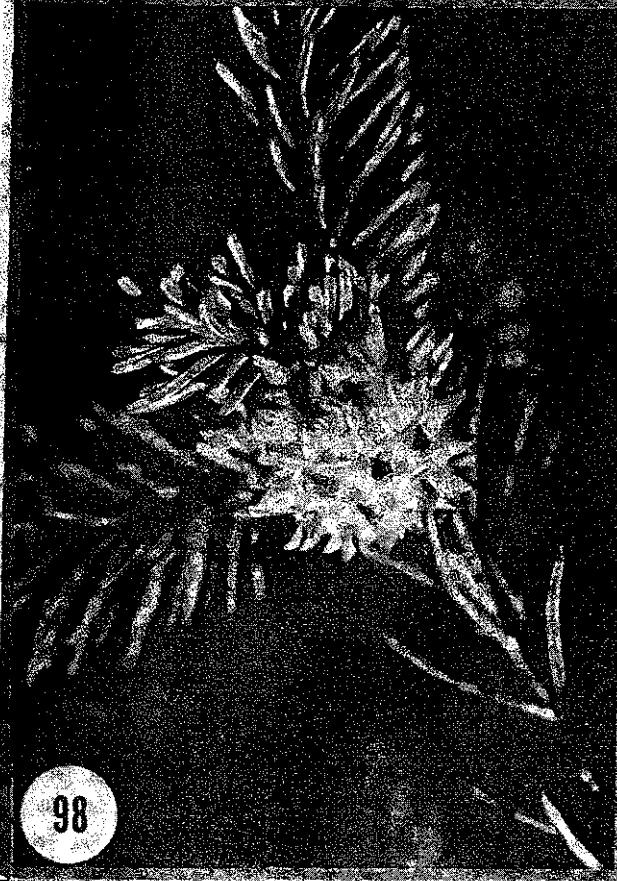
1. Galls on terminal bud, midge (Fig. 32) (References 9, 10, 20)
- *Rhabdophaga swainei* Felt
- Galls not on terminal bud 2
2. Galls swellings on new shoot, causing it to curl and twist, spruce bud
midge (Fig. 33) (References 20, 53)
- *Mayetiola piceae* (Felt)
- Galls not a swelling on a new shoot 3
3. Galls shaped like a pineapple (Figs. 94, 96, 98)
- Galls not shaped like a pineapple (Figs. 92, 93, 95, 97, 99) 5

FIGS. 92-95. 92, Galls of the pine leaf chermid, *Pineus piniifoliae* on
white spruce needles. 93 & 95, Galls of the spruce gall
aphid, *Pineus similis* on white spruce needles. 94, Galls
of the spruce gall aphid, *Adelges strobilobius* on black
spruce needles.



96

97



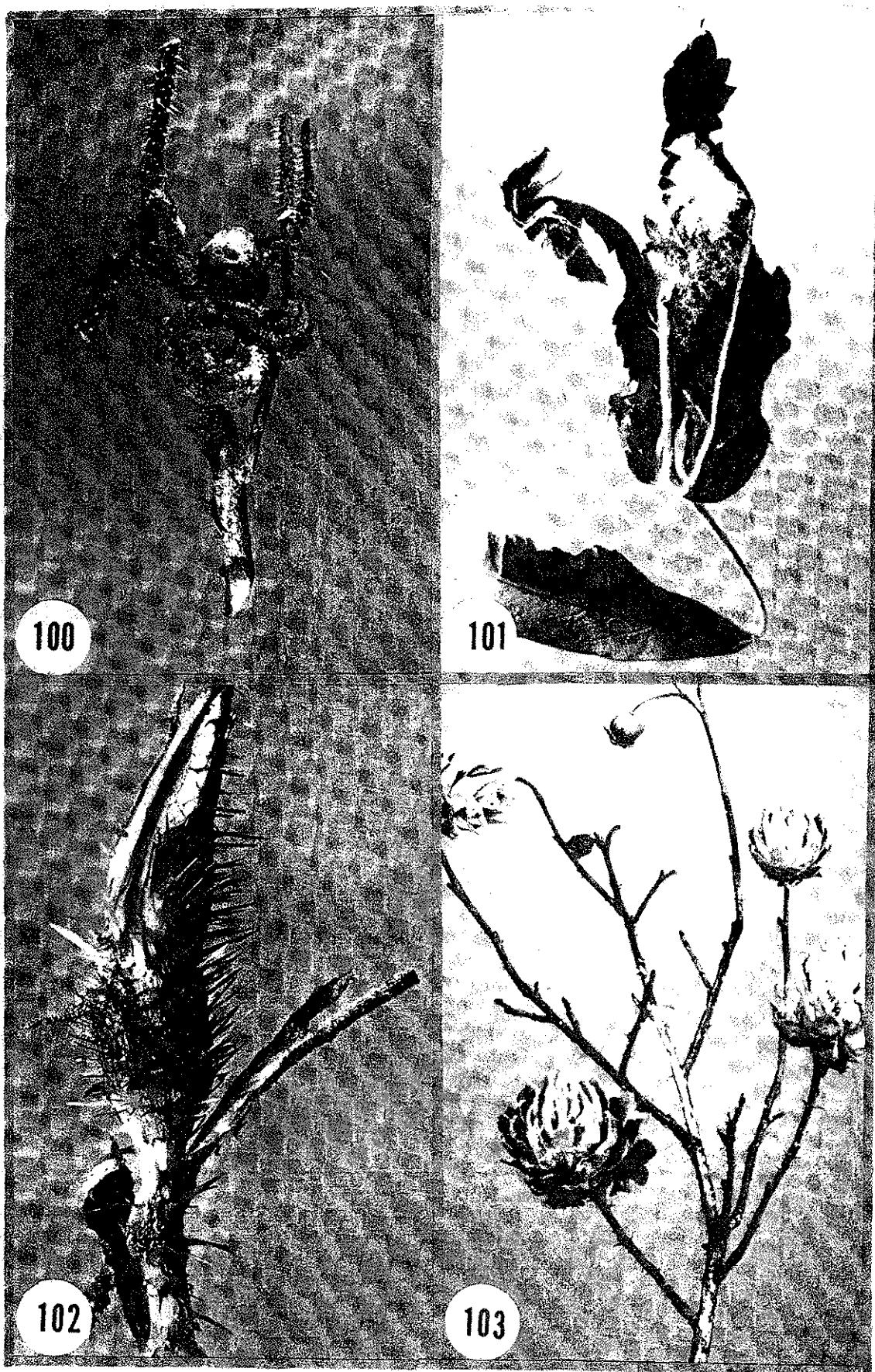
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99

