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New York State Museum Bulletin

Entered as second-class matter November 27, 1915, at the Post Office at Albany, New York, under the act of August 24, 1912

Published monthly by The University of the State of New York

No. 197 ALBANY, N. Y. May 1, 1917

The University of the State of New York
New York State Museum

John M. Clarke, Director

Homer D. House, State Botanist

REPORT OF THE STATE BOTANIST 1916

ALBANY

THE UNIVERSITY OF THE STATE OF NEW YORK

1918

M92r-F17-1500

The University of the State of New York
Science Department, February 16, 1917

Dr John H. Finley
President of the University

SIR:

I have the honor to communicate herewith for publication as a bulletin of the State Museum, the Annual Report of the State Botanist for the fiscal year 1916.

Very respectfully
JOHN M. CLARKE
Director

THE UNIVERSITY OF THE STATE OF NEW YORK
OFFICE OF THE PRESIDENT

Approved for publication this 20th day of February 1917

President of the University

New York State Museum Bulletin

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The University of the State of New York

New York State Museum

JOHN M. CLARKE, *Director*

REPORT OF THE STATE BOTANIST 1916

John M. Clarke

Director, Science Department

SIR:

I beg to communicate herewith my report on the work of the State Botanist's office for the fiscal year 1916.

Very respectfully

HOMER D. HOUSE

State Botanist

Scientific investigations. A rather limited amount of time was devoted to the completion of a reconnaissance of the vegetation and its ecological relations of the region about the eastern end of Oneida lake, a region of extensive sandy barrens, swamps and bogs in addition to the broad sandy beach of the lake, the shallow waters of the lake margin and the streams flowing into the lake, the home of numerous water-loving plants. Because of soil conditions and a climate influenced to some extent by the Great Lakes, the region is characterized by a large number of plants common to the northern coastal plain. The results of this investigation appear in another part of the report.

Wild Flowers of New York. The season of 1916 was largely spent in continuation of the field work necessary for the completion of the proposed memoir on the Wild Flowers of New York State. This work was started early in August 1915 and with the appearance of the earliest spring flowers in April 1916, the work was carried forward and completed late in September of the past year. During the two months of 1915 and the six months from April 15 to September 15, 1916, there were photographed in the field 364 species of plants which, because of their conspicuous flowers or attractive appearance might be classed under the rather indefinite term of "wild flowers."

The 364 illustrations will be in colors and grouped on about 264 plates, of which 155 plates will have each a single illustration and the 97 remaining plates will contain two illustrations each. The text will consist of a brief description of each species together with its range and such other remarks concerning its habitat as seem proper.

By means of a specially constructed apparatus as shown in the accompanying illustration (figure 1) each flower was photographed in position as it grew, without any interference from wind or excessive sunlight. For each subject there were taken one or two (usually two) dry-plate photographs and one Lumiere (autochrome) photograph. These were usually developed within a few hours so that any serious faults might be corrected by taking another exposure of the subject.

It is proper to remark here that the success of these photographs is largely due to the skill, patience and enthusiasm, often under disagreeable physical circumstances, shown by the two photographers employed: Mr Walter B. Starr of the Matthews-Northrup Company, Buffalo, and Mr Harold H. Snyder of the Zeese-Wilkinson Company, New York.

Each subject photographed was given a number in order to facilitate the designation of them in subsequent correspondence, engraving and arrangement in final order. Photographic proofs of the dry plates were marked with directions for size of completed illustration and such other alterations as seemed desirable and duplicate copies of such proofs were kept on file in the Botanist's office. From retouched photographs approved by the Botanist, the engraving companies made their plates for engraving, which were etched down with the autochrome positive as a color guide until each of the four copper plates gave the proper register of color when used upon the press in combination with one another, that is to say, blue, yellow, red and black.

Noteworthy contributions. The most important additions to the state herbarium during the past year are contributions of specimens from Prof. J. J. Davis, of Madison, Wis., the New York

Fig. 1. View of cage used to protect wild flowers from wind while photographing

Botanical Garden and Dr J. R. Weir of Missoula, Mont., in addition to the collections made by members of the staff.

Exchanges. Duplicate specimens of fungi, ferns and flowering plants have been exchanged for desirable material with the New York Botanical Garden, the National Herbarium at Washington, Prof. J. Dearness of London, Canada, Dr J. R. Weir of Missoula, Mont., and other institutions and individuals.

Additions to the herbarium. The number of specimens of New York State species which have been added to the herbarium from current collections of the staff during the past year is 528, from contributions 375, a total of 903 specimens. Of the total number of specimens received, 131 were new to the herbarium and 20 species are described as new to science.

In addition, about 900 specimens of species extralimital to New York, from the Sheldon herbarium, presented in 1914, representing characteristic species of the eastern and southern flora, have been remounted and incorporated into the herbarium. It is not the aim of the state herbarium to represent to any great extent the flora of regions beyond the State's border. The Sheldon herbarium, however, contains over 13,000 specimens, representing nearly 8000 species, most of them extralimital to New York, and it seems advisable gradually to incorporate the best of them into the herbarium for purposes of comparison with our native species and as an aid in the identification of specimens of plants collected outside the State by persons who bring or send them here for determination.

Twenty persons have contributed specimens to the herbarium; 363 species are represented by these contributions. This includes specimens sent or brought for identification which were desirable additions to the herbarium.

Collections have been made by the staff in the following counties: Albany, Bronx, Cayuga, Columbia, Genesee, Herkimer, Madison, Monroe, Nassau, Oneida, Onondaga, Ontario, Oswego, Queens, Rensselaer, Suffolk and Wayne.

Identifications. The number of identifications made of specimens sent or brought to the office by inquirers is 465. The number of persons for whom these identifications were made was 95.

Mushroom models. The Peck memorial collection of models cast in wax of edible and poisonous mushrooms now includes 56 groups, of which 8 represent poisonous species. This constitutes a most interesting exhibit and one of high educational value. It is planned to arrange these in an attractive manner in wall cases.

Many of these groups have been the subject of special study and illustration by Doctor Peck. The following list of the groups is collated with illustrations of them which have appeared in publications of the State Museum.

1 Craterellus clavatus (*Pers.*) *Fr.*
Memoir 4, pl. 56, fig. 17–21.
49th Rep't, pl. 44, fig. 1–5 (as Craterellus cantharellus)
2 Mitrula irregularis *Peck* (M. vitellina *Sacc.* var. irregularis *Peck*)
48th Rep't, pl. 5, fig. 8–14.
3 Russula cyanoxantha (*Schaeff.*) *Fr.*
4 Lepiota naucina *Fr.* (Lepiota naucinioides *Peck*)
48th Rep't, pl. 19.
5 Agaricus arvensis *Schaeff.*
48th Rep't, pl. 8.
6 Leottia lubrica (*Scop.*) *Fr.*
7 Peziza badia *Fr.*
8 Pleurotus sapidus *Kalchbr.*
9 Tricholoma personatum *Fr.*
48th Rep't, pl. 20.
10 Clavaria pistilaris umbonata *Peck*
Memoir 4, pl. 66, fig. 15–17.
11 Russula roseipes (*Secr.*) *Bres.*
51st Rep't, pl. 53, fig. 1–7.
Memoir 4, pl. 54, fig. 1–7.
12 Russula emetica *Fr.*
13 Lycoperdon pyriforme *Schaeff.*
14 Peziza aurantia *Pers.*
15 Tremellodon gelatinosum (*Scop.*) *Pres.*
16 Clavaria cristata *Pres.*
48th Rep't, pl. 39, fig. 8–12.
17 Chanterel cibarius *Fr.*
18 Lepiota procera (*Scop.*) *S. F. Gray*
48th Rep't, pl. 18.
19 Hypholoma perplexum *Peck*
48th Rep't, pl. 47, fig. 11–18.
Memoir 4, pl. 60, fig. 10–17.
20 Armillaria mellea (*Vahl*) *Quel.*
48th Rep't, pl. 20.
21 Scleroderma geaster *Fr.*
22 Boletus cyanescens *Bull.*
23 Tricholoma sejuncta (*Sow.*) *Quel.*
24 Craterellus cantharellus (*Schw.*) *Fr.*
25 Russula albidula *Peck*
26 Pleurotus serotinus (*Schrad.*) *Fr.*
27 Fistulina hepatica *Fr.*
48th Rep't, pl. 37, fig. 8–12.
28 Geoglossum ophioglossoides (*L.*) *Sacc.*
29 Hypomyces lactifluorum (*Schw.*) *Fr.*
Mus. Bul. 105, pl. 103.

30 Hydnum albidum *Peck*
Memoir 4, pl. 67, fig. 1-6.
51st Rep't, pl. 56, fig. 1-7.
31 Hygrophorus virgineus (*Wulf.*) *Fr.*
32 Collybia dryophila
33 Chanterel floccosus *Schw.*
Memoir 4, pl. 55, fig. 9-13.
52d Rep't, pl. 60, fig. 10-14.
34 Coprinus comatus *Fr.*
48th Rep't, pl. 10.
35 Boletus alboater *Schw.* (B. nigrellus *Peck*)
36 Clavaria vermicularia *Scop.*
37 Russula virescens *Fr.*
48th Rep't, pl. 31.
38 Calvatia elata *Massee*
39 Gyromitra brevipes *Fr.* (G. esculanta very similar to this is illustrated in 48th Rep't, pl. 5, fig. 1-3.)
40 Gyromitra brunnea *Underw.*
41 Sparassis crispa (*Wulf.*) *Fr.*
42 Morchella deliciosa *Fr.*
48th Rep't, pl. 3, fig. 4-7.
43 Strobilomyces strobilaceus (*Scop.*) *Berk.*
Mus. Bul. 94, pl. 92.
44 Craterellus cornucopioides (*L.*) *Pers.*
48th Rep't, pl. 24, fig. 7-10.
45 Polyporus sulphureus *Fr.*
48th Rep't, pl. 37, fig. 1-4.
46 Polyporus caudicinus (*Scop.*) *Murr.* (P. squamosus *Huds.*)
47 Agaricus campestris (*L.*) *Fr.*
48th Rep't, pl. 6, fig. 1-10.
48 Amanita caesarea (*Scop.*) *Pers.*
48th Rep't, pl. 10.
49 Tremella lutescens *Pers.*

CONTRIBUTORS AND THEIR CONTRIBUTIONS

Lizzie C. Allen, Newtonville, Mass.

Clavaria rugosa *Sowerby*
Hygrophorus minutulus *Peck*

W. W. Ashe, Washington, D. C.

Rhododendron punctatum *Andr.*

M. S. Baxter, Rochester, N. Y.

Amelanchier stolonifera *Wiegand*
Crepis capillaris (*L.*) *Wallr.*
Eupatorium maculatum *L.*
" purpureum *L. var.* foliosum *Fern.*
Hieracium florentinum *All.*
Lilium superbum *L.*
Sagittaria cuneata *Sheldon*
Teucrium occidentale *A. Gray*
Vaccinium angustifolium *Ait.*
Veronica americana *Schw.*
Viola palmata *L.*
" perpensa *Greene*

S. H. Burnham, Hudson Falls, N. Y.

Aristida dichotoma *Michx.*
Blephilia hirsuta (*Pursh*) *Torr.*
Acalypha gracilens *A. Gray*
Cassia marylandica *L.*
Chamaesyce glyptosperma (*Englm.*) *Small*
Diaporthe parasitica *Murrill*
Galium verum *L.*
Mitella nuda *L.*
Monarda punctata *L.*
Nothoholous lanatus (*L.*) *Nash.*
Omphalia austini *Peck*
Parietaria pennsylvanica *Muhl.*
Peniophora allescheri *Bres.*
Potentilla sulphurea *Lam.*

H. L. Clapp, Boston, Mass.

Boletus subglabripes *Peck*
Cortinarius armeniacus (*Schaeff.*) *Fr.*
Gomphidius rhodoxanthus *Schw.*
Hydnum cyaneotinctum *Peck*
Hydnum repandum *L.*
Lactaria deceptiva *Peck*
Polyporus admirabilis *Peck*

Prof. J. J. Davis, Madison, Wis.

Ascochyta wisconsina *Davis*
Asterina ribicola *E. & E.*
" rubicola *E. & E.*
Cercospora crassa *Sacc.*
" corni *Davis*
" dioscoreae *E. & M.*
" echinochloae *Davis*
" fingens *Davis*
" gaultheriae *E. & E.*
" passaloroides *Wint.*
" rhoina *C. & E.*
Cylindrosporium clematidis *E. & E.*
" padi *Karst.*
" vermiforme *Davis*
Discora artocreas (*Tode*) *Fr.*
Entoloma compositarum *Farl.*
Epichloe typhina (*Pers.*) *Tul.*
Erysiphe cichoracearum *DC.*
Exoascus communis *Sadeb.*
" mirabilis *Atk.*
Graphiothecium vinosum *Davis*
Leptothyrium periclymeni (*Desm.*) *Sacc.*
Marsonina castagnei (*D. & M.*) *Magn.*
" delastrei (*Delacr.*) *Magn.*
" fraxini *E. & D.*
" neilliae (*Hark.*) *Magn.*
" rhabdospora (*E. & E.*) *Magn.*
" violae (*Pass.*) *Magn.*
Melampsora arctica *Rostr.*
Microsphaera euphorbiae (*Peck*) *B. & C.*
Ovularia asperifolii *Sacc.*
Peronospora lophanthi *Farl.*
Phleospora celtidis *E. & M.*
Puccinia erikssonii *Bubak.*
" peckii (*DeToni*) *Howe*
" pustulata (*Curt.*) *Arth.*
Phyllosticta medicaginis (*Fckl.*) *Sacc.*
Plasmopara humili *Miyabe & Takahashi*
" ribicola *Schroet.*
" caricis *E. & E.*
Ramularia ionophila *Davis*
" nemopanthis *Peck*
" punctiformis (*Schl.*) *var. Hoehn.*
" rufomaculans *Peck*
" sambucina *Sacc.*
" uredinis (*Voss*) *Sacc.*
" variegata *Ell. & Holw.*
Septocylindrum aromaticum *Sacc.*
Septoria campanulae (*Lev.*) *Sacc.*
" cannabis (*Lasen*) *Sacc.*
" epilobii *E. & E.*
" lactucicola *E. & M.*
" musiva *Peck*
" pachyspora *Ell. & Holw.*
" rudbeckiae *Ell. & Hals.*
" saccharina *E. & E.*
" sigmoidea *E. & E.*
Tuberculina parsicina (*Ditm.*) *Sacc.*

Prof. John Dearness, London, Ont.

Alternaria solani (*E. & M.*) *Jones & Grout*
Cryptospora femoralis *Peck*
Diaporthe columbiensis *E. & E.*
Diatrype macounii *E. & E.*
Lepiota panaeola (*Fr.*) *P. Karst.*
Melanconium sphaeroideum *Link*
Phragmidium rosae-californiae *Diet.*
Phragmidium disciflorum (*Tode*) *James*
Polyporus fulvidus *E. & E.*
Puccinia antirrhinae *Diet. & Holw.*
" symphoricarpi *Hark.*
Sebacina incrustans *Tul.*
Septoria stachydis *Rob. & Desm.*
Stemphylium magnusianum *Sacc.*

Prof. J. H. Faull, Toronto, Ont.

Polyporus albellus *Peck*
" anceps *Peck*
Polyporus balsameus *Peck*
" chioneus *Fr.*

Mrs E. P. Gardner, Canandaigua, N. Y.

Camptosorus rhizophyllus (*L.*) *Link*
Centaura nigra *L.*
Gentiana quinquefolia *L.*
Serapias helleborine *L.*

J. M. Grant, Sequin, Wash.

Agaricus campestre *L.*
Armillaria mellea (*Vahl*) *Quel.*
Coprinus comatus *Fr.*
Cortinellus multiformis (*Schaeff.*) *Murr.*
Hypholoma fasciculare (*Huds.*) *Fr.*
Laccaria laccata (*Scop.*) *Berk.*
Lepiota granulosa (*Batsch*) *Fr.*
Lycoperdon pyriforme *Batsch*
Panaeolus papilionaceus *Fr.*
Pholiota minima *Peck*

Roy Latham, Orient, N. Y.

Cephalozia francisci *Hook.*
Coleosporium helianthi (*Schw.*) *Arth.*
Cucurbitaria elongata *Fr.*
Cylindrosporium iridis *E. & H.*
Eutypella densta *E. & E.*
Hendersonia robiniae *West.*
Hysterium pulicare *Pers.*
Hysteriographium cookeana (*Ger.*) *Sacc.*
" lesquereuxii (*Duby*)
Leptostromella litigiosum (*Desm.*) *Sacc.*
Nigredo polemonii (*Peck*) *Arth.*
" polygoni (*Pers.*) *Arth.*
Phoma sepincola (*Kichx.*) *Sacc.*
Phragmidium rosae-setigerae *Diet.*
Phyllachora cyperi *Rehm.*
Puccinia cicutae *Lasch.*
" fraxinata (*Link*) *Arth.*
" cyperi *Arth.*
" proserpinacae *Farl.*
Rhytisma decolorans *Fr.*
" ilicis-canadensis *Schw.*
Septoria oenotherae *West*
Taphrina quercus (*Cke.*) *Sacc.*
Valsa liquidambaris *Schw.*

New York Botanical Garden, New York

Acer pennsylvanicum *L.*
Alnus rugosa (*DuRoi*) *K. Koch*
Antennaria plantaginifolia (*L.*) *Rich.*
Aralia nudicaulis *L.*
Asclepias incarnata *L.*
Aureolaria villosa (*Muhl.*) *Raf.*
Betula alleghanensis *Britt.*
" coerulea *Blanchard*
Capnoides sempervirens (*L.*) *Borck.*
Chamaedaphne calyculata (*L.*) *Moench.*
Chionanthus virginica *L.*
Coreopsis lanceolata *L.*

Cyperus rivularis *Kunth.*
" strigosus *L.*
Dasystoma pedicularis (*L.*) *Benth.*
Dennstaedtia puncticuloba (*Michx.*) *Moore*
Dryopteris cristata (*L.*) *A. Gray*
" marginalis (*L.*) *A. Gray*
Eriocaulon decangulare *L.*
Grossularia cynosbati (*L.*) *Mill.*
" hirtella (*Michx.*) *Spach.*
Hudsonia montana *Nutt.*
Juncus georgianus *Coville*
Juniperus communis *L.*
Kalmia latifolia *L.*
Lepidium campestre (*L.*) *R. Br.*
Lupinus perennis *L.*
Lycopodium annotinum *L.*
" lucidulum *Michx.*
Meibomia dillenii (*Darl.*) *Kuntze*
Monarda mollis *L.*
Myriophyllum humile (*Raf.*) *Morong.*
Osmunda regalis *L.*
Panax trifolium *L.*
Polycodium stamineum (*L.*) *Greene*
Proserpinaca palustris *L.*
Prunus maritima *Wang.*
Quercus muhlenbergii *Engelm.*
Ranunculus abortivus *L.*
Rhamnus cathartica *L.*
Sabbatia campanulata (*L.*) *Torr.*
" dodecandra (*L.*) *B. S. P.*
Sedum roseum (*L.*) *Scop.*
Senecio obovatus *Muhl.*
Spiraea tomentosa *L.*
Steironema lanceolatum (*Walt.*) *A. Gray*
Syndesmon thalictroides (*L.*) *Hoffmg.*
Taxus canadensis *Marsh.*
Thalictrum dioicum *L.*
Tithymalus cyparissias (*L.*) *Hill*
Viburnum canbyi *Britton*
" semitomentosum (*Michx.*) *Rehder*
Viola pubescens *Ait.*

Joseph Rubinger, New York, N. Y.

Antennaria canadense *Greene*
" plantaginifolia (*L.*) *Rich.*
Aquilegia canadensis *L.*
Cardamine bulbosa (*Schreb.*) *B. S. P.*
Carex torta *Boott.*
Tithymalus cyparissias (*L.*) *Hill*
Floerkea proserpinacoides *Willd.*
Houstonia caerulea *L.*
Lycopodium clavatum *L.*
Polygala pauciflora *Willd.*
Azalea nudiflora *L.*
Ribes americanum *L'Her.*
Viola septentrionalis *Greene*
Zizia aurea (*L.*) *Koch.*

Prof. C. M. Scherer, Kent, Ohio

Gymnosporangium blasdaleanum (*D. & H.*) *Kern.*

F. A. Ward, Cortland, N. Y.

Botrychium lanceolatum (*S. G. Gmel.*) *Angs.*
" neglectum *Wood*
Carex asa-grayii *Bailey*
Mitella nuda *L.*
Potentilla canadensis *L.*
Selaginella apus (*L.*) *Spring*

Dr J. R. Weir, Missoula, Mont.

Aecidium allenii *Clinton*
Aleuria aurantia (*Pers.*) *Fckl.*
Aurantiporellus alboluteus (*E. & E.*) *Murr.*
Calyptospora columnaris (*A. & S.*) *Kuhn*
Cerrena unicolor (*Bull.*) *Murr.*
Coleosporium solidaginis (*Schw.*) *Thüm.*
Coltricia perennis (*L.*) *Murr.*
" tomentosa (*Fr.*) *Murr.*
Coniophora byssoides *Pers.*
Coriolus nigromarginatus (*Schw.*) *Murr.*

Coriolus prolificans (*Fr.*) *Murr.*
" versicolor (*L.*) *Quel.*
Coriolellus sequoiae (*Cope.*) *Murr.*
Creonectria purpurea (*L.*) *Seaver*
Cronartium comandrae *Peck*
" comptoniae *Arth.*
Dimerasporium collinsii (*Schw.*) *Thüm.*
Earlea speciosa (*Fr.*) *Arth.*
Echinodontium tinctorium *E. & E.*
Endothia gyrosa (*Schw.*) *Fckl.*
Fomes annosus (*Fr.*) *Cooke*
" ellisianus *F. W. Anders.*
" laricis (*Jacq.*) *Murr.*
" roseus (*A. & S.*) *Cooke*
" ungulatus (*Schaeff.*) *Sacc.*
Funalia stuppea (*Berk.*) *Murr.*
Gloeophyllum hirsutum (*Schaeff.*) *Murr.*
Grandinia granulosa *Fr.*
Gymnosporangium juvenescens *Kern.*
Hymenochaete curtisii *Berk.*
" tabaceum (*Sow.*) *Lev.*
Hypodermella laricis *Tub.*
Hypoxylon fuscum (*Pers.*) *Fr.*
" multiforme *Fr.*
Keithia thujina *Durand*
Laetiporus speciosus (*Batt.*) *Murr.*
Lophodermum nervisequum (*DC.*) *Rehm*
" pinastri *Schrad.*
Melampsora albertensis *Arth.*
" medusae *Thüm.*
Melampsorella elatina (*A. & S.*) *Arth.*
Melampsoropsis pyrolae (*DC.*) *Arth.*
Melampsoridium betulae (*Schum.*) *Diet.*
Neopeckia coulteri (*Peck*) *Sacc.*
Nyssopsora clavellosa (*Berk.*) *Arth.*
Ophiobolus acuminatus (*Schw.*) *Duby*
Peniophora carnosa *Burt*
" crassa *Burt*
" gigantea *Fr.*
" glebulosa *Bres.*
" glabrifera *E. & E.*
" velutina (*DC.*) *Cooke.*
Peridermium filamentosum *Peck*
Phacidium infestans *Karst.*
Piptoporus suberosus (*L.*) *Murr.*
Poria callosa *Fr.*
" carbonacea *B. & C.*
" corticola *Fr.*
" punctata *Fr.*
" undata (*Pers.*)
" vulgaris *Fr.*
Porodaedalea pini (*Thore*) *Murr.*
Puccinia acuminata *Peck*
" asteris *Duby*
" circaeae *Pers.*
" circii-lanceolati *Schw.*
" crandallii *Pam. & Hume*
" grossulariae (*Schum.*) *Lagerh.*
" koeleriae *Arth.*
" majanthae (*Schum.*) *Arth.*
" menthae *Pers.*
" obscura *Schroet.*
" peckii (*DeToni*) *Kellerm.*
" rhamni (*Pers.*) *Wettst.*
" stipae *Arth.*
" symphoricarpi *Hark.*
Pucciniastrum myrtillii (*Schum.*) *Arth.*
" pustulatum (*Pers.*) *Diet.*
Pycnoporus cinnabarinus (*Jacq.*) *Karst.*
Pyropolyporus igniarius (*L.*) *Murr.*
Rhizina inflata (*Schaeff.*) *Sacc.*
Rhytisma punctata (*Pers.*) *Fr.*
" salicina (*Pers.*) *Fr.*
Spongipellis borealis (*Fr.*) *Pat.*
Stereum chailletii *Fr.*
" purpureum *Pers.*
" sulcatum *Burt.*
Thelephora caryophyllea *Schaeff.*
" fimbriata *Schw.*
Trametes hexagoniformis *Murr.*
" setosus *Weir*
" suaveolens (*L.*) *Fr.*
Taphrina aurea (*Pers.*) *Fr.*
Tyromyces anceps (*Peck*) *Murr.*
Uromyces holwayi *Lagerh.*
Uropyxis sanguinea (*Peck*) *Arth.*
Wallrothiella arceuthobii (*Peck*) *Sacc.*

Douglas M. White, Rochester, N. Y.

Cynanchium vincetoxicum (*L.*) *Pers.*
Equisetum sylvaticum *L.*

Miss M. K. Smith, Jamaica, N. Y.

Agoseris glauca (*Nutt.*) *Greene*
Alsine longipes (*Goldie*) *Coville*
Aquilegia flavescens *S. Wats.*
Arnica cordifolia *Hooker*
Atragene columbiana *Nutt.*
Calochortus apiculatus *Baker*
Campanula rotundifolia *L.*
Chimaphila corymbosa *Pursh*
Dasiphora fruticosa (*L.*) *Rydb.*
Delphenium bicolor *Nutt.*
Erigeron speciosus *DC.*
" uniflorus *L.*
Geranium richardsonii *F. & T.*
Galium boreale *L.*
Homalobus tenellus (*Pursh*) *Britton*
Lupinus ornatus *Pursh*
Moneses uniflora (*L.*) *A. Gray*
Parnassia fimbriata *Konig.*
Peramium decipiens (*Hook.*) *Piper*
Pyrola bracteata *Hooker*
Ramischia secunda (*L.*) *Rydb.*
Senecio triangularis *Hooker*
Schizonotus discolor (*Pursh*) *Raf.*
Sphaeralcea rivularis (*Dougl.*) *Torr.*
Spiraea lucida *Dougl.*
Thlaspi arvense *L.*
Tiarella unifoliata *Hooker*
Veronica americana *Schw.*
Viola canadensis *L.*
" orbiculata *Geyer*
Xerophyllum tenax (*Pursh*) *Nutt.*
Zygadenus elegans *Pursh*

SPECIMENS ADDED TO THE HERBARIUM

New to the herbarium

Aposphaeria allantella *Sacc. & Roum.*
" striolata *Sacc.*
Ascochyta pirina *Peglion*
Cephalozia fransisci *Hook.*
Cercospora corni *Davis*
" lathyri *D. & H.*
" microstigma *Sacc.*
Colletotrichum sordidum *Davis*
Coriolellus sequoiae (*Copeland*) *Murr.*
Coryne sarcoides (*Jacq.*) *Tul.*
Coryneum pithoideum *D. & H.*
Cryptospora leiphaemioides *D. & H.*
Cryptosporium robiniae *D. & H.*
Curreya peckiana *Sacc.*
Cylindrosporium iridis *E. & H.*
Cytospora minuta *Thüm.*
" phomopsis *Sacc.*
" suffusa (*Fr.*) *Tul.*
Dendrodochium acerinum *D. & H.*
Dendrophoma phyllogena *Sacc.*
Diaporthe americana *Speg.*
" columbiensis *E. & E.*
" epimicta *E. & E.*
Diaporthe ocularia (*C. & E.*) *Sacc.*
" oncostoma (*Duby*) *Fckl.*
" paulula (*C. & E.*) *Sacc.*
" phomaspora (*C. & E.*) *Sacc.*
" sassafras *D. & H.*
Diatrype macounii *E. & E.*
Diatrypella subfulva (*B. & C.*) *Sacc.*
Diplodia benzoina *Sacc.*
" convolvuli *D. & H.*
" subcuticularis *D. & H.*
" thalictri *E. & D.*
Dothiorella peckiana *Sacc.*
Eutypella densta *E. & E.*
" gleditschiae *Berl.*
" staphyleae *D. & H.*
Fomitiporia pereffusa *Murr.*
Gibbera vaccinii (*Sow.*) *Fr.*
Gymnosporangium blasdaleanum (*D. & H.*) *Kern.*
Haplosporella malorum *Sacc.*
" velata *E. & B.*
Hendersonia anceps *Sacc.*
Hypochnus rubiginosus *Bres.*
" spongiosus (*Schw.*) *Burt*
Hypoderma tenellum *Sacc.*
Hysterographum lesquereuxii (*Duby*) *Sacc.*
Lepiota panaeola (*Fr.*) *P. Karst.*
Leptosphaeria consessa (*C. & E.*) *Sacc.*
" houseana *Sacc.*
" hydrophila *Sacc.*
" myricae *D. & H.*
Leptothryium dearnessii *Kabat & Bubak*

Massarinula brassicae *D. & H.*
Melanconium sphaeroideum *Link*
Meliola pitya *Sacc.*
Metasphaeria anthelmintica (*Cke.*) *Dearn.*
Microascus americanus *Sacc.*
Microdiplodia laurina *D. & H.*
Micropeltis pitya *Sacc.*
Mycena grantii *Murrill*
Myxosporium rhois (*B. & C.*) *Sacc.*
Oospora candidula *var.* carpogena *Sacc.*
Patellaria patinelloides (*S. & R.*) *Sacc.*
Peniophora allescheri *Bres.*
Phaeangium peckianum *Sacc.*
Phacidium andromedae *D. & H.*
Phialea pulchella (*Fckl.*) *Sacc.*
Phoma atomica *Sacc.*
" houseana *Sacc.*
" ochra *Cooke*
" oleracea *var.* meliloti *Sacc.*
" pleosporoides *Sacc.*
" vaccinii *D. & H.*
Phomopsis daturae *Sacc.*
" diachenii *Sacc.*
" viticola *Sacc.*
Phragmidium andersoni *Shear*
Phlyctanea verrucioides *Sacc.*
Phyllosticta crataegi (*Cooke*) *Sacc.*
" opaca *E. & E.*
" pirina *Sacc.*
Poria weirii *Murrill*
Propolidium atrovirens (*Fr.*) *Rehm.*
Puccinia angelicae (*Schum.*) *Lagerh.*
Puccinia antirrhinae *D. & H.*
" ceanothi (*E. & K.*) *Arth.*
" nodosa *E. & H.*
" ornata *Arth. & Holw.*
" proserpinacea *Farlow*
Rhabdospora clarkeana *Sacc.*
Sclerotium fallax *Sacc.*
" mendax *Sacc.*
Septoria breviuscula *Sacc.*
" gentiana *D. & H.*
" krigiae *D. & H.*
" macrosporia *Dearn.*
" rudbeckiae *var.* oaklandiae *Sacc.*
Sphaerella altera *Pass.*
" populifolia *Cooke*
" populnea *Sacc.*
" vaccinii *var.* corymbosi *Sacc.*
Sphaerographum hystricinum *var.* viburni *D. & H.*
Sphaeropsis aristolochiae *D. & H.*
" liquidambaris *D. & H.*
" punctata *D. & H.*
Sporodesmium opacum *Sacc.*
" pilulare *Sacc.*
Stemphylium magnusianum *Sacc.*
Stereum sulcatum *Burt*
Urophlyctis pluriannulatum (*B. & C.*) *Farlow*
Valsa americana *B. & C.*
" auerswaldi *Nke.*
" etherialis *E. & E.*
" nyssae *Grev.*

Amelanchier humilis *Wiegand*
" stolonifera *Wiegand*
Betula caerulea *Blanchard*
Elymus halophilus *Bicknell*
Heuchera curtisii *T. & G.*
Juncus georgianus *Coville*
Lycopus europaeus *L.*
" membranaceus *Bicknell*
Panicum pseudopubescens *Nash*
Potentilla sulphurea *Lam.*
Sagittaria cuneata *Sheldon*
Scabiosa arvensis *L.*
Solidago shortii *T. & G.*
Viburnum canbyi *Britton*
" semitomentosum (*Michx.*) *Rehder*

Not new to the herbarium

(Fungi)

Alternaria solani (*E. & M.*) *Jones & Grout*
Asteroma ribicolum *E. & E.*
Bjerkandera adusta (*Willd.*) *Karst.*

Bremia lactucae *Regel.*
Camarosporium robiniae (*West.*) *Sacc.*
Cenangium furfuraceum (*Roth.*) *De Not.*
Cercospora acetosella *Ell.*
" fingens *Davis*
" gaultheriae *E. & E.*
" omphacodes *Ell. & Holw.*
" pastinacea (*Sacc.*) *Peck*
Ceriomyces subglabripes (*Pk.*) *Murr.*
Chlorosplenium chlora (*Schw.*) *Massee*
Cintractia junci (*Schw.*) *Trel.*
Clavaria rugosa *Sowerby*
Clitocybe multiceps *Pk.*
Clitopilus abortivus *B. & C.*
Coleosporium helianthi (*Schw.*) *Arth.*
" solidaginis (*Schw.*) *Thüm.*
Coltricia perennis (*L.*) *Murr.*
" tomentosa (*Fr.*) *Murr.*
Coriolus nigromarginatus (*Schw.*) *Murr.*
" versicolor (*L.*) *Quel.*
Corticium incarnatum (*Pers.*) *Fr.*
" pezizoideum (*Schw.*) *von Schrenk*
Cortinarius armeniacus (*Schaeff.*) *Fr.*
Coryne sarcoides (*Jacq.*) *Tul.*
Crepidopus ostreatus (*Jacq.*) *S. F. Gray*
" serotinus (*Schrad.*) *Murr.*
Cronartium comandrae *Peck*
" comptoniae *Arth.*
Cryptospora aculeans (*Schw.*) *E. & E.*
" femoralis (*Peck*) *Sacc.*
Cucurbitaria elongata (*Fr.*)
Daedalea quercina (*L.*) *Pers.*
Diaporthe bicincta (*C. & P.*) *Sacc.*
" carpini (*Pers.*) *Fckl.*
Diaporthe comptoniae *Schw.*
" farinosa *Peck*
" neilliae *Peck*
" obscura (*Peck*) *Sacc.*
" oxyspora (*Pk.*) *Sacc.*
" parasitica *Murrill*
" woolworthii *Peck*
Diplodia melaena *Lev.*
" rubi *Fr.*
Discosia maculicola *Gerard*
Dothiorella quercina (*C. & E.*) *Sacc.*
Eutypella glandulosa (*Cke.*) *E. & E.*
" stellulata (*Fr.*) *Sacc.*
Fenestrella princeps *Tul.*
Geopetalum abietinum (*Schrad.*) *Murr.*
Gloeosporium salicis *West.*
" septorioides *Sacc.*
Gloniopsis cookeana (*Ger.*) *Sacc.*
Grandinia granulosa *Fr.*
Gymnosporangium juvenescens *Kern.*
Gyromitra esculenta *Fr.*
Helotium citrinum (*Batsch*) *Fr.*
Helvella gracilis *Pk.*
" infula *Schaeff.*
Hydnum cyaneotinctum *Peck*
Hygrophorus cantharellus *Schw.*
" miniatus *Fr.*
" minutulus *Peck*
Hymenochaete cinnamomea (*Pers.*) *Fr.*
Hypocrea sulphurea (*Schw.*) *Sacc.*
Hypoderma smilacis (*Schw.*) *Rehm.*
Hypoxylon morsei *B. & C.*
Hysterographium smilacis *Schw.*
Kuehneola potentillae (*Schw.*) *Arth.*
Laccaria laccata (*Scop.*)
Lactaria deceptiva *Peck*
Lentinus spretus *Pk.*
Leptosphaeria subconica (*C. & P.*) *Sacc.*
Leptostromella filicina (*B. & C.*) *Sacc.*
Leptothyrium vulgare (*Fr.*) *Sacc.*
Lophodermium pinastri *Schrad.*
Massaria vomitoria *B. & C.*
Melampsorella elatina (*A. & S.*) *Arth.*
Melampsoropsis pyrolae (*DC.*) *Arth.*
Melanconium oblongum *Berk.*
Microsphaera diffusa *C. & P.*
Mollisia cinerea (*Batsch*) *Karst.*
Neopeckia coulteri (*Pk.*) *Sacc.*
Nigredo caladi (*Schw.*) *Arth.*
" perigynius (*Halsted*) *Arth.*
" polemonii (*Peck*) *Arth.*
" polygoni (*Pers.*) *Arth.*
" prominens (*DC.*) *Arth.*
Odontia fimbriata (*Pers.*) *Fr.*
Omphalia austini *Peck*
Ophiobolus porphyrogonis (*Tode*) *Sacc.*
Peridermium filamentosum *Peck*
Peronospora parasitica (*Pers.*) *De Bark*
Phialea pulchella (*Fckl.*) *Sacc.*
Phoma pallens *B. & C.*
" sepincola (*Kickx.*) *Sacc.*
Phomopsis daturae (*R. & F.*) *Sacc.*
Phragmidium disciflorum (*Tode*) *James*
" rosae-californicae *Diet.*
" rosae-setigerae *Diet.*

Phyllachora cyperi *Rehm.*
Phyllosticta cornicola (*DC.*) *R.*
" latifolia *E. & E.*
" smilacis *E. & M.*
Plasmopara caricis *E. & E.*
" humuli *M. & T.*
" ribicola *Schroet.*
Pleospora herbarum (*Pers.*) *Rabh.*
Polyporus admirabilis *Pk.*
" fulvidus *E. & E.*
" polyporus (*Retz.*) *Murrill*
Polythelis fusca (*Pers.*) *Arth.*
" thalictri (*Chev.*) *Arth.*
Porodaedalea pini (*Thore*) *Murr.*
Puccinia andropogonis *Schw.*
" angustata *Peck*
" artemisiarum *Duby*
" asparagi *DC.*
" caricis (*Schum.*) *Reb.*
" cicutae *Lasch.*
" claytoniata (*Schw.*) *Peck*
" crandallii *Pam. & Hume*
" ellisiana *Thüm.*
" helianthi *Schw.*
" eriophori *Thüm.*
" extensicola *Plowr.*
" fraxinata (*Link*) *Arth.*
" grossulariae (*Schum.*) *Lagerh.*
" orbicula *P. & C.*
" peckii (*De Toni*) *Kellerm.*
" proserpinaceae *Farlow*
" pustulata (*Curt.*) *Arth.*
" rhamni (*Pers.*) *Wettsb.*
" symphoricarpi *Harkness*
" urticae *Lagerh.*
" violae (*Schum.*) *DC.*
Pucciniastrum pustulatum (*Pers.*) *Diet.*
Pycnoporus cinnabarinus (*Jacq.*) *P. Karst.*
Pyrenopeziza rubi (*Fr.*) *Rehm.*
Rumularia brunellae *E. & E.*
" celastri *Peck*
" plantaginis *E. & M.*
" ranunculi *Peck*
" variabilis *Fckl.* *var.* digitalidis *Sacc.*
Rhytisma decolorans *Fr.*
" ilicis-canadensis *Schw.*
Sebacina incrustans *Tul.*
Schizonella melanogramma (*DC*) *Schroet.*
Scoleconectria scolecospora (*Bref.*) *Seaver*
Septoria brunellae *E. & H.*
" dentariae *Peck*
" diervillae *E. & E.*
" erigerontis *Peck*
" oenotherae *West.*
" pileae *Thüm.*
" polygalae *Peck*
" saccharina *E. & E.*
" sedicola *Peck*
" sicyi *Peck*
" viride-tingens *Crut.*
Sphaerella arbutifoliae *Peck*
" pontederiae *Peck*
Sphaeropsis biformis *Peck*
" linearis *Peck*
" mali (*West.*) *Sacc.*
" platani *Peck*
" punctata *D. & H.*
" tiliacea *Peck*
Spongipellis borealis (*Fr.*) *Pat.*
Stamnaria equiseti (*Hoffm.*) *Sacc.*
Stemphylium magnusianum *Sacc.*
Taphrina aurea (*Pers.*) *Fr.*
" quercus (*Cooke*) *Sacc.*
Trametes cervinus *Pers.*
Tranzschelia punctata (*Pers.*) *Arth.*
Uredinopsis mirabilis (*Peck*) *Magn.*
Urocystis anemones (*Pers.*) *Schroet.*
Uropyxis sanguinae (*Pk.*) *Arth.*
Valsa ambiens (*Pers.*) *Fr.*
" americana *B. & C.*
" caryigena *B. & C.*
" ceratophora *Tul.*
" liquidambaris (*Schw.*) *Cooke*
" salicina (*Pers.*) *Fr.*
Valsaria exasperans (*Gerard*) *var.* aceris *Rehm.*
Valsonectria parasitica (*Murr.*) *Rehm*
Vermicularia violaerotundifoliae (*Sacc.*) *House*
Wallrothiella arceuthobii (*Pk.*) *Sacc.*

Not new to the herbarium

(Flowering plants and ferns)