4. Galls terminal, spruce gall aphid (Fig. 94) (References 2, 11, 38) ...
..... *Adelges strobllobius* (Kaltenbach)
- Galls rarely terminal, spruce gall aphid (Figs. 96, 98) (References 2,
11, 15, 38) *Adelges lariciatus* Patch
5. Galls conelike, needles of gall scalelike, pine leaf chermid (Fig. 92)
(References 2, 3, 11, 38, 61) *Pineus pinifoliae* (Fitch)
- Galls elongate, needles of gall not scalelike 6
6. Galls with swollen base of the needles joined laterally by tissue,
Cooley spruce gall aphid (Figs. 97, 99) (References 2, 11, 12,
13, 20, 34, 38, 50) *Adelges cooleyi* Gillette
- Galls with swollen base of the needles not joined laterally by tissue,
spruce gall aphid (Figs. 93, 95) (References 2, 11, 14, 20, 38) ..
..... *Pineus similis* (Gillette)

FIGS. 96-99. 96 & 98, Galls of the spruce gall aphid, *Adelges lariciatus* on white spruce needles. 97 & 99, Galls of the Cooley spruce gall aphid, *Adelges cooleyi* on white spruce needles.



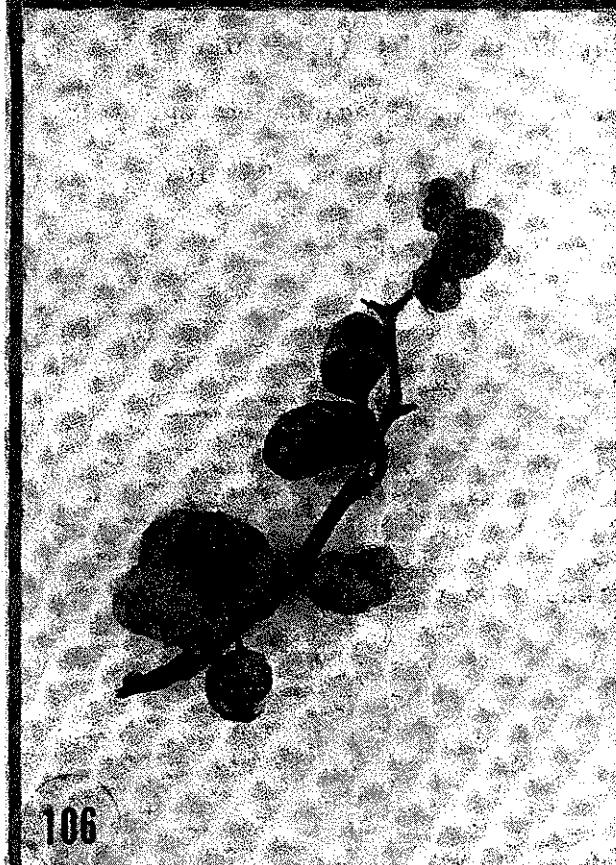
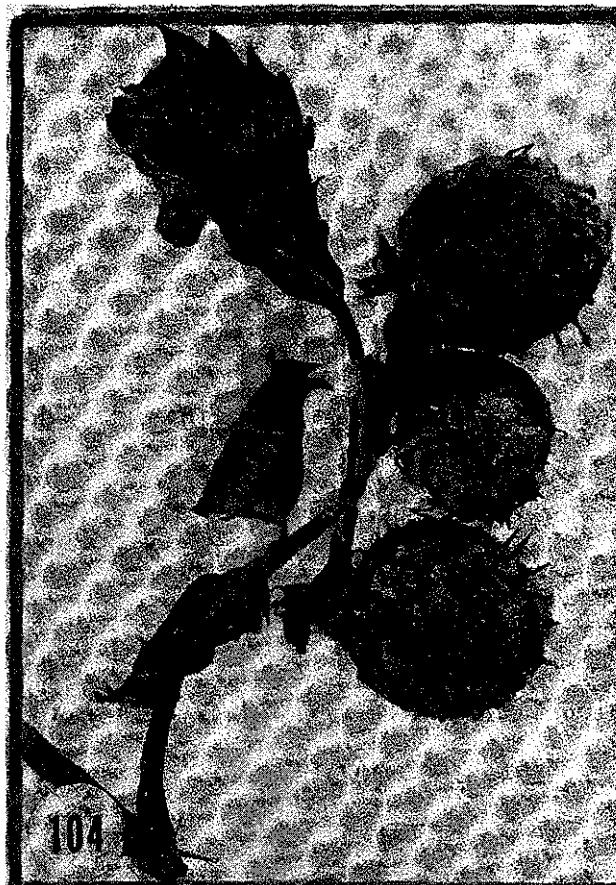
Galls of Rose, *Rosa* spp.

1. Galls on buds, rosette in appearance, rosette midge (Fig. 103)
 (Reference 20) *Rhabdophaga rosacea* Felt
- Galls not on buds 2