Acalypha gracilens *A. Gray*
Acer tomentosum *Desv.*
Acerates viridiflora *Ell.*
Acnida cannabina *Linn.*
Actaea alba (*L.*) *Mill.*
Agrimonia gryposepala *Wallr.*
" striata *Mx.*
Ailanthus glandulosa *Desf.*
Aletris farinosa *Linn.*
Allium canadense *Linn.*
Amelanchier canadensis (*L.*) *Medic.*
" intermedia *Spach.*
" spicata (*Lam.*) *C. Kock*
Anchistea virginica (*L.*) *Presl.*
Andromeda canescens *Small*
Anemone quinquefolia *Linn.*
Antennaria ambigens *Fernald*
" canadensis *Greene*
" fallax *Greene*
" grandis (*Fern.*) *House*
" neodioica *Greene*
" occidentalis *Greene*
" parlinii *Fernald*
" petaloidea *Fernald*
" plantiginifolia (*L.*) *Rich*
Anticlea elegans (*Pursh*) *Rydb.*
Apocynum androsaemifolium *L.*
Aquilegia canadensis *Linn.*
" vulgaris *Linn.*
Arabis glabra (*L.*) *Bernh.*
" lyrata *Linn.*
Arethusa bulbosa *Linn.*
Argentina anserina (*L.*) *Rydb.*
Aristida dichotoma *Michx.*
Aronia arbutifolia (*L.*) *Ell.*
" melanocarpa (*Mx.*) *Britt.*
Asarum canadense *Linn.*
Asclepias incarnata *Linn.*
" pulchra *Ehrh.*
" quadrifolia *Jacq.*
Aster ericoides *L.*
" laevis *L.*
" macrophyllus *L.*
" multiformis *Burgess.*
" novae-angliae *L.*
" prenanthoides *Muhl.*
" ptarmicoides (*Nees*) *T. & G.*
Aster tenuifolius *L.*
Azalea nudiflora *Linn.*
" viscosa *Linn.*
Bartonia virginica (*L.*) *B. S. P.*
Bicuculla canadensis (*Goldie*) *Millsp.*
" cucullaria (*L.*) *Millsp.*
Bidens cernua *L.*
" trichosperma (*Mx.*) *Britt.*
Blephariglottis blephariglottis (*L.*) *Rydb.*
" lacera (*Michx.*) *Farwell*
" psycodes (*L.*) *Rydb.*
Bromus tectorum *L.*
Blephilia hirsuta (*Pursh*) *Torr.*
Botrychium lanceolatum (*S. G. Gmel.*) *Angs.*
" neglectum *Wood*
Cakile edentula (*Bigel.*) *Hook.*
Calla palustris *Linn.*
Caltha palustrus *Linn.*
Camelina microcarpa *Andrz.*
Campanula aparinoides *Pursh*
" rapunculoides *Linn.*
" rotundifolia *Linn.*
Cardamine bulbosa (*Schreb.*) *B. S. P.*
" pratensis *Linn.*
Carex albicans *Willd.*
" aquatilis *Wahl.*
" arctata *Boott.*
" asa-grayi *Bailey*
" bromoides *Schk.*
" buxbaumii *Wahl.*
" canascens *L. var.* disjuncta *Fernald*
" cephaloidea *Dewey*
" communis *Bailey*
" crawfordii *Fernald*
" cristata *Schw.*
" deflexa *Hornem.*
" diandra *Schk.*
" festucacea *Schk.*
" folliculata *Linn.*
" gracillima *Schw.*
" granularis *Muhl.*
" grisea *Wahl.*
" hystricina *Muhl.*
" lacustris *Willd.*

Carex lanuginosa *Michx.*
" lasiocarpa *Schk.*
" laxiflora *Lam.*
" limosa *L.*
" magellanica *Lam.*
" muhlenbergii *Wahl.*
" oligosperma *Michx.*
" pallescens *L.*
" pedunculata *Muhl.*
" prasina *Wahl.*
" projecta *Mackenzie*
" retrorsa *Schw.*
" rosea *Schk.*
" rostrata *Stokes*
" scabrata *Schw.*
" scirpoides *Schk.*
" scoparia *Schk.*
" scoparia *var.* condensa *Fernald*
" sprengelii *Dewey*
" stellulata *Good.*
" stellulata *var.* cephalantha (*Bailey*) *Fernald*
" stricta *Lam.*
" torta *Boott*
" trichocarpa *Muhl.*
" typhinoides *Schw.*
" varia *Muhl.*
" vestita *Willd.*
" virescens *Muhl.*
" vulpinoidea *Michx.*
Cassia marylandica *Linn.*
Castalia tuberosa (*Paine*) *Greene*
Cathartolinum medium (*Planch.*) *Small*
" striatum (*Walt.*) *Small*
Chamaecyparis thyoides (*L.*) *B. S. P.*
Chamaesyce glyptosperma (*Engelm.*) *Small*
Chenopodium rubrum *Linn.*
Chimaphila maculata (*L.*) *Pursh*
Chiogenes hispidula (*L.*) *Torr. & Gray*
Chrysopsis falcata (*Pursh.*) *Ell.*
Cimicifuga racemosa (*L.*) *Nutt.*
Cirsium muticum *Michx.*
Claytonia caroliniana *Michx.*
Clethra acuminata *Michx.*
" alnifolia *Linn.*
Clinopodium vulgare *Linn.*
Clintonia borealis (*Ait.*) *Raf.*
" umbellulata (*Michx.*) *Torr.*
Comarum palustre *Linn.*
Commelina communis *Linn.*
Comptonia peregrina (*L.*) *Coulter*
Convolvulus repens *Linn.*
" spithamaeus *Linn.*
Coreopsis lanceolata *Linn.*
" major *Walt.*
" rosea *Nutt.*
" verticillata *Linn.*
Cornus canadensis *Linn.*
Coronilla varia *Linn.*
Crepis capillaris (*L.*) *Wallr.*
Crocanthemum majus (*L.*) *Britt.*
Cynanchum vincetoxicum (*L.*) *Pers.*
Cynoglossum officinale *Linn.*
Cyperus filicinus *Vahl*
" inflexus *Muhl.*
Cypripedium candidum *Willd.*
" parviflorum *Salisb.*
" pubescens *Pursh*
" reginae *Walt.*
Dalibarda repens *L.*
Dasystephana andrewsii (*Griseb.*) *Small*
Dasystoma flava (*L.*) *Wood*
Dentaria diphylla *Michx.*
" laciniata *Muhl.*
" maxima *Nutt.*
Deschampsia flexuosa (*L.*) *Trin.*
Dianthera americana *Linn.*
Dracocephalum virginicum *Linn.*
Drosera intermedia *Hayne*
" longifolia *L.*
" rotundifolia *Linn.*
Drymocallis agrimonoides (*Pursh*) *Rydb.*
Dryopteris dryopteris (*L.*) *Britt.*
" goldiana (*Hook.*) *Gray*
" simulata *Davenp.*
" spinulosa (*O. F. Müller*) *Kze.*
Echinochloa frumetacea (*Roxb.*) *Link*
" muricata (*Michx.*) *Fernald*
Elymus virginicus *Linn.*
Epilobium adenocaulon *Haussk.*
Equisetum sylvaticum *L.*
Erigeron philadelphicus *Linn.*
Eriophorum angustifolium *Roth.*
" gracile *Koch.*
" tenellum *Nutt.*
" virginicum *Linn.*
" viridicarinatum (*Engelm.*) *Fern.*

Erythronium americanum *Ker.*
Eubotrys racemosa (*L.*) *Nutt.*
Eupatorium hyssopifolium *L.*
" maculatum *Linn.*
" purpureum *L. var.* foliosum *Fern.*
Filipendula rubra (*Hill*) *Robinson*
Fissipes acaulis (*L.*) *Small*
Floerkea proserpinacoides *Willd.*
Fragaria virginiana *Duchesne*
Galeorchis spectabilis (*L.*) *Rydb.*
Galinsoga parviflora *Cav.*
Galium boreale *Linn.*
" verum *Linn.*
Gaylussacia baccata *Wang.*
" dumosa (*Andr.*) *T. & G.*
" frondosa (*L.*) *T. & G.*
Geum rivale *Linn.*
" virginianum *Linn.*
Glecoma hederacea *Linn.*
Glycine apios *Linn.*
Gratiola aurea *Muhl.*
Gymnadeniopsis clavellata (*Mx.*) *Rydb.*
Helenium autumnale *L.*
" latifolium *Pursh*
Helianthus decapetalus *L.*
" giganteus *Linn.*
" mollis *Lam.*
Heliopsis helianthoides (*L.*) *Sweet*
Hemerocallis fulva *Linn.*
Hepatica acutiloba *DC.*
" hepatica (*L.*) *Karst.*
Hieracium florentinum *All.*
" pilosella *Linn.*
Hordeum jubatum *Linn.*
Houstonia caerulea *Linn.*
" longifolia *Gaertn.*
Hudsonia tomentosa *Nutt.*
Hydrophyllum virginianum *Linn.*
Hypericum adpressum *Bart.*
" ascyron *Linn.*
" canadense *Linn.*
" punctatum *Lam.*
Hypopitys hypopitys (*L.*) *Small*
Hypoxis hirsuta (*L.*) *Coville*
Hystrix hystrix (*L.*) *Millsp.*
Ibidium plantagineum (*Raf.*) *House*
" praecox (*Walt.*) *House*
" romanzoffianum (*Cham.*) *House*
Ilysanthes attenuata (*Muhl.*) *Small*
Ionoxalis violacea (*L.*) *Small*
Isnardia palustris *L.*
Juncus gerardi *Loisel.*
Junipersus horizontalis *Moench.*
Kalmia angustifolia *Linn.*
" latifolia *Linn.*
Kneiffia alleni (*Britt.*) *Small*
" linearis (*Michx.*) *Spach*
" pumila (*L.*) *Spach*
" riparia (*Nutt.*) *Small*
Koellia virginianum (*L.*) *MacM.*
Lactuca canadensis *Linn.*
Lathyrus maritimus (*L.*) *Bigel.*
" myrtifolius *Muhl.*
Lechea intermedia *Leggett*
" leggettii *Britt. & Hollick*
" racemulosa *Lam.*
Lemna trisulca *Linn.*
Leptasea aizoides (*L.*) *Haw.*
Lilium philadelphicum *Linn.*
" superbum *Linn.*
Limnorchis hyperborea (*L.*) *Rydb.*
Limodorum tuberosum *Linn.*
Linaria canadense (*L.*) *Dumort.*
Lobelia cardinalis *Linn.*
" kalmii *Linn.*
" nuttallii *R. & S.*
Lonicera canadensis *Marsh.*
" oblongifolia (*Goldie*) *Hook.*
Lotus corniculatus *Linn.*
Ludwigia alternifolia *Linn.*
Lychnis alba *Mill.*
" flos-cuculi *Linn.*
Lycopodium alopecuroides *Linn.*
" clavatum *Linn.*
Lycopus americanus *Muhl.*
" uniflorus *Mx.*
" virginicus *L.*
Lysimachia quadrifolia *Linn.*
" terrestris (*L.*) *B. S. P.*
Lythrum salicaria *Linn.*
Malaxis unifolia *Michx.*
Malva moschata *Linn.*
Mariscus mariscoides (*Muhl.*) *Kuntze*
Medeola virginiana *Linn.*
Meibomia dillenii (*Darl.*) *Kuntze*
" grandiflora (*Walt.*) *Kuntze*
Melampyrum lineare *Lam.*
Memyanthes trifoliata *Linn.*
Mentha canadensis *Linn.*
Mikania scandens (*L.*) *Willd.*
Mimulus ringens *Linn.*

Mitella cordifolia *Linn.*
" nuda *Linn.*
Moehringia lateriflora (*L.*) *Fenzl.*
Monarda didyma *Linn.*
" mollis *Linn.*
" punctata *Linn.*
Muhlenbergia schreberi *J. F. Gmel.*
Myosotis scorpioides *Linn.*
Myrica caroliniana *Mill.*
Nabalus trifoliatus *Cass.*
Naumbergia thyrsiflora (*L.*) *Duby*
Nelumbo lutea (*Willd.*) *Pers.*
Neopieris mariana (*L.*) *Britt.*
Nothoholcus lanatus (*L.*) *Nash*
Nymphaea advena (*L.*) *Soland.*
Nyssa sylvatica *Marsh.*
Oenothera muricata *Linn.*
Ophioglossum vulgatum *Linn.*
Oxalis acetosella *Linn.*
Oxycoccus macrocarpus (*Ait.*) *Pursh*
" oxycoccus (*L.*) *MacM.*
Oxypolis rigidus (*L.*) *Raf.*
Panax trifolium *Linn.*
Panicularia grandis (*Wats.*) *Nash*
" nervata (*Willd.*) *Kuntze*
Panicum depauperatum *Muhl.*
" ashei *Pears.*
" dichotomum *L.*
" columbianum *Scribn.*
" meridionale *Ashe*
" virgatum *L.*
" " cubense *Griseb.*
Parietaria pennsylvanica *Muhl.*
Parnassia caroliniana *Michx.*
Pedicularis canadensis *Linn.*
Peltandra virginica (*L.*) *Kunth*
Penthorum sedoides *Linn.*
Pentstemon hirsutus (*L.*) *Willd.*
" pentstemon (*L.*) *Britt.*
Peramium pubescens (*Willd.*) *MacM.*
" tesselatum (*Todd.*) *Heller*
Persicaria muhlenbergii (*S. Wats.*) *Small*
Phalaris arundinacea *L.*
Phlox paniculata *Linn.*
" subulata *L.*
Phragmites phragmites (*L.*) *Karst.*
Physalis pruinosa *L.*
Plantago decipiens *Barneoud*
" rugelii *Decne.*
" virginica *Linn.*
Pogonia ophioglossoides (*L.*) *Ker.*
Polemonium vanbruntiae *Britt.*
Polycodium stamineum (*L.*) *Greene*
Polygala cruciata *L.*
" lutea *Linn.*
" nuttallii *T. & G.*
" pauciflora *Willd.*
" polygama *Walt.*
" senega *Linn.*
" verticillata *Linn.*
" viridescens *Linn.*
Polygonatum biflorum (*Walt.*) *Ell.*
Polygonum maritimum *Linn.*
" tenue *Michx.*
Polymnia canadensis *Linn.*
Potamogeton amplifolius *Tuckerm.*
" compressus *L.*
" natans *L.*
" pectinatus *L.*
" perfoliatus *L.*
Potentilla recta *Linn.*
Prunus cuneata *Raf.*
Pylaisia schimperi *R. & G.*
Pyrola americana *Sweet*
" elliptica *L.*
" uliginosa *T. &* G.
Pyxidanthera barbulata *Michx.*
Quercus ilicifolia *Wang.*
" marilandica *Moench*
Radicula palustris (*L.*) *Moench*
" sylvestris (*L.*) *Druce*
Ramischia secunda (*L.*) *Rydb.*
Ranunculus bulbosus *Linn.*
" fascicularis *Muhl.*
" hispidus *Michx.*
" pennsylvanicus *L. f.*
" scleratus *Linn.*
" septentrionalis *Poir.*
Rhexia virginica *Linn.*
Rhododendron punctatum *Andr.*
Rhyncospora alba (*L.*) *Vahl*
" glomerata (*L.*) *Vahl*
Ribes americana *L'Her.*
" glandulosum *Grauer*
" triste *Pall.*
Ridan alternifolia *L.*
Robertiella robertiana (*L.*) *Hanks*
Rosa virginiana *Mill.*
Rubus argutus *Link*
" hispidus *Linn.*
" procumbens *Muhl.*

Rubus sativus (*Bailey*) *Brainerd*
Rudbeckia sulivantii *Boynton & Beadle*
Sabbatia stellaris *Pursh*
Salicornia europea *L.*
Salix candida *Fluegge*
" lucida *Muhl.*
" sericea *Marsh.*
Sambucus racemosa *Linn.*
Samolus floribundus *H. B. K.*
Sanguinaria canadensis *Linn.*
Sanicula trifoliata *Bickn.*
Sarothra gentianoides *Linn.*
Savastana odorata (*L.*) *Scribn.*
Scheuchzeria palustris *L.*
Scirpus caespitosus *Linn.*
" paludosus *A. Nels.*
" robustus *Pursh*
" validus *Vahl*
Schrophularia leporella *Bicknell*
Scutellaria galericulata *Linn.*
Senecio aureus *Linn.*
Sericocarpus asteroides (*L.*) *B. S. P.*
Silene antirrhina *Linn.*
" pennsylvanica *Michx.*
Silphium integrifolium *Michx.*
" perfoliatum *Linn.*
" trifoliatum *Linn.*
Sisyrinchium arenicola *Bicknell*
" atlanticum *Bicknell*
" graminoides *Bicknell*
Sium cicutaefolium *Schrank.*
Smilax rotundifolia *L.*
Solidago houghtoni *T. & G.*
" odora *Linn.*
" ohioensis *Riddell*
" uniligulata (*DC.*) *Porter*
Sorghastrum nutans (*L.*) *Nash*
Stachys aspera *Michx.*
Steironema ciliatum (*L.*) *Raf.*
Syntherisma sanguinale (*L.*) *Dulac.*
Teucrium boreale *Bicknell*
" canadense *Linn.*
" littorale *Bicknell*
" occidentale *A. Gray*
Thalictrum dioicum *L.*
Tissa marina (*L.*) *Britt.*
" rubra (*L.*) *Britt.*
Tithymalopsis ipecacuanhae (*L.*) *Small*
Tithymalus cyperissias (*L.*) *Hill*
Tragopogon pratensis *Linn.*
Triantha glutinosa (*Michx.*) *Baker*
Trichostema dichotomum *L.*
Trientalis americana *Linn.*
Trillium cernuum *Linn.*
" undulatum *Willd.*
Uva-ursi uva-ursi (*L.*) *Britt.*
Uvularia grandiflora *Sm.*
" puberula *Michx*
Vaccinium angustifolium *Ait.*
Vagnera racemosa (*L.*) *Morong*
" stellata (*L.*) *Morong*
" trifolia (*L.*) *Morong*
Valeriana uliginosa (*T. & G.*) *Rydb.*
Verbena hastata *Linn.*
Vernonia noveboracensis (*L.*) *Willd.*
Veronica chamaedrys *Linn.*
" officinalis *Linn.*
" serpyllifolia *Linn.*
Viburnum cassinoides *Linn.*
" dentatum *Linn.*
" opulus *Linn.*
Vinca minor *Linn.*
Viola affinis *LeConte*
" brittoniana *Pollard*
" canadensis *Linn.*
" conspersa *Reichenb.*
" emarginata *LeConte*
" eriocarpa *Schw.*
" fimbriatula *J. E. Sm.*
" hirsutula *Brainerd*
" incognita *Brainerd*
" lanceolata *Linn.*
" nephrophylla *Greene*
" palmata *Linn.*
" papilionacea *Pursh*
" pedata *Linn.*
" primulifolia *Linn.*
" pubescens *Ait.*
" renifolia *A. Gray*
" sagittata *Ait.*
" selkirkii *Pursh*
" septentrionalis *Greene*
" sororia *Willd.*
" triloba *Schw.*
Vitis aestivalis *Michx.*
Waldsteinia fragarioides (*Michx.*) *Tratt.*
Woodsia ilvensis (*L.*) *R. Br.*
Xanthoxalis rufa *Small*
Xyris caroliniana *Walt.*
Zanthoxylum americanum *Mill.*
Zizia aurea (*L.*) *Koch*

NEW OR INTERESTING SPECIES OF FUNGI IV

a Fungi New to the State Flora

Camarosporium robiniae (West.) Sacc.

Of frequent occurrence on dead twigs of Robinia. Collected at North Bay, Oneida county, on Robinia viscosa. H. D. House, June 26, 1915, and at Orient, Long Island, on Robinia pseudo-acacia Linn. by Roy Latham, *no. 702*, February 4, 1915. Associated with Cucurbitaria elongata.

Cercospora lathyri Dearness & House, sp. nov.

Spots bluish gray and finally arid, limited by the veinlets and developing a narrow reddish boundary, 2–4 by 2–3 mm in extent.

Hyphae very short on numerous, evenly scattered, brownish bases, amphigenous.

Conidia more abundant on the upper surface, straight or slightly curved, continuous or obscurely 1–2-septate, 40–70 by $2\frac{3}{4}$–$3\frac{1}{4}$ μ.

On living leaves of Lathyrus maritimus (L.) Bigel. Wading River and Eastport. C. H. Peck, August, September. Type in the herbarium of the New York State Museum.

Cercospora microstigma Sacc.

On dead or dying leaves of Carex arctata Boott, Pecksport, Madison county. H. D. House, July 15, 1915. Also collected by Doctor Peck on Carex plantaginea Lam. at Taberg, Oneida county. The species is doubtless common on many Carices, and Professor Dearness records it also on C. granularis, C. albursina and C. laxiflora.

Cercospora pastinacae (Sacc.) Peck

On leaves of Pastinaca sativa L., Portage, N. Y. C. H. Peck, August 12th, (year not indicated). Professor Peck raised this from a variety of Cercospora apii Fres. to specific rank after an examination of material collected by J. M. Bates in Nebraska on the same host. Its occurrence in New York has never been recorded by Doctor Peck and this collection of his from Portage was among some undetermined material.

Coryne sarcoides (Jacq.) Tul.

On decayed logs of pine and chestnut. Karner, Albany county. H. D. House, November 2, 1916 (determined by F. J. Seaver).

Pileus purplish and waxlike when fresh, one-eighth to nearly one-half inch broad. Coryne urnalis (Nyl.) Sacc. has been collected by Doctor Peck at North Elba.

Coryneum pithoideum Dearness & House, sp. nov.

Acervuli in lenticel-like pustules thinly but regularly scattered, producing circular ruptures of the epidermis and contiguous cortex, 1–1.5 mm in diameter, seated in the cortex, not compact, of the size of the crateriform rupture, often appearing under the lens as if caespitose.

Conidia cask-shaped, variable in size, averaging about 25 by 12 μ, mostly 5-septate, brown with a hyaline cell at each end.

On dead stems of Celastrus scandens Linn., Kenwood swamp near Oneida, N. Y. H. D. House, May 15, 1915. Type in the herbarium of the New York State Museum.

This has the naked eye appearance of Coryneum pustulatum Peck, described on dead branches of oak and chestnut, but the spores are more nearly like those of Coryneum compactum B. & Br.

Cryptospora leiphaemoides Dearness & House, sp. nov.

Stromata scattered, raising the perforated epidermis and blackening the underlying cortical pustule, 1–1.5 mm; the disc .25–.3 mm, whitish at first, but becoming granular and darker when the very short, black ostiola appear thru it.

Perithecia 5 to 8 in a stroma, pale gray, lying in the unaltered cortex and in transection strongly resembling Diaporthe leiphaemia (Fr.).

Asci clavate-cylindrical, paraphysate, 65–90 μ, mostly about 75 x 10 μ. Sporidia parallel in the asci, cylindrical, subarcuate, subclavate, continuous, pluri-guttulate, 25–60 μ long, mostly about 45 μ, upper half 4–5 μ in the thickest part, lower half 2.5–3 μ.

On dead twigs of Quercus alba L. Astor woods, near Bronx Park, New York City. H. D. House, April 24, 1916. Type in the herbarium of the New York State Museum.

Externally the stroma and disc of this species resemble Cryptospora albofusca (C. & E.), also on Quercus, but it differs decidedly in its sporidia and paraphyses as represented in F. Col. 36 (material of Mr Ellis's collection). C. albofusca is described in the section Eucryptospora but in F. Col. 36 the sporidia are 3-septate in the copy examined.

Cryptospora suffusa (Fr.) Tul.

On dead twigs of Alnus rugosa (DuRoi) Spreng., Albany. H. D. House, January 30, 1916.

Cryptosporium robiniae Dearness & House, sp. nov.

Acervuli cortical, raising the epidermis into circular or elliptical uncolored pustules, gray in tangential sections, .2–1 mm showing when mature a central, circular, perforation in the epidermis.

Sporules hyaline, continuous, strongly falcate, 14–17 x 1–1.5 μ.

On dead twigs of Robinia pseudo-acacia L. Hills southeast of Rensselaer. H. D. House, May 4, 1916. Type in the herbarium of the New York State Museum.

Cylindrosporium iridis E. & H.

On living leaves of Iris versicolor L., Orient, N. Y. Roy Latham, October 15, 1915.

Dendrodochium acerinum Dearness & House, sp. nov.

Sporodochia verruciform, sparsely scattered, brown when dry, flat, .5–.7 mm in breadth, .2 mm in depth, apparently superficial on the cuticle but really developing from the cortex.

Conidia numerous, 4–5 x 1.5 μ, borne on curved, branching sporophores, the stalk and branches of which are of various lengths but usually totaling about 45 μ in length. The branches are 2 μ thick.

On dead twigs of Acer pseudoplatanus L. Menands, Albany county. H. D. House, December 2, 1914. Type in the herbarium of the New York State Museum.

Diaporthe americana Speg.

On dead twigs of Magnolia virginiana L. (M. glauca L.) Babylon, N. Y. H. D. House, April 21, 1916.

First collected in this country by Professor Ellis in January 1889 on Magnolia glauca and reported as D. americana Speg. Ten years afterward he published a revisal stating that the perithecia were too large for D. americana and proposed for his collection the name of Diaporthe magnoliae. The Babylon material shows marked variation, so much so, that Professor Dearness is inclined to regard the description of D. americana as covering the Babylon collection as well as Professor Ellis's D. magnoliae.

Diaporthe oncostoma (Duby) Fckl.

On dead twigs of Robinia pseudo-acacia L. Albany. H. D. House, November 26, 1915 and October 25, 1916.

Diaporthe paulula (C. & E.) Sacc.

On dead twigs of Nyssa sylvatica Marsh., Babylon, N. Y. H. D. House, April 20, 1916.

Diaporthe phomaspora (C. & E.) Sacc.

Grassy pond, Adirondack mountains, N. Y., on dead twigs of Myrica gale Linn. Dr C. H. Peck. Reported by Doctor Peck as "Diaporthe wibbei Nitsch.," a name which for the present must be stricken from the list of reported American fungi. This correction in determination was indicated by Professor Dearness after a most careful examination of the material in question.

Diaporthe sociata C. & E.

Catskill mountains, N. Y. on dead twigs of Benzoin aestivale (L.) Nees. Dr C. H. Peck, September.

Diatrypella subfulva (B. & C.) Sacc.

On dead twigs of Nyssa sylvatica Marsh., Shawangunk mountains, Dr C. H. Peck. (Determined by Dearness.)

Diplodia convolvuli Dearness & House, sp. nov.

Pycnidia thickly scattered, covered by the cuticle, perforate, depressed, .2 to .25 mm in diameter.

Conidia brown, uniseptate, but slightly when at all constricted, 18–24 by 9–12 μ, usually with similar cells but sometimes one is globose and the other subconic.

On dead stems of Convolvulus sepium Linn. Albany, N. Y. H. D. House, November 7, 1915. Type in the herbarium of the New York State Museum.

Diplodia subcuticularis Dearness & House, sp. nov.

Pycnidia densely gregarious, 12 to 18 in a circle 2 mm in diameter, dark brown, seated on the cortex, stellately rupturing the cuticle which soon becomes loosened from the cortex and shed.

Conidia brown, very tardily septate, not constricted at the septum, oblong-elliptic, ends rounded, 16–18 by 9–12 μ.

On dead branchlets of Sassafras variifolium (Salisb.) Kuntze. Sylvan Beach, Oneida county, N. Y. H. D. House, May 10, 1915.

This might be taken for a Sphaeropsis for in some cases the continuous spores appear to be more numerous than the septate ones. Diplodia decorticata C. & E., also on Sassafras, has strongly constricted spores in hysteriiform pycnidia.

Diplodia thalictri E. & D.

On dead stems of Thalictrum polygamum Muhl. Near Albany. H. D. House, June 13, 1915. (Determined by Dearness.)

Discosia kreigeriana Bres.

Karner, Albany county, on living and languishing leaves of Chamaenerion angustifolium (L.) Scop. (Epilobium angustifolium L.) H. D. House, July 20, 1915.

Eutypella deusta E. & E.

On decayed wood of oak limbs, Orient Point, N. Y. Roy Latham, May 1, 1911.

Eutypella gleditschiae Berl.

On dead twigs of Gleditsia triacanthos L. Orient, N. Y. Roy Latham, April 2, 1916. (*No. 724.*)

Eutypella staphyleae Dearness & House, sp. nov.

Stromata bullate, incorporating the cambium, lodged on the wood, leaving a whitened area when removed, immediately surrounded by a dark line which does not penetrate the wood, sometimes confluent, base mostly irregularly elliptic, 2–4 by 1–3 mm.

Perithecia 3 to 5 in a stroma or appearing numerous when confluent, black, globose, large, about 1 mm in diameter, ostiola sulcate, stout, short, .2 mm in width and height.

Asci long-clavate to fusoid, 60–75 by 8–12 μ, stipe linear, 20–80 μ long, paraphysate.

Sporidia allantoid, dark amber-colored, mostly 15–18 by 4 μ, extremes 14–20 by $3\frac{1}{2}$–$4\frac{1}{4}$ μ.

On dead stems of Staphylea trifolia Linn. Near Albany. Collected by C. H. Peck in April (year not indicated).

Gloeosporium lappae Dearness & House, sp. nov.

Spots subcircular, gray-brown with arid centers tending to crack and break away, the arid portions surrounded by several rather obscurely circinating ridges close together.

Acervuli epiphyllous on the arid areas, nearly concolorous, 40–100 μ; spores hyaline, with 2 to 3 nuclei causing some of them to appear uniseptate, 6–9 x 3 μ.

On living leaves of Arctium minus Schk. Albany. H. D. House, August 1916. Type in the herbarium of the New York State Museum.

Hendersonia vagans Fckl.

On dead twigs of Aronia melanocarpa (Michx.) Britt. Sylvan Beach, Oneida county. H. D. House.

There is nothing in the brief description of this species in Saccardo to separate the Sylvan Beach material from H. vagans Fckl., although they may not be the same. The Sylvan Beach material has spores 10–15 x 4–5 μ, and the stipes 5–40 x 2–3 μ. Associated with an unidentified Valsa.

Hypocrea sulfurea (Schw.) Sacc.

Covering over a growth of Exidia glandulosa on twigs and limbs of Populus and Alnus. Karner, Albany county. C. H. Peck, September. (Determined by Dr F. J. Seaver.) Reported by Doctor Peck as Hypocrea citrina (Pers.) Fr.

Hysterographium lesquereuxii (Duby) Sacc.

On dead branches of Gleditsia triancanthos L. Orient, N. Y. Roy Latham, April 8, 1915.

Haplosporella velata E. & B.

On dead stems of Celastrus scandens L. Karner, Albany county. H. D. House, June 16, 1915.

Leptosphaeria consessa (C. & E.) Sacc.

On dead stems of Helianthus annuus Linn. Oneida. H. D. House, June 5, 1916.

Leptosphaeria myricae Dearness & House, sp. nov.

Perithecia gregarious, globose-conical, nearly superficial, .3 x .4 mm in diameter above the bark; ostiola short, thick and blunt.

Asci linear-cylindrical, 80–120 x 5–5½ μ; paraphyses linear, abundant.

Sporidia strictly uniseriate or overlapping, brown, 3-septate, 12–15 x 4–5 μ.

On dead twigs and branches of Myrica gale L. Grassy pond, Adirondack mountains. C. H. Peck (date of collection unknown). Type in the herbarium of the New York State Museum. The specimens also contain Diaporthe phomaspora (C. & E.) Sacc. and Trichopeziza myricae (Peck) Sacc.

Leptothryium dearnessii Kabat & Bubak

On dead brown areas of living, languishing, or dead leaves of Erigeron philadelphicus L. Albany. H. D. House, November 1, 1916. Doctor Peck has also collected this upon Erigeron annuus, reported as L. punctiforme B. & C. He also noted that it differed from L. punctiforme in being upon both sides of the leaf and in other minor particulars.

Macrophoma ceanothi Dearness & House, nom. nov. (Macrophoma peckiana D. & H. Bul. N. Y. State Museum 179:31. 1915. Not Berl. & Vogl.)

On dead stems of Ceanothus americanus L., North Greenbush (Peck, type). Albany (House).

Massarinula brassicae Dearness & House, sp. nov.

Perithecia densely gregarious, carbonaceous, rugulose, papillate globose-conic, erumpent-superficial, 200–300 μ. Asci clavate, wal 3 μ thick, 4 or 8, mostly 8-spored, 70 to 120 μ, mostly about 90 x 12–15 μ. Sporidia chiefly biseriate, hyaline, fusoid, subarcuate, in sheath 2 μ thick, 1-septate, the upper cell rather abruptly thickened at the septum, sometimes each cell seems obscurely transversely divided, the sheath extended at the end, giving some sporidia the appearance of being obtusely appendiculate.

On dead stems of Brussels sprouts (Brassica oleracea L. var. gemmifera Hart.) Orient, N. Y. Roy Latham, September 1915. Type in the herbarium of the New York State Museum.

Metasphaeria anthelmintica (Cke.) Dearness, comb. nov.

(Sphaeria anthelmintica *Cke.;* Leptosphaeria *Sacc.*)

On dead stems of Chenopodium album L. Albany. H. D. House, November 7, 1916. Cooke placed this in Heptameria, a fact that throws doubt on Saccardo's location of it in Leptosphaeria. The spores are so dilutely colored that Metasphaeria is the better location for it as suggested by Professor Dearness. Most of the spores singly seem quite hyaline.

Microdiplodia laurina Dearness & House, sp. nov.

Pycnidia scattered, intracortical, covered by the adherent cuticle which ruptures in a narrow cleft, globose, dark brown, about .3 mm in diameter.

Conidia brown, 1-septate, oblong-elliptic, 9–12 by $3\frac{1}{2}$–5 μ.

On dead branchlets of Sassafras variifolium (Salisb.). Kuntze, Sylvan Beach, Oneida county, N. Y. H. D. House, May 1915. Also collected on same host at Albany, N. Y., November 1915.

Very distinct from Microdiplodia sassafras (Tracy & Earle) where a subhyaline septum divides the spores unequally.

Mollisia plicata (Rehm.) Sacc.

var. **baptisiae** Dearness & House, var. nov.

Asci 40–45 x 5–6 μ; paraphyses linear, thickened at the apex; spores 1-celled, about 6–8 x 2–$2\frac{1}{2}$ μ.

On dead twigs or stems of Baptisia tinctoria L. Manorville, N. Y. H. D. House, June 20, 1916.

Myxosporium rhois (B. & C.) Sacc.

On dead twigs of Rhus glabra, near Albany. H. D. House, November 25, 1915.

Phoma ochra Cooke

On dead stems of Hibiscus moscheutos L. Oceanside, N. Y. H. D. House, July 28, 1916. The spore measurements are nearest those given for Phoma malvacearum West., but other characters seem to relate it more closely to P. ochra, from which it differs only in having smaller spores (7 x 3 μ), instead of 10–12 x $3\frac{1}{2}$–4 μ.

The same specimens contain an interesting Diaporthe which seems referable to D. arctii Lasch.

Phoma oleracea var. **meliloti** Sacc.

On dead stems of Melilotus albus Desr. Karner, Albany county. H. D. House, April 10, 1916.

Phoma vaccinii Dearness & House, sp. nov.

Pycnidia minute, numerous, globose, 3 or 4 to the lineal mm, blackening the stems when erumpent, subcuticular at first then breaking through longitudinal clefts in the epidermis; ostiola round, black, shining; conidia hyaline, minute, oblong, straight or curved, 5 x 1.5–2 μ.

On dead stems of Vaccinium corymbosum L. Astor woods, near Bronx Park, New York City. H. D. House, May 17, 1916. Type in the herbarium of the New York State Museum.

Phyllosticta opaca E. & E.

On leaves of Ilex opaca L. Sold in the market, Albany, December 22, 1915.

Physalospora obtusa (Schw.) Sacc.

On dead stems of Rubus odoratus L. North of Rensselaer, N. Y. H. D. House, April 27, 1916.

Puccinia angelicae (Schum.) Lagerh.

On leaves of Angelica atropurpurea L. North of Rensselaer. Dr C. H. Peck, June. The year is not indicated and Doctor Peck gives the locality as "North Greenbush." Identified by J. C. Arthur who states that the species has heretofore been known in America only from the eastern Rocky mountain region.

Puccinia karelica Tranz.

Aecial stage on Trientalis americana L. Marsh east of Lake George, Warren county. S. H. Burnham, June 16, 1897. Telial stage on Carex diandra Schk. Hannibal, Oswego county. C. S. Sheldon, May 30, 1882. On Carex canescens L. Boonville. Dr J. V. Haberer, June 20, 1912. On Carex magellanica Lam. Summit. C. H. Peck. (Determined by Arthur.)

Puccinia magnusiana Korn.

On Phragmitis phragmitis (L.) Karst. Cayuga marshes. Collected by Dr C. H. Peck. (Determined by Arthur.)

Puccinia McClutchiana Diet. & Holw.

On Scirpus rubrotinctus Fernald. West Albany. Collected by Dr C. H. Peck. (Determined by Arthur.)

Puccinia minutissima Arth.

The aecial stage (Aecidium nesaeae Ger.) occurs upon Decodon verticillatus (L.) Ell. The telial stage occurs upon Carex filiformis L. Karner. C. H. Peck. Upon the same host, Hannibal, Oswego county. C. S. Sheldon, May 30, 1882.

Puccinia ornata Arth. & Holw.

On living leaves of Rumex britannica L. Sylvan Beach, Oneida county. H. D. House, September 18, 1916. (Determined by Arthur.) New to New York State. This is a short cycle rust in which the teliospores germinate immediately upon maturing, and it therefore possesses no alternate host. Its range is from Maine and New Hampshire to Wisconsin and Minnesota.

Puccinia patruelis Arth.

The aecial stage on Lactuca sp. Near Albany, collected by C. H. Peck, June. (Determined by Arthur.)

Puccinia poarum Niels.

On Poa annua L. Jamesville, Onondaga county. H. D. House, August 9, 1915. (Determined by Arthur.)

Puccinia rubellum (Pers.) Arth.

(P. arundinacea *Hedw.*)

On Phragmitis phragmitis (L.) Karst. Montezuma marshes. Collected by Dr C. H. Peck. (Determined by Arthur.)

Puccinia uniporula Orton

The two following collections have been referred to this species by Doctor Arthur: On Carex conoidea Schk., Pecksport, Madison county. H. D. House, July 2, 1915. On Carex virescens Muhl., Sand Lake. C. H. Peck.

Ramularia brunellae E. & E.

On living leaves of Prunella vulgaris L. Jamesville, Onondaga county. H. D. House, June 28, 1916. Also with Septoria brunellae E. & E. upon the same leaves.

Ramularia lanceolata Dearness & House, sp. nov.

Spots brick-red, indefinite, alike on both sides of the leaf, where numerous the leaf becomes yellowish, without an arid center as in Ramularia plantaginis E. & M., nor with a definite border line as in Ramularia peckii Sacc. & Syd.

Hyphae fasciculate, amphigenous, geniculate, yellowish, 25–45 x 4 μ; conidia hyaline, cylindrical, ends rounded, 0–3-septate, 15–33 x 5–6 μ.

On living and languishing leaves of Plantago lanceolata L. Oneida, Madison county. H. D. House, August 1916. Type in the herbarium of the New York State Museum.

Septoria gentianae Dearness & House, sp. nov.

Spots arid, small, subcircular, 1 to 5 mm in diameter, surrounded by a very narrow, sharply raised border extending outward into a reddish zone; when numerous the whole leaf becomes dilute brown. Pycnidia epiphyllous, brown, 30–35 μ, with a minute opening. Sporules continuous, 15–24 μ, but averaging 18–20 x .5 μ.

On leaves of Gentiana quinqueflora L. Taberg, Oneida county. H. D. House, August 1914. Type in the herbarium of the New York State Museum.

Septoria microsora Speg. on Gentiana, in Europe, is hypophyllous and is said to have widely gaping ostiola and pluriseptate sporules.

Septoria macrosporia Dearness

On living leaves of the white daisy (Chrysanthemum leucanthemum L.) Albany. H. D. House, November 1, 1916.

Septoria rudbeckiae E. & H.

var. **oaklandica** Sacc.

On living and languishing leaves of Rudbeckia hirta L. Albany. H. D. House, November 13, 1915. (Determined by Dearness.)

Sphaerographium hystricinum (Ell.) Sacc.

var. **viburni** Dearness & House, var. nov.

This variety on stems of Viburnum cassinoides has pungent, beaked pycnidia nearly 1 mm long. Sporules 15–30 x 2 μ, subarcuate, acute, simple and continuous or paucinucleate, borne on narrow, branching sporophores varying in length from 5 μ to that of the sporules.

On dead stems of Viburnum cassinoides L. Babylon, N. Y. H. D. House, April 20, 1916. Type in the herbarium of the New York State Museum.

Professor Peck figured the pycnidia and sporules of this form on Viburnum nudum in the 38th report. Mr Ellis's type was found upon Azalea and described as having sporules 25 μ long on stipes 35 μ long.

Sphaeropsis liquidambaris Dearness & House sp. nov.

Pycnidia .3 mm, globose, gregarious, surrounding the twigs, covered by the epidermis in which narrow clefts expose the very short ostiola; conidia tardily yellow-brown, on sporophores of about their own length, and half their thickness, various in shape, from globose to oblong-elliptic, but mostly subpyriform, 17–22 x 6–10 μ.

On dead twigs of Liquidambar styraciflua L. Astor woods near Bronx Park, New York City. H. D. House, May 17, 1916. Type in the herbarium of the New York State Museum.

Sphaeropsis punctata Dearness & House sp. nov.

Pycnidia minute, 50–110μ in diameter, thickly scattered, as many as 20 in a circle 2 mm in diameter; black, conical ostiola puncturing the thin epidermis.

Conidia pale brown, oblong-elliptic, 18–22 x 9–10 μ on short basidia.

On dead branchlets of Sassafras variifolium (Salisb.) Kuntze. Sylvan Beach, Oneida county. H. D. House, May 10, 1915. Also Albany, November 26, 1915 (type). Astor woods, near Bronx Park, New York City. H. D. House, May 17, 1916. Type in the herbarium of the New York State Museum.

S. sassafras C. & E. has papillaeform pycnidia and conidia 30–35 x 5 μ; S. seriatus Peck also on this host is characterized by "hard sclerotoid perithecia in linear arrangement." (33d Report, p. 24.)

Taphrina quercus (Cooke) Sacc.

On living leaves of Quercus velutina Lam. Orient, N. Y. Roy Latham, October 4, 1915.

Trichopeziza opulifoliae (Schw.) Sacc.

On dead stems of cultivated Spiraea. Oneida. H. D. House, June 20, 1915. Associated with Diaporthe neilliae Pk.

Urophlyctis pluriannulatum (B. & C.) Farlow

(Uromyces pluriannulatum *B. & C.;* Synchytrium, *Farlow*)

On living leaves, stems and peduncles of Sanicula marylandica L. Oneida, Madison county. H. D. House, June 10, 1916. (Determined by Prof. H. S. Jackson.)

Valsa americana B. & C.

On dead twigs of Malus malus (L.) Britt. Albany. H. D. House, February 20, 1915. Determined by Professor Dearness, who says concerning it, "This is the same as Mr Ellis named for me Valsa americana. The species is not fully described. This material is a long-stiped, long-paraphysate species." Upon the same twigs occurs Sphaeropsis mali (West) Sacc.

Valsa caryigena B. & C.

On dead twigs of Hicoria minima Britton. Van Cortlandt Park, New York City. H. D. House, April 20, 1916. Also with Sphaeropsis linearis Peck (S. caryae) on the same twigs.

Valsa ceratophora Tul.

On dead twigs of Sassafras variifolium (Salisb.) Kuntze. Van Cortlandt Park, New York City. H. D. House, April 20, 1916. The same twigs contain Sphaeropsis punctata Dearness & House, and a Cytospora which doubtless belongs to the Valsa and which may be Cytospora sphaerocephala Curtis.

Valsa cincta Fr.

On dead stems of Amelanchier canadensis (L.) Medic. Clear pond, Adirondack mountains, and Aiden Lair, Essex county, on dead twigs of Amelanchier bartramiana (Tausch) Roem. C. H. Peck, July. Associated with Sphaeronema pruinosum Peck.

Valsa etherialis E. & E.

On dead limbs of Acer rubrum L. Albany. H. D. House, November 2, 1913 and May 1914.

Valsa nyssae Grev.

On dead twigs of Nyssa sylvatica Marsh. Astor woods, Bronx, New York City. H. D. House, April 26, 1916. (Determined by Dearness.)

b Notes on Fungi

Bremia lactucae Regel.

On living leaves of Lactuca hirsuta Muhl. Near Albany, N. Y. H. D. House, November 13, 1915. Also known as Peronospora gangliformis (Berk.) DeBary.

Cintractia junci (Schw.) Trel.

On the inflorescence of Juncus tenuis L. near Baldwinsville, Onondaga county. H. D. House, June 27, 1916.

Diaporthe obscura (Peck) Sacc.

On dead stems of Geum strictum Ait. Eaton and Pecksport, Madison county. H. D. House, July 2 and 3, 1915. The characters accord very closely with the description by Peck (on Rubus strigosus) and this collection constitutes a new host for the species.

Diaporthe (Chorostate) oxyspora (Peck) Sacc.

(Sacc. Sylloge 1:627. 1882)

Valsa oxyspora Peck. Rep. N. Y. State Mus. 28, p. 75, pl. II, f. 26–29. 1876
Valsa ocularia C. & E. Grev. VI:11, pl. 95, f. 3. 1877
Diaporthe ocularia Sacc. Sylloge 1:616. 1882
Diaporthe epimicta E. & E. N. Am. Pyr. 439. 1892

The type of Valsa oxyspora was stated by Doctor Peck to be on Quercus (collected at Sand Lake, August 1874). This was a case of mistaken host identification which he later corrected but without study of related species upon the host (Nemopanthus mucronata (L.) Trel.) or other hosts of the Holly family. Meanwhile there has accumulated in the state herbarium specimens of Diaporthe upon Ilex and Nemopanthus under the additional names of D. ocularia and D. epimicta. Professor Dearness has made a careful study of the material here and in his own herbarium and specimens named by Mr Ellis as D. epimicta (and with particular care), are identical with D. oxyspora (Mechanicville on Ilex verticillata; Southfield on Ilex verticillata; Karner on Ilex verticillata and Sand Lake on Nemopanthus mucronata (type)). In all these collections the appendage of the spores seems to disappear with age, and suggests that D. ocularia is also the same, since other characters are very similar. Recently collected by Roy Latham, Orient, N. Y., on Ilex verticillata (February 7, 1915).

Funalia rigida (Berk. & Mont.)

Trametes rigida Berk. & Mont. Ann. Soc. Nat. III. 11:240. 1849
Polystictus extensus Cooke. Sacc. Syll. Fung. 6:244. 1888
Polystictus rigens Sacc. & Cub.; Sacc. Syll. 6:274. 1888
Coriolopsis rigida Murrill, North American Flora 9:75. 1907

Sporophore annual, sessile, varying to resupinate, margin thin and acute, 0–5 x 2–10 cm, usually about 1 cm thick or less, rather fragile when dry, densely hispid or hirsute, yellowish brown or darker with age; context very light brown; tubes usually not over 1 mm long, sometimes in large pileate specimens 3 to 5 mm long, angular, variable in size, sometimes irregular, averaging 2-3 a mm; cystidia none; spores cylindrical, 9-10 x 3 μ.

On dead limbs and trunks of Poplar. Albany, Westport and Horicon. Collected by Doctor Peck.

This species is reported by Doctor Peck as Trametes trogii Berk. in the 32d Report, page 35 (1879); it is the species described by J. J. Neuman (Polyporaceae of Wisconsin, page 39, 1914) under the name of Trametes trogii Berkeley and so far as the description of this in Fries (Hym. Eur. 583. 1874) goes, it may be the same as Berkeley's species. The species is placed in Coriolopsis by Doctor Murrill in Polyporaceae of the North American Flora (vol. 9), but is described by L. O. Overholts in the Polyporaceae of the Middle-western United States (p. 69) as Trametes rigida. The range of the species as given by Murrill should be extended northward to Essex county, New York, southern Ontario and Wisconsin.

Goniopsis cookeana (Ger.) Sacc.

Collected at Orient Point, Long Island, by Roy Latham upon the following hosts: Quercus alba (dead wood), Andromeda ligustrina (dead decorticated branches), Myrica caroliniensis (dead branches), Rhus glabra (dead decorticated branches).

Gymnopilus magna (Peck) Murrill

(Flammula magna *Peck;* Cortinarius validipes *Peck*)

Dr C. H. Kauffman, who has examined the species of Cortinarius in the state herbarium, suggests that the type specimen of Cortinarius validipes belongs in Flammula, and comparison seems to indicate that it is the same as Flammula magna described first from Westchester county. A collection also labeled C. validipes and made by S. H. Burnham at West Fort Ann (growing in a mass of sawdust and chips), belongs to Pholiota and is doubtless P. destruens (Brond.) Sacc.

Leptosphaeria subconica (C. & P.) Sacc.

On dead stems of Impatiens biflora Walt. Karner, Albany county. C. H. Peck, August 1906. (Determined by Dearness.) The type collection of this species appears to be upon

Ambrosia trifida, although Doctor Peck did not definitely determine the host. It has also been collected upon Solidago.

Leptostromella hysterioides (Fr.) Sacc.

On dead stems of Helianthus decapetalus L. Oneida. H. D. House, May 15, 1915. Spores curved, 20–21 x $2\text{–}2\frac{1}{2}$ μ.

Microdiplodia paupercula (B. & Br.) Dearness, comb. n.

(Diplodia paupercula *B. & Br.*)

Originally described on Lonicera. Our material is on Sambucus canadensis L. (Cascadeville) Adirondack mountains. C. H. Peck (40th Rep't, p. 60, 1887). See N. Am. Fungi No. 419 and Saccardo Sylloge 3:345, 1884. The spore measurements in Saccardo are given as 10 x 5 μ. In Doctor Peck's material only exceptional spores measure that large, the average being 7–9x 3.5–5 μ.

Nigredo perigynia (Halst.) Arth.

On Carex flava L. Peterboro, Madison county. H. D. House, June 12, 1916. (Determined by Arthur.) Also collected by Doctor Peck upon Carex arctata Boott; and on Carex scoparia Schk.

Phialea pulchella (Fckl.) Sacc.

Near Albany, on fallen needles of Pinus rigida, H. D. House, November 30, 1916.

Phoma infossa E. & E.

On dead twigs of Fraxinus pennsylvanica Marsh. Sylvan Beach, Oneida county. H. D. House, June 21, 1915. Also collected at Alcove, Albany county, by C. L. Shear (N. Y. Fungi No. 369).

Phoma pallens B. & C.

On dead carpels of Celastrus scandens L. Karner, Albany county. H. D. House, April 29, 1916. Also collected in May 1908 by Doctor Peck.

Phyllosticta latifolia E. & E.

On living leaves of Kalmia latifolia L. Merrick, N. Y. H. D. House, June 16, 1916. Professor Dearness verifies this by comparison with a cotype, and questions that this species has the pycnidial characters of a good Phyllosticta.

Pleospora herbarum (Pers.) Rabh.

On dead stems of Triglochin maritimum L. Bergen swamp, Genesee county. H. D. House, June 2, 1916.

Pyrenopeziza compressula Rehm.

On dead stems of Helianthus lacinatus L. Oneida H. D. House, June 5, 1916. (Determined by Dearness.)

Puccinia angustata Peck

Manorville, N. Y., on Scirpus cyperinus (L.) Kunth. H. D. House, June 20, 1916. (Determined by Arthur.) The other host species for this rust in New York are Scirpus atrocinctus Fernald; S. atrovirens Muhl.; S. sylvaticus L. The type of this rust is supposed to occur upon S. sylvaticus collected near "West Albany," by Doctor Peck, but since that sedge probably does not occur in that region the identity of the host remains in doubt. The aecial stage (Aecidium lycopi Ger.) is frequent upon various species of Lycopus.

Puccinia ellisiana Thum.

The aecial stage was collected at Manorville, N. Y., on leaves of Viola lanceolata L., June 20, 1916. It also occurs upon leaves of Viola blanda and V. affinis (Aecidium mariae-wilsoni Peck). The telial stage appears to be rather common upon Andropogon scoparius Michx. and A. furcatus Muhl. at Karner, Albany county, and on Long Island.

Puccinia extensicola Plowr.

The following species are represented among the hosts for the aecial stage in the state herbarium: Aster cordifolius, A. macrophyllus, A. novae-angliae, A. longifolius, A. puniceus, Erigeron pulchellus, E. philadelphicus, E. annuus, E. ramosus, Leptilon canadense, Euthamia graminifolia, Solidago canadensis, S. latifolia, S. odora, S. lanceolata, S. juncea, S. rugosa, S. thyrsoidea and S. uliginosa.

The hosts for the telial stage as represented in collections from New York State are: Carex crawfordii; C. backii, C. houghtonii, C. pennsylvanica, C. prairea, C. trisperma, C. tenella, C. vulpinoidea and Dulichium arundinaceum (including Puccinia dulichii Syd.).

Puccinia majanthae (Schum.) Arth.

The aecial stage on Vagnera stellata (L.) Morong. Buffalo. G. W. Clinton. On Uvularia sessilifolia L. Babylon. J. S. Merriam. The telial stages on Phalaris arundinacea L., Copake, and Watkins. Dr C. H. Peck. (Determined by Arthur.) The basis for Puccinia linearis Peck (=P. striatula Peck).

Puccinia mesomejalis B. & C.

Elk Park, Catskill mountains, on Clintonia borealis L. Dr L. H. Pennington, June 24, 1914.

Puccinia orbicula Pk. & Clinton

On leaves of Nabalus albus L. Jamesville. H. D. House, June 28, 1916. (Determined by Arthur.) The State Museum herbarium also contains collections of this rust upon the same host from Buffalo (Clinton), Cedarville and Watkins (Peck).

Ramularia urtica Ces.

On living and languishing leaves of Urtica gracilis Ait. Fisher's, Ontario county. H. D. House, June 3, 1916.

Rhytisma andromedae Fr.

Hempstead, N. Y., on leaves of Lyonia ligustrina (L.) DC. (Andromeda, Muhl., Xolisma, Britton). Common on leaves of Andromeda polifolia L. (including A. glaucophylla Link., the Bog Rosemary), but not previously reported upon the Male Berry (Lyonia ligustrina).

Scoleconectria scolecospora (Bref.) Seaver

On dead twigs of Nyssa sylvatica Marsh. Babylon, N. Y. H. D. House, April 20, 1916. A species of frequent occurrence upon pine, but rarely recorded on hardwood species.

Septoria krigiae Dearness & House, sp. nov.

Spots 1 to 2 mm broad, yellow-brown with reddish margins 1 mm wide. Pycnidia usually one, seldom more than three on a spot, central, mostly epiphyllous, 50 μ; sporules continuous, straight or flexuous, 24–60 x 1 μ.

On living leaves of Krigia amplexicaulis Nutt. Chelten Hills, Montgomery county, Pennsylvania. Martha Shoemaker, September 1879. Type in the herbarium of the New York State Museum.

Septoria sicyi Peck

On living leaves of Sicyos angulatus L. Liverpool, Onondaga county. H. D. House, August 12, 1915.

Septoria xanthismatis Dearness & House, sp. nov.

Spots sordid, yellowing of the affected portions of the leaf or of the whole leaf instead of definite maculae. Pycnidia amphigenous, innate, single or more or less gregarious and in the latter case making the area darker than the surrounding parts; stromata slightly erumpent, sometimes distinguishable by short yellow cirrhi of exuded sporules.

Sporules hyaline, continuous, curved or flexuous, 30–75 x 1–1.5 μ, exceptionally exceeding 100 μ in length.

On living leaves of Xanthisma texanum DC. Fort Sill (Indian Terr.), Oklahoma, C. S. Sheldon, August 1891. Type in the herbarium of the New York State Museum.

Sphaerella pontederiae Peck

On living, languishing and dead leaves of Nymphaea advena Ait. In a marsh near Hempstead, N. Y. H. D. House, June 19 and September 8, 1916.

This was first described as Sphaerella paludosa E. & E. but Mr Ellis later referred it to S. pontederiae (Fungi Col. no. 419). On Pontederia the perithecia are hypophyllous while on Nymphaea they are mostly epiphyllous, otherwise the description of Peck's species agrees with this.

Sphaeropsis aristolochiae Dearness & House, sp. nov.

Pycnidia numerous, nearly covering the affected areas, cortical, globose-conic, cuticle cleft or irregularly ruptured by the apex and short black ostiola, .3–.4 mm.

Conidia dark brown, subpyriform to oblong with rounded ends, nucleate, 18–20 x 10–11 μ, on sporophores about 10 x 3 μ.

On dead twigs of Aristolochia clematitis L. Kent, Ohio. H. D. House, March 1916. Type in the herbarium of the New York State Museum.

This is quite different from S. squiereae Clint. on Aristolochia. The latter has spherical conidia 15 μ, with walls 4–5 μ thick.

Sphaeropsis platani Peck

On dead twigs of Platanus occidentalis L. Van Cortlandt Park, New York City. H. D. House, April 20, 1916. Associated with a Cytospora of undetermined relationship.

Sphaeropsis tulipastri House, nom. nov.

Sphaeropsis dearnessii Sacc. & Trott. in Sacc. Syll. 22:978. 1913. Not S. dearnessii Sacc. & Syd. in Sacc. Syll. 16:922. 1899.
Sphaeropsis magnoliae Ell. & Dearn. Fungi Col. n. 2087. 1905 Not S. magnoliae Magnaghi (1902)

On dead twigs of Magnolia acuminata L. (Tulipastrum acuminatum Small). Ontario. J. Dearness. Associated with Valsaria magnoliae. Sphaeropsis dearnessii Sacc. & Syd. was a name proposed for S. mori E. & E. on Morus, and is the same as Sphaeropsis sepulta E. & E., but its publication invalidates the later use of the same name for the Sphaeropsis on Magnolia.

Tranzschelia punctata (Pers.) Arth.

On living leaves of seedlings of Prunus serotina Ait. in open woods near Albany. H. D. House, October 23, 1916. No infections upon the leaves of Prunus serotina which were older than the seedling stage could be found. This rust seems to have been but rarely collected in this State, the herbarium containing two collections by G. W. Clinton, one made at Buffalo, and the other at Albany. The aecial stage upon Anemone quinquefolia, Hepatica and Thalictrum has been frequently collected.

Tympanis turbinata Schw.

On dead stems of Viburnum cassinoides L. Babylon, N. Y. H. D. House, April 20, 1916. Substipitate, erumpent; asci about 100–110 x 18–20 μ, spores numerous, 3–4 x $\frac{3}{4}$ μ.

Uredinopsis mirabilis (Peck) Magnus

On living and languishing fronds of the Virginia Chain fern (Woodwardia virginica (L.) Sm.). Sylvan Beach, Oneida county. H. D. House, August 12, 1916.

Valsa liquidambaris (Schw.) Cooke

On dead stems of Hamamelis virginiana L. Orient Point, N. Y. Roy Latham, October 30, 1911. A new host species. The asci are 30–33 x 8 μ, the spores eight in an ascus, 8–9 μ x 2 μ, hyaline, allantoid.

Vermicularia violae-rotundifoliae (Sacc.) House

(V. peckii *var.* violae-rotundifoliae Sacc.)

On living leaves of Viola rotundifolia Michx. Taberg, Oneida county. H. D. House, June 7, 1916.

c Fungi Noveboracenses

The following list of New York fungi, containing 119 species, was determined recently by Dr P. A. Saccardo of Padova, Italy, from certain collections by C. H. Peck and H. D. House, sent to him for study. Several of them are new species and their descriptions as well as notes upon the others are found in Annales Mycologici, XIII, p. 115–22 (Berlin) 1915 and in Nuovo Giornale Botanico Italiano, XXIII, no. 2, p. 2–15. 1916.

The species in heavy faced type were described as new by Saccardo, and the cotypes are in the herbarium of the New York State Museum.

Aposphaeria allantella *Sacc. & Roum.* Clarksville. On wood of Quercus rubra (Peck)

Aposphaeria striolata *Sacc.* Rensselaer. On decorticated log of Populus deltoides (Peck)

Ascochyta pirina *Pegl.* Sylvan Beach. On living leaves of Aronia arbutifolia (Peck)

Botryosphaeria quercuum (*Schw.*) *Sacc.* Albany. On dead twigs of Quercus rubra (House)

Cercospora ampelopsidis *Peck.* Albany. On languishing leaves of Ampelopsis quinquefolia (House)

Cercospora rhoina *C. & E.* Bolton Landing. On leaves of Rhus copallina (Peck)

Diaporthe peckiana (*Sacc.*) (**Chorostate peckiana** *Sacc.*) Catskill mountains. On dead branches of Fraxinus (?) americana. (Peck). The host is quite certainly not Fraxinus and the texture and grain is more like maple.

Cladosporium caricicola *Corda.* Brownville. On dead leaves of Carex arctata (Peck)

Coniosporium tumulosum *Sacc.* Tupper Lake. On decorticated wood of Pinus strobus (House)

Cucurbitaria rosae *Sacc. & Wint.* Bergen swamp. On dead stems of Spiraea salicifolia (Peck)

Cucurbitaria stenocarpa *E. & E.* Southfield. On dead twigs of Rhus copallina (Peck)

Curreya peckiana *Sacc.* Tupper Lake. On dead twigs of Nemopanthes mucronata (House)

Cytospora minuta *Thüm.* Sand Lake. On dead branches of Fraxinus americana (Peck)

Cytospora phomopsis *Sacc.* Albany. On dead stems of Sassafras variifolium (House)

Dendrophoma phyllogena *Sacc.* Eaton. On languishing and dead leaves of Chamaedaphne calyculata (House)

Diatrype asterostoma *B. & Br.* (not *E. & E.*) *var.* betulae *Sacc.* Bashfisch. On dead branches of Betula lutea (Peck)

Diatrypella betulina (*Pk.*) *Sacc.* Oneida. On dead limbs of Betula lutea (House)

Diatrypella cephalanthi (*Schw.*) *Sacc.* Southfield. On dead branches of Cephalanthus occidentalis (Peck)

Diatrypella decorata *Nits.* Sand Lake. On dead branches of Betula lutea (Peck). In Europe this occurs on Betula alba.

Didymosphaeria empetri (*Fr.*) *Sacc.* Mount Marcy. On leaves of Empetrum nigrum (House)

Dimerosporium balsamicola (*Pk.*) *E. & E.* Tupper Lake. On leaves of Abies balsamea (House). North Elba. (Peck)

Diplodia benzoina *Sacc.* Karner. On dead twigs of Benzoin aestivale (Peck)

Diplodia dulcamaeae *Fckl.* Copake. On dead stems of Solanum dulcamara (Peck)

Diplodia rhois *Sacc.* Southfield. On dead twigs of Rhus copallina (Peck)

Dothidea baccharidis *Cooke.* Sag Harbor. On dead stems of Baccharis halimifolia (Peck)

Dothidea sambuci (*Pers.*) *Fr.* Albany. On dead twigs of Sambucus racemosa (House)

Dothidella junci (*Fr.*) *Sacc.* Albany. On dead and languishing stems of Juncus effusus (House)

Dothiorella peckiana *Sacc.* Salamanca. On dead stems of Viburnum alnifolium (Peck)

Eutypa heteracantha *Sacc.* Cold Spring. On dead branches of Ailanthus glandulosus (Peck)

Eutypa ludibunda *Sacc.* Savannah. On dead twigs of Hicoria glabra (Peck)

Eutypa longirostris *Peck.* Albany. On dead twigs of Ulmus americana (House)

Gibbera vaccinii (*Sow.*) *Fr.* Featherstone lake, Schenectady county, on languishing leaves of Oxycoccus macrocarpus (House)

Gloeosporium crataeginum *Sacc.* Crown Point. On leaves of Crataegus crus-galli.

Gnomonia petiolophila (*Peck*) *Berl. & Vogl.* Albany. On fallen petioles of Acer spicatum (House). Adirondack mountains on same host (Peck)

Godronia cassandrae *Peck.* Albany. On dead twigs of Chamaedaphne calyculata (House)

Haplosporella malorum *Sacc.* Rensselaer. On dead twigs of Pyrus malus (Peck)

Harpographium magnum *Sacc.* Albany. On dead branches of Prunus cuneata (House)

Hendersonia anceps *Sacc.* Hewitt's pond, Adirondack mountains. On dead stems of Spiraea salicifolia (Peck)

Hypoderma tenellum *Sacc.* Bennetts. On dead stems of Thalictrum dioicum (Peck)

Hypoxylum coccineum *Bull.* Menands. On bark of Fagus americana, and Boreas, Adirondack mountains, on Amelanchier canadensis (Peck)

Leptosphaeria doliolum (*Pers.*) *DeNot.* Albany. On dead stems of Verbascum thapsus (House). Sprakers. On dead stems of Urtica dioica (Peck)

Leptosphaeria dumetorum *Niessl.* Wading River. On dead stems of Lathyrus maritimus (Peck)

Leptosphaeria houseana *Sacc.* Albany. On dead stems of Thalictrum dioicum (House)

Leptosphaeria hydrophila *Sacc.* Oneida. On leaves of Typha angustifolia (House)

Leptostroma pinastri *Desm.* New Scotland and Karner. On fallen needles of Pinus rigida (Peck)

Leptothyrium alneum (*Lev.*) *Sacc.* Karner. On fallen leaves of Alnus rugosa (Peck)

Leptothyrium periclymeni (*Desm.*) *Sacc.* Kirkville. On leaves of Lonicera oblongifolia (House)

Lophodermium melaleucum (*Fr.*) *DeNot.* Sand Lake. On fallen leaves of Vaccinium corymbosum (Peck)

Lophodermium petiolicola *Fckl.* Bennetts. On fallen petioles of Fraxinus americana (Peck)

Meliola pitya *Sacc.* Caroga. On languishing leaves of Taxus canadensis (Peck)

Microascus americanus *Sacc.* Catskill mountains. On wood of Liriodendron tulipifera (Peck)

Micropeltis pitya *Sacc.* Tupper Lake. On dead or languishing leaves of Abies balsamea (House)

Oospora candidula *Sacc. var.* **carpogena** *Sacc.* Albany. On fruit of Ceanothus americanus (House)

Ophiobolus porpyrogonus (*Tode*) *Sacc.* Menands. On dead stems of Urticastrum divaricatum (Peck)

Ophionectria scolecospora *Bref.* Lake Placid. On dead limbs of Pinus strobus (Peck)

Patellaria (Karschia) patinelloides (*S. & R.*) *Sacc.* Lake Henderson, Adirondack mountains. On bark of Abies balsamea (Peck). This species occurs upon Robinia in Europe.

Phaeangium peckianum *Sacc.* Sand Lake. On bark of Acer saccharum (Peck)

Phoma atomica Albany. *Sacc.*. On bark of Salix nigra (Peck)

Phoma houseana *Sacc.* Featherstone lake, Schenectady county. On dead twigs of Vaccinium corymbosum (House)

Phoma leguminium *West.* Clarksville. On fallen seed pods of Robinia pseudoacacia (Peck)

Phoma pleosporoides *Sacc.* Sand Lake. On dead stems of Impatiens fulva (Peck)

Phoma pulchella (*B. & C.*) *Sacc.* Southfield. On dead twigs of Rhus copallina (Peck)

Phoma samararum *Desm.* West Albany. On fallen samaras of Fraxinus nigra (Peck)

Phoma solidaginis *Cooke var.* longiscula *Sacc.* Rensselaer. On dead stems of Solidago (Peck)

Phomopsis ailanti (*Sacc.*) *Trav.* Cold Spring. On dead stems of Ailanthus glandulosus (Peck). Pycnidial stage of Diaporthe ailanthi.

Phomopsis daturae (*Roll. & Fautr.*) *Sacc.* Albany. On dead stems of Datura stramonium (House)

Phomopsis diachenii *Sacc.* Albany. On dry fruit of Pastinacea sativa (House)

Phomopsis viticola *Sacc.* (Phoma viniferae *Cooke*). Albany. On dead stems of Vitis aestivalis (House)

Phragmidium andersoni *Shear*. Copake. On leaves of Dasiphora fruticosa (Peck)

Phyllosticta crataegi (*Cooke*) *Sacc.* Westport. On living leaves of Crataegus holmesiana (Peck)

Phyllosticta cruenta (*Fr.*) *Kickx.* Oneida. On leaves of Vagnera racemosa (House)

Phyllosticta maculiformis *Sacc.* Indian Lake. On fallen leaves of Alnus rugosa (Peck)

Phyllosticta phomiformis *Sacc.* Oneida. On leaves of Quercus alba (House)

Phyllosticta pirina *Sacc.* Albany. On leaves of Pyrus malus (House)

Phlyctaena verrucarioides *Sacc.* Albany. On dead limbs of Tilia americana (House)

Pleospora vulgaris *Niessl.* Central Bridge. On dead stems of Gerardia quercifolia (Peck)

Propolidium atrovirens (*Fr.*) *Rehm.* Clarksville. On decaying wood of Quercus rubra (Peck)

Pseudovalsa stylospora *E. & E.* North Elba. On bark of Acer spicatum (Peck)

Pyrenopeziza rubi (*Fr.*) *Rehm.* Morehouseville. On dead stems of Rubus strigosus (Peck)

Pyrenopeziza thalictri (*Pk.*) *Sacc.* Sand Lake. On dead stems of Thalictrum purpurascens (Peck)

Rabenhorstia tiliae *Fr.* Albany. On dead branches of Tilia americana (Peck)

Rhabdospora clarkeana *Sacc.* Sand Lake. On dead stems of Aquilegia canadensis (House)

Sclerotium fallax *Sacc.* Spencertown. On leaves of Potentilla canadensis (Peck)

Sclerotium mendax *Sacc.* Karner. On leaves of Solidago altissima (Peck)

Septoria albaniensis *Thum.* Oneida. On leaves of Salix cordata (House)

Septoria breviuscula *Sacc.* Eaton. On dead leaves of Linnaea americana (House)

Septoria coptidis *B. & C.* Sand Lake. On dead leaves of Coptis trifoliata (Peck)

Septoria cornicola *Desm.* Albany. On languishing leaves of Cornus alternifolia (House)

Septoria dalibardae *Peck.* Oneida. On languishing leaves of Dalibarda repens (House)

Septoria francisci *Sacc.* (S. dolichospora *E. & E.*, not Trail) Karner. On leaves of Solidago (Peck)

Septoria increscens *Peck.* Oneida Lake. On languishing leaves of Trientalis americana (House)

Septoria irregularis *Peck.* Oneida. On languishing leaves of Rhus toxicodendron (House)

Septoria lobeliae *Peck, var.* **lobeliae-inflatae** *Sacc.* Albany. On leaves of Lobelia inflata (House)

Septoria ludwigiae *Cooke.* Oneida. On leaves of Ludwigia palustris (House)

Septoria polygalae *Peck & Cooke.* Albany. On dead and languishing leaves of Polygala paucifiora (House)

Septoria ribis *Desm. var.* **ribis-rotundifolii** *Sacc.* Oneida. On leaves of Ribes rotundifolia (House)

Septoria rubi *West. var.* **brevispora** *Sacc.* North Chatham. On leaves of Rubus hispididus, and Schoharie on leaves of Rubus villosus (Peck)

Sphaerella altera *Pass.* Karner. On dead stems of Equisetum hyemale (Peck)

Sphaerella colorata *Peck.* Oneida Lake. On leaves of Kalmia angustifolia (House)

Sphaerella gaultheriae *C. & R.* Albany. On leaves of Gaultheria procumbens (House)

Sphaerella populifolia *Cooke.* North Elba. On fallen leaves of Populus balsamifera (Peck)

Sphaerella populnea *Sacc.* Tupper Lake. On fallen leaves of Populus balsamifera (House)

Sphaerella punctiformis (*Pers.*) *Rob.* Highland Mills. On fallen leaves of Fraxinus americana (Peck)

Sphaerella sarraceniae (*Schw.*) *Sacc.* Sand Lake. On dead leaves of Sarracenia purpurea (Peck)

Sphaerella vacinii *Cooke, var.* **corymbosi** *Sacc.* Spruce pond, Adirondack mountains. On fallen leaves of Vaccinium corymbosum (Peck)

Sphaeronema truncatum *Fr.* Racquette Lake. On wood of Tsuga canadensis (Peck)

Sporocybe azaleae (*Peck*) *Sacc.* Albany. On dead buds and twigs of Azalea viscosa (House)

Sporodesmium opacum *Sacc.* Bolton Landing. On decayed wood of Juglans cinerea (Peck)

Sporodesmium pilulare *Sacc.* Albany. On decorticated wood of Juniperus virginiana (House)

Stemphylium magnusianum *Sacc.* Oneida. On bark of dead branches of Carpinus caroliniana (House)

Tremella nigricans (*Fr.*) *Sacc.* Albany. On dead limbs of Tilia americana (House.) Whitehall. On same host (Peck)

Tympanis pinastri *Tul.* (T. laricina *Fckl.*). Mount Marcy and Hardscrabble pond, Adirondack mountains. On bark of Abies balsamea (Peck)

Valsa abietis *Fr.* Old Forge. On dead bark and branches of Tsuga canadensis (Peck)

Valsa auerswaldi *Nke.* Rensselaer. On dead twigs of Fagus americana (Peck)

Valsa brevis *Peck.* Tupper Lake. On dead branches of Abies balsamea (House)

Venturia compacta *Peck.* Grafton. On languishing leaves of Oxycoccus macrocarpus (Peck)

Venturia pulchella *C. & P.* Sand Lake. On leaves of Chamaedaphne calyculata (Peck)

Vermicularia dematium (*Pers.*) *Fr.* Albany. On fallen petioles of Ailanthus glandulosus (House.) Oneida. On dead stems of Sedum purpureum (House)

Vermicularia saponariae *Allersch.* Rensselaer. On dead stems of Saponaria officinalis. (Peck)

LOCAL FLORA NOTES IV

1 ALBANY COUNTY

Antennaria occidentalis Greene

Indian Ladder, Helderberg mountains. J. B. Rubinger, June 13, 1916. Menands. J. B. Rubinger, May 24, 1916.

Carex oligosperma Michx.

Karner. H. D. House, July 26, 1915, *No. 5948.*

Lotus corniculatus L.

Near Albany. H. D. House, July 9, 1916. Selkirk. C. E. Jones, July 1907.

Viola septentrionalis Greene

Kenwood. J. B. Rubinger, May 10, 1916.

2 COLUMBIA COUNTY

Panicum virgatum L.

Marsh along the east bank of the Hudson river near Stuyvesant. H. D. House, August 5, 1916. A species of moist barrens and salt marshes chiefly southward. Rarely collected this far northward. According to Hitchcock & Chase (Cortr. U. S. Nat. Herb. 15:91. 1910), the only localities for this grass farther north than this are Brattleboro, Vermont, and Toronto, Canada, in the eastern states. Doctor Peck collected it several years ago along the Hudson river above Rensselaer (then known as North Greenbush).

3 FULTON COUNTY

Antennaria petaloidea Fernald

Sandy fields near Northampton. H. D. House, May 28, 1914.

Poa nemoralis Linn.

Woods near Cranberry Creek. H. D. House, May 27, 1914. Determined by A. S. Hitchcock.

4 GENESEE COUNTY

Anticlea elegans (Pursh) Rydb.

Marl bog in Bergen swamp. H. D. House, August 14, 1916.

Fig. 2 Cypripedium candidum Willd., from the open marl bog in Berg n swamp, Genesee co.

Cypripedium candidum Willd.

(Figure 2)

Marl bog in Bergen swamp. H. D. House, June 2, 1916.

Arethusa bulbosa Linn.

Marl bog in Bergen swamp. H. D. House, June 2, 1916.

Comandra umbellata Nutt.

Common on the surface of very wet marl bog in Bergen swamp. H. D. House, June 2, 1916. Not a rare plant, but the habitat is unusual, as the species is usually found in sandy or dry soils.

Myrica caroliniensis Mill.

Around the margins and on the marl bogs in Bergen swamp. H. D. House, June 2, and August 14, 1916.

A frequent species along the Atlantic coast, but known inland only in the swamps of Bergen, Junius, Parma and Caledonia, all in the western part of the State and previously reported as Myrica cerifera, a related species of the south.

Parnassia caroliniana Michx.

Common in Bergen swamp. H. D. House, June 2, 1916. When growing on the surface of the marl bogs it is often dwarfed.

Viola nephrophylla Greene

Marl and Sphagnum bogs, Bergen swamp. H. D. House, June 2, 1916.

Viola septentrionalis Greene

Damp shaded places in Bergen swamp. H. D. House, June 2, 1916.

Scirpus caespitosus Linn.

Marl bogs in Bergen swamp. H. D. House, June 2, 1916. Also reported from here by G. W. Clinton.

Trianthera glutinosa (Michx.) Baker

Marl and Sphagnum bogs of Bergen swamp. H. D. House, August 14, 1916.

Solidago uniligulata (DC.) Porter

Marl and Sphagnum bogs in Bergen swamp. H. D. House, August 14, 1916.

Solidago houghtonii Torr. & Gray

Wet surface of marl bogs in Bergen swamp. H. D. House, August 14, 1916.

Solidago ohioensis Riddell

Swampy places, edge of Bergen swamp. H. D. House, August 14, 1916.

Oryzopsis racemosa (Sm.) Ricker

Dry banks, " The Gulf." M. S. Baxter, August 1, 1914.

Sorghastrum nutans (L.) Nash

Open places in Bergen swamp. H. D. House, August 14, 1916.

5 MADISON COUNTY

The following species of Carex have been collected during the past three seasons in Madison county:

Near Oneida

Carex cristata *Schw.*	Carex scirpoides *Schk.*
" crawfordii *Fernald*	" rosea *Schk.*
" pallescens *Linn.*	" aurea *Nutt.*

Fiddler's green, Pecksport

Carex communis *Bailey*	Carex lacustris *Willd.*
" granularis *Muhl.*	" arctata *Boott*
" palescens *Linn.*	" bromoides *Schk*
" laxiflora *Lam.*	" rosea *Schk.*
" cephaloidea *Dewey*	" teretuiscula *Good.*
" stricta *Lam.*	" aurea *Nutt.*
" grisea *Wahl.*	" magellanica *Lam.*

According to Doctor Holm (in lit.), Lamarck in his diagnosis of Carex magellanica meant that *all* of the spikes contain some staminate flowers, a character constant in his Carex magellanica, as well as in the European plant, the one named Carex irrigua by Wahlenburg and finally also in our American plant named Carex paupercula by L. C. Richardson. Lamarck's name should be retained for these forms, and failure to do so in recent works is apparently due to a misunderstanding of Lamarck's diagnosis.

Doctor Holm further remarks that regarding Carex teretuiscula Good., the species designated by Schkuhr. as Carex diandra is according to the author of it a mixture of Carex teretuiscula Good., Carex paradoxa and Carex

Fig. 3 Polemonium vanbruntiae Britton, from near Peterboro, Madison co., growing in open marsh with sedges

paniculata, and hence the retention of Gooding's name seems preferable to that of Carex diandra.

Polemonium vanbruntiae Britton

(Figure 3)

Marshy ground near Peterboro. H. D. House, June 29, 1916, and near Warren, Herkimer co. These constitute new localities for this rare species which in this State is confined chiefly to the western and southern Catskill region. The state herbarium contains the following collections:

Schoharie county (locality not indicated). Miss Rhoda Waterbury. Charlotteville swamp. C. H. Peck.

Chenango county. McDonough. F. V. Coville.

Ulster county. Sand Pond. A. P. Van Gievon. Balsam Lake. Agnes M. Blodgett.

Delaware county. Balsam mountain. Agnes M. Blodgett.

6 MONROE COUNTY

Camelina microcarpa Andrz.

Irondequoit. H. D. House, June 1, 1916.

Antennaria ambigens (Greene) Fernald

Sandy fields near Irondequoit. Staminate and pistillate plants. H. D. House, June 1, 1916.

Amelanchier stolonifera Wiegand

Wet marshes along with Dasiphora fruticosa. Mendon. M. S. Baxter. May 8 (flowers) and June 20 (immature fruit), 1916.

Crepis capillaris (L.) Wallr.

In lawns. Rochester. M. S. Baxter, August 10, 1916.

Cynanchium vincetoxicum (L.) Pers.

Pinnacle hills, Rochester. Douglas M. White, June 4, 1916. A native of the old world, recorded as escaped from cultivation in southern Ontario. It differs from C. nigrum (which possesses dark purple flowers with the segments pubescent within) by having greenish white flowers with glabrous corolla lobes. It was collected also near Rochester by Dr C. H. Peck and reported in 1913 under the name of C. nigrum. Doctor Peck's specimens were in fruit and hence easily mistaken for that species.

Carex tuckermanni Dewey

Penfield. M. S. Baxter, July 1, 1914.

Cyperus engelmanni Steud.

Pittsford. M. S. Baxter. September 1, 1914.

Agrostis perennans (Walt.) Tuckerm.

On wet logs, Genesee river. M. S. Baxter, September 10, 1914.

Festuca elatior arundinacea Celak

Wet meadows near Rochester. M. S. Baxter, July 26, 1914.

Centaurea maculosa Lam.

Sandy fields, Brighton. M. S. Baxter, August 4, 1914.

Sagittaria cuneata Sheldon

Wet shores, Irondequoit bay. M. S. Baxter, August 10, 1916.

7 NASSAU COUNTY

Antennaria ambigens (Greene) Fernald

Sandy field near Merrick. H. D. House, June 16, 1916. These specimens possess unusually broad leaves, green but persistently and conspicuously woolly above, and without doubt are similar if not identical with Antennaria calophylla Greene as described in Britton's Manual. Except for the relatively broader leaves they are the same as recent collections of A. ambigens made in Albany and Monroe counties.

Teucrium littorale Bicknell

Brackish marshes near Oceanside and Long Beach. H. D. House, July 27, 1916. In Rhodora 10:84, 1908, Mr Fernald reduces this to a variety of T. canadense. As a matter of fact the characters of T. littorale, namely, leaves tapering at the base and the villous calyx, make it more closely related to T. boreale and T. occidentalis. Specimens from Orient Point (coll. Roy Latham) possess densely villous calyces and densely soft pubescent or velvety leaves. Specimens from Long Beach vary from canescent calyces to canescent with numerous long villous hairs. Its general appearance, habitat and distinct characters seem to indicate it as well marked in a group of very closely related species.