2. Galls on leaves (Figs. 101, 106, 108-111) 3
 - Galls not on leaves (Figs. 100, 102, 104, 105, 107) 5

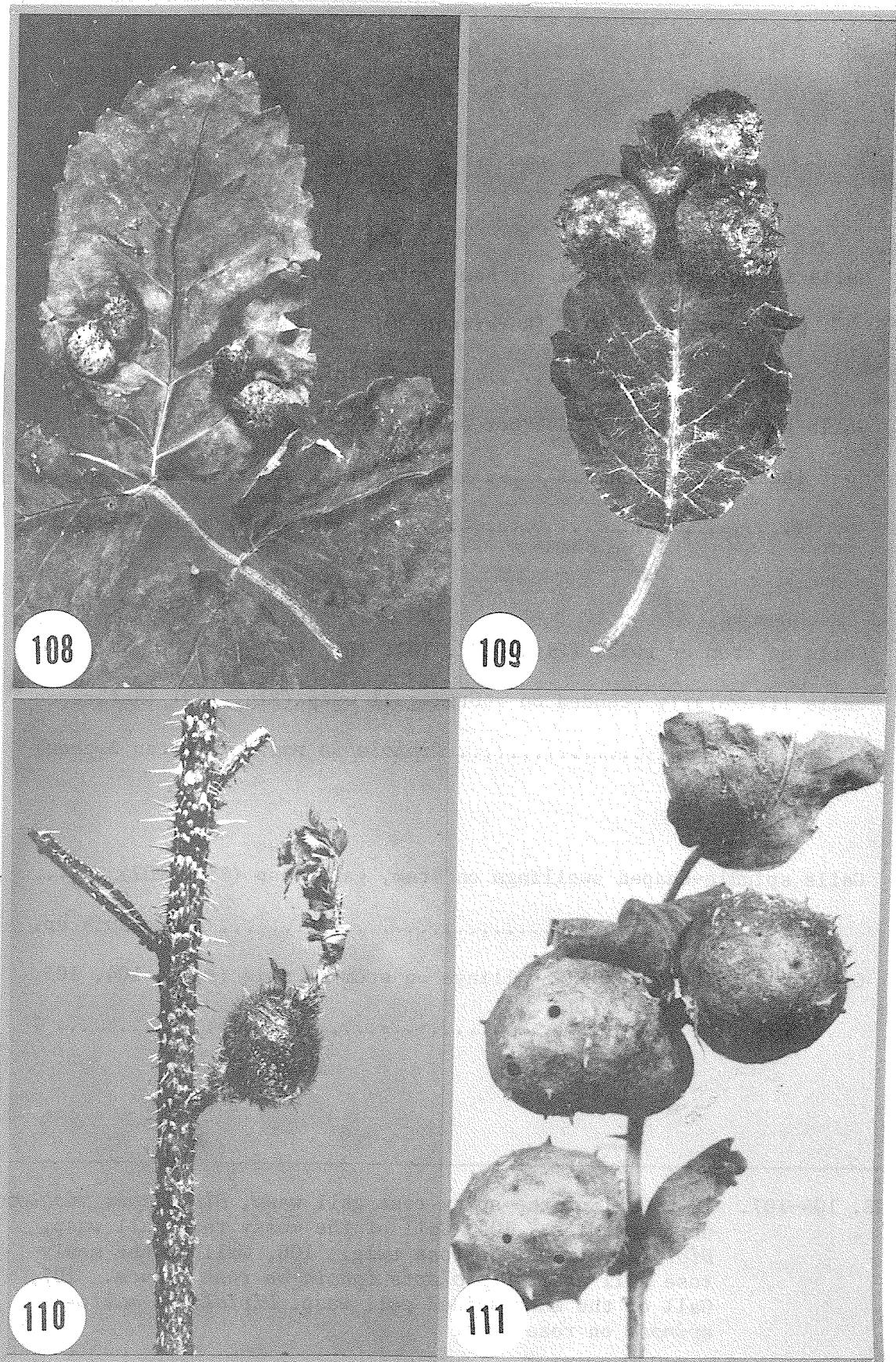
3. Galls formed by thickened and folded leaf, midge (Fig. 101) ..
 - *Cecidomyiid* sp.
 - Galls not formed by thickened and folded leaf (Figs. 106, 108-111) 4

FIGS. 100-103. 100, Gall of the gall wasp, *Diplolepis radicum* on rose root. 101, Gall of a midge, *Cecidomyiid* sp. on rose leaves. 102, Gall of a gall wasp, *Diplolepis* sp. on rose stem. 103, Gall of the rosette midge, *Rhabdophaga rosacea* on rose buds.



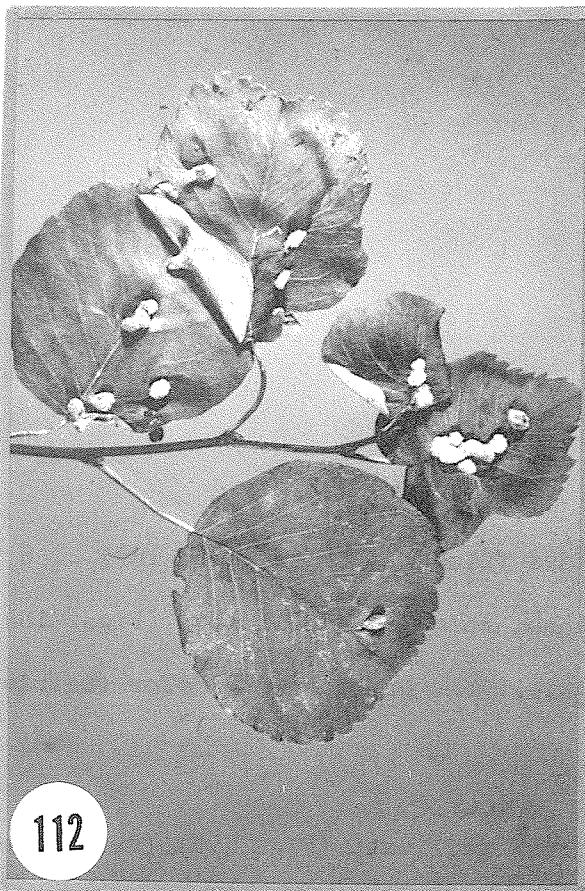
4. Galls irregularly rounded, without spines, soft and dry, mealy rose gall wasp (Fig. 106) (Reference 20)
- *Diplolepis ignota* (Osten Sacken)
- Galls globular with spines, not soft, gall wasp (Figs. 108-111) (Reference 20)
- *Diplolepis nebulosa* (Bassett)
- *Diplolepis polita* Ashmead
5. Galls on stem or twigs (Figs. 102, 104, 105, 107) 6
- Galls irregularly rounded on roots, gall wasp (Fig. 100) (Reference 20)
- *Diplolepis radicum* (Osten Sacken)
6. Galls spindle-shaped swellings on stem, gall wasp (Fig. 102)
- *Diplolepis* sp.
- Galls not spindle-shaped swellings on stem or twig (Figs. 104, 105, 107) 7

FIGS. 104-107. 104, Gall of the spiny rose gall wasp, *Diplolepis bicolor* on rose twigs. 105, Gall of the mossy rose gall wasp, *Diplolepis rosae* on rose twig. 106, Gall of the mealy rose gall wasp, *Diplolepis ignota* on rose leaves. 107, Gall of the many-spined gall wasp, *Diplolepis multi-spinosa* on rose twig.