Kneiffia alleni (Britt.) Small

In sand near Long Beach. H. D. House, July 31, 1916.

Viola brittoniana x fimbriatula Dowell

Hempstead meadows. H. D. House, June 19, 1916.

Viola affinis x brittoniana Dowell

Hempstead meadows. H. D. House, May 18, 1916.

Lycopus europaeus Linn.

Near Hempstead. H. D. House, September 8, 1916. This resembles rather closely L. americanus, but the stems are densely pubescent, and it appears to match European specimens of L. europaeus.

Panicum virgatum cubense Griseb.

Along the edge of salt marshes near Oceanside. H. D. House, July 31, 1916. Also collected by Doctor Peck at Riverhead, Suffolk county, several years ago. It has been variously designated as Panicum virgatum obtusum Wood, and Panicum virgatum breviramosum Small.

8 ONONDAGA COUNTY

Amelanchier humilis Wiegand

A very distinct shrubby species growing on the limestone ledges of central New York. Labrador pond near Apullia, on the limestone ledges east of the pond. H. D. House, August 13, 1916, in fruit. One to three feet high, irregular in growth, usually spreading and deeply rooted in the crevices of the rock. Leaves elliptical oblong to nearly orbicular, sharply serrate with curved teeth, except at the base. Fruit dark blue without bloom.

Carex lasiocarpa Schk.

"Old Fly" near Pompey. H. D. House, June 28, 1916. Also collected near Baldwinsville, June 27, 1916 and at Carpenter's pond, June 29, 1915.

Carex buxbaumii Wahl.

"Old Fly" near Pompey. H. D. House, June 28, 1916. Growing with Carex aquatilis Wahl.

Carex deweyana Schw.

Open swampy ground around Carpenter's pond near Fabius. H. D. House, June 29, 1915.

Moneses uniflora (L.) A. Gray

Under hemlocks and cedar. Carpenter's pond. H. D. House, June 29, 1915. The species was very abundant there in 1915, but a year later, on June 28, 1916, it could not be found. However the season of 1916 was very wet and the woods where the plant had formerly been found was largely under water so that its failure to flower in 1916 was not surprising. Since such conditions occur frequently it probably does not result in the extermination of the species.

9 ONTARIO COUNTY

Antennaria occidentalis Greene

Near Fishers. H. D. House and M. S. Baxter, June 3, 1916.

Eupatorium purpureum var. **foliosum** Fernald

Swamp near Fishers. M. S. Baxter, September 10, 1916.

Paspalum muhlenbergii Nash

Fishers. M. S. Baxter, September 15, 1914. Also collected by Mr Baxter at Perriton, Monroe county, September 15, 1910.

Viola perpensa Greene

Leaflets 1:184. 1906

Related to Viola palmata L. Earliest leaves deeply and palmately cut into 5 to 7 more or less blunt lobes. Blades of the summer leaves primarily 3-lobed, the middle lobe 3-cleft, the lateral lobes 3 to 5-cleft into lanceolate, acute to long-acuminate lobes which stand obliquely forward from the middle lobe. Entire arrearance of the plant in late summer taller and more slender than Viola palmata. Early foliage glabrous to sparingly pubescent; later leaves 2 to 4 inches long, nearly as broad, pubescent especially on the veins beneath and on the slender petioles. Flowers 2 to 3.5 cm broad, on pedicels about equaling the foliage at flowering time. Sepals ovate-lanceolate, green, hyaline margined and glabrous, 3-nerved, 6 to 8 mm long, 2.5 mm wide, the basal auricle ovate and blunt, about 1 mm long; petals dark blue to violet, the lateral ones oblong, broadly rounded at their tips as is the spur petal which is scarcely broadened at the end and beardless, the lateral petals with small tufts of white hairs at the base; spur about 4 mm long, full and rounded. Cleistogenes on short horizontal or deflexed pedicels; their pods oblong, 6 to 8 mm long, seeds ovate, drab-colored.

Fishers, Ontario county. On shaded hillsides and moist woodlands which become dry in late summer. H. D. House and M. S. Baxter, June 3, 1916. Same locality. M. S. Baxter, September 10, 1916.

Hybridizes freely with Viola fimbriatula J. E. Smith, producing luxuriant clumps of sterile plants with elongated leaves in which the middle segment is greatly elongated and 3-lobed above the middle, the lateral segments greatly reduced and sometimes not divided, giving a pinnate appearance to the entire leaf-blade. This may be designated as **Viola fimbriatulax perpensa** hyb. nov.

Viola perpensa is regarded by Mr Brainerd (Torrey Club Bul. 37:583. 1910) as a "form or geographical race" of Viola palmata. It ranges from central New York westward through the Ontario lowlands and the Great Lakes region to Minnesota. In the first edition of Britton and Brown's Illustrated Flora it is referred to as a "form with the lateral leaf-lobes linear, perhaps distinct." In Britton's Manual it is included in the description of Viola bernardi Greene.

10 OSWEGO COUNTY

Among the species of Carex to be recorded for Oswego county are the following:

Carex albicans *Willd.* Lewis' bluff near Oswego (Sheldon)
" deflexa *Hornm.* Lewis' bluff near Oswego (Sheldon)
" pallescens *L.* Lewis' bluff near Oswego (Sheldon)
" communis *Bailey.* Lewis' bluff near Oswego (Sheldon)
" pedunculata *Muhl.* Lewis' bluff near Oswego (Sheldon)
" albursina *Sheldon.* Lewis' bluff near Oswego (Sheldon)
" projecta *Mackenzie.* Lake shore near Oswego (House)
" hystricina *Muhl.* Swamp near Oswego (Sheldon)
" bromoides *Schk.* Mud lake near Hannibal (House)
" stellulate *Good.* *var.* cephalantha (*Bailey*) *Fernald.* Mud lake near Hannibal (House)
" scabrata *Schw.* Panther lake near Constantia (House)

11 RENSSELAER COUNTY

Carex typhinoides Schw.

Sand Lake. H. D. House. *No. 5179.* July 4, 1913.

Lycopus membranaceus Bicknell

Bald mountain near Lansingburg. H. D. House and Joseph Rubinger, August 25, 1916. Also collected at Green Island by Doctor Peck. Distinguished from other species of Lycopus by its large, pale green, long-petioled leaves of thin, membranacous texture, small clusters of flowers, small corollas and stems conspicuously tuberiferous at the base, usually with numerous, long and filiform, non-tuberous stolons, arising from the main stem above the tubers and often one to two feet long.

12 SUFFOLK COUNTY

Viola emarginata LeConte

Babylon. H. D. House, May 23, 1916. Manorville, June 21, 1916.

Viola hirsutula Brainerd

Babylon. H. D. House, May 23, 1916.

The following hybrid violets were also collected:

Viola cucullata x fimbriatula. Manorville
" fimbriatula x hirsutula. Babylon
" affinis x hirsutula. Babylon
" hirsutula x palmata. Babylon
" emarginata x sagittata. Babylon

Panicum pseudopubescens Nash

Sandy woods of oak and pine, near Manorville. H. D. House, June 20, 1916.

13 WAYNE COUNTY

On August 12, 1916 a visit was made to the southern end of Sodus bay for the purpose of collecting the American Lotus in flower (Nelumbo lutea (Willd.) Pers.). The date was a little early for only a few plants were in flower, but they alone well repaid for the trouble encountered in reaching the spot. The Lotus here grows in water two to eight feet in depth just outside the zone of Typha and Scirpus along the shore. (Figure 4.) The flowers are pale yellow and very fragrant, the large, orbicular, peltate leaves are usually 1 to 2 feet above the water on stout petioles, while the flowers stand from 2 to 3 feet out of the water. The large white water-lily (Castalia tuberosa (Paine) Greene) is also abundant here.

Fig. 4 View of the colony of American Lotus (*Nelumbo lutea*) at Resort on the head of Sodus bay. The Lotus grows in water two to six feet deep in front of a dense marginal growth of Scirpus, Typha and Juncus along the shore in shallower water. *Nymphaea tuberosa* and several species of Potamegoton are also abundant here

THE VEGETATION OF THE EASTERN END OF ONEIDA LAKE

Introduction. The geographical location of New York State, with the Atlantic ocean upon one side and the Great Lakes on the other, gives it a unique position in regard to certain factors which influence vegetation — relative humidity, rainfall and snowfall. The general character of the climate of New York is conducive to forest growth, in contrast to conditions in the middle western states, while the extremes of temperature are considerably modified by the ocean and the inland lakes.

In the higher Adirondacks, the growing season, as measured between the last spring frost and the first fall frost, is between 90 and 120 days, while the growing season at Oneida lake is about 145 days, and on Lake Ontario near Oswego, 170 days, being exceeded in New York only by portions of Long Island and Staten Island with a growing season of 170 to 200 days.

The marshes, sandy plains and shores of the eastern end of Oneida lake have been for many years a most interesting field of study for botanists. The literature of botany in New York contains numerous references to this region and to certain species found growing there, but hitherto no attempt has been made to discuss fully the vegetation of this region.

Among the botanists who have collected here are Dr John Torrey, Dr Asa Gray, Peter Kneiskern, Dr George Vasey, John Paine, jr, Dr J. V. Haberer, William R. Maxon, Dr C. H. Peck and many others. The herbariums of many institutions are rich in specimens collected here by the above-named botanists, as well as by other collectors.

A casual review of the vegetation of this region indicates an unusual number of species of sedges, grasses and aquatic plants. There also appears a certain element which is more suggestive of the vegetation of the northern coastal region than of the typical Canadian-Transition flora which chiefly surrounds this region. The general prevalence of sandy soils is doubtless responsible in large measure for this, but on the other hand, many species typical of the northern coastal plain and other sandy regions in the north, are conspicuous by their absence.

What now remains of the original forest condition which once prevailed here is very slight indeed, but there is sufficient evidence to establish the fact that the white pine was one of the predominant trees of the primeval forest on these sandy lowlands. Lumbering and subsequent fires, the latter of frequent recurrence on some areas, has resulted in a more or less complete change of vegetation and in the production of conditions which has favored the spread of sand-loving species of herbs and shrubs. (Figure 5.)

Geology. The only portion of geological history which is of concern here is the Quaternary Period, including the great Ice Age and the subsequent changes in drainage which have taken place in central New York, and especially of Oneida lake which lies in a depression of the southeastern lobe of the Postglacial Lake Iroquois, which discharged its waters to the east through the Mohawk valley. During the retreat of the ice sheet in this region, the St Lawrence valley was still buried under the ice.

Much later the ice sheet retreated sufficiently to allow the discharge of the water along the northern base of the Adirondacks and into the Champlain and Hudson valleys and finally retreated far enough to free the St Lawrence valley and lower the surface of Lake Iroquois so that Oneida lake became isolated from the main body of Postglacial waters, and its drainage was turned from the Mohawk to the Oswego river. Higher levels of Oneida lake are plainly marked by ridges of sand east of the present western shore line which are similar to the low ridge of sand now existing within the fringe of vegetation (figure 6) along the shore, and caused by the action of high water and strong westerly winds.

Climatic influences. The influence of the waters and low elevations of the Great Lakes region serves to produce a distinct climatic province with longer growing season than any other part of the State except the lower Hudson valley and coastal islands. It is a well-known fact that large bodies of water absorb more heat, hold more heat, are warmed to greater depths and absorb and radiate heat more slowly than land areas. In addition to this, probably half of the insolation on water areas is used in evaporating water, and since the prevailing winds of the Ontario lowlands are westerly, the total effect of these conditions is to make cooler summers, milder winters, to prolong the fall season and to retard spring as well as to check to some extent sudden changes in temperature.

These climatic influences are reflected in the character of the vegetation of the Ontario lowlands, where the prevailing forest trees are oak, hickory, chestnut, tulip-tree, elm, basswood, ash, black gum and sassafras, while of infrequent occurrence except in bogs are spruce, tamarack, balsam and white cedar.

This apparent Austral influence is reflected in the character of the forests of the Ontario lowlands as far eastward as the lowlands

Fig. 5 View looking south along a road through the sandy plains — a region formerly covered with forest of pitch pine, oaks and white pine. Only the pitch pine and some of the oaks are left. Repeated fires have changed the character of the soil which now supports a luxuriant growth of Epilobium, *Betula populifolia*, Aronia, Vaccinium, *Pteris aquilina*, *Populus tremuloides*, *Rubus villosus*, etc.

Fig. 6 Eastern shore of Oneida lake, south of Sylvan Beach, showing formation of small dunes in the margin of the forest (*Pinus rigida*, *Pinus strobus*, *Quercus alba*, *Quercus rubra*) and clumps of *Salix petiolaris* in the foreground

Fig. 7 Sand plain forest east of Sylvan Beach composed chiefly of pitchpine, *Quercus rubra*, *Q. alba*. The lower vegetation in open places consists chiefly of *Pteris aquilina*, *Dryopteris noveboracensis*, *Dennstaedia punctiticuloba*, *Vaccinium pennsylvanicum*, *Polycodium staminium*, etc.

of Onondaga and Madison counties, and is even apparent at the east end of Oneida lake where the tulip tree, black gum, oaks, sassafras and elm are abundant, but where soil conditions have excluded the chestnut in favor of white pine, hemlock, pitch-pine and birch.

The moderating influence of Oneida lake upon the climate of the surrounding land is almost inappreciable because of its shallowness. Covering an area of about 100 square miles the lake is but 20 to 55 feet deep, the greatest depth, near Cleveland, being about 55 feet.

Life zones. In order to make clear the position of the Ontario lowlands and the regions to the northeast and to the immediate south, it seems advisable to introduce at this point an outline of the life zones as defined by Doctor Merriam (Bulletin 10, U. S. Geol. Survey, 1898).

1 Boreal region
  - *a* Arctic-Apline zone
  - *b* Hudsonian zone. Limited in the eastern United States to the highest mountains of New England to western North Carolina
  - *c* Canadian zone. The zone of red spruce, balsam fir, paper birch and mountain ash. In New York confined to the Adirondack region and the higher points of the Catskill mountains

2 Austral region
  - *d* Transition zone, the eastern humid portion of which is called the Alleghanian zone. It is the region of oaks, hickories, chestnut, with mixtures of birches, beech, hemlock, and sugar maple, which are not lacking in the Canadian zone
  - *e* Upper Austral zone, the eastern humid portion of which is called the Carolinian zone. It is the zone of the tulip tree, hackberry, sweet gum, redbud, persimmon and black gum. In New York extending up the lower Hudson valley and including Long Island and Staten Island
  - *f* Lower Austral zone (Austroriparian area)

3 Tropical region
  - *g* Tropical zone

It will be seen from this outline that all these zones, excepting the first and the last two, are represented in New York State.

Forests. The region around the eastern end of Oneida lake represents in the character of its arborescent vegetation a close relationship to the Alleghanian-Transition zone. Upon the sandy areas (figure 7) which are not covered by swamp or marsh vegetation the principal trees are:

White pine	Pinus strobus *L.* (represented chiefly by stumps and seedlings.
Hemlock	Tsuga canadensis (*L.*) *Carr.*
Pitch pine	Pinus rigida *Mill.*
White oak	Quercus alba *L.*

Red oak	Quercus rubra *L.*
White birch	Betula populifolia *Marsh.*
Yellow birch	" lutea *Michx. f.*
Witch-hazel	Hamamelis virginiana *L.*
Black oak	Quercus velutina *Lam.*
Wild black cherry	Prunus serotina *Ehrh.*
Juneberry	Amelanchier canadensis (*L.*) *Medic.*
Sassafras	Sassafras sassafras (*L.*) *Karst.*
Bird cherry	Prunus pennsylvanica *L. f.*

In low wet situations (swamp-forest) the principal trees are:

Red maple	Acer rubrum *L.*
Yellow birch	Betula lutea *Michx. f.*
Tupelo or black gum	Nyssa sylvatica *Marsh.*
Elm	Ulmus americana *L.*
Silver maple	Acer saccharinum *L.*
Basswood	Tilia americana *L.*
Swamp hickory	Hicoria cordiformis (*Wang.*) *Britt.*
Swamp white oak	Quercus bicolor *Willd.*
Striped maple	Acer pennsylvanicum *L.*
Red ash	Fraxinus pennsylvanica *Marsh.*
Tulip-tree	Liriodendron tulipifera *L.*
Black ash	Fraxinus nigra *Marsh.*
Cottonwood	Populus deltoides *Marsh.*

The presence here of certain trees like the tulip-tree, the oaks, sassafras, black gum, cottonwood, and chestnut (north of the lake, but not on the low sandy soils about Sylvan Beach), while they do not form a conspicuous element of the forest, excepting the oaks, would seem to indicate that the influence of the climate of the Great Lakes region is felt to some extent in this eastward indentation of the Ontario-Iroquois lowlands.

There is not lacking, however, a good representation of shrubs and herbs very characteristic of the Canadian-Transition zone, the most noteworthy being the following:

Bush honeysuckle	Diervilla diervilla (*L.*) *MacM.*
True wood-sorrel	Oxalis acetosella *L.*
Partridge-berry	Mitchella repens *L.*
Wild sarsaparilla	Aralia nudicaulis *L.*
Gold-thread	Coptis trifolia (*L.*) *Salisb.*
Yellow clintonia	Clintonia borealis (*Ait.*) *Raf.*
Two-leaved Soloman's seal	Unifolium canadensis (*Desf.*) *Greene*
Bunch-berry	Cornus canadensis *L.*
Hobble-bush	Viburnum alnifolium *Marsh.*
Dalibarda	Dalibarda repens *L.*
Canada violet	Viola canadensis *L.*

It is interesting to note that for the most part these species of the Canadian-Transition zone are inhabitants here of dense woodlands, while the large element of Austral shrubs and herbs is mainly

Fig. 8 The broad sandy beach near the mouth of Fish creek showing the encroaching vegetation of *Scirpus americanus*, Juncus (several species), *Salix petiolaris*, various grasses, followed by *Betula lutea*, *Acer rubrum*, Populus, etc. The advance vegetation upon the sand consists of such small species as *Gnaphalium uliginosum*, *Bidens cernua*, *Scirpus debilis*, *Eleocharis acicularis*, *E. diandra*, *Hemicarpa micrantha*, *Polygonum buxiforme*, *Eragrostis hypnoides*, *Agrostis maritima*, *Fimbri-*

Fig. 9 Eastern shore of Oneida lake, north of Sylvan Beach. The forest is bordered by a zone of willows, which maintains a constant struggle with the sand, wind and waves in summer time, and ice and high water in winter time

in open places — low, sandy plains and the depressions in the sandy plains — open marshes, swamps and shores.

With an almost pure sandy soil, and in most portions of the sandy plains with the water level often very close to the surface, the normal changes in soil temperature are considerably modified, the soil losing less heat at night by radiation because of the closeness of the water level to the surface. This becomes an important factor in the ecology of the vegetation, especially in early spring and late fall, retarding spring vegetation, modifying the extremes of temperature between day and night in summer and retarding the freezing of the soil in late fall, conditions which in connection with the sandy character of the soil favors the development of Austral species of shrubs and herbs to even a greater extent than any modifying influence of the Great Lakes which may extend this far eastward on the Ontario lowlands.

This sandy region affords, therefore, a meeting-ground of southern and northern species, with conditions favoring the southern species in the open and the northern species on the more densely wooded areas.

Austral elements of the vegetation. The broad, sandy beach (figures 8 and 9) along the eastern shore of Oneida lake, together with the sandy plains, depressions, open marshes, and sandy fields, in which the water level is often close to the surface and which frequently lacks well-defined surface drainage, together with a climate modified to some extent by the prevailing winds from the Great Lakes, is favorable to the development of a large Austral element in the vegetation, as indicated in the following list of species which are largely absent from the Transition flora of the territory to the south, east and northeast. Some botanists may explain the presence of certain of these species as due to ecological conditions similar to those prevailing in certain sandy regions of the northern coastal plain, rather than to any marked Austral climatic conditions.

The mere age of a geologic formation is of little consequence in determining the character of plant growth. The important factor is the lithologic character, mechanical and chemical, irrespective of age. Also important is the texture or size of grain of the resulting soils, determining the rate at which plant foods pass into solution, and the structural features helping or hindering drainage.

A sandy soil, whether a recent dune or one derived from the disintegration of Triassic or Paleozoic sandstones, is the home of similar sand-loving plants where moisture conditions are the same, however much the areas may differ in altitude within given limits, or in latitude within certain limits and modifications.

Similarly a heavy soil, whether glacial till or cretaceous clays (both abundant in central New York), might be equally available as a home for species which require such a mechanical condition for their proper growth. Likewise trees requiring a merely rocky soil are largely indifferent as to whether the rock is Eozoic granite or Mesozoic trap.

These principles of soil texture as a determining factor in plant distribution within regions of the same general altitude and climatic conditions are responsible very largely for the characteristic differences between the flora of the sandy plains east of Oneida lake and the clay and loamy soils of the surrounding uplands, and explain at the same time the ease with which the species of the northern coastal plain have invaded this territory.

On hilly clay soil near Tallahassee, Florida, many northern plants occur in a region chiefly sandy and covered by species of the Carolinian flora. This to a certain extent is the reverse of the conditions which exist at the eastern end of Oneida lake.

Further, if we are to consider the various elements of our flora as having migrated northward after the retreat of the ice sheet of the Glacial epoch, it is apparent that the first advance forward of any element of the flora at any time will follow the line of least resistance, which means favorable soil conditions rather than unfavorable conditions where the climatic influences are otherwise identical. The sandy soils of the eastern end of Oneida lake are of alluvial origin (although geologically recent), and hence better adapted to the growth of the Austral species of the northern coastal plain than are gravelly drift, clays and cold humus of the northern Alleghanian plateau in New York State.

With this in mind, the element of Austral vegetation of the region east of Oneida lake as shown in the following list of species becomes of great importance to the student of plant ecology and plant distribution.

Dodge's shield fern..............	Dryopteris simulata *Davenp.*
Virginia chain fern..............	Anchistia virginica (*L.*) *Presl.*
Carolina azolla..................	Azolla caroliniana *Willd.*
Shore horsetail..................	Equisetum littorale *Kuhlewein*
Ground-pine......................	Lycopodium tristachyum ***Pursh***
Awned cyperus....................	Cyperus inflexus *Muhl.*
Slender cyperus..................	" filiculmis *Vahl.*
Spreading spike-rush.............	Eleocharis diandra *C. Wright*
Low fimbristylis.................	Fimbristylis geminata (*Nees*) *Kunt*
Common hemicarpha................	Hemicarpha micrantha (*Vahl*) *Britt.*
Long sedge.......................	Carex folliculata *L.*
Whip-grass.......................	Scleria triglomerata *Michx.*
Lindheimer's panic-grass.........	Panicum lindheimeri *Nash*

Red-top panic-grass	Panicum agrostoides *Spreng.*
Ashe's panicum	" ashei *Pearson*
Low stiff panic-grass	" addisonii *Nash*
American panic-grass	" columbianum *Scribn.*
Hemlock panic-grass	" tsugetorum *Nash*
Tennessee panic-grass	" tennesseense *Ashe*
Shore bent-grass	Agrostis maritima *Lam.*
Beard grass	Andropogon furcatus *Muhl.*
Yellow-fringed orchis	Blephariglottis ciliaris (*L.*) *Rydb.*
Lizard's-tail	Saururus cernuus *L.*
Cottonwood	Populus deltoides *Marsh.*
Sweet fern	Comptonia peregrina (*L.*) *Coulter*
Slender ladies'-tresses	Ibidium gracilis (*Bigel.*) *House*
Hispid cat brier	Smilax hispida *Muhl.*
Wild orange-red lily	Lilium philadelphicum *L.*
Jointed knotweed	Polygonella articulata (*L.*) *Meissn.*
Shore knotweed	Polygonum buxiforme *Small*
Bastard toadflax	Comandra umbellata (*L.*) *Nutt.*
Long-fruited anemone	Anemone cylindrica *A. Gray*
Wind-flower	" quinquefolia *L.*
Rue anemone	Syndesmon thalictroides (*L.*) *Hoffm.*
Pokeweed	Phytolacca americana *L.*
Sassafras	Sassafras sassafras (*L.*) *Karst.*
Virginia spring beauty	Claytonia virginica *L.*
Willow-leaved meadowsweet	Spiraea alba *Dukoi*
Dewberry	Rubus villosus *Ait.*
Low June-berry	Amelanchier intermedia *Spach*
Lupine	Lupinus perennis *L.*
Beach pea	Lathyrus maritimus (*L.*) *Bigel.*
Round-leaved tick trefoil	Meibomia michauxii *Vail*
Hairy bush-clover	Lespedeza hirta (*L.*) *Hornem.*
White baneberry	Actaea alba (*L.*) *Mill.*
Milkwort	Polygala viridescens *L.*
Hairy-leaved winterberry	Ilex verticillata *var.* padifolia (*Willd.*) *T. & G.*
Frostweed	Helianthemum canadense (*L.*) *Michx.*
Pinweed	Lechea intermedia *Leggett*
Ovate-leaved violet	Viola fimbriatula *J. E. Smith*
Pine-weed	Sarothra gentianoides *L.*
Meadow beauty	Rhexia virginica *L.*
Tulip-tree	Liriodendron tulipifera *L.*
Sycamore	Platanus occidentalis *L.*
Panicled dogwood	Cornus paniculata *L'Her.*
Black gum	Nyssa sylvatica *Marsh.*
Pinkster flower	Azalea nudiflora *L.*
Male-berry	Lyonia ligustrina (*L.*) *DC.*
Squaw huckleberry	Polycodium stamineum (*L.*) *Greene*
Coast-region cranberry	Oxycoccus macrocarpus (*Ait.*) *Pursh*
Blue curls	Trichostema dichotomum *L.*
Yellow hedge-hyssop	Gratiola aurea *Muhl.*

Rough hedge-nettle	Stachys aspera *Michx.*
Red ash	Fraxinus pennsylvanica *Marsh.*
Slender agalinis	Agalinis tenuifolia (*Vahl*) *Britt.*
Slender lobelia	Lobelia spicata *Lam.*
Venus's looking-glass	Specularia perfoliata (*L.*) *A. DC.*
White-topped aster	Sericocarpus asteroides (*L.*) *B. S. P.*
Linear-leaved aster	Ionactis linearifolius (*L.*) *Greene*
Climbing hemp-weed	Mikania scandens (*L.*) *Willd.*
Flat-topped goldenrod	Euthamia graminifolia (*L.*) *Nutt.*
Large-leaved antennaria	Antennaria fallax *Greene*

Perhaps not less marked is the absence of a large number of Austral species, typical of the sandy plains between Schenectady and Albany, and almost as far north as Oneida lake, such as Quercus ilicifolia, Q. prinoides, Ceanothus americanus, and several others. In the case of the Albany-Schenectady plains, there is a more direct connection with the coastal plain by way of the Hudson valley and the sand-loving Austral species have taken a firmer and earlier possession of that region.

Plant formation. A consideration of the plant formations of the region east of Oneida lake is necessarily influenced by the fact that extensive lumbering operations in the past and repeated fires have produced conditions or changes in the vegetation and caused interruptions in the normal succession of floras that are not easy to collate with the primeval conditions. Seemingly, the only plant formations remaining unaffected are those of the shore and the hardwood swamps.

Shore Vegetation

(Figures 8 and 9)

The broad, sandy shore of the eastern end of Oneida lake is the home of numerous, shore-loving species, the most noteworthy of which are the following:

Agrostis maritima *Lam.*
Argentina anserina (*L.*) *Rydb.*
Bidens cernua *L.*
" frondosa *L.*
Cyperus inflexus *Muhl.*
" rivularis *Kunth*
" esculentus *L.*
" speciosus *Vahl*
Echinochloa frumentacea (*Roxb.*) *Link.*
Eleocharis acicularis (*L.*) *R. & S.*
" diandra *C. Wright*
" intermedia (*Muhl.*) *Schultes*
" palustris (*L.*) *R. & S.*
Eragrostis hypnoides (*Lam.*) *B. S. P.*
Fimbristylis geminata (*Nees*) *Kunth*
Gnaphalium uliginosum *L.*
Hemicarpa micrantha (*Vahl*) *Pax.*
Isnardia palustris *L.*
Juncus bufonius *L.*
" acuminatus *Michx.*
Lathyrus maritimus (*L.*) *Bigel.*
Mollugo verticillata *L.*
Polygonum buxiforme *Small*
Ranunculus reptans *L.*
Salix humilis *Marsh.*
Scirpus americanus *Vahl*
" debilis *Pursh*
Sporobolus uniflorus (*Michx.*) *Scribn. & Merr.*

Fig. 10 View along Fish creek near Sylvan Beach. Shore thickets of *Salix nigra*, *Acer rubrum*, *Alnus incana* etc. Shallow water vegetation of Sparganium, Pon tederia, Sagittaria, Alisma, Juncus, Nymphaea, Scirpus, Typha, etc.

Lake Vegetation

The quieter waters of some of the bays, especially when protected from the prevailing winds by a wooded point, are rich in aquatic species. The deeper waters containing:

Castalia tuberosa (*Paine*) *Greene*
Nymphaea microphylla *Pers.*
" variegata (*Engelm.*) *G. S. Miller*
Potamogeton pectinatus *L.*
Potamogeton angustifolius *B. & P.*
" lucens *L.*
" perfoliatus *L.*
Naias flexilis (*Willd.*) *R. & S.*
Nymphoides lacunosum (*Vent.*) *Kuntze*

Near the shores or in shallower water occurs extensive stretches of "swale-grass," as it is locally known, consisting of Scirpus americanus Pers., Spartina michauxiana Hitchc., Scirpus validus Vahl, Juncus effusus L., Eleocharis palustris vigens Bailey, Typha latifolia L., with smaller and varying quantities of the following species: Scirpus fluviatilis (Torr.) A. Gray, Pontederia cordata L., Persicaria amphibia (L.) S. F. Gray, Dianthera americana L., Mariscus mariscoides (L.) Kuntze, Alisma subcordatum Raf., Persicaria muhlenbergii (S. Wats.) Small, Saururus cernuus L., Calamagrostis canadensis (Michx.) Beauv., Cinna arundinacea L., and various other species.

Stream Vegetation

The quieter and deeper waters of the streams (figure 10) and their shallow sandy or muddy shores contain an unusually large aquatic vegetation, among which the following are the most conspicuous by their abundance:

Nymphaea variegata (*Engelm.*) *G. S. Miller*
" rubrodisca (*Morong*) *Greene*
Castalia odorata (*Dryand.*) *Woodv. & Wood*
Myriophyllum verticillatum *L.*
Lemna minor *L.*
" trisulca *L.*
Vallisneria spiralis *L.*
Philotria canadensis (*Michx.*) *Britton*
Persicaria amphibia (*L.*) *S. F. Gray*
Zannichellia palustris *L.*
Azolla caroliniana *Willd.*
Potamogeton natans *L.*
" epihydrus *Raf.*
" angustifolius *B. & P.*
" heterophyllus *Schreb.*
" perfoliatus *L.*
" diversifolius *Raf.*
" praelongus *Wulf.*
" pusillus *L.*
Neobeckia aquatica (*Eaton*) *Greene*

Marsh Meadow Vegetation

Marshy meadows in which the dominant species are Carices and grasses are rather abundant in the lowlands east of Oneida lake.

In most of them there is a tendency for the marsh to develop into a swamp-shrub or swamp-forest composed of Alder, Ilex, Salix, Betula, Acer rubrum and a few other species. The commoner species of the marsh-meadows are the following:

Carex stricta *Lam.*
" stipata *Muhl.*
" vulpinoidea *Michx.*
" scoparia *Schk.*
Cinna arundinacea *L.*
Juncus effusus *L.*
Iris versicolor *L.*
Acorus calamus *L.*
Lilium canadense *L.*
Scirpus atrovireus *Muhl.*
" cyperinus (*L.*) *Kunth*
Panicularia canadensis (*Michx.*) *Kuntze*

These meadows were without question at one time covered by forest and where undisturbed for a few years show in many places a very rapid succession of vegetation back to the forest type. This is usually first indicated by an abundance of royal-fern, cinnamon-fern, meadow-rue, Canada lily and other tall, herbaceous species which generally precede the development of a swamp-shrub formation consisting of:

Alnus rugosa (*Du Roi*) *Spreng.*
Salix lucida *Muhl.*
Nemopanthus mucronata (*L.*) *Trel.*
Viburnum cassinoides *L.*
Salix sericea *Marsh.*
Aronia melanocarpa (*Michx.*) *Britt.*
Ilex verticillata (*L.*) *A. Gray.*
Cornus femina *Mill.*
Vaccinium corymbosum *L.*

These in turn being succeeded by the swamp-forest type consisting of red maple (Acer rubrum L.), American elm (Ulmus americana L.), black gum (Nyssa sylvatica Marsh.), silver maple (Acer saccharinum L.), yellow birch (Betula lutea Michx. f.), hemlock (Tsuga canadensis (L.) Carr.) and a few others of less importance.

In the shallow water of one of the arms of Fish creek (figure 11) occurs a small growth of shrubs forming a dense thicket with the forest in the background. This is composed almost exclusively of Cornus femina Mill., Cephalanthus occidentalis L., Decodon verticillatus (L.) Ell., with a few red maples, alders, Ilex and Comarum. This aquatic " forewold " is also beautifully developed along both banks of Black creek (figure 12), where the growth consists almost entirely of Cornus femina Mill.

Sandy Fields

Sandy fields, whether of present cultivation or abandoned, as are most of them, must be regarded as artificial habitats and it is in such situations that one finds the majority of introduced species.

Fig. 11 A small swamp-shrub formation in shallow water of a branch of Fish creek consisting of a dense thicketlike growth of Cornus femina with some Cephalanthus, Decodon, Ilex, Comarum, Salix, Betula lutea and Acer rubrum

Fig. 12 View looking north on Black creek which flows through a hardwood swamp of red maple, silver maple, black ash, elm, and black gum. The stream is bordered by a dense marginal growth of Cornus femina with some Cephalanthus, Decodon, Alnus and Ilex

The vegetation upon these fields which have been abandoned is largely of an adaptive character, consisting chiefly of the following species:

Panicum dichotomiflorum *Michx.*
" depauperatum *Muhl.*
" linearifolium *Scribn.*
" dichotomum *L.*
" meridionale *Ashe*
" tsugetorum *Nash*
" capillare *L.*
Anthoxanthum odoratum *L.*
Aristida dichotoma *Michx.*
Deschampsia flexuosa (*L.*) *Trin.*
Bromus secalinus *L.*
Lolium perenne *L.*
Cyperus filiculmis *Vahl.*
Carex pennsylvanica *Lam.*
" umbellata *Schk.*
" scoparia *Schk.*
" muhlenbergii *Schk.*
Carex crawfordii *Fernald*
Juncus tenuis *Willd.*
" filiformis *L.*
Juncoides campestre (*L.*) *Kuntze*
Hypoxis hirsuta (*L.*) *Coville*
Comptonia peregrina (*L.*) *Coulter*
Polygonella articulata (*L.*) *Meissn.*
Arenaria serpyllifolia *L.*
Rubus hispidus *L.*
Lupinus perennis *L.*
Lespedeza capitata *Michx.*
Andropogon furcatus *Muhl.*
Oenothera biennis *L.*
Verbascum blattaria *L.*
" thapsus *L.*
" lychnitis *L.*
Lepidium virginicum *L.*

LIST OF FERNS, CONIFERS AND FLOWERING PLANTS OF THE ONEIDA LAKE REGION

PTERIDOPHYTA

Ophioglossaceae Presl.

Botrychium obliquum *Muhl.*

Botrychium dissectum *Spreng.* Intermediate forms between this and the preceding species are rather frequent.

Botrychium silaifolium *Presl.* Sandy field along edge of woods. August 24, 1906 (H. D. House). This station has since been obliterated, but the species doubtless occurs elsewhere in this vicinity.

Botrychium virginianum *(L.) Sw.* Common in moist woodlands.

Ophioglossum vulgatum *L.* Depressions in the sandy plains.

Osmundaceae R. Br.

Onoclea sensibilis *Linn.* Common in wet and moist places.

Osmunda regalis *Linn.* Open swamps and wet woods. Common.

Osmunda cinnamonea *Linn.* Swamps and woods. Common.

Osmunda claytoniana *Linn.* Open swamps. Less abundant than the two preceding species.

Matteucia struthiopteris *(L.) Todaro.* Alluvial soil along Fish creek. The American form of this fern is called Matteucia nodulosa (Michx.) by Fernald (Rhodora 17:161. 1915). The name Pteretis Raf. (1818) antedates Matteucia Todaro (1866) and Nieuwland (Am. Mid. Nat. 4:333. 1916) proposes to call our Ostrich-fern Pteretis nodulosa (Michx.) Nwd.

Dennstaedtia punctilobula *(Michx.) Moore.* Common in rather moist woods and fields.

Polystichum acrostichoides *(Michx). Schott.* Moist woods, etc. Common.

Dryopteris noveboracensis *(L.) A. Gray.* Dry woods and fields and moist meadows. Common.

Dryopteris thelypteris *(L.) A. Gray.* Open marshy places. Very abundant.

Dryopteris simulata *Davenport.* A single station for this rare species exists near Sylvan Beach.

Dryopteris cristata *(L.) A. Gray.* Wet mossy thickets and bogs. Rare.

Dryopteris clintoniana *(D. C. Eaton) Dowell.* Low moist woods. Rare.

Dryopteris marginalis (*L.*) *A. Gray*. Woods and thickets. Common.

Dryopteris spinulosa (*Muell.*) *Kuntze*. Low moist woodlands. Common.

Dryopteris intermedia (*Muhl.*) *A. Gray*. Low moist woodlands. Common.

Phegopteris dryopteris (*L.*) *Fee*. Low woods and mossy swamps. Not common.

Anchistea virginica (*L.*) *Presl*. Open sunny marshes. Common. A coastal plain species which has also been found at Kasoag and north of Schroeppel's bridge in Oswego county.

Asplenium platyneuron (*L.*) *Oakes*. Woods and banks near North Bay.

Athyrium pycnocarpon (*Spreng*). *Tidestrom*. Low woods near South Bay.

Athyrium thelypteroides (*Michx.*) *Desv*. Asplenium acrostichoides *Sw*. Low woodlands. Rare.

Athyrium felix-foemina (*L.*) *Roth*. Woods and banks. Common. The most abundant form is A. felix-foemina var. Michauxii Mett. (= Athyrium angustum (Willd.) Presl.)

Adiantum pedatum *Linn*. Woods and thickets. Not common.

Pteridium aquilinum (*L.*) *Kuhn*. Sandy fields and dry woods. Everywhere abundant.

Salviniaceae Reichenb.

Azolla caroliniana *Willd*. Abundant on the surface of Black creek. Also reported from here by Warne, 28th Ann. Rep't State Botanist. p. 85, 1876.

Equisetaceae Michx.

Equisetum arvense *Linn*. Sandy fields and embankments. Very abundant.

Equisetum pratense *Ehrh*. Marshy places and along streams.

Equisetum sylvaticum *L*. Swampy woodlands adjacent to Black creek.

Equisetum fluviatile *L*. Swamps along streams.

Equisetum littorale *Kuehl*. Marshy lake shore, North Bay, H. D. House, June 19, 1915, *No. 5866*. Chiefly the var. gracile Milde.

Equisetum hyemale *L*. Sandy soil. Very abundant, the var. intermedium Eaton frequent along the lake shore.

Lycopodiaceae Michx.

Lycopodium lucidulum *Michx.* Moist shaded woodlands, usually under evergreens. Common.

Lycopodium inundatum *L.* Depressions and dessicated bogs in the sandy plains east of Verona Beach.

Lycopodium obscurum *L.* Low or moist woodlands.

Lycopodium clavatum *L.* Open woods and thickets.

Lycopodium complanatum *L.* Woods and thickets. Rare.

Lycopodium tristachyum *Pursh.* Sandy soil along edge of woods or in open dry woods. Common.

Lycopodium annotinum *L.* Under hemlocks and pines near Panther lake north of Constantia, but not recorded from the east end of the lake.

Selaginellaceae Underwood

Selaginella apus (*L.*) *Spring.* Moist soil in shaded places, frequently in swamps and often overlooked because of its small size.

Isoetaceae Underwood

Isoetes macrospora *Durieu.* Shallow water, mouth of Oneida creek.

SPERMATOPHYTA

GYMNOSPERMAE

Pinaceae Lindl.

Pinus strobus *L.* Common in former days forming a large and important element of the forests in this region. Old stumps remaining in the woods show that it frequently reached a diameter of five feet.

Pinus rigida *Miller.* Common in the sandy woods close to the lake shore and on the plains east of Verona Beach.

Pinus resinosa *Ait.* Reported from the Pine plains of Rome by Kneiskern. Not seen recently in this region.

Picea rubens *Sargent.* A few young trees of this species occur in the second growth on low land east of Sylvan Beach. Possibly of recent introduction from the north.

Tsuga canadensis (*L.*) *Carr.* One of the most abundant forest trees of this section.

Thuja occidentalis *L.* In swamps along the base of the hills toward Vienna, about two miles northeast of Sylvan Beach, but rare or absent from the swamps in the immediate vicinity of the east end of Oneida lake.

Taxaceae Lindl.

Taxus canadensis *Marsh.* Common in low shaded woodlands.

ANGIOSPERMAE

MONOCOTYLEDONES

Typhaceae J. St. Hil.

Typha latifolia *L.* Common in open marshes and swales.

Sparganiaceae Agardh.

Sparganium eurycarpon *Engelm.* Marshy places. Common.
Sparganium americanum *Nutt.* Shallow water and swamps.

Zannichelliaceae Dumort.

Potamogeton angustifolius *B. & P.* (Peck)
Potamogeton epihydrus *Raf.* (*P. nuttallii Cham. & Schlecht.*)
Potamogeton diversifolius *Raf.*
Potamogeton heterophyllus *Schreb.*
Potamogeton lucens *L.* (Oneida lake, Peck)
Potamogeton compressus *L.*
Potamogeton natans *L.*
Potamogeton pectinatus *L.*
Potamogeton perfoliatus *L.*
Potamogeton praelongus *Wulf.* (Peck)
Potamogeton pusillus *L.*
Potamogeton richardsonii (*Benn.*) *Rydb.* (Peck)
Naias flexilis (*Willd.*) *Rost. & Schmidt.* Quiet waters of bays on north and south shores of the lake and frequently brought by the wind into Fish creek.

Alismaceae DC.

Alisma subcordatum *Raf.* (A. plantago-aquatica *Auth.*) Common everywhere in shallow water and marshy places.
Sagittaria latifolia *Willd.* In similar situations and as abundant as the preceding species.
Sagittaria graminea *Michx.* Shallow water and marshes along the shores of the lake on the north and south sides. Also reported from here by Kneiskern.

Scheuchzeriaceae Agardh.

Triglochin palustris *L.* Mossy and boggy places in the sandy plains east of the head of the lake.

Scheuchzeria palustris *L.* Abundant in the swamps of Rome, (*Kneiskern.*) Probably to be looked for in situations similar to the preceding species.

Vallisneriaceae Dumort.

Philotria canadensis (*Michx.*) *Britton.* Shallow and quiet waters of the lake. Common.

Philotria nuttallii (*Planch.*) *Rydb.* Fish creek (Underwood).

Vallisneria spiralis *L.* Shallow waters of the lake and adjacent streams.

Gramineae Juss.[1]

Syntherisma filiforme (*L.*) *Nash.* Sandy soil. Rare.

Syntherisma sanguinale (*L.*) *Dulac.* Sandy fields and waste places. Common.

Syntherisma ischaemum (*Schreb.*) *Nash.* (Syntherisma humifusum *Rydb.*) Fields and waste places. Common.

Andropogon furcatus *Muhl.* Sandy ridges and fields east of Verona Beach. Locally abundant.

Sorghastrum nutans (*L.*) *Nash.* Sandy plains. Common. Also reported by Kneiskern.

Echinochloa crus-galli (*L.*) *Beauv.* Waste and cultivated ground.

Echinochloa frumentacea (*Roxb.*) *Link.* Sandy plains and shores.

Panicum addisonii *Nash.* Sylvan Beach. Haberer, *No. 3293.*

Panicum agrostoides Spreng. Moist shores of the lake.

Panicum ashei *Pearson.* Open woods, North Bay, House, June 19, 1915, *No. 5865.*

Panicum boreale *Nash.* North Bay. House.

Panicum boscii *Poir.* Moist thickets, rare.

Panicum capillare *L.* Sandy shores. Rare.

Panicum columbianum *Scribn.* (House, *No. 5716.*)

Panicum dichotomiflorum *Michx.*

Panicum dichotomum *L.*

Panicum clandestinum *L.*

Panicum depauperatum *Muhl.*

Panicum huachucae *Ashe.* This and the variety silvicola *Hitchc. & Chase* are very abundant in open woodlands.

Panicum implicatum *Scribn.* (House, *No. 5703.*)

Panicum latifolium *L.*

Panicum lindheimeri *Nash.*

[1] I am indebted to Professor Hitchcock of the United States Department of Agriculture for the determination of most of the grasses here reported.

Panicum linearifolium *Scribn.*

Panicum meridionale *Ashe* (P. subvillosum *Ashe*). (House.)

Panicum philadelphicum *Bernh.* Thickets and roadsides. Rare.

Panicum sphaerocarpon *Ell.* (House, *No. 5618.*)

Panicum tsugetorum *Nash.* Common.

Panicum spretum *Schult.* Sylvan Beach. (House.)

Panicum tennesseensis *Ashe.* Dry oak woods, Sylvan Beach. (House.)

Panicum virgatum *L.* Island in Oneida lake (Kneiskern, in herb. Sartwell, Hamilton College fide Paine).

Panicum xanthophysum *A. Gray.* Near Sylvan Beach. House, July 20, 1915. "Pine barrens along Wood creek near Oneida lake." Gray.

Chaetochloa verticillata (*L.*) *Scribn.*

Chaetochloa glauca (*L.*) *Scribn.*

Chaetochloa viridis (*L.*) *Scribn.* Only the last two have been seen around Sylvan Beach, but the first may confidently be looked for as it is abundant like the others in waste places and fields throughout this region.

Zizania aquatica *L.* Shallow water and marshes along the north and south shores of Oneida lake. Also reported from here by Kneiskern.

Homalocenchrus virginicus (*Willd.*) *Britt.* Open swamps. Common.

Homalocenchrus oryzoides (*L.*) *Poll.* Marshes along the lake shore and swales and swamps east of the lake. Common.

Phalaris arundinacea *L.* Ditches and marshes. Common.

Anthoxanthum odoratum *L.* Everywhere abundant in sandy fields and meadows.

Oryzopsis pungens (*Torr.*) *Hitchc.* (O. canadensis *Torr.*) "Near Oneida lake." Gray.

Oryzopsis racemosa (*J. E. Smith*) *Ricker.* (O. melanocarpa *Muhl.*) Around Oneida lake. Gray, fide Paine.

Aristida dichtoma *Michx.* Extremely abundant in the sandy fields and plains.

Muhlenbergia foliosa *Trin.* Swamps and marshy fields. Common.

Muhlenbergia racemosa (*Michx.*) *B. S. P.* Marshes and open swamps. Common.

Brachyelytrum erectum (*Schreb.*) *Beauv.* Moist open woods. Common in places.

Phleum pratense *L.* Common in waste places and fields.

Alopecurus aristulatus *L.* Marshy meadows. Rare. Also reported from near Fort Bull, along Wood creek by Kneiskern.

Sporobolus uniflorus (*Michx.*) *Scribn. & Merr.* Moist sandy soil. Common.

Cinna arundinacea *L.* Marshes, swamps and wet thickets. Common.

Cinna latifolia (*Trev.*) *Griseb.* Open wet woods. Rare.

Agrostis alba *L.* Fields, meadows and marshes. The var. vulgaris (With.) Thurber common in moist fields, and the var. aristata A. Gray in sandy places.

Agrostis maritima *Lam.* Moist sand along the shore of Oneida lake. (House, *No. 5615.*) (A. coarctata Ehrh.)

Agrostis perennans (*Walt.*) *Tuckerm.* Dry open woodlands and fields.

Agrostis hyemalis (*Walt.*) *B. S. P.* Meadows, fields and marshes. Common.

Calamagrostis canadensis (*Michx.*) *Beauv.* Marshes, swamps and shores. Common.

Deschampsia caespitosa (*L.*) *Beauv.* Low meadows and fields.

Deschampsia flexuosa (*L.*) *Trin.* One of the characteristic grasses of the very dry sandy plains east of the lake and very abundant.

Avena sativa *L.* Persistent in fields and along roadsides.

Arrhenatherum elatius (*L.*) *Beauv.* Fields and waste places.

Danthonia spicata (*L.*) *Beauv.* Common in the dry sandy plains.

Danthonia compressa *Austin.* Open woods, North Bay. (House.)

Spartina michauxiana *Hitchc.* Marshes and shallow water along the shores of Oneida lake.

Eleusine indica (*L.*) *Gaertn.* Waste places and fields.

Phragmites phragmites (*L.*) *Karst.* Swamps and shores, usually in large colonies.

Eragrostis capillaris (*L.*) *Nees.* A common weed in all cultivated fields and waste places.

Eragrostis pilosa (*L.*) *Beauv.*

Eragrostis major *Host.*

Eragrostis hypnoides (*Lam.*) *B. S. P.* Described by Gray as abundant over the low sandy shores all along the head of Oneida lake, which is still true.

Sphenopholis pallens (*Spreng.*) *Scribn.* (Eatonia pennsylvanica of previous reports.)

Melica striata (*Mx.*) *Hitchc.* (Trisetum purpurascens *Torr.* not *DC.*) Swampy woodlands east of Verona Beach. Also reported from near Wood creek by Kneiskern.

Dactylis glomerata *L.* Rich soil around dwellings.

Poa alsodes *A. Gray.* North Bay. (House.)

Poa compressa *L.* Meadows and fields.

Poa annua *L.* Around dwellings and in dooryards.

Poa triflora *Gilib.* Woods near Sylvan Beach. House, June 21, 1915, *No. 5869.*

Panicularia laxa *Scribn.* Open swamps.

Panicularia canadensis (*Michx.*) *Kuntze.* Common in swamps.

Panicularia torreyana (*Spreng.*) *Merrill* (P. elongata (*Torr.*) *Kuntze*). Open wet wooded places. House, July 11, 1905, *No. 1184.*

Panicularia nervata (*Willd.*) *Kuntze.* Low meadows and swamps.

Panicularia pallida (*Torr.*) *Kuntze.* "Oneida lake" (Peck); "Abundant on shore of Oneida lake" (Torrey); "Wood creek near New London" (Kneiskern).

Festuca octoflora *Walt.* Common in sandy fields, meadows and open woods.

Festuca elatior *L.* Common in fields and meadows.

Bromus ciliatus *L.* Woods and thickets. Not common.

Bromus kalmii *A. Gray.* Banks of Fish creek and woods along Oneida creek.

Bromus secalinus *L.* Waste places, banks etc.

Lolium perenne *L.* Fields, roadsides etc. Common.

Agropyron repens (*L.*) *Beauv.* Common along roadsides, railroads, fences and in meadows.

Elymus virginicus *L.* Low woods and thickets. Common.

Elymus canadensis *L.* Banks of Fish creek and Oneida creek.

Cyperaceae J. St Hil.

Cyperus rivularis *Kunth.* Wet soil, depressions in the sand plains and sandy shores.

Cyperus inflexus *Muhl.* (C. aristatus *Boeckl.*) Sandy shores of Oneida lake. Also reported from here by Gray and by Kneiskern.

Cyperus dentatus *Torr.* Swamps and depressions in the sand plains east of the head of Oneida lake.

Cyperus esculentus *L.* (C. phymatodes *Muhl.*) "Shores of Oneida lake." Torrey.

Cyperus erythrorhizos *Muhl.* Wet soil and along streams.

Cyperus speciosus *Vahl.* (C. michauxianus *Schult.*) "Borders of Oneida lake." Kneiskern.

Cyperus strigosus *L.* Wet places and marshes. Common. "Borders of swamps on the plains of Rome." Kneiskern.

Cyperus filiculmis *Vahl.* Abundant everywhere in the dry sandy soil of the fields and plains east of the head of the lake. Our northern form has recently been designated as Cyperus macilentus (Fernald) Bicknell.

Eleocharis ovata (*Roth*) *R. & S.* (E. diandra *C. Wright*). Sandy shores of Oneida lake.

Eleocharis obtusa (*Willd.*) *R. & S.* Wet soil, edge of streams, swamps, and in wet meadows.

Eleocharis palustris (*L.*) *R. & S.* Represented here by the very stout variety Vigens *Bailey*, common at South Bay, and the variety Glaucescens, common at North Bay along the lake shore and around Sylvan Beach.

Eleocharis acicularis (*L.*) *R. & S.* Common in wet or damp soil.

Eleocharis tenuis (*Willd.*) *Schultes.* Common in grassy swamps and swales.

Eleocharis intermedia (*Muhl.*) *Schultes.* Moist sand and marshy places. Including the variety Habereri *Fernald.*

Eleocharis mutata (*L.*) *R. & S.* (E. quadrangulata *R. & S.*) "Outlet of Oneida lake." Gray's Manual. Not reported from the east end of the lake.

Stenophyllus capillaris (*L.*) *Britton.* Sandy fields.

Fimbristylis geminata (*Nees*) *Kunth.* (F. frankii *Steud.*) Moist sand along the east shore of Oneida lake. Reported in Torreya 3: p. 165 as F. autumnalis.

Eriophorum viridicarinatum (*Engelm.*) *Fernald.* In boglike depressions of the sand plains and in wet meadows. Common.

Eriophorum virginicum *L.* Bogs and swamps. Common.

Scirpus debilis *Pursh.* (S. smithii *A. Gray.*) Common in damp sand along the shore of Oneida lake. Also reported from here by Kneiskern.

Scirpus americanus *Pers.* (S. pungens *Vahl.*) Very common in marshes and shallow water along the lake shore and in marshes.

Scirpus validus *Vahl.* Marshes and shallow water along the lake shore.

Scirpus atrovirens *Muhl.* Swamps and wet meadows. Common. Also the variety pycnocephalus *Fern.*

Scirpus microcarpus *Presl.* (C. rubrotinctus *Fern.*) Wet wood and swamps. Common.

Scirpus pedicellatus *Fernald.* Wet meadows, swales and swamps.

Scirpus fluviatilis (*Torr.*) *A. Gray.* Borders of Oneida lake (Kneiskern) Lake shore near mouth of Oneida creek (House).

Scirpus cyperinus (*L.*) *Kunth.* Swamps and marshes. Common. Also the varieties pelius Fernald and condensatus Fernald.

Scirpus atrocinctus *Fernald.* Swamps. Rare.

Hemicarpa micrantha (*Vahl.*) *Pax.* Moist sand along the shore of Oneida lake. Common.

Dulichium arundinaceum (*L.*) *Britton*. Swamps and marshes. Common.

Rhyncospora alba (*L.*) *Vahl*. Sphagnous depressions in the sand plains. Rare.

Rhynchospora capillacea *Torr*. " Cranberry marsh at the head of Oneida lake " (Kneiskern). Torrey, Flora N. Y. 2:364, 1843.

Rhynchospora glomerata (*L.*) *Vahl*. Swamps.

Mariscus mariscoides (*Muhl.*) *Kuntze*. Marshes along the north shore near North bay and at Panther lake, north of Constantia.

Scleria triglomerata *Michx*. " Plains of Rome " (Kneiskern).

Carex aenea *Fernald*.

Carex annectens *Bicknell*.

Carex albicans *Willd*. Woods, North Bay. (House.)

Carex arctata *Boott*. Cleared land west of Fort Bull (Paine).

Carex Asa-Grayi *Bailey*. Wood creek. Gray.

Carex bromoides *Schk*. Swamps. Not common.

Carex canascens *L*. Sylvan Beach. (House, July 11, 1915, *No. 1180*.)

Carex castanea *Wahl*. Near Fort Bull (Haberer).

Carex cephalophora *Muhl*.

Carex crawfordii *Fernald*.

Carex crinita *Lam*.

Carex communis *Bailey*.

Carex cristatella *Britton*. (C. cristata *Schw*.)

Carex diandra *Schk*. Open boggy swamps. Rare.

Carex disperma *Dewey*. Mossy swamps.

Carex debilis *Michx*. " Border of streams near Oneida lake," Kneiskern. " Site of old Fort Bull on Wood creek," Vasey.

Carex echinata *Murr*. (C. Leersii Willd.; C. stellulata Good.) with the variety angustata Boott.

Carex folliculata *L*.

Carex filiformis *L*. " Swamps just over the ridge along the head of Oneida lake," Paine.

Carex formosa *Dewey*. " Site of old Fort Bull, near Rome," Vasey.

Carex flava *L*. Bogs and mossy depressions in the sand plains.

Carex gracillima *Schw*.

Carex granularis *Muhl*.

Carex gynandra *Schw*.

Carex hystricina *Muhl*.

Carex interior *Bailey*.

Carex intumescens *Rudge*.

Carex lacustris *Willd*. " Oneida lake," Kneiskern.

Carex laxiflora *Lam.*

Carex laxiculmis *Schw.*

Carex leptalea *Wahl.*

Carex lupulina *Muhl.*

Carex lupliformis *Sartwell.*

Carex lurida *Wahl.*

Carex muhlenbergii *Schk.* Sandy fields and woods.

Carex oligocarpa *Schk.* "Borders of sandy plains, Rome," Kneiskern. "Banks of Woods creek between New London and Oneida lake," Gray.

Carex oligosperma *Michx.* "Oneida lake," Kneiskern. "Bogs in sphagnum swales 6 miles west of Rome," Paine.

Carex pallescens *L.* Woods near North Bay. Common.

Carex pedunculata *Muhl.*

Carex pennsylvanica *Lam.* Very abundant on sandy fields and plains.

Carex plantaginea *Lam.* Woods near North Bay. Common.

Carex projecta *Mackenzie.*

Carex retrorsa *Schw.*

Carex rosea *Schk.*

Carex rosaeoides *E. C. Howe.* Near Fort Bull (Peck).

Carex scirpoides *Schk.* Common.

Carex scoparia *Schk.* With the variety moniliformis *Fern.* very common in wet places.

Carex scabrata *Schw.* Marshy places. Rare.

Carex stipata *Muhl.*

Carex stricta *Lam.* Common in swamps, forming large hummocks.

Carex sprenglei *Dewey.* Oneida lake, Vasey.

Carex tenuiflora *Wahl.* "Open moss-swamp west of Fort Bull, south of the canal where it is abundant," Paine.

Carex tenella *Schk.* Mossy depressions and bogs of the sand plains. "Bogs of Rome." (Paine). "Beyond Fort Bull in low open woods. In the extensive swamp northwest of New London, on north side of Wood creek." (Paine).

Carex trisperma *Dewey.* Mossy woods and thickets. House. Also reported by Kneiskern.

Carex tribuloides *Wahl.*

Carex umbellata *Schk.* Sandy woods. Common. (House.)

Carex tenuis *Rudge.* Woods near Sylvan Beach, House, July 11, 1905, *No. 1211.*

Carex triceps *Michx.* Woods near Sylvan Beach, House, July 11, 1905, *No. 1216.*

Carex varia *Muhl.* Dry woods. Not common.
Carex vulpinoidea *Michx.* Common in wet places.
Carex virescens *Muhl.*

Araceae Neck.

Arisaema triphyllum (*L.*) *Torr.*
Arisaema pusillum (*Peck*) *Nash.* Bogs and mossy thickets of the sand plains.
Peltandra virginica (*L.*) *Kunth.* Swamps and margins of back waters.
Calla palustris *L.* Wet woods, bogs, and mossy thickets.
Spathymea foetida (*L.*) *Raf.* (Symplocarpus foetidus *Nutt.*) Low wet woods and meadows.
Acorus calamus *L.* Wet meadows, etc. Common.

Lemnaceae Dumort.

Spirodela polyrhiza (*L.*) *Schleid.* Surface of quiet water. Fish creek, Black creek and ponds.
Lemna trisulca *L.* Shallow water of ditches, ponds etc. Rare.
Lemna minor *L.* Surface of quiet water, everywhere common.
Wolffia columbiana *Karst.* Surface of Black creek. Common.

Eriocaulaceae Lindl.

Eriocaulon septangulare *With.* (E. articulatum (*Huds.*) *Morong*) Shallow water of the shore of Oneida lake and sandy shores of Fish creek.

Pontederiaceae Dumort.

Pontederia cordata *Linn.* Shallow water along the shore of Oneida lake, North and South bay and along Fish creek, Black creek, Oneida creek and other wet places.
Heteranthera dubia (*Jacq.*) *MacM.* Shallow water near mouth of Oneida creek and shore of the lake. (House.)

Juncaceae Vent.

Juncus dudleyi *Wiegand.* Moist depressions in the sand plains. A rather unusual habitat for this species which is confined chiefly to marl bogs. (Specimens determined at the Gray herbarium.)
Juncus effusus *L.*
Juncus filiformis *L.* Swales and wet places. Also reported from head of Oneida lake by Gray.
Juncus bufonius *L.* Moist sand and waste places. Common.
Juncus tenuis *Willd.* Common in dry and moist places.

Juncus secundus *Beauv.* Sandy fields. Common.

Juncus marginatus *Rostk.* Woods and open places. Not rare.

Juncus pelocarpus *E. Meyer.* Swamps and marshy lake shores.

Juncus militaris *Bigel.* Shallow water of sheltered bays along north shore. Rare.

Juncus articulatus *L.* Sylvan Beach. (Peck.)

Juncus nodosus *L.* Common.

Juncus torreyi *Coville.* Marshes along head of the lake. Rare.

Juncus canadensis *J. Gay.* Moist or wet depressions in the sand plains, and along shores.

Juncus brevicaudatus (*Engelm.*) *Fernald.* Moist depressions in the sand plains (*Haberer*).

Juncus acuminatus *Michx.* Shallow water of pools and depressions and wet places. Common.

Juncoides carolinae (*S. Wats.*) *Kuntze* (Luzula saltuensis *Fern.*) Dry woods. Common.

Juncoides campestre (*L.*) *Kuntze.* Fields and open woods. Very common.

Melanthaceae R. Br.

Veratrum viride *Ait.* Low meadows, wet woods, and stream banks. Not common.

Liliaceae Adans.

Allium tricoccum *Ait.* Moist woods. Common in woods north and south of the lake. Rare at Sylvan Beach.

Allium canadense *L.* Low meadows and thickets, not common.

Lilium philadelphicum *L.* Dry woods and thickets. Common.

Lilium canadense *L.* Low meadows and swamps. Common.

Erythronium americanum *Ker.* Woods. Common.

Hemerocallis fulva *L.* (Common Day Lily). A frequent species established along roadsides, shores and old yards, especially on the north and south shores of the lake.

Convallariaceae Link.

Asparagus officinalis *L.* Frequent as an escape.

Clintonia borealis (*Ait.*) *Raf.* Moist woods, most usually under evergreens. Common.

Vagnera racemosa (*L.*) *Morong.* Woods and thickets. Not abundant.

Vagnera stellata (*L.*) *Morong.* Rather common in alluvial soil along the streams.

Vagnera trifolia (*L.*) *Morong.* Mossy thickets and bogs of the sand plains.

Unifolium canadense (*Desf.*) *Greene*. Common in woods.
Uvularia perfoliata *L.* Common in woods. (The large Bellflower, U. g r a n d i f l o r a *J. E. Sm.*, common on the hills south of Oneida lake was not observed around Sylvan Beach, but doubtless occurs in some of the woods on the hills north of the lake.)
Uvularia sessilifolia *L.* Sandy woods. Common. (Oakesia sessilifolia *Wats.*)
Streptopus roseus *Michx.* Moist woods. Common.
Polygonatum biflorum (*Walt.*) *Ell.* Woods and thickets, common.
Polygonatum commutatum (*R. & S.*) *Dietr.* Moist woods along streams.

Trilliaceae Lindl.

Mediola virginiana *L.* Moist woodlands. Common.
Trillium grandiflorum (*Michx.*) *Salisb.* Woods, North Bay. Usually absent from the sandy woods.
Trillium erectum *L.* Woods and thickets. Common.
Trillium cernuum *L.* Moist thickets in sandy soil. Rare.
Trillium undulatum *Willd.* Woodlands. Common.

Smilaceae Vent.

Smilax herbacea *L.* Woods and thickets. Common.
Smilax rotundifolia *L.* Moist thickets especially along Black creek.
Smilax hispida *Muhl.* Reported from Cicero swamp, and doubtless occurs in other swamps of this region. Seen by the author at Pecksport, Madison county, and at Panther lake, Oswego county.

Amaryllidaceae Lindl.

Hypoxis hirsuta (*L.*) *Coville*. Sandy fields and meadows. Common.

Iridaceae Lindl.

Iris versicolor *L.* Wet meadows, marshes, and shores.
Sisyrinchium angustifolium *Mill.* Fields and meadows. Common.
Sisyrinchium graminoides *Bicknell.* Wet meadows. Rare.

Orchidaceae Lindl.

Criosanthes arietina (*R. Br.*) *House* (Cypripedium arietinum *R. Br.*). Recorded from east of Oneida lake by Dr Asa Gray (Torrey, Flora of N. Y. 2:288, 1843.)
Cypripedium acaule *Ait.* (Fissipes acaulis *Small*). Sandy woods. Common.

Galeorchis spectabilis (*L.*) *Rydb.* Moist woods. Rare.

Coeloglossum bracteatum (*Willd.*) *Parl.* Moist open woods along Black creek.

Gymnadeniopsis clavellata (*Michx.*) *Rydb.* Wet or moist woods. Common.

Pogonia ophioglossoides (*L.*) *Ker.* Mossy depressions in the sand plains. Rare.

Lysias orbiculata (*Pursh*) *Rydb.* Woods back of Verona Beach. Panther lake north of Constantia. Rare.

Lysias hookeriana (*A. Gray*) *Rydb.* "Pine barrens along Wood creek near New London," Paine.

Blephariglottis ciliaris (*L.*) *Rydb.* Depressions in the sand plains. Rare.

Blephariglottis lacera (*Michx.*) *Farwell.* Low woods and thickets. Common.

Blephariglottis psycodes (*L.*) *Rydb.* Meadows and swamps. Common.

Blephariglottis grandiflora (*Bigel.*) *Rydb.* "Shady swamp west of Fort Bull, Rome," Paine.

Isotria verticillata (*Willd.*) *Raf.* Reported by Paine from mossy bogs on the plains of Rome.

Triphora trianthophora (*Sw.*) *Rydb.* Reported by Kneiskern from the pine plains west of Rome.

Limodorum tuberosum *L.* Mossy depressions and bogs. Common.

Ibidium strictum (*Rydb.*) *House* Boglike depressions.

Ibidium cernuum (*L.*) *House.* Meadows, swamps and rarely in almost dry sandy soil.

Ibidium gracile (*Bigel.*) *House.* Sandy fields. Common.

Peramium tesselatum (*Lodd.*) *Heller.* Coniferous woods. Rare.

Peramium pubescens (*Willd.*) *MacM.* Chiefly in dry woods. Infrequent.

Liparis loeselii (*L.*) *L. C. Rich.* Mossy depressions of the sand plains. Reported from about Oneida lake by Gray.

Corallorhiza maculata *Raf.* Woods and thickets. Rare.

Corallorhiza odontorhiza (*Willd.*) *Nutt.* Woods and thickets.

DICOTYLEDONES

Saururaceae Lindl.

Saururus cernuus *L.* Shallow water in swamps along Fish creek, Black creek and Oneida creek. Common. Reported from the "borders of Oneida lake" by Kneiskern and by Gray.

Juglandaceae Lindl.

Juglans cinerea *L.* Woods and bottom lands, not common near Sylvan Beach but frequent at South Bay and North Bay.

Hicoria cordiformis (*Wang.*) *Britt.* Low woods and along streams.

Hicoria glabra (*Mill.*) *Britton.* Low meadows and woods.

Hicoria ovata (*Mill.*) *Britt.* Rich soil, North Bay.

Myricaceae Dumort.

Comptonia peregrina (*L.*) *Coulter.* " Plains of Rome and Oneida lake " (Kneiskern). Not seen near Sylvan Beach.

Myrica gale *L.* Swamps near Panther lake. Not observed around the head of Oneida lake.

Salicaceae Lindl.

Populus grandidentata *Michx.*

Populus atheniensis *Ludw.* Neue wilde Baumz. 35, 1760. (P. tremuloides *Michx.* 1803.). This and the preceding are exceedingly abundant on burned over areas, along with Betula populifolia.

Populus deltoides *Marsh.* Low woods along Black creek. Also reported from this region by Kneiskern, Gray and others.

Populus nigra *L.* Cultivated and sparingly escaped.

Salix nigra *Marsh.* Along streams and shores. Common.

Salix lucida *Muhl.* Swamps and wet places. Common.

Salix cordata *Muhl.*

Salix discolor *Muhl.*

Salix petiolaris *J. E. Smith.*

Salix humilis *Marsh.* Lake shore amd pine plains. Also reported from here by Kneiskern.

Betulaceae Agardh.

Carpinus caroliniana *Walt.* Low woods.

Corylus americana *Walt.* Woods and thickets. Common.

Betula populifolia *Marsh.* Common everywhere on the sandy plains east of the lake.

Betula lutea *Michx. f.* Rich woods. Common.

Betula nigra *L.* Banks of Fish creek and Wood creek. Rare. Reported from Fish creek by Paine and also from Deerfield, Oneida co.

Alnus incana (*L.*) *Willd.* Very common everywhere.

Alnus rugosa (*DuRoi*) *Spreng.* Rare.

Fagaceae Drude

Fagus grandifolia *Ehrh.*

Castanea dentata *Borkh.* Woods and banks, north shore of lake, also south of the lake but rare or absent on the sand plains.

Quercus rubra *L.* Common especially in the woods along the head of the lake.

Quercus velutina *Lam.* Sandy woods. Common.

Quercus ilicifolia *Wang.* "Plains of Rome," Paine. Not found at Sylvan Beach where the character of the soil would lead one to expect it, and Sargent (Silva of N. Am. 8:156) says that this species "apparently does not reach central New York". Paine was a careful observer but in this instance he may have been mistaken.

Quercus alba *L.* Sandy woods. Common.

Quercus bicolor *Willd.* Swamps and low woods. Common.

Ulmaceae Mirbel

Ulmus americana *L.* Low woods. Common.

Ulmus fulva *Michx.* Bottom lands. Not rare.

Celtis occidentalis *L.* "Near Oneida lake" (Kneiskern).

Urticaceae Reichenb.

Urtica gracilis *Ait.* Low woods and swamps. Common.

Urticastrum divaricatum (*L.*) *Kuntze.* Open wet woodlands. (Laportea canadensis (*L.*) *Gaud.*)

Pilea pumila (*L.*) *A. Gray.*

Boehmeria cylindrica (*L.*) *Sw.* Swamps. Common.

Parietaria pennsylvanica *Muhl.* Low woods, moist waste places, etc. Common.

Santalaceae R. Br.

Comandra umbellata (*L.*) *Nutt.* Sandy fields and open woods.

Aristolochiaceae Blume

Asarum canadense *L.* Rich woods. Common.

Polygonaceae Desv.

Rumex acetosella *L.* Common everywhere in waste places and fields.

Rumex acetosa *L.* Fields etc. Not common.

Rumex verticillatus *L.* Swamps and shores, often in water.

Rumex altissimus *Wood.* Deep swamps. Rare.

Rumex britannica *L.* Swamps and wet thickets. Common.
Rumex crispus *L.* Common in waste places.
Rumex obtusifolius *L.* A common week in shaded grounds.
Polygonum aviculare *L.*
Polygonum neglectum *Besser.*
Polygonum erectum *L.* This and the two preceding are frequent weeds in waste and cultivated ground.
Polygonum buxiforme *Small.* Forming broad mats on the sandy shore, head of Oneida lake.
Tovara virginiana (*L.*) *Raf.* Woods and thickets. Common.
Persicaria amphibia (*L.*) *S. F. Gray.* Ponds and quiet water. Common. Foliage slimy when fresh (Polygonum fluitans Eaton). In shallow water occurs a form which is Persicaria mesochroa Greene.
Persicaria muhlenbergii (*S. Wats.*) *Small.* Marshy places.
Persicaria pennsylvanica (*L.*) *Small.* Open marshes and wet places.
Persicaria lapathifolium *L.* Low wet places, apparently introduced.
Persicaria persicaria (*L.*) *Small.* Introduced.
Persicaria hydropiperoides (*Michx.*) *Small.*
Persicaria hydropiper (*L.*) *Opiz.* Wet places, apparently introduced.
Persicaria punctata (*Ell.*) *Small.* Swamps.
Fagopyrum fagopyrum (*L.*) *Karst.* Persistent on abandoned fields.
Tracaulon sagittatum (*L.*) *Small.* Wet thickets and low woods.
Tracaulon arifolium (*L.*) *Raf.* Rare.
Bilderdykia convolvulus (*L.*) *Dumortier.* Naturalized along roads and banks. (Polygonum convolvulus *L.*)
Bilderdykia scandens (*L.*) *Lunell.* (Polygonum scandens *L.*)
Polygonella articulata (*L.*) *Meissn.* Sandy fields and pine plains. Common. Reported from here by Gray, Kneiskern and Paine.

Amaranthaceae J. St. Hil.

Amaranthus retroflexus *L.*
Amaranthus hybridus *L.* This and the preceding, both introduced species, are quite common as weeds in waste places and fields.
Amaranthus graecizans *L.* Waste ground and railroad banks. Rare.

Chenopodiaceae Dumort.

Chenopodium album *L.*
Chenopodium botrys *L.* Banks of Fish creek, (Kneiskern).
Chenopodium polyspermum *L.* Brewerton, (S. N. Cowles).
Chenopodium glaucum *L.*

Atriplex hastata *L.* Railroad banks. Rare.
Salsola pestifer *A. Nelson.* Sandy fields. Introduced from the west.

Phytolaccaceae Lindl.

Phytolacca americana *L.* Common.

Corrigiolaceae Reichenb.

Anychia canadensis (*L.*) *B. S. P.* "Pine plains of Rome" (Vasey).
Scleranthus annuus *L.* Sandy fields, banks, etc. Rare.

Aizoaceae A. Br.

Mollugo verticillata *L.* Moist sandy places. Common.

Portulacaceae Reichenb.

Claytonia virginica *L.* Rich woods. Common.
Claytonia caroliniana *Michx.* Woods. North Bay, etc.
Portulaca oleracea *L.* Fields and waste places. Rare.

Alsinaceae Wahl.

Alsine media *L.* A common weed.
Alsine longifolia (*Muhl.*) *Britt.* Damp places in woods and swamps.
Cerastium vulgatum *L.*
Arenaria serpyllifolia *L.* Sandy fields, railroad banks, etc.
Moehringia lateriflora (*L.*) *Fenzl.* Common in woods.
Spergula arvensis *L.* Sandy shores of Oneida lake.

Caryophyllaceae Reichenb.

Agrostemma githago *L.*
Silene antirrhina *L.*
Silene latifolia (*Mill.*) *Britton & Rendle.* (S. inflata *J. E. Smith.*) Sandy fields.
Silene armeria *L.* Roadsides, North Bay.
Lychnis alba *Mill.* & L. dioica *L.* Occasional in grain fields and persistent in sandy fields and roadsides.
Silene dichotoma *Ehrh.* Sandy fields. Rare.
Saponaria officinalis *L.* Common.
Vaccaria vaccaria (*L.*) *Britton.* Meadows etc. Common.

Ceratophyllaceae A. Gray.

Ceratophyllum demersum *L.* Ponds and streams.

Cabombaceae A. Gray.

Brasenia schreberi *Gmel.* " Stagnant pools in Verona," Kneiskern.

Nymphaceae DC.

Nymphaea microphylla *Pers.* (N. kalmiana *Sims*). Shallow water of Oneida lake. Also reported from here by Paine.

Nymphaea rubrodisca (*Morong.*) *Greene* (N. hybrida *Peck*). Fish creek, mouth of Black creek and shallow water of shores of Oneida lake.

Nymphaea americana (*Prov.*) *Miller & Standley* (N. variegata (*Engelm.*) *G. S. Miller*). Common in streams and lakes. (N. advena of Floras, in part).

Castalia odorata (*Dryand.*) *Woodv. & Wood.* Ponds, streams and shallow water of Oneida lake.

Castalia tuberosa (*Paine*) *Greene.* Shallow water near South Bay. " In Oneida lake, where it is abundant near its head a little west of South Bay, in marshes of Dianthera americana and Scirpus lacustris," Paine (type loc.).

Magnoliaceae J. St. Hil.

Liriodendron tulipifera *L.* A common tree in the low woods around Oneida lake. Absent, however, from the shale and limestone formations on the hills to the south.

Ranunculaceae Juss.

Caltha palustris *L.*

Coptis trifolia (*L.*) *Salisb.*

Actaea rubra (*Ait.*) *Willd.*

Actaea alba (*L.*) *Mill.*

Aquilegia canadensis *L.*

Anemone cylindrica *A. Gray.* Sandy woods and clearings about the east end of Oneida lake.

Anemone virginiana *L.*

Anemone canadensis *L.*

Anemone quinquefolia *L.* Moist woodlands. Common.

Hepatica acutiloba *DC.*

Hepatica triloba *Chaix.* More abundant around Oneida lake than the preceding, which is the prevailing species on the hills to the south. Both species are almost entirely absent from the sandy plains east of Oneida lake.

Syndesmon thalictroides (*L.*) *Hoffmg.* Sandy soil in thickets and open woods. Fish Creek Station and North Bay. Not common.

Ranunculus reptans *L.* Moist sand along shore of Oneida lake.

Ranunculus abortivus *L.*

Ranunculus sceleratus *L.* Ditches, swamps etc.

Ranunculus purshii *Richards.* In pools and quiet water. The plants mentioned by Paine (cat. p. 54) as R. purshii var. β probably belong here.

Ranunculus recurvatus *Poir.*

Ranunculus acris *L.*

Ranunculus obtusiusculus *Raf.* (R. alismaefolius *A. Gray*). Open grassy swamps and swales, rare.

Ranunculus pennsylvanicus *L. f.* Swamps and wet woods.

Ranunculus septentrionalis *Poir.*

Ranunculus repens *L.* (R. clintoni *Beck*). Wet meadows and swamps.

Batrachium circinatum (*Sibth.*) *Rehb.* Fish creek, Vienna (Kneiskern).

Thalictrum revolutum *DC.* Wet meadows.

Thalictrum dioicum *L.*

Thalictrum polygamum *Muhl.* The common species in woods and low meadows, conspicuous in July and August.

Clematis virginiana *L.*

Berberidaceae Desv.

Caulophyllum thalictroides (*L.*) *Michx.*

Podophyllum peltatum *L.*

Menispermaceae DC.

Menispermum canadense *L.* Low thickets and woods, especially along streams.

Lauraceae Lindl.

Sassafras sassafras (*L.*) *Karst.* Common in woods and thickets, forming an important part of the second growth in damp places on the burned over portions of the pine plains.

Bensoin aestivale (*L.*) *Nees.* Swamps and low woods. Common.

Papaveraceae B. Juss.

Sanguinaria canadensis *L.*

Fumariaceae DC.

Bicuculla cucullaria (*L.*) *Millsp.*

Bicuculla canadensis (*Goldie*) *Millsp.*

Cruciferae B. Juss.

Draba verna *L.* Sandy fields.
Bursa bursa-pastoris (*L.*) *Britt.*
Radicula sylvestris (*L.*) *Druce.*
Radicula palustris (*L.*) *Moench.*
Neobeckia aquatica (*Eaton*) *Britton* (Nasturtium lacustre *Gray*). In streams flowing into Oneida lake. First found here in 1831 by Dr. Asa Gray.
Norta altissima (*L.*) *Britt.*
Sisymbrium nasturtium-aquaticum *L.*
Lepidium campestre (*L.*) *R. Br.*
Lepidium virginicum *L.*
Cheirinia cheiranthoides (*L.*) *Link.*
Erysimium officinale *L.*
Arabidopsis thaliana (*L.*) *Britton.* Sandy fields.
Arabis glabra (*L.*) *Bernh.* Fields and waste places.
Arabis drummondii *A. Gray.* " At Humaston's a few miles east of Sylvan Beach " (Vasey).
Barbarea barbarea (*L.*) *MacM.*
Barbarea rivularis *Martr.* (B. stricta in recent floras). Frequent and seemingly native along the lake shore.
Cardamine pennsylvanica *Muhl.*
Cardamine pratensis *L.*
Cardamine bulbosa (*Schreb.*) *B. S. P.* Wet meadows and thickets.
Cardamine hirsuta *L.*
Dentaria laciniata *Muhl.*
Dentaria diphylla *Michx.*
Sinapis arvensis *L.*
Brassica nigra (*L.*) *Koch.*

Capparidaceae Lindl.

Polanisia graveolens *Raf.* " Shore of Oneida lake near Constantia " (Vasey).

Sarraceniaceae La Pyl.

Sarracenia purpurea *L.* Mossy or sphagnous places.
Drosera rotundifolia *L.* Mossy swamps and bogs.

Penthoraceae Rydb.

Penthorum sedoides *L.* Ditches, low meadows and swamps.

Saxifragaceae Desv.

Micranthes pennsylvanica *(L.) Haw.* (Saxifraga pennsylvanica *L.*). Open swamps and wet woods.
Tiarella cordifolia *L.*
Mitella dyphylla *L.*
Mitella nuda *L.* Mossy thickets north of the lake.
Chrysoplenium americanum *Schw.* Wet places in woods.

Hamamelidaceae Lindl.

Hamamelis virginiana *L.*

Grossulariaceae Dumort.

Ribes americanum *Mill.* Swampy places.
Ribes glandulosum *Grauer.* (R. prostratum *L'Her.*) Mossy thickets, in the sand plains. Rare.
Ribes americanum *Mill.* (R. floridum *L'Her.*) Low woods near North Bay.

Platanaceae Lindl.

Platanus occidentalis *L.* A large tree commonest along streams.

Rosaceae B. Juss.