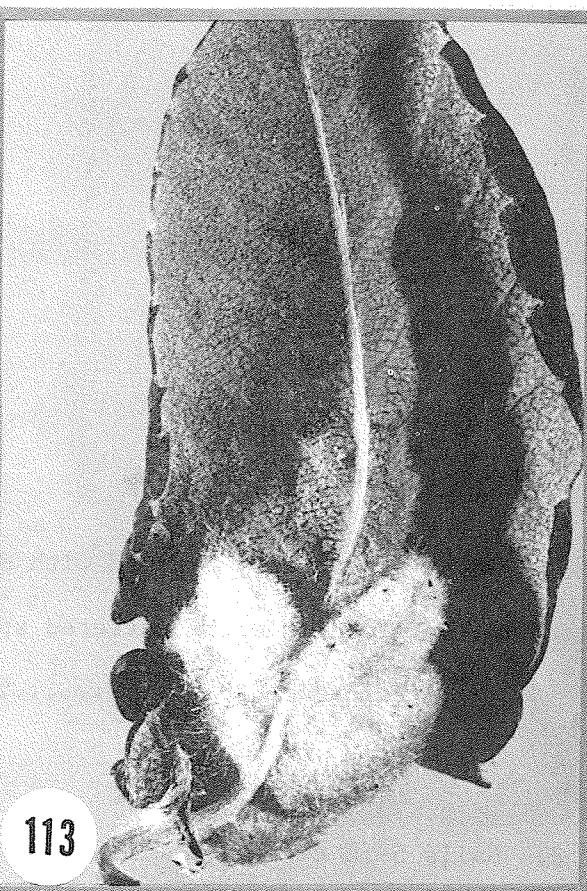


7. Galls irregularly rounded with dense filaments (Figs. 105, 107) .. 8
 Galls globular with scattered spines, spiny rose gall wasp (Figs. 104)
 (Reference 20) *Diplolepis bicolor* (Harris)
8. Galls 5-10 cm in diameter, mossy rose gall wasp (Fig. 105) (Reference
 20) *Diplolepis rosae* (Linnaeus)
 Galls less than 5 cm in diameter, many-spined twig gall wasp (Fig.
 107) (Reference 20) *Diplolepis multispinosa* (Gillette)

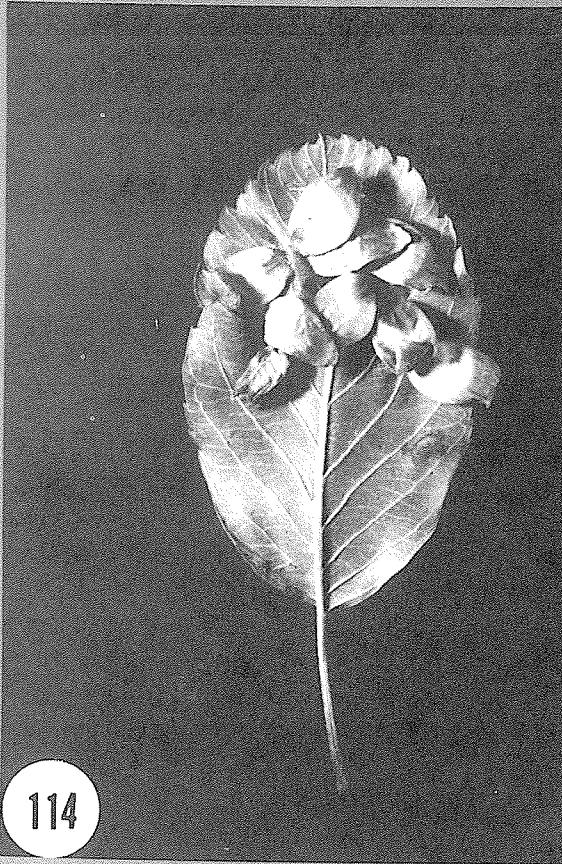
FIGS. 108-111. 108 to 111, Galls of a gall wasp, *Diplolepis* spp. on rose leaves.



112



113



114



115

Galls of Saskatoon-Berry, *Amelanchier alnifolia* (Nutt.)

1. Galls nipplelike, pink, and covered with whitish hairs on upper side of leaf, mite (Fig. 112) (Reference 33)
..... *Eriophyes cerasi-crumena* Walsh
- Galls not nipplelike and on underside of leaf 2
2. Galls on vein and covered with pale hairs, midge (Fig. 113)
..... Cecidomyiid sp.
- Galls purselike and not covered with pale hairs, midge (Fig. 114)
(Reference 20) possibly *Cecidomyia* sp.

Gall of Plum, *Prunus* sp.

1. Galls long, fingerlike, mite (Fig. 115) (Reference 33)
..... *Phytoptus* sp. nr. *padi* Nalepa

FIGS. 112-115. 112, Gall of the mite, *Eriophyes cerasi-crumena* on Saskatoon-berry leaf. 113, Gall of a midge, Cecidomyiid sp. on Saskatoon-berry leaf. 114, Gall of a midge, possibly *Cecidomyia* sp. on Saskatoon-berry leaf. 115, Gall of a mite, *Phytoptus* sp. nr. *padi* on plum leaves.



116



117



118



119

Galls of Willow, *Salix* spp.

1. Galls shaped like a pine cone, willow cone gall midge (Fig. 116)
 (Reference 65) *Rhabdophaga strobilooides* (Osten Sacken)

 Galls not shaped like a pine cone 2

2. Galls like open rosettes in cluster, willow rosette gall midge
 (Fig. 118) (Reference 20)

 *Rhabdophaga salicisbrassicoides* (Packard)

 Galls not like open rosettes in clusters 3

3. Galls formed by misshapen leaves, spongy in appearance, mite (Fig.
 119) *Eriophyes* sp.

 Galls not formed by misshapen leaves 4

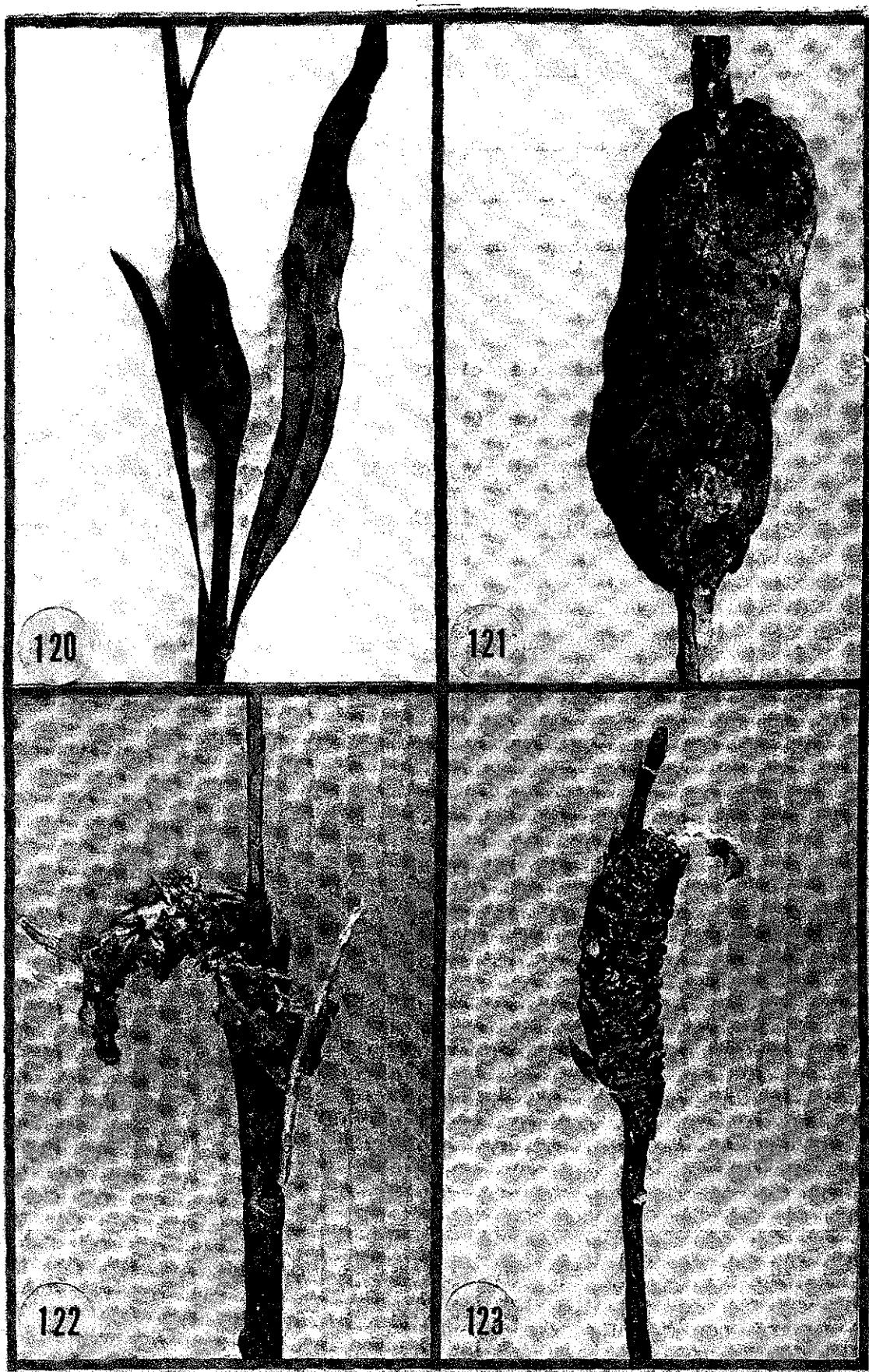
4. Galls of buds (Figs. 117, 122, 123) 5

 Galls of stem or leaves (Figs. 120, 121, 124-139) 7

5. Galls with a beak (Figs. 122, 123) 6

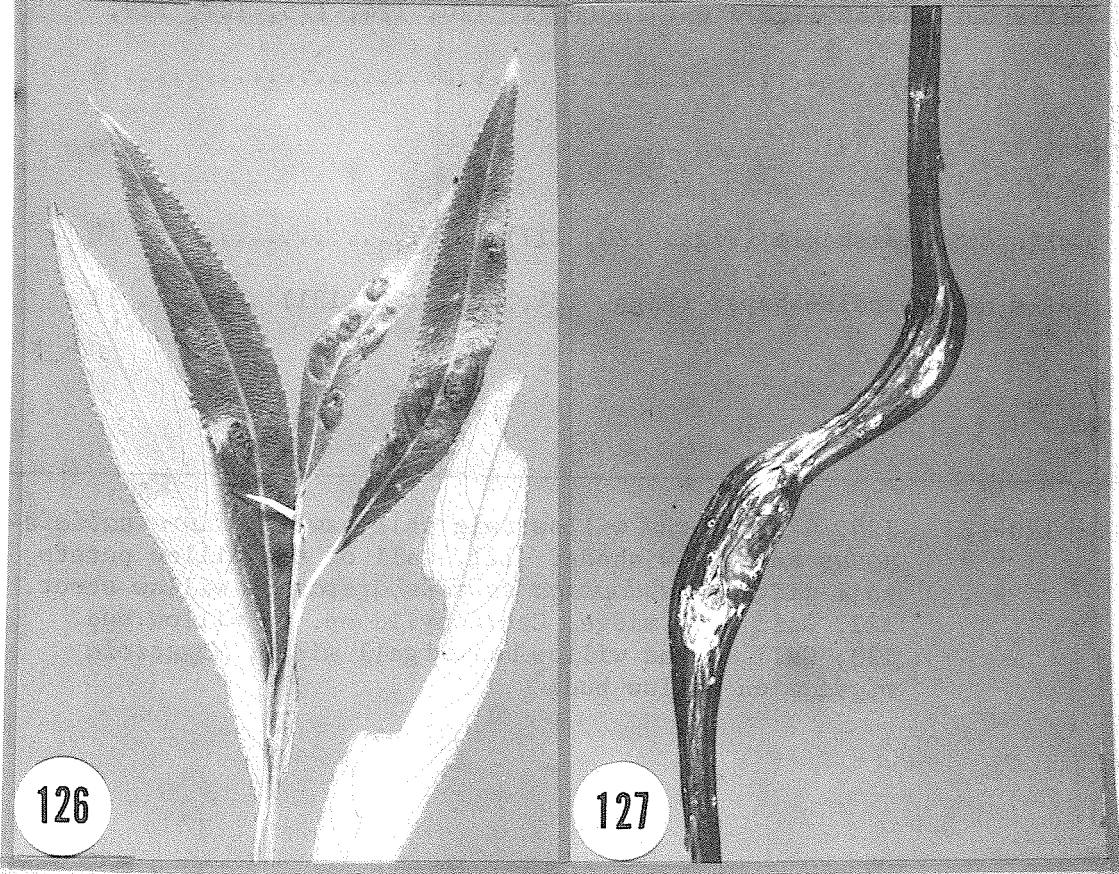
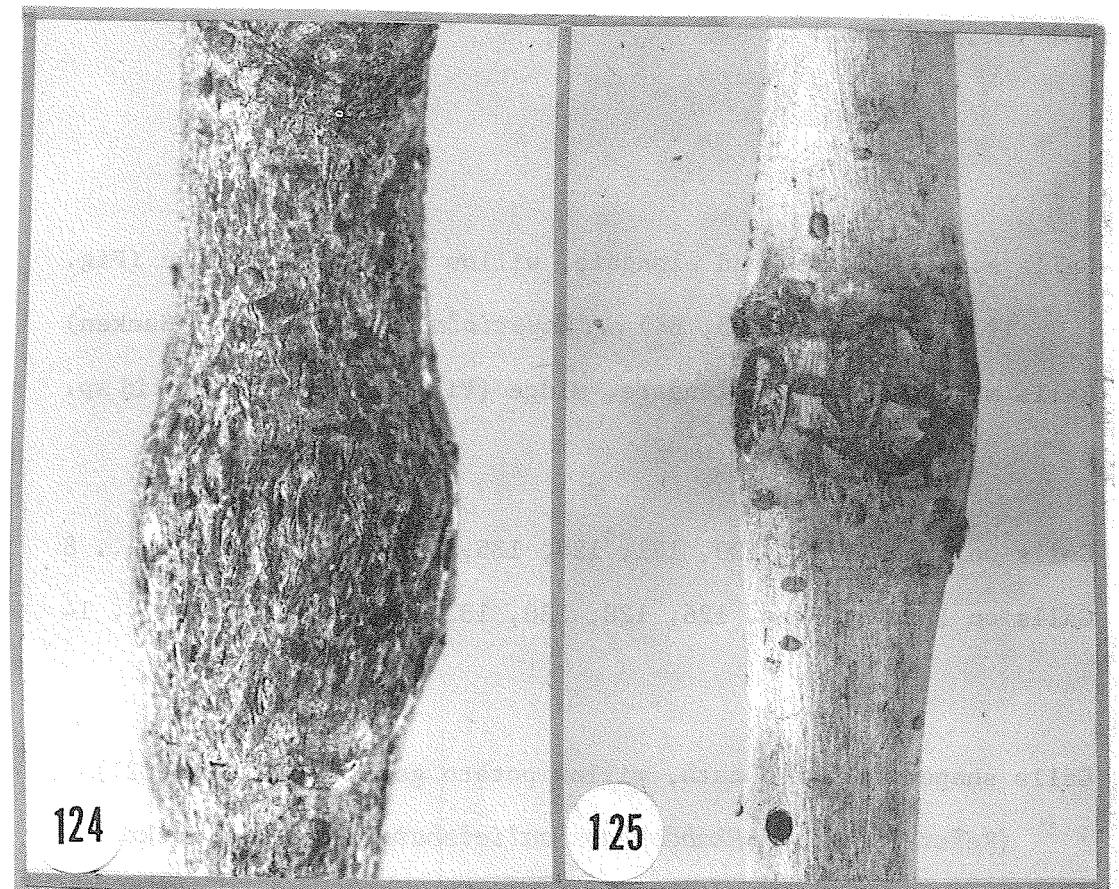
 Galls without a beak, ovoid in appearance, midge (Fig. 117) (References 19, 20) *Oligotrophus salicifolius* Felt