Spiraea latifolia *(Ait.) Borkh.* Open marshes and swamps.
Spiraea tomentosa *L.* In similar situations, also on sandy plains.
Spiraea alba *DuRoi.*
Filipendula rubra *(Hill) Robinson.* Roadside near West Vienna.
Dalibarda repens *L.* Moist rich woods.
Potentilla simplex *Michx.*
Potentilla canadensis *L.*
Potentilla monspeliensis *L.*
Potentilla argentea *L.*
Potentilla recta *L.* Rare.
Argentina anserina *(L.) Rydb.* Lake shores. Common. A form of this described as A r g e n t i n a b a b c o c k i a n a Rydberg, is reported by Rydberg from the shores of Oneida lake.
Comarum palustre *L.* Marshes and shallow water along slow streams. Common, forming a large percentage of the vegetation bordering Black creek.
Fragaria virginiana *Duchesne.*
Fragaria americana *(Porter) Britton.* North Bay.
Fragaria canadensis *Michx.* Sandy fields. Common.

Agrimonia gryposepala *Wallr.* (A. hirsuta (*Muhl.*) *Bicknell*).
Agrimonia striata *Michx.*
Geum virginianum *L.*
Geum canadense *Jacq.*
Geum strictum *Ait.*
Geum rivale *L.*
Rubus odoratus *L.*
Rubus strigosus *Michx.* Sandy soil in thickets.
Rubus occidentalis *L.*
Rubus triflorus *Richards.* (R. americanus (*Mx.*) *Britt.*) Mossy swamps and bogs.
Rubus canadensis *L.* Woods and thickets.
Rubus procumbens *Muhl.* (R. villosa *Ait.*) Common, everywhere.
Rubus hispidus *L.* Rare.
Rosa carolina *L.* Frequent in swamps.
Rosa virginiana *Mill.* (R. lucida *Ehrh.*). Sandy thickets and open woods.

Malaceae Small.

Sorbus americana *Marsh.* Moist woods east of Verona Beach.
Malus malus (*L.*) *Britt.*
Malus glaucescens *Rehder.* (M. coronaria *Auth.*) Woods and thickets along the north shore of Oneida lake.
Aronia melanocarpa (*Michx.*) *Britt.* Leaves glabrous beneath and more abundant everywhere than the following.
Aronia arbutifolia (*L.*) *Lf.*
Amelanchier canadensis (*L.*) *Medic.* (A. botryapium (*L. f.*) *DC.*) Common in woodlands.
Amelanchier laevis *Wiegand.* Hillsides and rich woods. North Bay.
Amelanchier intermedia *Spach.* Thickets and wet woods.
Amelanchier spicata (*Lam.*) *C. Koch.* A low shrub of the sand plains.
Crataegus punctata *Jacq.*
Crataegus lobulata *Sarg.* South Bay (Harberer).
Crataegus albicans *Ashe.* South Bay (Harberer as C. polita *Sarg.*).
Crataegus streeterae *Sarg.* Lewis point (Harberer).

Amygdalaceae Reichb.

Prunus nigra *Ait.*
Prunus pennsylvanica *L. f.*
Padus nana (*Du Roi*) *Roemer.* Choke cherry. (P. virginiana of earlier reports).

Padus virginiana (*L.*) *Mill.* (P. serotina *Ehrh.*) Wild black cherry. Common.

Fabaceae Reichenb.

Robinia pseudo-acacia *L.* Planted for ornament and established in places.

Robinia viscosa *Vent.* Well established along a roadside and throughout an open wood, near North Bay. In bloom June 19, 1915.

Lupinus perennis *L.* Common in sandy fields.

Medicago lupulina *L.*

Medicago sativa *L.*

Melilotus alba *Desv.*

Melilotus officinalis (*L.*) *Lam.*

Trifolium procumbeus *L.* Sandy woods, thickets etc.

Trifolium arvense *L.* Common in sandy fields.

Trifolium pratense *L.*

Trifolium hybridum *L.*

Trifolium repens *L.*

Meibomia nudiflora (*L.*) *Kuntze.*

Meibomia grandiflora (*Walt.*) *Kuntze.*

Meibomia michauxii *Vail.* (Desmodium rotundifolium *DC.*) Sandy woods and thickets. "Reported from pine plains of Rome" by Kneiskern.

Meibomia paniculata (*L.*) *Kuntze.*

Meibomia dillenii (*Darl.*) *Kuntze.*

Meibomia canadensis (*L.*) *Kuntze.*

Meibomia obtusa (*Muhl.*) *Vail.* (Desmodium ciliare *DC.*) "Pine plains of Rome" (Kneiskern).

Lespedeza frutescens (*L.*) *Britton.* Sandy fields.

Lespedeza hirta (*L.*) *Hornem.* More abundant than the following.

Lespedeza capitata *Michx.*

Vicia cracca *L.*

Vicia americana *Muhl.*

Vicia tetrasperma (*L.*) *Moench.*

Lathyrus maritimus (*L.*) *Bigel.* var. glaber (*Seringe*) *Eames.* Sandy woods along east end of Oneida lake north of Sylvan Beach.

Lathyrus myrtifolius *Muhl.* Common in marshes and moist thickets. Collected by C. H. Peck at South Bay and by H. D. House at various places around the east and north shores of the lake.

Lathyrus latifolius *L.* Established along a roadside near Constantia.

Glycine apios *L.* (Apios tuberosa *Moench.*) Moist thickets and woods.

Falcata comosa (*L.*) *Kuntze.*

Geraniaceae J. St. Hil.

Robertiella robertiana (*L.*) *Hanks.* (Geranium robertianum *L.*) Rich wood, North bay. Not common in the sand plain region.

Geranium maculatum *L.* Common.

Geranium bicknellii *Britton.* Sandy fields near South Bay.

Geranium pusillum *L.* Waste places and fields. Reported from near Constantia by Vasey.

Erodium cicutarium (*L.*) *L'Her.* Reported from near Constantia. and from an island in Oneida lake opposite Constantia, by Vasey.

Oxalidaceae Lindl.

Oxalis acetosella *L.* Damp or moist woods. Common.

Xanthoxalis stricta (*L.*) *Small.* Common.

Xanthoxalis rufa *Small.* Sandy fields and dry woods.

Linaceae Dumort.

Linum usilatissimum *L.* Adventive along a railroad near Sylvan Beach.

Cathartolinum virginianum (*L.*) *Reichenb.* (Linum virginianum *L.*) Sandy fields, open woods and thickets.

Balsaminaceae Lindl.

Impatiens biflora *Walt.*

Impatiens pallida *Nutt.*

Limnanthaceae Lindl.

Floerka proserpinacoides *Willd.*

Polygalaceae Desv.

Polygala verticillata *L.*

Polygala viridescens *L.*

Polygala pauciflora *Willd.* Woods and thickets. North Bay. H. D. House, *No. 5885*, June 25, 1915. Also reported from pine plains of Rome by Vasey.

Polygala polygama *Walt.* Reported from pine plains west of Rome by Vasey. One mile north of New London by Kneiskern. Oneida lake, Gray.

Euphorbiaceae J. St. Hil.

Acalypha virginica *L.*
Chamaesyce maculata (*L.*) *Small.*
Chamaesyce preslii (*Guss.*) *Arthur.*
Chamaesyce rafinesqui (*Greene*) *Small.*
Tithymalus cyparissias (*L.*) *Hill.*

Callitrichaceae Lindl.

Callitriche palustris *L.*
Callitriche heterophylla *Pursh.*

Anarcardiaceae Lindl.

Rhus copallina *L.*
Rhus hirta (*L.*) *Sudw.*
Rhus glabra *L.*
Toxicodendron vernix (*L.*) *Kuntze.*
Toxicodendron radicans (*L.*) *Kuntze.*

Ilicaceae Lowe.

Ilex verticillata (*L.*) *A. Gray.* A very abundant shrub in open swamps and along streams. The form with leaves pubescent beneath (variety padifolia) is also frequent.

Nemopanthus mucronata (*L.*) *Trelease.* Abundant in open swamps and marshes.

Celastraceae Lindl.

Celastrus scandens *L.* Thickets, especially near streams.

Aceraceae J. St. Hil.

Acer saccharinum *L.* The soft or silver maple, one of the most abundant trees of the low wet deciduous woodlands around the head of the lake.

Acer rubrum *L.* Common in low woods and swamps.

Acer saccharum *Marsh.* Not common in the low woods around the head of Oneida lake.

Acer pennsylvanicum *L.* Low woods and swamps.

Acer spicatum *Lam.* Swamps. Not common.

Rhamnaceae Desv.

Rhamnus alnifolia *L'Her.* Swamps and boggy thickets. Not common.

Vitaceae Lindl.

Vitis labrusca *L.*
Vitis aestivalis *Michx.*
Parthenocissus quinquefolia (*L.*) *Planch.*

Tiliaceae Juss.

Tilia americana *L.* Frequent in low, moist woodlands.

Malvaceae Neck.

Malva rotundifolia *L.* Yards and roadsides, South Bay.
Malva moschata *L.* Roadsides near North Bay.

Hypericaceae Lindl.

Hypericum ellipticum *Hook.* Swamps, marshy meadows and sandy depressions.
Hypericum perforatum *L.* A common weed.
Hypericum punctatum *Lam.* Common in moist soil.
Hypericum mutilum *L.* Common in moist soil.
Hypericum boreale (*Britton*) *Bicknell.* Marshy places. Rare.
Hypericum majus (*Gray*) *Britton.* Marshes and wet depressions in the sand plains.
Hypericum canadense *L.* Common.
Sarothra gentianoides *L.* Sandy soil. Common.
Triadenum virginicum (*L.*) *Raf.* Swamps, marshes and borders of ponds and lakes. Common.

Elatinaceae Lindl.

Elatine americana (*Pursh.*) *Arn.* Rare.

Cistaceae Lindl.

Crocanthemum canadense (*L.*) *Britton.* (Helianthemum canadense *Michx.*) Sandy fields and woods. Common.
Lechea intermedia *Leggett.* Sandy fields.

Violaceae DC.

Viola sororia *Willd.* Rare in the sandy region but common at North bay.
Viola affinis *LeConte.* Low woods and swamps.
Viola cucullata *Ait.* Swampy woods and marshes.

Viola fimbriatula *J. E. Sm.* Sandy fields. Common. A hybrid with V. s o r o r i a is common near Verona Beach.
Viola porteriana *Pollard* (V. cucullata x fimbriatula).
Viola incognita *Brainerd.* Common in rich damp woods.
Viola blanda *Willd.* Rich woods.
Viola pallens (*Banks*) *Brainerd.* Bogs and wet mossy places. Common.
Viola eriocarpa *Schw.* Sandy woods. Common.
Viola pubescens *Ait.*
Viola canadensis *L.*
Viola conspersa *Reichenb.*
Viola subvestita *Greene.* Sandy fields. Rare.

Daphnaceae Desv. (Thymeleaceae Reichenb.)

Dirca palustris *L.* Moist woods and thickets. Not common.

Salicariaceae Desv. (Lythraceae Lindl.)

Decodon verticillatus (*L.*) *Ell.* Common in swamps and along slow streams in shallow water and shores of Oneida lake.
Lythrum alatum *Pursh.* Open marshes. Rare.
Lythrum salicaria *L.* Lake shore north of Sylvan Beach.

Melastomaceae R. Br.

Rhexia virginica *L.* Low meadows north of Sylvan Beach. Reported from this region by Vasey and by Kneiskern.

Epilobiaceae Vent.

(Oenotheraceae *Desv.*, Onagraceae *Dumort.*)

Isnardia palustris *L.* Sandy shores. Common.
Chamaenerion angustifolium (*L.*) *Scop.* Very abundant on the burned over portions of the sand plains, and elsewhere in waste places.
Epilobium lineare *Muhl.* Swamps and boggy depressions.
Epilobium coloratum *Muhl.* Common in low ground.
Epilobium adenocaulon *Haussk.* Common.
Oenothera biennis *L.*
Oenothera muricata *L.* Sandy fields. Common.
Kneiffia pumila (*L.*) *Spach.*
Circaea latifolia *Hill.* (C. lutetiana).
Circaea alpina *L.* Wet woods and swamps.

Haloragidaceae Kl. & Garcke

Myriophyllum verticillatum *L.* In quiet water. Common.

Araliaceae Vent.

Aralia racemosa *L.*
Aralia nudicaulis *L.*
Aralia hispida *Vent.* Sandy woods and plains. Common.

Ammiaceae Presl.

Sanicula marylandica *L.* North Bay.
Sanicula canadensis *L.* Common.
Daucus corota *L.*
Washingtonia claytoni (*Michx.*) *Britton.*
Washingtonia longistylis (*Torr.*) *Britton.*
Deringa canadensis (*L.*) *Kuntze.*
Pastinaca sativa *L.*
Heracleum lanatum *Michx.*
Conioselinum chinense (*L.*) *B. S. P.* Swamps and swampy woods. Not rare.
Angelica atropurpurea *L.*
Thaspium barbinode (*Michx.*) *Nutt.*
Taenidia integerrima (*L.*) *Drude.* "Gravelly borders of Oneida lake," Kneiskern.
Zizzia aurea (*L.*) *Koch.*
Hydrocotyle americana *L.*
Conium maculatum *L.*
Sium cicutaefolium *Schrank.*
Cicuta maculata *L.*
Cicuta bulbifera *L.*
Carum carui *L.*

Cornaceae Link.

Cornus rugosa *Lam.* (C. circinata *L'Her.*) Edge of woods and in moist thickets.
Cornus amomum *Mill.*
Cornus stolonifera *Michx.*
Cornus femina *Mill.* (C. candissima *Marsh.*, C. paniculata *L'Her.*) Very common in marshy places.
Cornus alternifolia *L. f.* Open woods and plains. Common.
Cornus canadensis *L.* "Dwarf Cornel." (Chamaepericlymenum canadense *Asch. & Graebr.*) Common.
Cornus florida *L.* (Cynoxylon floridum *Raf.*) North Bay.
Nyssa sylvatica *Marsh.* A common tree in the deep swamps.

Pyrolaceae Agardh.

Pyrola americana *Sweet.* Rich woods, Fish Creek Station, North Bay, etc. Rare.

Pyrola elliptica *Nutt.* Rich woods. Common.

Pyrola secunda *L.* Woods and thickets. Not rare. The variety pumila *Paine*, with broader and blunter leaves is occasionally found.

Chimaphila corymbosa *Pursh* (C. umbellata *Nutt.*) Dry or rich woods. Common.

Monotropaceae Desv.

Monotropa uniflora *L.* Moist rich woods. Common.

Ericaceae DC.

Ledum groenlandicum *Oeder.* Marshy places in the pine plains.

Azalea nudiflora *L.* Edge of woods and open swamps.

Kalmia angustifolia *L.* Sandy fields and open woods.

Chamaedaphne calyculata (*L.*) *Moench.* Marshy places. Common.

Xolisma ligustrina (*L.*) *Britton.* (Andromeda ligustrina *Muhl.*) Dry woods.

Epigaea repens *L.* Open woods.

Gautheria procumbens *L.* Common.

Arctoslaphylos uva-ursi (*L.*) *Spreng.* Reported from " near Oneida lake " by Gray.

Vacciniaceae Lindl.

Gaylyssacia baccata (*Wang.*) *K. Koch.* (G. resinosa *T. & G.*)

Polycodium stamineum (*L.*) *Greene.*

Vaccinium corymbosum *L.* Swamps. Common.

Vaccinium canadense *Kalm.* Open woods and thickets.

Vaccinium angustifolium *Ait.* (V. pennsylvanicum *Lam.*) Very abundant in sandy woods.

Vaccinium vacillans *Kalm.*

Vaccinium atrococcum (*A. Gray*) *Heller.* Moist thickets.

Oxycoccus macrocarpus (*Ait.*) *Pursh.* Bogs and open wet mossy places.

Chiogenes hispidula (*L.*) *T. & G.* Rare.

Primulaceae Vent.

Samolus floribundus *H. B. K.*

Lysimachia quadrifolia *L.*

Lysimachia producta (*A. Gray*) *Fernald.* Seemingly a hybrid between the preceding and the following species.

Lysimachia terrestris (*L.*) *B. S. P.*
Lysimachia nummularia *L.*
Steironema ciliatum (*L.*) *Raf.*
Steironema lanceolatum (*Walt.*) *A. Gray.* Collected by Peck.
Naumbergia thrysiflora (*L.*) *Duby*
Trientalis americana *Pursh.*

Jasminaceae Desv. (Oleaceae Lindl.)

Syringa vulgaris *L.* Persistent and spreading near North Bay.
Fraxinus americana *L.*
Fraxinus pennsylvanica *Marsh.*
Fraxinus nigra *Marsh.*

Gentianaceae Desv.

Gentian crinita *Froel.*
Gentian quinquefolia *L.*
Dasystephana saponaria (*L.*) *Small.*
Dasystephana andrewsii (*Griseb.*) *Small.*
Halenia deflexa (*J. E. Sm.*) *Griseb.* Rare.
Bartonia virginica (*L.*) *B. S. P.*

Menyanthaceae G. Don.

Menyanthes trifoliata *L.*

Apocynacea Desv.

Vinca minor *L.* Roadsides and woods. North Bay.
Apocynum androsaemifolium *L.*
Apocynum sibiricum *Jacq.* (A. hypericifolium *Ait.*)

Asclepiadaceae Lindl.

Asclepias tuberosa *L.* Dry fields. Not rare. Reported from this region by Kneiskern.
Asclepias incarnata *L.*
Asclepias pulchra *Ehrh.*
Asclepias amplexicaulis *J. E. Sm.*
Asclepias exaltata (*L.*) *Muhl.*
Asclepias quadrifolia *Jacq.*
Asclepias syriaca *L.*

Convolvulaceae Vent.

Ipomoea purpurea (*L.*) *Lam.* Cultivated and sometimes persistent.
Ipomoea hederacea *Jacq.* Sometimes escaped from cultivation.
Convolvulus sepium *L.*

Convolvulus arvensis *L.* Along a railroad embankment.

Convolvulus spithamaeus *L.* "Plains of Rome" (Kneiskern). Common north of the lake in Oswego county.

Cuscutaceae Durmort.

Cuscuta gronovii *Willd.*

Polemoniaceae DC.

Phlox maculata *L.* Near Oneida Valley.

Phlox paniculata *L.* North Bay.

Hydrophyllaceae Lindl.

Hydrophyllum virginianum *L.*

Hydrophyllum canadense *L.* Rather rare, except in deep, cool woods near North Bay.

Boraginaceae Lindl.

Cynoglossum officinale *L.*

Lappula virginiana (*L.*) *Greene.*

Mertensia virginica (*L.*) *DC.*

Myosotis laxa *Lehm.* Collected by Peck.

Myosotis virginica (*L.*) *B. S. P.*

Myosotis scorpioides *L.*

Lithospermum arvense *L.*

Lithospermum officinale *L.*

Mertensia virginica (*L.*) *DC.* "Banks of Oneida and Fish creeks" (Kneiskern). Formerly abundant along Oneida creek south toward Oneida, but not seen recently.

Onosmodium hispidissimum *Mackenzie.*

Symphytum officinale *L.*

Echium vulgare *L.*

Verbenaceae J. St. Hil.

Verbena urticifolia *L.*

Verbena hastata *L.* Dwarf forms only a few inches high are common along the lake shore.

Labiatae B. Juss.

Trichostema dichotomum *L.*

Teucrium canadense *L.*

Teucrium occidentale *A. Gray* (T. boreale *Bicknell*).

Scutellaria lateriflora *L.*

Scutellaria galericulata *L.*
Nepeta cataria *L.*
Glecoma hederacea *L.*
Prunella vulgaris *L.*
Galeopsis tetrahit *L.*
Leonurus cardiaca *L.*
Lamium amplexicaule *L.*
Stachys aspera *Michx.*
Monarda didyma *L.*
Monarda fistulosa *L.*
Blephilia ciliata (*L.*) *Raf.*
Hedeoma pulegioides (*L.*) *Pers.*
Clinopodium vulgare *L.*
Koellia virginiana (*L.*) *MacM.*
Koellia incana (*L.*) *Kuntze*
Lycopus virginicus *L.*
Lycopus uniflorus *Michx.*
Lycopus americanus *Muhl.*
Mentha spicata *L.*
Mentha canadensis *L.*
Collinsonia canadensis *L.*

Solanaceae Pers.

Physalis virginiana *Mill.*
Physalis heterophylla *Nees.*
Solanum nigrum *L.*
Solanum dulcamara *L.*
Datura stramonium *L.*

Scrophulariaceae Lindl.

Verbascum thapsus *L.* At Sylvan Beach is a hybrid with V. lychnitis *L.*
Verbascum lychnitis *L.* Dry sandy fields near Sylvan Beach.
Verbascum blattaria *L.*
Linaria linaria (*L.*) *Karst.* (L. vulgaris *Hill*).
Linaria canadensis (*L.*) *Dumort.*
Scrophularia leporella *Bicknell.* Along railroad north of Sylvan Beach and evidently introduced there.
Chelone glabra *L.*
Pentstemon pentstemon (*L.*) *Britton.* (P. laevigatus *Soland*).
Mimulus ringens *L.*
Gratiola virginiana *L.*
Gratiola aurea *Muhl.* Rare.

Ilysanthes dubia (*L.*) *Barnhart.*
Veronica americana *Schw.*
Veronica scutellata *L.*
Veronica officinalis *L.*
Veronica serpyllifolia *L.*
Veronica peregrina *L.*
Veronica arvensis *L.*
Aureolaria virginica (*L.*) *Pennell.* Paine reports this from Oneida lake on the authority of Gray, under the name of Gerardia quercifolia. He also reports Gerardia flava, now called Aureolaria villosa (*Muhl.*) *Raf.* on the authority of Kneiskern. Both of these need confirmation.
Agalinis tenuifolia (*Vahl.*) *Raf.*
Pedicularis canadensis *L.*
Melampyrum lineare *Lam.*
Castilleja coccinea (*L.*) *Spreng.* "Oneida lake," Gray.

Lentibulariaceae Lindl.

Utricularia macorrhiza *LeConte.*
Stomoisia cornuta (*Michx.*) *Raf.* Sphagnous depressions in the sand plains. Rare.

Orobanchaceae Lindl.

Conopholis americana (*L. f.*) *Wallr.* Common under oak trees.
Leptamnium virginianum (*L.*) *Raf.* Oak woods, not common.

Acanthaceae J. St. Hil.

Dianthera americana *L.* Shallow water of lake shore and of streams flowing into the lake.

Phrymaceae Schauer in DC.

Phryma leptostachya *L.*

Plantaginaceae Lindl.

Plantago major *L.*
Plantago rugellii *Decne.* Lake shores and moist places.
Plantago lanceolata *L.*
Plantago aristata *Michx.* Sandy fields. Introduced.

Rubiaceae B. Juss.

Cephalanthus occidentalis *L.* Swamps and shallow water, often forming dense thickets.

Mitchella repens *L.*
Galium pilosum *Ait.* Sandy fields, and open woods.
Galium circaezans *Michx.* Dry woods.
Galium boreale *L.* North shore of Oneida lake.
Galium lanceolatum *Torr.* Moist or dry woods.
Galium triflorum *Michx.* Woods and moist thickets. Common.
Galium trifidum *L.* Mossy and swampy places. Common.
Galium claytoni *Michx.* Mossy swamps and depressions.
Galium palustre *L.* Moist places, thickets and swamps.
Galium asprellum *Michx.* Thickets and woods. Common.

Caprifoliaceae Vent.

Sambucus canadensis *L.*
Sambucus racemosa *L.* (S. pubens *Michx.*)
Viburnum alnifolium *Marsh.*
Viburnum opulus *L.* Low woods and swamps. Not common.
Viburnum acerifolium *L.*
Viburnum dentatum *L.* Swamps and low woods. Common.
Viburnum lentago *L.*
Viburnum cassinoides *L.* Swamps and marshes. Common.
Lonicera dioica *L.*
Lonicera tartarica *L.* Escaped or persistent around North Bay.

Cucurbitaceae B. Juss.

Micrampelis lobata (*Michx.*) *Greene.* Along Fish creek in moist thickets, also along Oneida creek.
Sicyos angulatus *L.* Stream banks and moist thickets. Common.

Campanulaceae Juss.

Campanula rapunculoides *L.*
Campanula aparinoides *Pursh.* Swamps and marshes. Not common.
Specularia perfoliata (*L.*) *A. DC.* Dry sandy fields and open woods. Common.

Lobeliaceae Dumort.

Lobelia cardinalis *L.* Low meadows and marshes. Common.
Lobelia syphilitica *L.* Moist soil. Common.
Lobelia spicata *Lam.* (L. claytoniana *Michx.*, L. goodenioides *Willd.*) Dry sandy soil in fields and open woods.
Lobelia inflata *L.* Dry soil, fields and woods. Common.

Cichoriaceae Reichenb.

Cichorium intybus *L.* Roadsides, along railroads, etc.
Krigia virginica (*L.*) *Willd.* Sandy fields. Common.
Tragopogon pratensis *L.*
Leontodon taraxacum *L.*
Leontodon erythrosperum (*Andrz.*) *Britton.*
Sonchus oleraceus *L.*
Sonchus arvensis *L.*
Lactuca virosa *L.*
Lactuca hirsuta *Muhl.*
Lactuca spicata (*Lam.*) *Hitchc.*
Lactuca canadensis *L.*
Hieracium canadense *Michx.*
Hieracium paniculatum *L.*
Hieracium scabrum *Michx.*
Hieracium venosum *L.*
Hieracium florentinum *All.*
Hieracium aurantiacum *L.*
Nabulus altissimus (*L.*) *Hook.*
Nabulus trifoliatus *Cass.*
Nabulus serpentarius (*Pursh*) *Hook.*

Ambrosiaceae Reichenb.

Ambrosia trifida *L.*
Ambrosia elatior *L.* (A. artemisiaefolia *L.*)
Xanthium commune *Britton.*
Xanthium americanum *Walt.*

Compositae Adans.

Eupatorium maculatum *L.*
Eupatorium purpureum *L.*
Eupatorium perfoliatum *L.*
Eupatorium urticaefolium *Reichard.* (E. ageratoides *L. f.*)
Mikania scandens (*L.*) *Willd.* Marshes and swamps, climbing over shrubs and herbs.
Solidago caesia *L.*
Solidago flexicaulis *L.*
Solidago bicolor *L.*
Solidago hispida *Muhl.*
Solidago ulignosa *Nutt.*
Solidago odora *Ait.*

Solidago rugosa *Mill.*
Solidago neglecta *T. & G.* In sphagnous depressions of sand plains.
Solidago juncea *Ait.*
Solidago canadensis *L.*
Solidago serotina *Ait.*
Solidago nemoralis *Ait.*
Euthamia graminifolia (*L.*) *Nutt.*
Sericocarpus asteroides (*L.*) *B. S. P.*
Aster divaricatus *L.*
Aster macrophyllus *L.*
Aster multiformis *Burgess.* In the pine woods near North Bay a form is abundant which corresponds to the description of Aster securiformis Burgess.
Aster cordifolius *L.*
Aster undulatus *L.*
Aster patens *Ait.*
Aster novae-angliae *L.*
Aster puniceus *L.*
Aster tardiflorus *L.*
Aster prenanthoides *Muhl.*
Aster laevis *L.*
Aster concinnus *Willd.*
Aster lateriflorus (*L.*) *Britton* (A. miser *Nutt.*, A. diffusus *Ait.*)
Aster hirsuticaulis *Lindl.*
Aster ericoides *L.*
Aster multiflorus *Ait.*
Aster salicifolius *Lam.*
Aster paniculatus *Lam.*
Aster tradescanti *L.*
Aster acuminatus *Michx.*
Erigeron pulchellus *Michx.*
Erigeron philadelphicus *L.*
Erigeron annuus (*L.*) *Pers.*
Erigeron ramosus (*Walt.*) *B. S. P.*
Leptilon canadense (*L.*) *Britton* (Erigeron canadense *L.*)
Doellingeria umbellata (*Mill.*) *Nees.*
Ionactis linariifolius (*L.*) *Greene.*
Antennaria plantaginifolia (*L.*) *Richards.*
Antennaria neodioica *Greene.*
Antennaria neglecta *Greene.*
Antennaria grandis (*Fernald*) *House.*
Antennaria fallax *Greene.*

Anaphalis margaritacea (*L.*) *Benth. & Hook.*
Gnaphalium obtusifolium *L.*
Gnaphalium uliginosum *L.*
Inula helenium *L.*
Rudbeckia hirta *L.*
Rudbeckia laciniata *L.*
Helianthus tuberosus *L.*
Helianthus divaricatus *L.*
Helianthus decapetalus *L.*
Helianthus strumosus *L.*
Bidens cernua *L.*
Bidens connata *Muhl.*
Bidens frondosa *L.*
Bidens vulgata *Greene.*
Bidens bipinnata *L.*
Galinsoga parviflora *Cav.*
Helenium autumnale *L.*
Achillea millefolium *L.*
Anthemis cotula *L.*
Chrysanthemum leucanthemum *L.*
Tanacetum vulgare *L.* Common near North Bay.
Artemisia canadensis *Michx.* Shores of lakes, Oneida county, Kneiskern.
Artemisia vulgaris *L.*
Artemisia stelleriana *Bess.* In sand along shore of Oneida lake north of Sylvan Beach.
Tussilago farfara *L.*
Erechtites hieracifolia (*L.*) *Raf.*
Senecio aureus *L.*
Arctium minus *Schk.*
Cirsium lanceolatum (*L.*) *Hil.*
Cirsium arvense (*L.*) *Scop.*
Cirsium muticum *Michx.* Common in swamps.
Carduus crispus *L.*

FUNGI OF CHAUTAUQUA COUNTY, N. Y.

DAVID R. SUMSTINE

The following list of fungi is based on collections made by the writer in June 1908, in July 1911 and in July 1916. The principal collecting stations were the following: Mayville, Chautauqua, Bemus Point, Jamestown, Panama and Sherman.

The specimens have been placed in the herbarium of the Carnegie Museum, Pittsburgh, Pa.

MYXOMYCETES

Arcyria cinerea (*Bull.*) *Pers.*
Arcyria denudata (*L.*) *Sheldon*
Arcyria ferruginea *Saut.*
Arcyria nutans (*Bull.*) *Grev.*
Ceratiomyxa fructiculosa (*Muell.*) *Macbr.*
Ceratiomyxa porioides (*A. & S.*) *Schroet.*
Diachea leucopoda (*Bull.*) *Rost.*
Fuligo ovata (*Schaeff.*) *Macbr.*
Hemitrichia serpula (*Scop.*) *Rost.*
Lachnobolus globosus (*Schw.*) *Rost.*
Lycogala epidendrum (*Buxb.*) *Fr.*
Stemonitis morgani *Peck*
Tubifera ferruginosa (*Batsch*) *Macbr.*

CHYTRIDIALES

Synchytriaceae

Synchytrium decipiens *Farl.* On Falcata comosa (*L.*) *Kuntze*

PERONOSPORALES

Albuginaceae

Albugo bliti (*Biv.*) *Kuntze.* On Amaranthus retroflexus *L.*
Albugo candida (*Pers.*) *Kuntze.* On Arabis lyrata *L.*
Albugo tragopogonis (*Pers.*) *S. F. Gray.* On Ambrosia artemisiaefolia *L.*

Peronosporaceae

Peronospora alta *Fckl.* On Plantago major *L.*
Plasmopara viticola (*B. & C.*) *Berl. & DeToni.* On Vitis *sp.*
Plasmopara geranii (*Peck*) *Berl. & DeToni.* On Geranium maculatum *L.*

MUCORALES

Mucoraceae

Syzygites aspergillus (*Scop.*) *Pound.* On different species of Agarics.

EXOASCALES

Exoascaceae

Exoascus deformans (*Berk.*) *Fckl.* On peach leaves

HELVELLALES

Geoglossaceae

Microglossum rufum (*Schw.*) *Underw.*

PEZIZALES

Pezizaceae

Lachnea scutellata (*L.*) *Sacc.*
Peziza nebulosa *Cooke*
Peziza dehnii *Rabh.*

Helotiaceae

Chlorosplenium aeruginosum (*Oed.*) *De Not.*
Sarcoscypha floccosa (*Schw.*) *Sacc.*
Sarcoscypha occidentalis (*Schw.*) *Cooke*

Cenangiaceae

Bulgaria rufa *Schw.*

PHACIDIALES

Phacidiaceae

Clithris quercina (*Pers.*) *Rehm.*

HYSTERIALES

Hysteriaceae

Glonium stellatum *Muhl.*

HYPOCREALES

Hypocreaceae

Chromocrea gelatinosa (*Tode*) *Seaver*
Hypomyces chrysospermus (*Bull.*) *Tul.*
Hypomyces hyalinus (*Schw.*) *Tul.*
Hypomyces lactifluorum (*Schw.*) *Tul.*

PERISPORIALES

Erysiphaceae

Erysiphe cichoracearum *DC.* On Aster sp.
Erysiphe communis (*Wallr.*) *Link.* On Ranunculus acris *L.*
Microsphaera alni (*DC.*) *Wint.* On Syringa vulgaris *L.*
Sphaerotheca castagnei *Lev.* On Leontodon taraxacum *L.*
Sphaerotheca mors-uvae (*Schw.*) *B. & C.* On Geranium maculatum *L.*

SPHAERIALES

Diatrypaceae

Diatrypella quercina (*Pers.*) *Nits.*

Valsaceae

Diaporthe parasitica *Murrill.* On Castanea dentata (*Marsh.*) *Borkh.*

Xylariaceae

Daldinia concentrica (*Bolt.*) *Ces. & De Not.*
Hypoxylon coccineum *Bull.* With Institale acariforme *Fr.*
Ustulina vulgaris *Tul.*
Xylaria corniformis *Fr.*
Xylaria polymorpha (*Pers.*) *Grev.*

USTILAGINALES

Ustilaginaceae

Ustilago avenae (*Pers.*) *Jens.* On oats.

Tilletiaceae

Urocystis carcinodes (*B. & C.*) *Fish.* On Cimicifuga racemosa *Nutt.*

UREDINALES

Melampsoraceae

Melampsora farinosa (*Pers.*) *Schroet.* On Salix sp.
Coleosporium sonchi-arvensis (*Pers.*) *Wint.* On Aster sp.

Pucciniaceae

Gymnoconia interstitiales (*Schlecht.*) *Lagerh.* On various species of Rubus
Phragmidium potentillae *Wint.* On Potentilla canadensis *L.*
Puccinia anemones-virginianae *Schw.* On Anemone virginiana *L.*
Puccinia asteris *Duby.* On leaves of Asters
Puccinia circaeae *Pers.* On Circaea lutetiana *L.*
Puccinia dayi *Clinton.* On Steironema ciliatum (*L.*) *Raf.*
Puccinia graminis *Pers.* On wheat
Puccinia heucherae (*Schw.*) *Diet.* On Mitella diphylla *L.*
Puccinia hieracii (*Schum.*) *Mart.* On Hieracium canadense *Michx.*
Puccinia impatientis (*Schw.*) *Arth.* On Impatiens biflora *Walt.*
Puccinia malvacearum *Mont.* On Malva sp. cultv.
Puccinia menthae *Pers.* On Mentha canadensis *L.*
Puccinia obtegens (*Link*) *Tul.* On Carduus arvensis (*L.*) *Robs.*
Puccinia osmorrhizae (*Pk.*) *Cke. & Pk.* On Washingtonia longistylis (*Torr*). *Britt.*
Puccinia podophylli *Schw.* On Podophyllum peltatum *L.*
Puccinia veratri *Niessl.* On Veratrum viride *Ait.*
Puccinia violae (*DC.*) *Schroet.* On Viola sp.
Uredo agrimoniae (*Schum.*) *DC.* On Agrimonia gryposepala *Wallr.*

Uromyces caladii (*Schw.*) *Farl.* On Arisaema triphyllum (*L.*) *Torr.*
Uromyces hedysari-paniculati (*Schw.*) *Farl.* On Meibomia paniculata (*L.*) *Kuntze*
Uromyces howei *Peck.* On Asclepias syriaca *L.*
Uromyces junci (*Desm.*) *Tul.* On Juncoides pilosum (*L.*) *Kuntze*
Uromyces polygoni (*Pers.*) *Fckl.* On Polygonum aviculare *L.*
Uromyces trifolii (*Hedw.*) *Lev.* On Trifolium pratense *L.*

DACRYOMYCETALES

Dacryomycetaceae

Guepinia spatularia (*Schw.*) *Fr.*

AGARICALES

Thelophoraceae

Asterostoma albido-carneum *Massee*
Corticium pallescens (*Schw.*) *Massee*
Craterellus cantharellus (*Schw.*) *Fr.*
Hymenochaete corrugata (*Fr.*) *Lev.*
Hymenochaete rubiginosa *Lev.*
Sebacina helvelloides (*Schw.*) *Burt*
Solenia fasciculata *Pers.*
Stereum frustulosum *Fr.*
Stereum lobatum *Fr.*
Thelophora schweinitzii *Berk.*

Clavariaceae

Clavaria formosa *Pers.*
Clavaria cristata *Pers.*
Physalacria inflata *Peck*

Hydnaceae

Grandinia coriaria *Peck* (Determined by Dr H. J. Banker)
Hydnum subcarnaceum *Fr.*
Mucronella calva (*A. & S.*) *Fr.*
Phlebia hydnoides *Schw.* (Determined by Dr H. J. Banker)
Steccherinum ochraceum (*Pers.*) *Gray*
Steccherinum pulcherrimum (*B. & C.*) *Banker*

Polyporaceae

Antrodia mollis (*Sommerf.*) *Karst.*
Bjerkandera adusta (*Willd.*) *Karst.*
Bjerkandera puberula (*B. & C.*) *Murrill*
Cerrena unicolor (*Bull.*) *Murrill*
Coltricia cinnamomea (*Jacq.*) *Murrill*
Coriolellus sepium (*Berk.*) *Murrill*
Coriolus abietinus (*Dicks.*) *Quel.*
Coriolus biformis (*Klotsch.*) *Pat.*
Coriolus nigromarginatus (*Schw.*) *Murrill*
Coriolus prolificans (*Fr.*) *Murrill*
Coriolus pubescens (*Schw.*) *Murrill*

Coriolus versicolor (*L.*) *Quel.*
Daedalea confragosa (*Bolt.*) *Pers.*
Elfvngia megaloma (*Lev.*) *Murrill*
Fomes annosus (*Fr.*) *Cooke*
Fomes populinus (*Schum.*) *Cooke*
Fomes ungulatus (*Schaeff.*) *Sacc.*
Fomitiporia obliquiformis *Murrill*
Fuscoporia viticola (*Schw.*) *Murrill*
Fuscoporia ferruginisa (*Schrad.*) *Murrill*
Ganoderma tsuagae *Murrill*
Gloeophyllum hirsutum (*Schaeff.*) *Murrill*
Gloeophyllum trabeum (*Pers.*) *Murrill*
Hapalopilus gilvus (*Schw.*) *Murrill*
Hapalopilus rutilans (*Pers.*) *Murrill*
Hexagona alveolaris (*DC.*) *Murrill*
Ischnoderma fuliginosum (*Scop.*) *Murrill*
Laetiporus speciosus (*Batsch.*) *Murrill*
Lenzites betulinus (*L.*) *Fr.*
Piptoporus suberosus (*L.*) *Murrill*
Phaeolus sistotremoides (*Alb. & Schw.*) *Murrill*
Polyporus arcularius (*Batsch.*) *Fr.*
Polyporus elegans (*Bull.*) *Fr.*
Polyporus fissus *Berk.*
Porodisculus pendulus (*Schw.*) *Murrill*
Poronidulus conchifer (*Schw.*) *Murrill*
Pycnoporus cinnabarinus (*Jacq.*) *Karst.*
Pyropolyporus conchatus (*Pers.*) *Murrill*
Pyropolyporus igniarius (*L.*) *Murrill*
Pyropolyporus robiniae *Murrill*
Spongipellis borealis (*Fr.*) *Pat.*
Spongipellis galactinus (*Berk.*) *Pat.*
Tyromyces chioneus (*Fr.*) *Karst.*
Tyromyces guttulatus (*Peck*) *Murrill*
Tyromyces lacteus (*Fr.*) *Murrill*
Tyromyces semipileatus (*Peck*) *Murrill*
Tyromyces spraguei (*B. & C.*) *Murrill*

Boletaceae

Fistulina hepatica (*Schaeff.*) *Fr.*
Strobilomyces strobilaceus (*Scop.*) *Berk.*
Ceriomyces communis (*Bull.*) *Murrill*
Ceriomyces retipes (*B. & C.*) *Murrill*
Ceriomyces subtomentosus (*L.*) *Murrill*
Gyroporus castaneus (*Bull.*) *Quel.*
Suillellus frostii (*Russell*) *Murrill*
Suillellus luridus (*Schaeff.*) *Murrill*
Tylopilus felleus (*Bull.*) *Karst.*

Agaricaceae

Agaricus campestris *L.*
Agaricus placomyces *Peck*

Amanita phalloides (*Fr.*) *Quel.*
Amanita rubescens *Pers.*
Amanita verna *Bull.*
Amanitopsis vaginata (*Bull.*) *Roze*
Armillaria mellea (*Vahl*) *Quel.*
Cantharellus cibarius *Fr.*
Cantharellus aurantiacus (*Wulf.*) *Fr.*
Cantharellus cinnabarinus *Schw.*
Claudopus nidulans (*Pers.*) *Peck*
Clitocybe illudens *Schw.*
Clitocybe infundibuliformis *Schaeff.*
Clitocybe phyllophila *Fr.*
Collybia platyphylla *Fr.*
Collybia radicata *Rehl.*
Collybia velutipes *Curt.*
Crepidotus malachius *B. & C.*
Galera tener (*Schaeff.*) *Gill.*
Hypholoma appendiculatum *Bull.*
Hypoloma perplexum *Peck*
Laccaria laccata (*Scop.*) *B. & Br.*
Lactaria hygrophoroides *B. & C.*
Lactaria lactiflua (*L.*) *Burl.*
Lactaria piperata (*L.*) *Pers.*
Lactaria scrobiculata (*Scop.*) *Fr.*
Lactaria subdulcis (*Pers.*) *Fr.*
Lactaria vellerea *Fr.*
Lentinus lepideus *Fr.*
Marasmius campanulatus *Peck*
Marasmius oreades *Fr.*
Marasmius rotula *Fr.*
Marasmius urens (*Bull.*) *Fr.*
Mycena leaiana *Berk.*
Omphalia campanella *Batsch.*
Panaeolus campanulatus *L.*
Panus rudis *Fr.*
Panus stipticus *Fr.*
Pholiota praecox *Pers.*
Pleurotus ostreatus *Jacq.*
Pleurotus petaloides *Bull.*
Pluteus cervinus *Schaeff.*
Pluteus granularis *Peck*
Pluteus longistriatus *Peck*
Psathyrella disseminata *Pers.*
Psilocybe foenisecii *Pers.*
Russula emetica *Fr.*
Russula foetens *Fr.*
Russula lepida *Fr.*
Russula nigricans *Fr.*
Schizophyllum alneum (*L.*) *Schroet.*
Tricholoma rutilans *Schaeff.*

PHALLALES

Clathraceae

Phallogaster saccatus *Morgan*

Phallaceae

Dictyophora ravenelii (*B. & C.*) *Burt*

LYCOPERDALES

Lycoperdaceae

Astraeus hygrometricus (*Pers.*) *Morgan*
Lycoperdon gemmatum *Batsch*
Lycoperdon pyriforme *Schaeff.*

NIDULARIALES

Nidulariaceae

Crucibulum crucibuliforme (*Scop.*) *White*
Cyathia hirsuta (*Schaeff.*) *White*
Sphaerobolus carpobolus *L.*

SCLERODERMATALES

Sclerodermataceae

Scleroderma bovista *Fr.*
Scleroderma vulgare *Horn.*

FUNGI INPERFECTI

Melasmia acerina *Lev.*
Phyllosticta acericola *C. & E.* On Acer sp.
Phyllosticta phomiformis *Sacc.* On Quercus sp.
Phyllosticta podophylli *Wint.* On Podophyllum peltatum *L.*
Septoria aegopodii *Desm.* On Washingtonia longistylis (*Torr.*) *Britt.*
Septoria malvicola *Ell. & Mart.* On Malva rotundifolia *L.*
Septoria nabali *B. & C.* On Nabalus albus (*L.*) *Hook.*
Septoria oenotherae *B. & C.* On Oeneothera biennis *L.*
Septoria podophyllina *Peck.* On Podophyllum peltatum *L.*
Septoria polygonorum *Desm.* On Polygonum sp.
Septoria trillii *Peck.* On Trillium sp.
Septoria violae *Westd.* On Viola sp.
Sphaeropsis malorum *Westd.* On leaves of Malus malus (*L.*)
Vermicularia concentrica *Peck & Clinton.* On Trillium sp.
Vermicularia peckii *Sacc.* On Viola sp.
Coryneum kunzei *Corda.* On dead branches.
Gloeosporium lindemuthianum *Sacc. & Magn.* On beans.
Myxosporium nitidum *B. & C.* On branches of Cornus.