FIGS. 116-119. 116, Gall of the willow cone gall midge, *Rhabdophaga strobilooides* at apex of willow shoot. 117, Gall of the midge, *Oligotrophus salicifolius* on willow bud. 118, Gall of the willow rosette gall midge, *Rhabdophaga salicisbrassicoides* on willow foliage. 119, Galls of a mite, *Eriophyes* sp. on willow leaves.



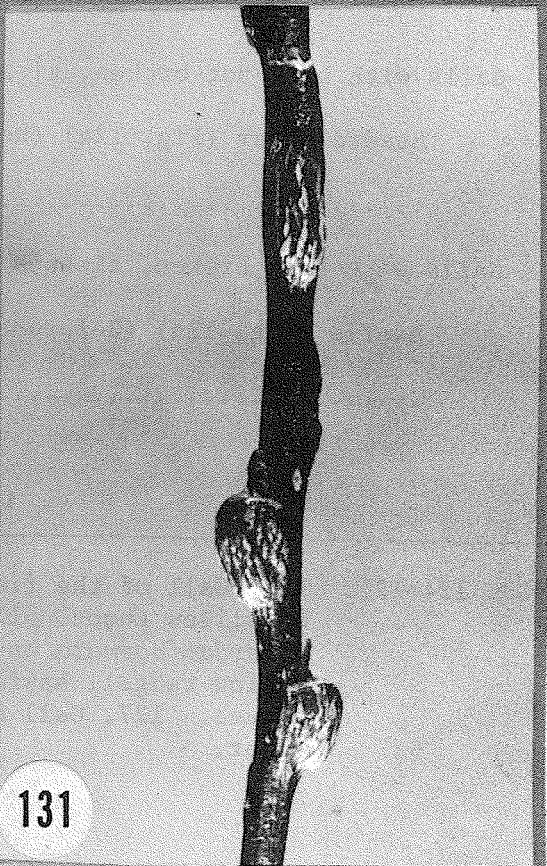
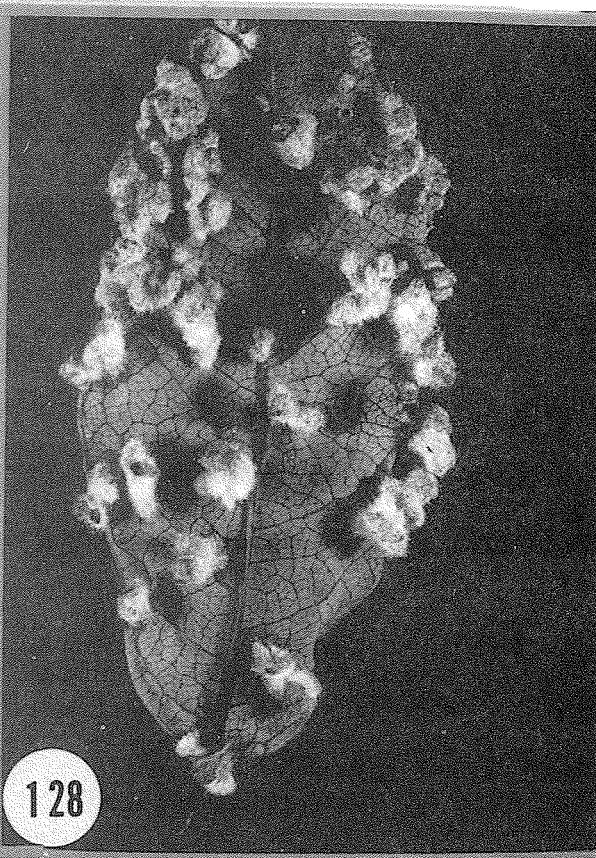
6. Galls spindle-shaped and elongate, willow beaked gall midge (Fig. 123) (References 55, 64) ... *Mayetiola rigidae* (Osten Sacken)
 Galls more ovoid than elongate, midge (Fig. 122)... *Cecidomyiid* sp.
7. Galls on stem (Figs. 120, 121, 124, 125, 127, 129, 131) 8
 Galls on leaves (Figs. 126, 128, 130, 132-139) 14
8. Galls shaped like a potato, willow potato gall midge (Fig. 121)
 (Reference 20) .. *Rhabdophaga salicisbatatas* (Osten Sacken)
 Galls not shaped like a potato (Figs. 120, 124, 125, 127, 129,
 131) 9
9. Galls spindle-shaped (Figs. 120, 127) 10
 Galls not spindle-shaped (Figs. 124, 125, 129, 131) 11

FIGS. 120-123. 120, Gall of the willow twig gall sawfly, *Euura salicis-nodus* on willow shoot. 121, Gall of the willow potato gall midge, *Rhabdophaga salicisbatatas* on willow shoot. 122, Gall of a midge, *Cecidomyiid* sp. on willow bud. 123, Gall of the willow beaked gall midge, *Mayetiola rigidae* on willow bud.



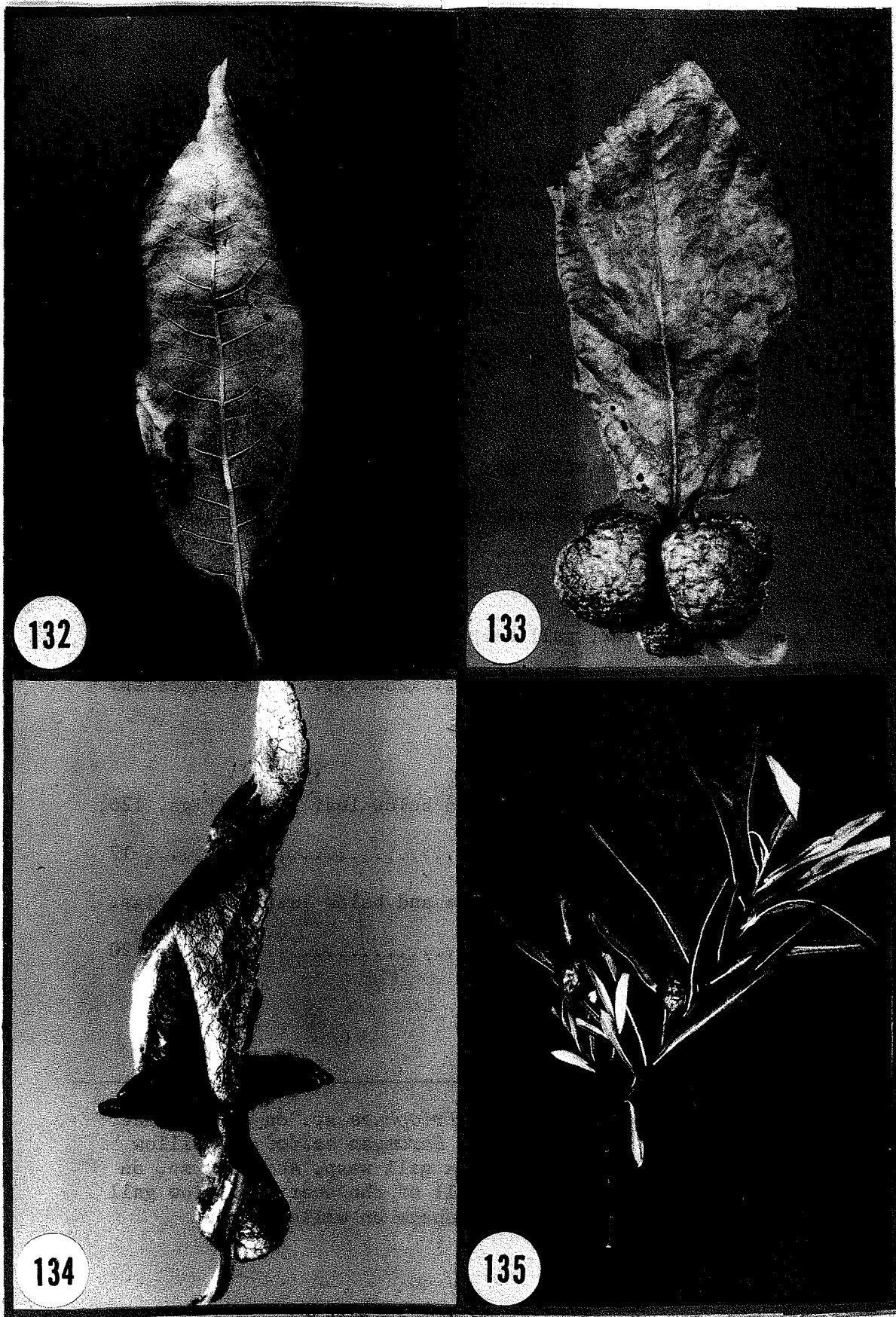
10. Galls relatively straight, willow twig gall sawfly (Fig. 120)
 (Reference 35) *Euura salicis-nodus* (Dalla Torre)
- Galls distinctly curved, sawfly (Fig. 127) *Euura* sp.
11. Galls globose surrounding stem (Figs. 124, 125) 12
 Galls not globose on one side of stem (Figs. 129, 131) ... 13
12. Galls with bark not broken, tissues not exposed beneath, flat-headed borer (Fig. 124) (Reference 69)
 *Agrilus criddlei* Frost
- Galls with bark broken, tissues exposed beneath, longhorned beetle (Fig. 125) (References 42, 44, 68)
 *Saperda inornata* Say.

FIGS. 124-127. 124, Gall of the flatheaded borer, *Agrilus criddlei* on willow shoot. 125, Gall of the longhorned beetle, *Saperda inornata* on willow shoot. 126, Galls of the willow redgall sawfly, *Pontania proxima* on willow leaves. 127, Gall of a sawfly, *Euura* sp. on willow shoot.