HYPHOMYCETES

Cercospora clavata (*Gerard*) *Cooke.* On Asclepias syriaca *L.*
Cercospora symplocarpi *Peck.* On Spathyma foetida (*L.*) *Raf.*

Cladosporium herbarum (*Pers.*) *Link*
Diplocladium minus *Bon.*
Fusicladium pirinum (*Lib.*) *Fckl.*
Isaria farinosa (*Dicks.*) *Fr.*
Oidium album *Sumstine*
Polyscytalum flavum *Sumstine*
Rhinotrichum bicolor *Sumstine*
Rhinotrichum curtisii *Berk.*
Rhinotrichum ramosissimum *B. & C.*
Scolecotrichum graminis *Fckl.* On Dactylis glomerata *L.*
Sepedonium chrysospermum *Fr.*
Sporodesmium antiquum *Corda*
Streptothrix pereffusa *Sumstine*
Tuberculina persicina (*Ditm.*) *Sacc.*
Verticillium candelabrum *Bon.*

Sterile Mycelium

Ozonium auricomum *Link*

Peabody High School,
Pittsburgh, Pa.

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New York State Museum Bulletin

Entered as second-class matter November 27, 1915, at the Post Office at Albany, New York, under the act of August 24, 1912

Published monthly by The University of the State of New York

No. 198 ALBANY, N. Y. JUNE 1, 1917

The University of the State of New York

New York State Museum

JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

32d REPORT OF THE STATE ENTOMOLOGIST

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1916

ALBANY

THE UNIVERSITY OF THE STATE OF NEW YORK

1918

M91r-F17-1500

The University of the State of New York
Department of Science, January 11, 1917

Dr John H. Finley
President of the University

Sir: I have the honor to transmit herewith and to recommend for publication as a bulletin of the State Museum, the Annual Report of the State Entomologist, being for the fiscal year 1916.

Very respectfully
John M. Clarke
Director

THE UNIVERSITY OF THE STATE OF NEW YORK
OFFICE OF THE PRESIDENT

Approved for publication this 3d day of February 1917

John H. Finley

President of the University

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No. 198 ALBANY, N. Y. June 1, 1917

The University of the State of New York

New York State Museum

JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

THIRTY-SECOND REPORT OF THE STATE ENTOMOLOGIST

1916

Dr John M. Clarke, Director of the State Museum

I have the honor to present herewith my report on the injurious and other insects of the State of New York for the year ending September 30, 1916.

The frequent and rather heavy rains of the spring and early summer offset, in large measure, depredations of various early leaf feeders by producing an unusual growth of vegetation. Apple tent caterpillars were numerous in many localities and yet the damage was relatively small. There were no complaints of injuries by the forest tent caterpillar and very little serious damage by the elm leaf beetle, a pest which in earlier years defoliated thousands of trees and has been responsible for the death of many shade trees in the Hudson valley.

Fruit tree insects. Practical work with the codling moth was continued the past season in cooperation with the bureau of horticulture of the State Department of Agriculture, and the Monroe county farm bureau. These studies were conducted in four commercial orchards in western New York, through the hearty cooperation of their respective owners, and an effort made to determine the relative value, as in former years, of the first, second and third sprays for the control of this pest. In connection with these investigations, observations were also made upon the development and biology of the codling moth. The data secured show, as do those of earlier years, the very great benefits which can be derived from the first or so-called calyx spray, and indicate most strongly the necessity of thoroughness if satisfactory results are to be obtained. The work in the orchard of Mr H. E. Wellman, Kendall, when compared with that of the preceding year, shows a very gratifying reduction in infestation. The same plots were used and the wormy apples of the past season were from one-third to two-thirds less than those of 1915. A careful study of the different types of codling moth injury have enabled us to verify earlier opinions as to the relation existing between them and the habits of the insect, and also to outline rules for determining the period during which different injuries may be inflicted, something of considerable importance in connection with the enforcement of the apple grading and packing law. We have also, through the cooperation of several local observers, secured detailed tabulations of evening temperatures and other meteorological data under orchard conditions. Unfortunately the egg laying of the moth was so distributed the past season that it was impossible to demonstrate a well-marked relation between evening temperatures and the deposition of eggs, though it is probable that such exists. The meteorological data recorded constitute a substantial basis for subsequent investigations. The work with this insect developed serious and somewhat general injury to Baldwin foliage in particular, due probably to the application of a rather strong fungicide immediately after a series of rains which produced an unusually tender growth. The details of this work are discussed on the following pages.

Apple maggot. Owing to the continued injuries by this pest an investigation of the insect, with special reference to practical control measures, was started and through the cooperation of Mr Edward Van Alstyne of Kinderhook, and Mr George T. Powell of Ghent, a test of sweetened poisons for the destruction of the adults was conducted. The results were so equivocal that we are unable to recommend this spray and for the present are contenting ourselves with advising the early destruction of infested fruit, supplemented by good orchard practice. The investigations of the past season demonstrated such variations in the habits of the insect in nearby orchards that a continuance of this study is planned for another year.

Leaf roller. Investigations in connection with the codling moth work showed this serious pest of the fruit grower in the western part of the State to be much less abundant than was the case in

1915. This is probably due to one of the natural and frequently unexplainable oscillations in insect life.

Red bugs. Observations of the past year indicate that these two somewhat new insects are becoming more generally established in the fruit-growing sections of the State and here and there are causing serious injury. The practical work of the past two years has demonstrated nothing to be more effective than the use of a tobacco extract, 40 per cent nicotine, just before the blossoms open. This may be applied simply with soap to aid in spreading the insecticide or added to the delayed dormant spray, and in case of bad infestations, this treatment should be supplemented by the use of tobacco in the usual calyx spray for the codling moth, applying this as soon as possible after the dropping of the blossoms.

San José scale. This greatly feared pest of earlier years has caused comparatively little injury in the Hudson valley and in some sections has been remarkable for its scarcity. This reduction is probably attributable in large measure to the activities of various small parasites though climatic conditions may have some influence. Unsprayed orchards, even though they have been infested with the scale for a series of years, are in somewhat better condition, generally speaking, than they were eight or ten years ago, and a few fruit growers have been encouraged by this comparative scarcity of the pest to omit the early spring application for the control of the scale. No serious consequences have followed this omission to our knowledge though it is a practice which can not be recommended unqualifiedly.

Pear thrips. This minute and destructive insect has been abundant here and there in the Hudson valley and has caused serious injury in a few localities, particularly where it appeared in numbers before the grower could give the requisite treatment. Through a combination of fortunate conditions we were able to secure a somewhat satisfactory test of the value of a thick lime-sulphur wash as a means of controlling the thrips. The results are most encouraging, though owing to the erratic habits of the pest there can be only a qualified recommendation. The details of this work are given below.

Pear psylla. Injuries by this pest have not been serious as a rule in Hudson valley orchards, and in many comparatively few eggs were deposited in early spring. The late application of the winter lime-sulphur wash for the destruction of the eggs is the most satisfactory method of controlling this pest and occasionally this must be supplemented by midsummer spraying with a contact insecticide.

Gipsy moth. There has not been a marked change in the infestation at Mount Kisco, though the scouting of the winter of 1915–16 showed an extension of the infested area. This latter was well cleaned during the summer, thoroughly sprayed and an examination in midsummer indicated the prevalence of very gratifying conditions. There is no reason why this local infestation should not be eradicated if the work is prosecuted with desirable thoroughness.

Grass and grain pests. The grasshopper devastations of the last two years on the borders of the Adirondacks were much reduced during the past season though many young insects hatched in early spring, as shown by observations in Lewis, Saratoga and Albany counties. There are two causes for this change. The frequent and copious rains of the spring and summer produced an abundant forage capable of supporting many grasshoppers without marked injury. The rains doubtless killed many of the young insects and, in addition, the systematic poisoning of earlier years over large areas resulted in a great decrease in the pests. The experience of the last three years has amply demonstrated, generally speaking, the practicability of local control through the distribution of poisoned baits.

The white grub outbreak of 1915 was followed, as was to be expected, by numerous full-grown grubs in many fields last spring and as a consequence many farmers were afraid to plant susceptible crops on such land. The Entomologist advised moderately late planting of these areas, and the outcome in the fall fully justified the recommendation. General notices were also issued calling attention to the more salient features in the life history of these destructive insects and pointing out the most practical means of avoiding injury. Studies were continued of the white grub robber fly, a species which has proved an important natural enemy of white grubs.

Incidental observations during recent years upon several minor clover insects have been brought together and are placed on record in this report. It will be seen by referring to these accounts that two European weevils in addition to the much better known and earlier introduced punctured clover leaf weevil, Hypera punctata Fabr., have become established in recent years in the Hudson valley and in certain localities, at least, are causing an appreciable amount of injury.

Shade tree insects. There has been comparatively little damage to the shade trees of the State, owing to the climatic conditions being unusually favorable for the growth of vegetation.

An interesting injury, that by the maple leaf stem borer, was studied at Rye. This insect is a comparatively unknown one in New York State and occasionally, as shown by observations in other portions of the country, becomes somewhat abundant and injurious. An account of this species may be found in the body of the report.

There is annually more or less bleeding from wounded trees and the past season was characterized by an unusual prevalence of this trouble. While there may be other causes for this phenomenon, observations of the last few years have enabled us to associate much of this damage with slender, white maggots, the young of a small and hitherto almost unknown fly. A general account of the insect with suggestions for control may be found on the following pages.

Forest tree pests. Injuries by the hickory bark beetle have continued though the damage the past season appears to be materially less and in certain cases, at least, seems to be favored by a weakened condition following the severe drought of earlier years. Studies of this species have resulted in securing valuable information respecting the biology and habits of several associated species and these latter data have been correlated and placed on record in this report.

Greenhouse pests. Several destructive greenhouse insects have been brought to notice during the past year and investigated so far as opportunities permitted. The Florida fern caterpillar, a well-known southern insect, was found well established in a fern house at Lockport, and an account of the insect with remedial measures is given below. The rose gall midge, a dangerous enemy of indoor roses, has again appeared in greenhouses in the lower Hudson valley, while reports from different localities indicate a wide dissemination for the recently introduced chrysanthemum gall midge, a species liable to appear in numbers in almost any chrysanthemum house in the State.

Periodical cicada. A brood of this remarkable insect appeared in the western part of the State and detailed records concerning its distribution and abundance, together with observations upon its habits, have been collated and are given elsewhere in the report.

Flies. There is continued interest in the control of the house fly and the Entomologist has complied with a number of requests for information in regard to this insect. Mobilization of troops the past summer made it necessary to control flies under camp conditions, and at the request of Dr H. L. Van Winkle, the Entomologist made a personal examination of Camp Whitman, Greenhaven, and submitted a series of recommendations for the control of the house fly.

A serious outbreak of infantile paralysis made it very desirable to investigate thoroughly the possibility of flies or other insects acting as carriers of this infection, and at the invitation of Dr Haven Emerson, commissioner of health of New York City, the Entomologist attended a conference for the purpose of outlining a fly survey. This work is in charge of an entomologist employed by the department of health of the city of New York and will be reported upon in due time.

Gall midges. It will be seen by referring to preceding paragraphs that an unusual number of economic and comparatively unknown species belonging to this group have been brought to attention during the past year, and the probabilities are that there will be more, rather than less, injury in the future by gall midges.

The studies of these insects have been continued and a number of new species, mostly reared, and several new genera described.

As a result of these investigations many insect galls have been forwarded for identification and, as a matter of convenience, an illustrated key to American insect galls has been prepared. This tabulates over 1400 galls in relation to their food plants, gives the principal characters of each deformity and a reference to the best or more accessible description. The key has greatly facilitated the identification of galls and it is believed that its publication will materially increase the interest in this branch of natural history.

Lectures. The Entomologist has delivered a number of lectures on insects, mostly economic species, before various agricultural and horticultural gatherings, some of them being in cooperation with the Bureau of Farmers Institutes or county farm bureau agents. Several lectures have also been given under the auspices of local welfare associations.

Publications. A number of brief popular accounts regarding such common pests as the apple tent caterpillar, pear thrips, white grubs and grasshoppers have been prepared and widely circulated through the press. Owing to delay in the printing of the report for 1914, two reports have been issued during the past year. A list of the more important publications of the office is given in this report.

The increased interest in agriculture and nature study resulted in a large demand from school teachers for information relating to insects and, as a consequence, the editions of certain more popular bulletins and reprints, some dating back a number of years, were exhausted the past summer. These publications could hardly have been placed to better advantage.

Faunal studies. Investigations along these lines have been continued and a manuscript list of the insects of the Adirondack region, based mostly upon material in the state collections, is nearly ready for publication. This list is a growing one, additions being constantly made thereto in connection with other work carried on within the limits of this faunal area, such, for example, as the study of grasshoppers noted above.

Another valuable addition to the natural history of the State of New York is practically ready for the printer, namely "A Monographic Account of the Caddis Flies or Trichoptera," by Dr Cornelius Betten. This work had its inception in the studies of aquatic insects begun at the entomological field station, Saranac Inn, in 1901, many of the results of which are published in Museum Bulletins 47, 68, 86 and 124. The Trichoptera are an important group economically, since there are numerous species occurring in all kinds of fresh waters throughout the State, some of them being exceedingly abundant and consequently of great value as food for fish and other aquatic life.

Substantial progress on the Monograph of the Stone Flies or Plecoptera has been made by Prof. James G. Needham. This is another study begun at the entomological field station mentioned above and will make an extensive addition to our knowledge of an important and comparatively unknown group of aquatic insects. These studies and those already published on aquatic forms comprise by far the most important additions to our knowledge of American aquatic insects.

The contributions this office has made to a natural history survey of the State are worthy of mention in this connection. The scope of these studies is indicated by the titles cited and the amount of work involved is suggested by the approximately 3500 pages of text with numerous illustrations devoted to the discussion of the various groups. The more important titles, aside from the long series of reports and bulletins treating of specially destructive forms, are listed below.

Entomological Contributions 1–4 by J. A. Lintner, appearing in the 23d, 24th, 26th and 30th Museum Reports, respectively, contain many and valuable additions to the knowledge of our local fauna.

Scale Insects of Importance and List of the Species in New York State, by the Entomologist, Museum Bulletin 46.

Aquatic Insects in the Adirondacks, by J. G. Needham and Cornelius Betten, Museum Bulletin 47. This contains comprehensive accounts of many aquatic forms.

Monograph of the Genus Saperda, by the Entomologist and L. H. Joutel, Museum Bulletin 74.

Mosquitos or Culicidae of New York State, by the Entomologist, Museum Bulletin 79.

Aquatic Insects in New York State, by J. G. Needham, A. D. MacGillivray, O. A. Johannsen and K. C. Davis, Museum Bulletin 68. This contains accounts of numerous aquatic forms with monographic discussions of several groups.

May Flies and Midges of New York State, by J. G. Needham, J. K. Morton and O. A. Johannsen, Museum Bulletin 86. The greater part of this bulletin deals with the Ephemeridae and Chironomidae and there is, in addition, a valuable paper on the Hydroptilidae.

Studies in Culicidae; Jassidae of New York State; List of Hemiptera Taken in the Adirondack Mountains, by the Entomologist, Herbert Osborn and E. P. Van Duzee, respectively, Museum Bulletin 97.

Catalogue of the "Phytoptid" Galls of North America; Report of the Entomological Field Station, Old Forge, 1905; New North American Chironomidae; Studies in Cecidomyiidae II, by G. H. Chadwick, J. G. Needham, O. A. Johannsen and the Entomologist, respectively, Museum Bulletin 124.

Catalogue of the Described Scolytidae of America North of Mexico, by J. M. Swaine, Museum Bulletin 134.

A Study of Gall Midges, Parts 1–4, by the Entomologist, in Museum Bulletins 165, 175, 180 and 186, portions of a monographic account of this large and important family.

Insects Affecting Park and Woodland Trees, by the Entomologist, Museum Memoir 8; contains many New York records relating to forest and shade tree insects.

Collections. The assembling and preparation of the enlarged exhibit of insects extended well into 1916, and owing to the large amount of time required, necessarily prevented very desirable work in the arrangement and classification of the reference collections. Additions to these are constantly being made, especially of specimens representing the early stages and work of various injurious forms, since biological material of this character greatly facilitates identification of the different insects and is indispensable in a well-prepared exhibit illustrating the life histories of different species. Several special collecting trips in connection with grasshopper or other investigations were made by Mr D. B. Young and resulted in securing a considerable number of very desirable specimens. The identification of this material, especially of the crane flies or Tipulidae, has been taken advantage of to rearrange this interesting and hitherto largely neglected family. The state collections now contain a large amount of material which is invaluable because of the associated data. Numerous microscopic preparations of smaller insects have been made and incorporated in the collections as in earlier years.

A number of very desirable additions have been made by exchange, notably those from Mr Paul B. Sears of Columbus, Ohio, Mr W. J. Chamberlin of Corvallis, Ore., and Mr J. R. Malloch of Urbana, Ill. The species acquired are listed with the other accessions.

The need of additional boxes or trays referred to in previous reports still exists. The wooden cases containing the insect collections should be replaced by steel cabinets and more provided to accommodate the extra boxes and trays required. No adequate provision has as yet been made for the constantly increasing biological material, which is also true of the large number of microscopic slides, many of them containing types of species and genera and therefore unique. A metallic filing case for the collection of negatives and photographs illustrating insects or other work is also greatly needed.

Office. The assistant state entomologist has been in charge of the office and responsible for correspondence and other matters during the absence of the Entomologist. The usual routine work, except as mentioned above, has fully occupied the time of various members of the staff.

Nursery inspection. The nursery inspection work of the State Department of Agriculture has resulted in a number of specimens representing various stages of insect development, some in very poor condition, being submitted to this office for identification. As such material may originate in a foreign country, determinations of this character are laborious and require for their successful prosecution a large collection and an excellent library of both domestic and foreign works. The correct identification of such material is important, since the disposal of an entire shipment of nursery stock must depend in considerable measure upon the character of the infestation.

General. The work of the office has been materially aided, as in past years, by the identification of a number of species through the courtesy of Dr L. O. Howard, chief of the Bureau of Entomology, United States Department of Agriculture, and his associates. There has been, as already stated, very effective cooperation with the State Department of Agriculture, a number of county farm bureaus and other public welfare agencies in the State. A number of correspondents have donated valuable specimens and many have rendered efficient service by transmitting local data respecting various insects. It is a pleasure to note that there has been, as in the past, a most helpful cooperation on the part of all interested in the work of the office.

Respectfully submitted

Ephraim Porter Felt

State Entomologist

October 16, 1916

INJURIOUS INSECTS

CODLING MOTH

Carpocapsa pomonella Linn.

The experimental work of last year, with particular reference to the serious injury caused by the codling moth in the western part of the State, was continued the past season, in cooperation with the Bureau of Horticulture of the State Department of Agriculture, and also with the Monroe county farm bureau. The orchards selected for the experiments were located through the courtesy of Messrs A. B. Buchholz of Albion and L. F. Strickland of Lockport, both agents of the State Department of Agriculture, and of Mr L. A. Toan of Rochester, manager of the Monroe county farm bureau. An effort was made, as last year, to secure orchards which promised a fairly good and uniform crop, and in the main we were successful though vagaries in setting of the fruit gave somewhat different yields from what was anticipated in some instances.

Satisfactory orchards were located in Monroe, Orleans and Niagara counties, and through the courtesy and cooperation of Messrs Fred W. Curtis, Hilton; H. E. Wellman, Kendall; A. G. Snyder, Albion; and G. H. Stahler, Newfane, every facility was placed at our disposal, these gentlemen agreeing to spray in substantial accordance with the plan of last year. In each case the man and the equipment on the place were used, the Entomologist supervising the operations. There were twenty experimental trees in each orchard, a few producing good crops, so that the manual labor involved in the actual sorting and classification was by no means small, and acknowledgments are due Messrs Toan, Buchholz, Strickland, L. H. Spooner and J. B. Achilles for assistance in the classification of the fruit in the orchards, the two last named aiding in the grading of the apples from all four experimental orchards.

Life history and habits. Before giving the details of the experimental work, the life history of the insect may well be outlined, since a knowledge of its habits is essential to satisfactory control work. The codling moth or apple worm winters in a tough, silken cocoon usually located in an oval cell under the rough bark of trees. The caterpillars transform to brown, apparently lifeless pupae in late April and early May, and the moths commence to emerge and continue to appear throughout the greater part of June. Cool evenings, that is a temperature below 60°, may delay egg laying considerably, which appears to be a somewhat important factor in the western part of the State. The minute, whitish eggs are deposited largely on the leaves though under certain conditions, as shown by our observations of last year and the past season, they may be more abundant on the young fruit. The eggs hatch in about a week and consequently the young larvae of the first brood may be entering the fruit from early in June, approximately three weeks after the blossoms fall, to the end of the month and even to the latter part of July. Some of these young caterpillars, especially those hatching from late-deposited eggs, have the habit of gnawing a small hole in the side of the fruit, excavating a circular gallery with a radius of approximately one-sixteenth of an inch, and then deserting this cavity and entering at the blossom end. This appears particularly likely to occur in the western part of the State during late June and early July and is very generally known as " side injury " (see plate 1) and is the type characterized in the tables below as " shallow." The caterpillars require about four weeks to complete their growth, at which time they desert the fruit, wander to a sheltered place, spin a cocoon, transform to pupae and in about two weeks, namely, the last of July or early in August, another brood of moths may appear. These in turn deposit eggs which hatch in due time and the young larvae enter the side of the fruit, especially where two apples touch or a leaf hangs against the apple, as well as at the blossom end. Two broods appear to be the rule in the northern fruit-growing section of the United States though some investigators claim a third in the southwest.

Time of injury. The apple grading and packing law has created a demand for information which may be useful in determining the time when any specific type of codling moth injury may have occurred, since some growers are inclined to believe that serious damage may be caused by this pest after the fruit is barreled. In the first place, a considerable proportion of the partly healed-over scars which are generally known as " side injury " or " shallow " (plate 1) and which are made by the newly hatched caterpillars working for a few days just under the skin and then deserting the initial point of injury, is the work of the first brood, and almost invariably in the case of fall and winter fruit in particular, the damage occurs upon the tree, though under very exceptional conditions there may be a little injury of this type after the fruit is picked and, in such a case, must come from eggs deposited by second brood codling moths.

The injury after barreling in New York State is, in our estimation, confined mostly to the rather large side worm holes (plate 2) which are made by partly-grown or full-grown caterpillars leaving one apple or entering another either at the side or blossom end. These late injuries after picking time, unless the examination is greatly delayed, usually give some indication of recent work, such as partly dried, hanging borings and possibly the presence of active caterpillars. In any event, if material injury occurred after barreling, living caterpillars in some numbers should be found in the barrel or near the fruit if it is not in a tight container. The absence of such living larvae would be almost indubitable evidence of the mischief having been done before the fruit was placed in storage and probably before it was picked.

The distinction between first brood and second brood codling moth injury is not particularly vital, so far as the apple packing law is concerned, except that very little or no such injury would occur on late fall and winter fruit after picking and not much in all probability on the summer and early fall apples. Most of the partly grown larvae found in winter apples at picking time belong to the second brood, while those fully developed may have come from late-deposited eggs of the first brood, much depending upon the season. A scrutiny of the injury at this time, even if no larvae are present, is of some service in enabling one to decide whether it is moderately recent and therefore the work of the second brood or older and presumably caused by first brood larvae.

EXPERIMENTAL WORK

Kendall Orchard

The experiments of last year were continued in the greening orchard of Mr H. E. Wellman of Kendall. It is located north of the house and is bounded on the west by a highway, a rather well-marked drive on the south and extends north to another highway. Eleven trees lie between the experimental plots and the western highway.

Plots 1, 2 and 3 were located as last year, plot 1 being three trees north from the southern margin, plot 2 nine trees north, and plot 3 fifteen trees north. The check trees of last year were 22 trees north, while this year the trees X and Y were 20 and 21 trees north respectively, the change being necessitated by irregularities in fruiting. Two rows on each side of the experimental trees were used as barriers. The orchard is about 40 years old, the trees being set 33 by 33 feet and large enough so that the branches are moderately close but not so near as to prevent satisfactory spraying.

The first application was made June 1st, using 18 pounds of Dow's arsenate of lead and 7 gallons of Dow's lime-sulphur wash to 250 gallons of spray. The application was very thorough, 250 gallons being used on 22 trees, or upwards of 10 gallons a tree. The spraying began about 2 o'clock and continued until after 6 o'clock, at which time the western trees in the experimental plots were all sprayed, except trees D and F of plot 3, and the western side of the eastern trees was similarly treated. Owing to the lateness of the hour the remainder of the trees were not sprayed till the next morning. The pressure was maintained at about 200 pounds. One man stood on a 11 foot tower and the other on the ground, the latter man provided with 50 feet of hose, and both equipped with 10 foot extensions. About three-fourths of the blossoms were off at the time of spraying, the bloom was very uniform and rather abundant and the day bright, moderately warm and with a light, shifting breeze. Mr Wellman stated that the two rows in which the experimental trees were located were also sprayed in the pink of the bloom for the purpose of controlling scab and leaf roller, and that the seven trees at the south end of the eastern row, namely trees B, D and F of plot 1, were not treated. Considerable of this application was washed off as a result of heavy rains shortly after the treatment. He also stated that the two rows west of the experimental trees were sprayed with scalecide after the leaves had started to some extent, in an effort to control the leaf roller. These rows showed some burning of the foliage.

The man on the tower covered the top of one tree and touched up the inner side of the windward row, while the man on the ground went around the tree and also touched up the inner side of the windward row. The distribution of the spray was very uniform, there being practically no unsprayed areas and almost no overloading of the foliage, though considerable more spray was used to each tree than last year.

The second spraying of plots 2 and 3 was given June 21, 7 gallons of lime-sulphur wash and 18 pounds of Dow's arsenate of lead to 250 gallons being used. The work began at 2.30 p. m., with the first two trees north of plot 1, these being sprayed mostly on the north side on account of the great danger of the breeze carrying the spray back onto the experimental trees of plot 1. There were 250 gallons used on 21 trees and the work was completed by 4.40 p. m. The application was very thorough and the spray dried rapidly. There was practically no burning of the foliage on the greening trees in this orchard, though Baldwins standing on either side and sprayed at the same time showed some though not an excessive amount of injury. Green fruit worms were noticeably scarcer than in 1915.

Plot 3 was sprayed for the third time August 5th, 20 pounds of Dow's arsenate of lead being used to 250 gallons of water, to which was added lime-sulphur as before. This amount sufficed for the treatment of 23 trees.

Kendall orchard, plot 1 (sprayed once), 1916

TREE		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shal-low	Side August
A	No........	1 740	936	538	215	185	7	62	60	56
	Per cent....	....	53.79	30.92	12.35	10.63	....	3.63	3.44	3.21
B	No........	1 987	1 050	533	323	153	2	38	80	41
	Per cent....	....	52.89	26.82	17.26	7.70	....	1.91	4.26	2.06
C	No........	581	335	89	134	51	....	13	30	14
	Per cent....	....	57.66	15.32	23.06	8.77	....	2.23	5.16	2.40
D	No........	1 746	927	327	415	186	1	31	113	59
	Per cent....	....	53.09	18.73	23.75	10.65	....	1.77	6.47	3.37
E	No........	496	271	66	112	68	2	6	41	19
	Per cent....	....	54.63	13.30	22.49	13.50	....	1.20	8.26	3.83
F	No........	284	161	43	71	19	....	3	15	1
	Per cent....	....	56.61	15.14	24.86	6.69	....	1.05	5.28	....
Total........		6 834	3 680	1 596	1 270	662	12	153	339	190
Per cent......		....	53.84	23.35	18.58	9.68	0.17	2.23	4.96	2.78

It will be seen from the preceding tabulation that the yield of trees in plot 1 ranged from 284 to 1987, a rather wide variation which is not accompanied by a corresponding difference in the number of wormy apples. The percentages of the latter on individual trees varies from 6.69 to 13.50, the lowest percentage being upon one of the least fruitful trees, contrary to the usual rule. The average percentage of wormy apples for the plot was 9.68, a marked contrast to the 27.67 per cent of wormy fruit obtained from these trees in 1915. It should be noted that approximately half of the apples on the entire plot had the characteristic side injury or "shallow" wound produced by larvae hatching from late-deposited eggs entering the fruit, making the characteristic circular gallery just under the skin and then deserting the initial point of attack. The damage resulting from end wormy infestations was almost negligible, it averaging for the plot less than one-fifth of 1 per cent.

Kendall orchard, plot 2 (sprayed twice) 1916

TREE		TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shallow	Side August
A	No.	881	586	93	159	69	....	6	47	17
	Per cent.	....	66.51	10.55	18.03	7.83	....	....	5.33	1.92
B	No.	397	259	19	100	30	2	3	30	4
	Per cent.	....	65.24	4.78	25.16	7.55	....	....	7.55	1.00
C	No.	991	605	132	191	88	1	16	51	16
	Per cent.	....	61.05	13.31	19.27	8.88	....	....	5.14	1.61
D	No.	303	215	22	54	17	....	3	11	4
	Per cent.	....	70.99	7.26	17.82	5.61	....	....	3.63	1.32
E	No.	73	51	5	7	12	....	2	7	3
	Per cent.	....	69.86	6.84	9.67	16.43	....	....	9.67	4.10
F	No.	419	283	19	77	50	....	4	34	13
	Per cent.	....	67.54	4.53	18.35	11.93	....	....	8.11	3.10
Total		3 064	1 999	290	588	266	3	34	180	57
Per cent.		....	65.20	9.46	19.19	8.68	0.09	1.10	5.87	1.20

The yield of plot 2 was approximately half of that in plot 1 and amounted to 3064 apples, the number to each tree ranging from 73 to 991 and the percentage of wormy fruit varying from 5.61 to 16.43, the highest in this instance being on a tree producing only 73 apples. Here, as in the preceding plot, a very large proportion of the apples damaged showed the characteristic " shallow " type of injury produced by late-hatching larvae. The fruit infested by the codling moth in this plot amounted to 8.68 per cent. This second application shows a marked increase in the perfect fruit and a corresponding decrease in the number of scabby apples, the difference being really more marked than indicated by the figures, since many of the scabby apples were decidedly less infected than was the case with the fruit from plot 1.

Kendall orchard, plot 3 (sprayed three times) 1916

TREE		TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shallow	Side August
A	No.	90	60	....	17	15	....	....	12	3
	Per cent	....	66.66	....	18.88	16.66	....	....	13.33	3.33
B	No.	278	180	34	27	48	1	3	48	10
	Per cent	....	64.74	12.23	9.71	17.26	....	1.07	17.26	3.59
C	No.	147	98	8	25	24	....	2	14	8
	Per cent	....	66.66	5.44	17.00	16.32	....	1.36	9.52	5.44
D	No.	471	338	12	74	58	1	3	46	6
	Per cent	....	71.75	2.54	15.71	12.31	....	0.63	9.76	1.27
E	No.	131	91	3	23	16	....	....	15	2
	Per cent	....	69.46	2.29	17.55	12.21	....	....	11.45	1.52
F	No.	333	240	16	36	46	....	1	40	5
	Per cent	....	72.07	4.77	10.81	13.84	....	0.30	12.12	1.50
Total		1 450	1 007	73	202	207	2	9	175	34
Per cent		....	69.44	5.03	13.93	14.27	0.13	0.62	12.06	2.35

The yield from plot 3 is decidedly lower than in the case of either plots 1 or 2, the product of individual trees ranging from 90 to 471 apples, while the percentage of wormy fruit varied from 12.21 to 17.26, the average for the plot being 14.27 per cent. This higher percentage of wormy fruit is correlated to a certain extent with the much smaller crop in comparison with the other two plots. Here, as in the preceding plots, a very large percentage of the wormy fruit, namely 12.06 of the 14.27 affected, showed the characteristic "shallow" injury due to the work of larvae coming from late-deposited eggs. There is a marked gain in the percentage of perfect fruit and a corresponding decrease in the scabby apples, a condition not adequately expressed by the figures, since the infected areas on the apples from plot 3 were decidedly less than those on plot 2 and much smaller than in the case of plot 1.

Kendall orchard, checks (unsprayed) 1916

TREE		TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shallow	Side August
X	No.	389	168	160	54	43	3	7	30	7
	Per cent	....	43.16	41.13	13.87	11.05	0.76	1.79	7.71	1.79
Y	No.	599	209	294	111	86	4	12	59	14
	Per cent	....	34.87	49.08	18.53	14.35	0.60	2.00	9.84	2.33
Total		988	377	454	165	129	7	19	89	21
Per cent		....	38.15	45.95	16.59	13.05	0.70	1.72	9.00	2.12

The check trees bore 389 and 599 apples, respectively, the percentage of wormy fruit being 11.05 and 14.35, respectively, a marked change from the 60.59 and 68.52 per cent of wormy fruit of the nearby check in the experiments of 1915. The end-wormy apples on these two trees were comparatively few, while by far the greater number showed the characteristic " shallow " type of injury and this alone indicates that this method of feeding is not affected to any material extent at least, by the spraying of the season during which the damage occurs.

Kendall orchard, summary of plots 1916

PLOT	TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
					Total	End	Side July	Shallow	Side August
1 Total	6 838	3 680	1 596	1 270	662	12	153	339	190
Per cent	....	53.84	23.35	18.58	9.68	.17	2.23	4.96	2.78
2 Total	3 064	1 999	290	588	266	3	34	180	57
Per cent	....	65.20	9.46	19.19	8.68	.09	1.10	5.87	1.20
3 Total	1 450	1 007	73	202	207	2	9	175	34
Per cent	....	69.44	5.03	13.93	14.27	.13	.62	12.06	2.35
1–3 Total	11 352	6 686	1 959	2 060	1 135	17	196	694	281
Per cent	....	58.98	17.24	18.15	10.01	.15	1.72	6.11	2.47
Two special Total	1 354	786	201	263	172	7	15	132	18
Per cent	....	58.05	14.87	19.42	12.70	.51	1.10	9.82	1.32
Checks Total	988	377	454	165	129	7	19	89	21
Per cent	....	38.15	45.95	16.59	13.05	.70	1.72	9.00	2.12

A study of the summary of the plots gives in brief compass an idea of the results obtained. It will be noted, first of all, that the yields of plots 1, 2 and 3 decreased, each, as was true last year, being about one-half smaller than the preceding and that there is a higher percentage of wormy fruit on plot 3 than in the case of either plots 1 or 2, this apparent anomaly being due, in our estimation, to the much smaller crop on plot 3. There is a constant increase in the percentage of perfect fruit between plots 1 and 3, this being due in large measure to a reduction in the amount of scabby fruit, a condition by no means adequately expressed by the figures, since the scabby areas were decidedly smaller on the apples of plot 3.

Compared with the check or unsprayed trees, these three plots show a very marked improvement in the amount of perfect fruit and a substantial though by no means so striking a difference in the number of wormy apples. This is probably due not only to the very small crop on plot 3, but also to the fact that the thorough spraying of last year may have aided materially in reducing the number of codling moths which were able to winter and breed upon the trees this year. It is worthy of note in passing that the percentages of perfect and scabby fruit and also of apples injured by the leaf roller and the codling moth for the three sprayed plots, do not vary widely from the results secured from two special trees farther north on the experimental rows. These trees were not sprayed under supervision and presumably received about the same treatment as those in the plots. The fruit was classified simply for the purpose of comparing the yields from trees bearing a moderate crop with those showing a light fruitage.

Kendall orchard, comparison of plots, 1915 and 1916

PLOT	TOTAL FRUIT		PERFECT		WORMY		SIDE JULY[1]	
	1915	1916	1915	1916	1915	1916	1915	1916
1 Total	5 598	6 838	2 107	3 680	1 549	662	1 419	492
Per cent	......	......	37.63	53.84	27.67	9.68	25.34	7.19
2 Total	2 847	3 064	1 092	1 999	901	266	837	214
Per cent	......	......	38.35	65.20	31.64	8.68	29.36	6.97
3 Total	1 683	1 450	589	1 007	582	207	564	184
Per cent	......	......	34.99	69.44	34.52	14.27	33.51	12.68
Checks								
Total	651	988	63	377	430	129	373	108
Per cent	......	......	9.52	38.15	67.58	13.05	57.29	10.72

[1] This includes the side July and " Shallow " of the 1916 classification.

The same trees were used in this orchard for plots 1–3 in both 1915 and 1916 and the above comparison is therefore of more than usual interest. In the first place it should be noted that there is no very wide divergence between the yields of the trees in the various plots during these two years, though the crop on the check trees in 1916 was somewhat larger than that for 1915. It will be noted that there is a substantial increase in both the number and the percentage of perfect apples on the three plots and the check trees, and a marked decrease in both number and percentage of wormy apples and those classed as " side July " (these are included in the wormy and are separated for the purpose of comparing the results obtained with one type of injury) in all three plots, the reduction in the wormy fruit of both classes amounting approximately to from one-third to two-thirds of the infested apples. This is true of the check trees as well as of those sprayed, and here the relatively low percentage of wormy fruit is undoubtedly due in part to the fact that the check trees of 1916 had been sprayed in 1915 as thoroughly or nearly as thoroughly as the experimental trees. Too much importance should not be attached to this, since the entire orchard had been sprayed for several years before and the probabilities are that the codling moth infestation in this orchard the past season was not so serious as in 1915. The comparison between the two years is, on its face, most gratifying and a portion of the gain at least can be legitimately ascribed to the thorough work of the preceding year; if this is the case a further improvement should be noted next season.