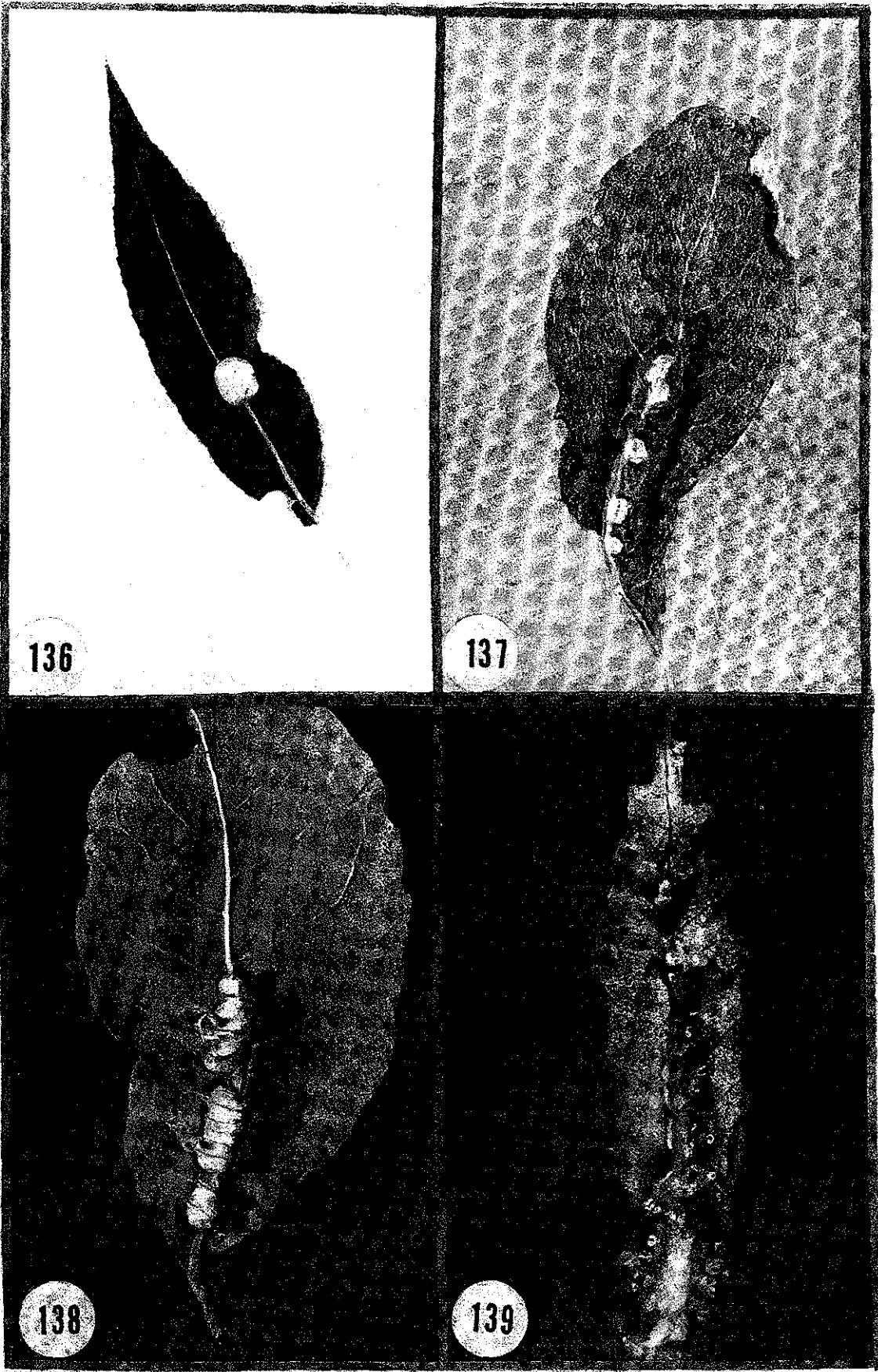
13. Galls subglobose, with grooves, scarred willow gall (Fig. 131)
 (Reference 20) *Mayetiola tumidosae* Felt
 Galls irregularly oval without grooves, fly (Fig. 129) (Reference 20) *Hexomyza salicis* (Malloch)
14. Galls on leaf covered with hair (Figs. 128, 130) 15
 Galls on leaf not covered with hair (Figs. 132-139) 16
15. Galls at base of leaf, gall wasp (Fig. 130) *Andricus* sp.
 Galls over most of leaf, mite (Fig. 128) *Eriophyes* sp.
16. Galls protruding equally above and below leaf blade (Figs. 126, 133-135) 17
 Galls not protruding equally above and below leaf blade (Figs. 132, 136-139) 20

FIGS. 128-131. 128, Gall of a mite, *Eriophyes* sp. on willow leaf.
 129, Gall of the fly, *Hexomyza salicis* on willow shoot.
 130, Gall of a gall wasp, *Andricus* sp. on willow leaf.
 131, Gall of the scarred willow gall midge, *Mayetiola tumidosae* on willow shoot.



17. Galls bean-shaped, willow redgall sawfly (Fig. 126) (Reference 8)
 *Pontania proxima* (Lepeletier)
 Galls not bean-shaped (Figs. 133-135) 18
18. Galls long and conical, midge (Fig. 134) Cecidomyiid sp.
 Galls globose (Figs. 133, 135) 19
19. Galls with rough surface, more than one gall at base of leaf, sawfly (Fig. 133) (Reference 40) *Pontania* sp.
 Galls with smooth surface, single gall on leaf, sawfly (Fig. 135) (Reference 40) *Pontania* sp.
20. Galls along midvein (Figs. 136-139) 21
 Galls not along midvein, small, brownish and nutlike, midge (Fig. 132) Cecidomyiid sp.

FIGS. 132-135. 132, Gall of a midge, Cecidomyiid sp. on willow leaf.
 133, Galls of a sawfly, *Pontania* sp. on willow leaf.
 134, Gall of a midge, Cecidomyiid sp. on willow leaf.
 135, Gall of a sawfly, *Pontania* sp. on willow leaves.



- KEY TO GALLS ON WILLOW LEAVES
- (See Figures 136-139)
21. Galls on both side of midvein (Figs. 137, 139) 22
- Galls on one side of midvein (Figs. 136, 138) 23
22. Galls liplike, willow-lipped gall midge (Fig. 139) (Reference 20) ..
- *Trishormomyia salicisverruca* (Osten Sacken)
- Galls not liplike, midge (Fig. 137) Cecidomyiid sp.
23. Galls palisadelike, midge (Fig. 138) Cecidomyiid sp.
- Galls rounded, sawfly (Fig. 136) (Reference 20)
- *Pontania hospes* (Walsh)

FIGS. 136-139. 136, Gall of the sawfly, *Pontania hospes* on willow leaf.
 137, Gall of a midge, Cecidomyiid sp. on willow leaf.
 138, Gall of a midge, Cecidomyiid sp. on willow leaf.
 139, Gall of the willow-lipped gall midge, *Trishormomyia salicisverruca* on willow leaf.

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