The close relation existing between the reduction in the percentage of wormy apples and the percentage showing the "side July" type of injury (this latter including the "side July" and the "shallow" of the 1916 classification) is shown by the fact that the ratio between the percentage of wormy of 1915 and "side July" of that year is very nearly the same as the ratio existing between the wormy for 1916 and the "side July" of 1916. This is true not only of plot 1 but also of plots 2 and 3 and the check trees. Furthermore, a similar ratio between the percentage of wormy of 1916 for plots 1 and 2 is very nearly the same as the ratio existing between the "side July" affected fruit for the same year, and this also holds with remarkable closeness between plots 2 and 3. These relationships are another indication that the reduction in the "side July" wormy fruit closely parallels that of the total wormy.

Albion Orchard

This is a fine king orchard about 2½ miles northeast of Albion and belonging to Mr A. G. Snyder. These trees are about 40 years old, set 40 feet apart and are in a good, thrifty condition.

Three plots and one check tree were selected as follows:

Plot 1 consists of trees 1 and 2 north from the southern boundary of the orchard and trees 1, 2 and 3 west from the eastern boundary or adjacent highway.

Plot 2 consists of trees 4 and 5 north and trees 1, 2 and 3 west.

Plot 3 consists of trees 8 and 9 north and 1, 2 and 3 west, except that tree C in row 9 was replaced by a tree in row 10 directly north of tree A.

The check tree was 5 trees west, and 1 tree north from the southeastern corner, there being a vacancy in this row where tree 4 should stand.

Plots 1–3 were sprayed May 31st under the supervision of Mr A. B. Buchholz, nursery inspector, with Swift's arsenate of lead and a lime-sulphur wash in substantially the same proportions as later.

The second spraying was given June 21st, with Riches's and Pivers's 15 per cent arsenate of lead at the rate of 12 pounds to 200 gallons of water, and lime-sulphur wash, 33° Baumé, at the rate of 1 to 40 or $5\frac{1}{4}$ gallons to 200 gallons of water. In this latter treatment one man stood on the tower and one on the ground and the application was extremely thorough. Plot 2 was sprayed on both sides, while the trees in plot 3 had been sprayed on the west side June 17th. The spraying began about 8 o'clock in the morning and was finished by 9 at the beginning of a moderate rain which started gently before the last trees which were sprayed could have dried, and continued for a period, being rather heavy until 11.30. It is probable that no very great amount of poison was washed from the trees by this rain.

The third spraying occurred August 3d, Riches's and Pivers's arsenate of lead being used at the rate of 6 pounds to 100 gallons of water, with a home-made lime-sulphur wash. This application was confined to plot 3 and was made under the supervision of Mr Buchholz.

Albion orchard, plot 1 (sprayed once) 1916

TREE		TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shallow	Side August
A	No.	1 076	90	951	41	108	......	42	38	28
	Per cent	......	8.36	88.38	3.81	10.04	......	3.90	3.53	2.60
B	No.	857	59	774	17	91	1	32	35	23
	Per cent	......	6.88	90.31	1.98	10.61	......	3.73	4.08	2.88
C	No.	1 043	96	899	45	109	2	48	48	11
	Per cent	......	9.21	86.19	4.31	10.45	......	4.60	4.60	1.05
D	No.	1 103	99	970	48	104	......	37	63	4
	Per cent	......	8.98	87.94	4.34	9.43	......	3.35	5.71	0.36
E	No.	907	70	794	130	94	2	41	33	18
	Per cent	......	7.71	87.54	14.33	10.35	......	4.52	3.63	1.98
F	No.	769	148	571	19	100	5	37	50	8
	Per cent	......	19.24	74.25	2.44	13.00	......	4.82	6.51	1.04
Total		5 755	562	4 959	300	606	10	237	267	92
Per cent		......	9.77	86.16	5.23	10.53	0.17	4.10	4.62	1.59

Plot 1, it will be seen from the above tabulation, produced a moderately uniform crop, the number of apples ranging from 769 to 1103, while the wormy fruit varied from 91 to 108. The percentage of infested apples exhibits no great variation, the lowest being 9.43 and the highest 13. The last, as might be expected, was found on the tree producing the smallest crop. There is likewise comparatively little variation in either the number or percentage of perfect fruit, except in the case of tree F, and the same is true of the number and percentage of scabby apples. The number of apples showing the typical "shallow" type of injury ranges from approximately one-third to over one-half of the wormy fruit, the average for the plot being a little below one-half.

Albion orchard, plot 2 (sprayed twice) 1916

TREE		TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shallow	Side August
A	No.	298	105	168	9	34	....	12	21	2
	Per cent	....	35.23	56.37	3.02	11.41	....	4.02	7.05	.67
B	No.	593	175	390	4	44	....	10	26	8
	Per cent	....	29.51	65.76	.07	7.42	....	1.68	4.38	1.35
C	No.	453	120	280	16	52	1	16	34	1
	Per cent	....	26.49	61.81	3.53	11.47	....	3.53	7.44	.....
D	No.	680	260	350	24	86	....	23	57	6
	Per cent	....	38.23	51.47	3.53	12.64	....	3.38	8.38	....
E	No.	987	85	863	26	127	....	44	77	6
	Per cent	....	8.61	87.43	2.62	12.86	....	4.46	7.80	....
F	No.	466	120	328	12	41	1	10	30	....
	Per cent	....	25.75	70.40	2.57	8.80	....	2.14	6.43	....
Total		3 477	865	2 388	91	384	2	115	245	23
Per cent		....	24.87	68.68	2.62	11.04	....	3.30	7.04	.66

Plot 2 produced a smaller crop than plot 1 and shows a relatively greater variation in the yield, the product of individual trees ranging from 298 apples to 987 and the wormy fruit varying from 34 to 127 apples, the percentage ranging from 7.42 to 12.86, this last occurring on the tree producing the greatest quantity of fruit. This particular tree stood by the roadside and it is possible that its proximity to the fence may have interfered to some extent with the thoroughness of the spraying. The number of apples showing the "shallow" type of injury is larger than in the preceding plot, it varying for individual trees from 21 to 77 apples, and the percentage ranging from 4.38 to 8.38. Approximately two-thirds of the wormy apples on this plot were injured in this manner.

Albion orchard, plot 3 (sprayed three times) 1916

TREE		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shal-low	Side August
A	No.	1 068	290	733	23	77	....	14	62	1
	Per cent	....	27.15	68.63	2.15	6.98	....	1.31	5.80	....
B	No.	699	183	482	17	89	4	27	53	7
	Per cent	....	26.18	68.95	2.43	12.73	....	3.86	7.57	....
C	No.	1 139	384	709	18	77	....	18	53	6
	Per cent	....	33.71	62.24	1.58	6.76	....	1.58	4.65	......
D	No.	1 090	150	894	30	100	1	27	64	8
	Per cent	....	13.76	82.18	2.75	9.20	....	2.47	5.87	....
E	No.	1 618	360	1 185	56	103	1	22	79	1
	Per cent	....	22.25	73.23	3.46	6.36	....	1.36	4.88	......
F	No.	805	73	698	23	94	....	23	70	1
	Per cent	....	9.06	86.70	2.85	11.62	....	2.85	8.69	....
Total		6 419	1 440	4 701	167	540	6	131	381	24
Per cent		....	24.43	73.23	2.60	8.41	.09	2.04	5.93	.37

The yield of plot 3 approximates closely that of plot 1, though there is a somewhat greater variation in the yield of individual trees, this ranging from 699 to 1618. There is a considerable variation in the number and percentage of perfect and scabby fruit. There is no great variation in the number of wormy apples to each tree, these ranging from 77 to 103, while the percentage of such fruit varies from 6.36 to 12.73, the smallest being on the tree producing next to the largest crop. There is a somewhat larger number of apples showing the " shallow " type of injury, as compared with the other plots, this varying for individual trees from 53 to 79 and comprising for the plot, approximately two-thirds of the wormy apples.

Albion orchard, summary of plots, 1916

PLOT		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shal-low	Side August
1	Total	4 755	562	4 959	300	606	10	237	267	92
	Per cent	....	9.77	86.16	5.23	10.53	.17	4.10	4.62	1.59
2	Total	3 477	865	2 388	91	384	2	115	245	23
	Per cent	....	24.87	68.68	2.62	11.04	....	3.30	7.04	.66
3	Total	6 419	1 440	4 701	167	540	6	131	381	24
	Per cent	....	24.43	73.23	2.60	8.41	.09	2.04	5.93	.37
1–3	Total	15 651	2 867	12 131	558	1 530	18	483	893	139
	Per cent	....	18.42	77.50	3.56	9.77	.11	3.08	5.09	.88
Check tree										
	Total	643	....	605	12	201	37	102	51	1
	Per cent	....	....	94.07	1.86	31.25	5.75	15.86	7.93	1.7

An examination of the above summary shows that plot 2 produced a light crop and that while there is a progressive increase in the number of perfect apples on the plots sprayed once, twice and three times, there is not for some reason or other an equally good showing in percentage returns. This improvement, as might be expected, is largely due to the more efficient control of scab as a result of the later applications. The figures do not adequately express the true condition of affairs, since many apples counted as scabby on plot 3 showed very much less infection than was the case with plot 2 and even more so of plot 1. The percentage of total wormy fruit for the three plots is about as might be expected after making allowance for the smaller yield of plot 2 and the heavier crop of plot 3, and although the percentage would appear to indicate a marked reduction in wormy apples on trees sprayed three times, yet we believe this variation may be explained, in considerable measure at least, by the larger number of apples. The variation in total wormy, both in number and percentage, corresponds fairly closely with the number and per cent of apples showing the "shallow" type of injury.

The significance of this summary can best be appreciated by comparing the data with those obtained from the check tree with its total absence of perfect fruit, its 94 per cent of scabby apples and over 31 per cent codling moth infestation. It will be noted that the end-wormy apples on this tree amounted to 5.75 per cent, while on the sprayed plots this percentage was cut down to less than one-fifth of 1 per cent and lower. It is worthy of note that the percentage and relative number of apples showing the "shallow" type of injury on the check trees does not vary greatly from that on plots 1–3, plainly indicating that repeated poison applications are of little value in preventing blemishes of this kind for the season in which the application is made.

Hilton Orchard

A series of experimental plots were located June 1st in the Baldwin orchard of Mr Fred W. Curtis, Hilton, N. Y. The trees are about 30 years old and stand at an approximate distance of 30 feet from one another. The orchard is somewhat uneven, some trees being missing and, generally speaking, pear trees have been interplanted. The Baldwins were mostly well loaded with blossoms and owing to an occasional missing tree the plots are somewhat irregular.

The experimental orchard was on the north side of the road east of the barn and the numbering began with the easternmost row and ran west, the trees in the rows being numbered from the road northward.

Plot 1 began on row 9 with the third apple tree north from the road, and on row 10 with the second apple tree north, these being trees 1 and 3, respectively, while trees 2, 4, 5 and 6 were the third, fourth and sixth apple trees, respectively, on the ninth row.

Plot 2, trees 1 and 5 were the sixth and seventh apple trees, respectively, north from the road on row 10, and trees 2, 3, 4 and 6 were the eighth, ninth, tenth and eleventh apple trees, respectively, north from the road on row 9.

Plot 3, trees 1, 3 and 5 were the third, fourth and fifth apple trees, respectively, north from the road on row 15, while trees 2, 4 and 6 were the third, fourth and fifth apple trees, respectively, north from the road on row 14.

The check tree was the seventh apple tree north from the road in row 15. North of the check tree were a series of greenings.

The first spraying was begun June 1st. Thompsen's BT dry soda-sulphur was used at the rate of 3 pounds to 50 gallons of water, and 4 pounds of Niagara arsenate of lead was added. The blossoms were mostly off, fully 98 per cent having dropped. One man sprayed all the trees from the top of the tank, the tops being hit only by drift in the case of the larger trees. The application was fairly thorough though there probably was a little missed here and there. At 12 o'clock all the plots had been sprayed except the southern six apple trees on row 9, and these Mr Curtis finished up early in the afternoon. The day was ideal, bright and sunny and with only a light breeze. Mr Curtis stated that the orchard had been sprayed for years and that he had experienced comparatively little trouble from side-worm injury.

The second spraying began about 9.30 June 22d and was completed at 10.40. Thompsen's paste arsenate of lead was used at the rate of 3 pounds to 50 gallons of water and Thompsen's lime-sulphur wash at the rate of 1 to 45. At this time some burning of the leaves was evident, though in most cases the damage was not serious. Mr Curtis stated that in each instance this had followed an application June 5th or 6th, made only a few days after the exceptionally heavy rains of June 1st and 2d. The Baldwins at this time had a diameter of one-half to three-fourths of an inch and showed a marked fuzziness. There was abundant fruit on the check tree and considerable fungus though the foliage was not in markedly poorer condition than that on plot 3. Mr Curtis stated that tree 3 of plot 3 was sprayed from the east side after June 1st by mistake and the considerable burning on the east side of that tree substantiated his statement and illustrated in a striking manner the connection between excessive precipitation and the danger of burning. Tree 3 of plot 1 was sprayed by mistake on the west side June 22d. Neither of these applications appear to have had any material influence upon the yield as will be seen by referring to the tabulated data below.

The third spraying was given August 3d, 3 pounds of arsenate of lead paste to 50 gallons of water and lime-sulphur diluted at the rate of 1 to 45 being used. Between 190 and 200 gallons of mixture were applied at a pressure of 175 pounds. The work was done under the supervision of Mr L. A. Toan.

Hilton orchard, plot 1 (sprayed once) 1916

TREE		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shal-low	Side August
1	No.	796	36	745	151	160	9	77	54	20
	Per cent	....	4.52	93.59	18.97	20.10	1.13	9.67	6.78	2.51
2	No.	823	10	799	111	183	5	114	52	12
	Per cent	....	1.21	97.08	13.48	22.24	.60	13.85	6.31	1.45
3	No.	268	14	247	31	58	6	21	27	4
	Per cent	....	5.22	92.16	11.57	21.64	2.23	7.83	10.07	1.49
4	No.	741	74	646	85	128	2	38	69	20
	Per cent	....	9.98	87.17	11.47	17.27	.26	5.12	9.31	2.69
5	No.	593	65	494	102	104	5	31	63	5
	Per cent	....	10.86	82.58	17.03	17.37	.83	5.17	10.52	.83
6	No.	1 694	167	1 483	171	230	4	76	128	23
	Per cent	....	9.88	87.54	10.14	13.58	.23	4.48	7.55	1.35
Total		4 915	366	4 414	651	863	31	357	393	84
Per cent		....	7.44	89.80	13.27	17.55	0.63	7.26	7.99	1.70

The trees in plot 1 show a great variation in yield, this ranging from 268 to 1694 apples and there is nearly as wide a variation in the amount of perfect fruit, the percentage of scabby apples running high and in no case falling below 82.58. The total wormy apples vary from 13.58 to 22.24 per cent, the smallest being on the most fruitful tree and the largest on the one producing the next heaviest yield. The proportion of " shallow " affected apples runs from approximately one-third to one-half of the total wormy, being somewhat lower than in other orchards.

Hilton orchard, plot 2 (sprayed twice) 1916

TREE		TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shallow	Side August
1	No.	1 221	160	986	92	187	4	66	101	16
	Per cent	....	13.10	80.75	7.53	15.32	.32	5.40	8.27	1.31
2	No.	706	66	594	41	148	5	55	85	2
	Per cent	....	9.34	84.13	5.80	20.96	.70	7.97	12.04	.28
3	No.	566	33	513	46	80	1	29	46	4
	Per cent	....	5.83	90.63	8.12	14.13	.17	5.12	8.12	.70
4	No.	659	87	532	54	108	3	39	60	8
	Per cent	....	13.20	80.73	8.19	16.38	.45	5.91	9.10	1.21
5	No.	735	100	596	59	94	2	29	58	7
	Per cent	....	13.60	81.08	8.02	12.78	.27	3.94	7.89	.95
6	No.	535	48	465	47	93	....	34	55	4
	Per cent	....	8.97	86.91	8.78	17.38	....	6.35	10.29	.74
Total		4 422	494	3 686	339	710	15	252	405	41
Per cent		....	11.17	83.35	7.66	16.05	.33	5.69	9.15	.92

The crop in plot 2 was more even than in the preceding, the individual trees producing from 535 to 1221 apples, the perfect fruit ranging from 48 to 160 and the percentage of the wormy apples varying from 12.78 to 20.96. This latter variation follows no definite rule and is somewhat anomalous. The "shallow" affected fruit approximates a little over one-half of the total wormy and in this respect approaches closely the conditions obtaining in plot 3.

Hilton orchard, plot 3 (sprayed three times) 1916

TREE		TOTAL FRUIT	PERFECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shallow	Side August
1	No.	1 229	205	922	74	186	4	23	139	20
	Per cent	....	16.68	75.02	6.02	15.13	.33	1.87	11.31	1.62
2	No.	1 894	305	1 462	80	305	2	106	181	16
	Per cent	....	16.10	77.19	4.23	16.10	.10	5.59	9.55	.84
3	No.	1 768	334	1 274	125	210	4	53	128	26
	Per cent	....	18.89	72.05	7.07	11.87	.22	2.99	7.23	1.47
4	No.	1 737	321	1 278	116	218	4	39	158	17
	Per cent	....	18.48	73.57	6.67	12.55	.23	2.24	9.09	.97
5	No.	1 442	269	1 056	135	127	1	18	96	12
	Per cent	....	18.65	73.23	9.36	8.80	.07	1.24	6.65	.83
6	No.	1 828	385	1 307	160	196	2	53	135	6
	Per cent	....	21.06	71.49	8.75	10.72	.10	2.89	7.38	.32
Total		9 898	1 819	7 299	690	1 242	17	292	837	97
Per cent		....	18.37	73.74	6.98	12.54	.17	2.95	8.45	.99

The yield of plot 3 was considerably larger than that of the two preceding, amounting to nearly 10,000 apples, the range for individual trees being from 1229 to 1828, while the perfect fruit varied from 205 to 385 apples. The lowest percentage of wormy apples was 8.80 and the highest in this plot 16.10, the average being 12.54. The " shallow " injured fruit varied from approximately one-half to three-fourths of the total wormy, the average for the plot being two-thirds.

Hilton orchard, summary of plots, 1916

PLOT		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY				
						Total	End	Side July	Shal-low	Side August
1	Total	4 915	366	4 414	651	863	31	357	393	84
	Per cent	....	7.44	89.80	13.27	17.55	.63	7.26	7.99	1.70
2	Total	4 422	494	3 686	339	710	15	252	405	41
	Per cent	....	11.17	83.35	7.66	16.05	.33	5.69	9.15	.92
3	Total	9 898	1 819	7 299	690	1 242	17	292	837	97
	Per cent	....	18.37	73.74	6.98	12.54	.17	2.95	8.45	.99
1–3	Total	19 235	2 679	15 399	1 680	2 815	63	901	1 635	222
	Per cent	....	13.93	80.05	8.75	14.64	.33	4.69	8.51	1.16
Check										
	Total	3 423	88	3 299	274	372	12	125	203	33
	Per cent	....	2.57	96.37	8.00	10.87	.35	3.65	5.93	.96

The summarized tabulation shows a decidedly heavier crop on plot 3 with a corresponding increase in the percentage of perfect apples and a marked decrease in the percentage of scabby apples, this latter ranging from nearly 90 per cent in the case of plot 1, to $83\frac{1}{3}$ per cent for plot 2, and $73\frac{3}{4}$ per cent for plot 3. These figures should be compared with the $96\frac{1}{3}$ per cent of scabby fruit on the check trees. There is also a marked decrease in the percentage of wormy fruit in plots 1–3, though this is to be explained to some extent, at least, by the fact that the yield on plot 3 was nearly equal to that of plots 1 and 2 combined, thus the apparent benefit from the third spraying must be reduced considerably if we make allowance for this factor. The proportion of " shallow " injured fruit is a little less than one-half the total wormy for plot 1, a little over one-half for plot 2 and a little over two-thirds of the total wormy for plot 3, which would indicate no great reduction in this type of injury as a result of the later sprayings. The average percentage of wormy fruit for the three plots is 14.64 and this makes a poor comparison with the 10.87 per cent of wormy fruit on the one check tree, which latter, it should be noted, produced 3423 apples, a decidedly larger crop than that from any of the sprayed trees. This large yield explains in considerable measure the low percentage of wormy fruit on the check trees. There is no question but what material benefits in the control of the codling moth were obtained in this orchard though the large variation in the yields of different plots, and especially of the check trees, makes a fair comparison impossible. It is interesting to note that the proportion of " shallow " injured fruit on plots 1–3, as compared with the total wormy, does not vary greatly from the proportion on the unsprayed tree.

Newfane Orchard

This work was conducted in cooperation with Mr G. H. Stahler of Newfane, his orchard being located close to the stop known as Jacques road. The trees are Baldwins, about 40 years old, set approximately 38 feet apart and stand in sod. The orchard has had a reputation of producing large crops of apples and is in good condition.

Plot 1 was located on the eighth and ninth rows from the west side and comprised the eighth, ninth and tenth trees from the south end.

Plot 2 was located on the fourteenth and fifteenth rows from the west side and comprised the ninth, tenth and eleventh trees from the south.

Plot 3 was in the same rows and comprised the fourth, fifth and sixth trees from the south.

The check trees were on the eighth and ninth rows near plot 1 and were the twelfth from the south end, there being only one tree intervening between the northern trees of plot 1 and the check trees.

The first application was made with the wind on the morning of June 2d, the day being sunny and with light and fitful breezes. One man sprayed from the top of the tank, using three nozzles which delivered the spray in nearly parallel lines. The work was continued until there was some dripping and the application was made only with the wind. The blossoms were all off and the stamens shriveled although there was no closing of the petals. The work started with one spraying outfit, a pressure of 150 pounds being used and the application being made to the east side of trees 1, 3 and 5 of plot 1, and then owing to engine troubles another spraying outfit was substituted with a continuance of the same type of nozzles and method of application. The pressure in this latter case was 250 pounds and the application was made to the east side of trees 2, 4 and 6 of plot 1. Additional engine troubles developed and the work was interrupted by a heavy shower, followed by rain most of the afternoon and the completion of the spraying of these plots was left in the hands of Mr Strickland. Plots 2 and 3 were sprayed on the west side, under the supervision of Mr Strickland, on June 6th and on the east side June 5th. A "Gifford" angle nozzle was used and a pressure of 250 pounds maintained. The calyxes were closing rapidly and these plots were sprayed with the west wind, since it was not deemed wise to wait for an east wind. Plot 3 was sprayed on the west side of the trees on June 5th, the same straight nozzle being used as was employed to spray the east side of the trees June 2d.

Four pounds of "Adheso" were used for each 50 gallons. The following is a transcription of the ingredients as stated on the label:

Metallic copper 2.8 to 2.9 per cent
Dry lead arsenate 27½ to 28½ per cent; inert ingredients 64 to 69 per cent; total arsenic (expressed as percentage of metallic arsenic) 5¾ to 6 per cent
Arsenic in water soluble form less than ½ of 1 per cent
The metallic copper and metallic arsenic present are equivalent to "copper hydrate" for 4.2 to 4.35 per cent, arsenic oxide 8.9 to 9.3 per cent

It will be seen from the above formula that the amount of poison actually applied was relatively light and approximately equivalent to 2 pounds of 15 per cent arsenic oxide (paste arsenate of lead) to 50 gallons of water.

The second application to plots 2 and 3 was made on the morning of June 20th, a very heavy home-made lime-sulphur wash being used, approximately 6 gallons of this to 180 gallons of water. This home-made mixture contained a considerable amount of sediment, and even after the addition of so much of this preparation, the hydrometer read less than 1.1 per cent. Thompsen's paste arsenate of lead was used at the rate of 10½ pounds to 180 gallons. Spraying began at 9.30 and was completed at 11.10, the application being restricted to the 12 experimental trees, 155 gallons being applied.

An examination at this time showed that many of the leaves on the Baldwin trees were badly spotted and that a considerable number had turned yellow. Some were on the ground and others were dropping. This unfortunate condition is very probably due to burning following the application of the lime-sulphur wash just after the very heavy showers of June 1st and 2d.

The third treatment was practically identical with the second and was given in early August under the supervision of Mr Stahler.

Newfane orchard, plot 1 (sprayed once) 1916

TREE		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY					RUST
						Total	End	Side July	Shal-low	Side Aug-ust	
A	No.	438	91	273	87	85	1	12	68	4	115
	Per cent	......	20.77	62.32	19.90	19.40	......	2.73	15.53	.91	26.25
B	No.	706	162	493	85	96	3	12	80	3	166
	Per cent	......	22.81	69.83	12.04	13.59	.42	1.69	11.33	.42	23.51
C	No.	253	55	184	37	25	1	4	21	......	31
	Per cent	......	21.73	72.72	14.63	9.88	......	1.58	8.31	......	12.25
D	No.	1 838	508	1 165	290	257	1	20	232	4	344
	Per cent	......	27.62	63.38	15.78	13.98	......	1.08	12.62	.21	18.71
E	No.	286	107	114	49	53	1	11	41	......	69
	Per cent	......	37.42	39.86	17.13	18.53	......	3.84	14.33	......	24.12
	No.	610	233	236	116	81	1	8	72	......	183
	Per cent	......	38.20	38.68	19.02	13.28	......	1.31	11.81	......	30.00
Total		4 131	1 156	2 465	664	597	8	67	514	11	908
Per cent		......	27.98	59.67	16.07	14.45	.19	1.62	12.47	.26	21.98

A scrutiny of the data from plot 1 shows a considerable variation in the yield from individual trees, it ranging from 253 to 1838 apples and the perfect fruit varying from 91 to 508 apples. There is a considerable range in the percentage of wormy apples, this amounting to from 9.88 to 19.40, both extremes being on trees producing comparatively light crops. The average wormy fruit for the plot amounted to 14.45 per cent. It should be noted that the proportion of " shallow " affected apples is high, approximating five-sixths for the plot and nearly that for most of the trees.

Newfane orchard, plot 2 (sprayed twice) 1916

TREE		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY					RUST
						Total	End	Side July	Shal-low	Side Aug-ust	
A	No.	597	167	360	76	105	8	14	78	7	94
	Per cent	......	27.97	60.3	12.73	17.58	1.34	2.34	13.06	1.17	15.74
B	No.	279	112	131	15	31	1	6	24	......	79
	Per cent	......	40.14	46.95	5.37	11.11	.35	2.15	8.60	......	28.32
C	No.	482	200	187	38	105	1	7	93	4	129
	Per cent	......	41.49	38.79	7.88	21.78	.20	1.45	19.29	.82	26.76
D	No.	117	40	47	15	29	2	7	20	3	18
	Per cent	......	34.18	40.17	12.82	24.78	1.7	5.98	17.09	2.56	15.39
E	No.	365	125	173	45	73	5	13	48	13	37
	Per cent	......	34.24	47.39	12.32	20.00	1.36	3.56	13.18	3.56	10.16
F	No.	46	28	5	10	4	......	1	3	......	6
	Per cent	......	60.87	10.87	21.73	8.69	......	2.17	6.52	......	13.04
Total		1 886	672	903	199	347	17	48	266	27	363
Per cent		......	34.82	47.93	10.31	18.39	.90	2.54	14.10	1.43	19.24

The yield on plot 2 was considerably smaller than that from plot 1, individual trees producing from 46 to 597 apples and the perfect fruit varying from 40 to 200. There is a wide variation in the percentage of wormy fruit, this ranging from 8.69 to 24.78 with an average for the plot of 18.39. The proportion of "shallow" affected fruit approximates two-thirds of the wormy apples though there is considerable variation between individual trees.

Newfane orchard, plot 3 (sprayed three times) 1916

TREE		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY: Total	End	Side July	Shal-low	Side Aug-ust	RUST
C	No.	2 420	715	1 212	258	346	7	43	286	13	393
	Per cent	....	29.54	50.08	10.66	14.30	.28	1.77	11.81	.54	16.24
D	No.	2 098	690	1 259	202	386	4	46	333	6	398
	Per cent	....	32.88	60.00	9.62	13.63	.19	2.19	15.87	.28	18.97
E	No.	3 092	997	1 889	258	461	8	71	374	11	580
	Per cent	....	32.24	61.09	8.34	14.90	.25	2.32	12.09	.35	18.75
F	No.	2 911	842	1 774	281	487	22	84	346	38	552
	Per cent	....	28.92	60.94	9.65	16.72	.75	2.88	11.89	1.31	18.91
Total		10 521	3 244	6 134	999	1 680	41	244	1 339	68	1 923
Per cent		....	30.91	58.43	9.50	16.00	.39	2.32	12.75	.64	18.28

The yield on plot 3 was much larger than that of the other plots and owing to time limitations the apples of but four trees were canvassed. These ranged in number from 2098 to 3092 and an examination of the other two trees showed they were about as heavily loaded. The perfect fruit varied from 715 to 997 and the percentage of wormy apples ranged from 13.63 to 16.72, a moderate variation. Approximately three-fourths of the wormy apples showed the "shallow" type of injury. The percentage of wormy fruit is quite high when allowance is made for the heavy yield.

Newfane orchard, checks (unsprayed) 1916

TREE		TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY: Total	End	Side July	Shal-low	Side Aug-gust	RUST
X	No.	1 868	15	1 820	123	419	138	104	172	16	15
	Per cent	....	.81	97.43	6.58	22.43	7.38	5.55	9.20	.85	......
Y	No.	1 198	59	1 104	256	226	36	43	147	3	8
	Per cent	....	4.92	92.23	21.37	18.86	3.00	3.58	12.27	.25	......
Total		3 066	74	2 924	379	645	174	147	319	19	23
Per cent		....	2.41	95.36	12.36	21.03	5.67	4.79	10.40	.61	......

The check trees in this orchard produced 1868 and 1198 apples, respectively, with 15 and 59 of these being classed as perfect, the remainder showing some form of defect, usually scab. The wormy fruit comprised 22.43 and 18.86 per cent of the crop, a rather low proportion showing the " shallow " type of injury.

Newfane orchard, summary of plots, 1916

PLOT	TOTAL FRUIT	PER-FECT	SCAB	LEAF ROLLER	CODLING MOTH, WORMY Total	End	Side July	Shal-low	Side Aug-ust	RUST
1 Total	4 131	1 156	2 465	664	597	8	67	514	11	908
Per cent	....	27.98	59.67	16.07	14.45	.19	1.62	12.47	.26	21.98
2 Total	1 886	672	903	199	347	17	48	266	27	363
Per cent	....	34.82	47.93	10.31	18.39	.90	2.54	14.10	1.43	19.24
3 Total	10 521	3 244	6 134	999	1 680	41	244	1 339	68	1 923
Per cent	....	30.91	58.43	9.50	16.00	.39	2.32	12.75	.64	18.28
1-3 Total	16 538	5 072	9 502	1 862	2 624	66	359	2 119	106	3 194
Per cent	....	30.66	57.45	11.25	15.86	.39	2.17	12.81	.64	19.31
Check Total	3 066	74	2 924	379	645	174	147	319	19	23
Per cent	....	2.41	95.36	12.36	21.03	5.67	4.79	10.40	.16	.75

A comparison of the data secured from the various plots results in a rather poor showing for plot 3 when allowance is made for the much larger yield of the trees classified. There is, for example, in the perfect fruit, a gain of from 27 to 34 per cent between plots 1 and 2, while for plot 3 it is a little less than 31 per cent. This drop is probably to be explained in part by the fact that the trees in plot 3 were larger, thicker, and therefore more difficult to spray thoroughly, especially from the top of a spraying outfit. The observations in regard to the perfect fruit apply, though in reverse order, in relation to scab, since this was the infection which disqualified much fruit. There is a similar lack of returns in the percentage of wormy fruit from the three plots, though there is and should be some difference between the sprayed and the check trees, this amounting to an average of a little over 4 per cent for all of the sprayed trees as compared with those untreated.

At the time the fruit was picked our attention was called to a russeting of the apples, which is probably due to spray injury. The extent of this is well shown in this summary, it varying for different plots from 18.32 to 21.98 per cent, while on the unsprayed trees there was only three-fourths of 1 per cent. This russeting affected the appearance of the fruit and probably checked its development to some extent, hence care should be exercised not to use too strong or irritating sprays.

Data from Various Orchards

A comparison of results obtained in the different orchards is interesting though the returns are somewhat anomalous. It will be noted by referring to the preceding tabulations that in the plots sprayed once at Kendall and Albion, the percentage of wormy fruit was 9.68 and 10.53, while those similarly sprayed at Newfane and Hilton gave 14.45 and 17.55 per cent of wormy fruit. In our judgment the smaller yields of the plots sprayed once in the two orchards last named is hardly an adequate explanation for the difference.

Again, the plots sprayed twice in the Kendall and Albion orchards produced 8.68 and 11.04 per cent of wormy fruit, while those similarly treated in the Newfane and Hilton orchards bore 18.39 and 16.05 per cent of wormy apples. Plot 2 of the Newfane orchard produced about two-thirds of the crop as compared with the Kendall and Albion orchards and less than one-half the number of apples on plot 2 in the Hilton orchard. Here again we have a higher percentage of wormy apples without an adequate variation in the size of the crop.

Finally, the Kendall and Albion orchards produced 14.27 and 8.41 per cent of wormy fruit on the trees sprayed three times, while the Newfane and Hilton orchards yielded 16 and 12.54 per cent wormy apples, respectively. The crop on plot 3 of the Kendall orchard was only 1450 apples, a marked difference between over 6000 of the Albion orchard and nearly 10,000 each of the Newfane and Hilton orchards on corresponding plots.

The percentage of apples on the check trees in these four orchards is also worthy of comparison in connection with the yield. The Kendall check trees produced 988 apples and 13.05 per cent wormy apples, the Albion check tree, 643 apples and 31.25 per cent of wormy fruit, while the two Newfane check trees produced over 3000 apples, 21.03 per cent of which were wormy, and the Hilton check tree over 3400 apples with 10.87 per cent wormy.

This summary of conditions in the various plots shows, broadly speaking, a high percentage of wormy fruit in the Newfane and Hilton orchards which were sprayed by one man working from the tower with a moderately long extension nozzle, and while an honest effort was made to do thorough work we do not believe that so good results can be secured as where one man with a long hose works on the ground and cooperates with the tower man. This latter method is characteristic of the Kendall and Albion orchards and the greater thoroughness possible under such conditions explains in part at least, we believe, this somewhat striking discrepancy between the two groups of orchards, though there are undoubtedly other factors which have influenced the character of the yield.

Relation between Shallow and total Wormy Apples

There seems to be a moderately definite relation between shallow and total wormy apples, and to show this the following tabulation was prepared:

Comparison of percentages between wormy and "shallow" apples, 1916

PLOT	KENDALL ORCHARD			ALBION ORCHARD			HILTON ORCHARD		
	Wormy	Approx. shallow	Shallow	Wormy	Approx. shallow	Shallow	Wormy	Approx. shallow	Shallow
1	9.68	4.84	4.96	10.53	5.26	4.62	17.55	8.77	7.99
2	8.68	5.78	5.87	11.04	7.36	7.04	16.05	10.70	9.15
3	14.27	9.41	12.06	8.41	5.61	5.93	12.54	7.36	8.45
Ch	13.05	8.60	9.00	31.25	20.83	7.93	10.87	6.25	5.93

An examination of the above tabulation shows an interesting relation existing between the percentage of wormy fruit and the peculiar side injury included in the foregoing, which we have designated as "shallow." The first column under each plot gives the percentage of wormy fruit and the third column the percentage of "shallow" affected apples. The middle column gives a figure which was obtained by subtracting from the percentage of total wormy a definite proportion which, in the case of plot 1 is one-half, and of plots 2, 3 and the check trees is one-third. It will be seen that in the case of plot 1 very nearly one-half of the percentage of wormy apples showed the peculiar "shallow" defect, while in the other plots this type of injury was restricted fairly closely to one-third of the total per cent, a marked exception being in the case of the check tree in the Albion orchard, where only one-fourth of the total wormy comes much nearer to representing the actual number of "shallow" affected apples. The probable explanation for this marked discrepancy is that the check tree from which these figures were derived, produced a smaller crop than the others and the infestation was much more general. It is possible that this figure approaches the proportion showing the " shallow " injury on unsprayed trees and that the much larger proportion of " shallow " affected apples on the other check trees is due in part to the sprayings of preceding years.

The above data are interesting, since they suggest a moderately constant ratio between the total wormy and this peculiar type of injury. The moderate and, for the most part well-defined proportion, intimates that this type of injury may be a response by the young caterpillars to an inherited instinct, and there certainly is nothing in these figures which would suggest any disproportionate reduction in the number of " shallow " injured apples as a result of additional sprayings. In fact, the data show a somewhat higher proportion of " shallow " affected apples on the plots sprayed two and three times as compared with those sprayed but once, which would tend to indicate a greater reduction in the other types of injury and a " lagging " in benefits accruing from repeated treatments so far as " shallow " injury is concerned, though this conclusion must be stated with some caution, since it is not entirely justified by the returns from the check trees. These latter, however, are relatively few in number and the data they give are therefore more subject to individual variation or local peculiarities.

Weather and the Codling Moth

Insects are materially affected by weather conditions and several observers have noted relations existing between the activities of the codling moth and climatic changes. The history of this insect in western New York, particularly during the last few years, suggests there might be a close relation between evening temperatures and the extensive deposition of eggs. An attempt to show this, based on earlier records of oviposition, was made last year and was not entirely successful, owing to the impossibility of more than approximating evening temperatures from the published minimum temperatures.

The past season, through the cooperation of the weather bureau of the United States Department of Agriculture and more particularly Prof. Wilford M. Wilson, in charge of the weather bureau at Ithaca, the loan of standard thermometers and rain gauges was secured and a portion of the records given below are based on data obtained with these instruments and the voluntary aid of local observers, namely: Messrs F. W. Curtis, Hilton; F. N. Stevens, Kendall; Harold Snyder, Albion; L. F. Strickland, Lockport; and G. H. Stahler, Newfane.

The meteorological observations were made under typical orchard conditions and the data secured from representative localities make possible a fairly accurate comparison of temperature changes in particular throughout the season. Unfortunately there was no such well-marked periodic deposition of eggs as characterized 1915, and consequently sharply defined variations in egg laying could not be demonstrated. It is felt, however, that the data recorded below make a substantial addition to the meteorology of New York State orchards and may well be used as a basis for further investigations which may enable us to state the conditions favorable for the deposition of large numbers of codling moth eggs. This matter is something which may be of great practical importance in connection with the destruction of young caterpillars before they have materially injured the fruit.

A comparison of the temperature records for the latter part of June, the period when climatic conditions are most likely to affect codling moth oviposition, shows an interesting discrepancy between temperatures at Kendall near the lake and those in the relatively nearby Albion orchard, approximately 10 miles south and west. It will be noted that there was a marked rise in temperature beginning June 24th, and on the 28th there was a difference of 14 degrees between the temperatures recorded for 8 p. m. at Kendall and Albion, the latter being higher and the difference ample to affect materially the deposition of eggs, provided this is a factor of some importance. It will further be noted that on comparing data from other localities where observations were recorded, while this period showed a distinct increase in the evening temperatures, the difference was not nearly so marked as between the two places mentioned above. This is very possibly to be explained in part at least by the fact that the Albion orchard was more remote from the lake and consequently less liable to be affected by the relatively high evening temperatures occurring in sections somewhat distant from a body of water.

An examination of the data obtained at Kendall plainly indicates the difficulty of approximating with a fair degree of accuracy evening temperatures from minimum temperatures. The difference between the two, as will be seen from this table, varies within considerable limits and is materially modified by weather conditions, especially by the presence of clouds.

1916 Weather records, Kendall orchard *Locality*, Kendall, N. Y.
Observer, F. N. Stevens

DATE	TEMPERATURE				RAIN			NOTES
June	8 p. m.	9 p. m.	Max.	Min.	Amt.	Evening	Approx. duration	Conditions at 8 p. m.
4	58	58	......	......	Tr.	7.30 p. m.	....	Cloudy; still
5	59	56	71	54	....	....	....	Clear; light west wind
6	55	55	61	49	....	....	....	Clear; light east wind
7	58	57	62	52	Lgt.	5 p. m.	....	Cloudy; brisk east wind
8	59	58	68	56	Lgt.	4.30–5.30 p. m.	....	Clear; light east wind
9	......	54	72	53	....	4–7.30 p.m.	....	Cloudy; light east wind
10	54	54	68	53	TS	1–9 p. m.	....	Cloudy; light east wind
11	54	51	64	50	....	....	....	Fog; still
12	56	56	69	48	....	....	....	Cloudy; still
13	65	58	76	55	....	....	....	Clear; still
14	66	65	76	58	....	....	....	Clear; still
15	59	58	70	60	....	12.30 p. m.	....	Rain; light east wind
16	65	65	70	60	....	....	....	Cloudy; light east wind
17	61	59	73	59	....	....	....	Clear; light southeast wind
18	58	55	70	58	....	....	....	Cloudy; light west wind
19	54	54	63	51	....	....	....	Cloudy; still
20	54	53	60	50	....	....	....	Cloudy; still
21	55	54	63	50	.04	....	9.30–11 a. m.	Clear; still. Rain gauge installed
22	56	56	68	48	....	....	....	Clear; light west wind
23	58	58	67	48	Tr.	....	5.30 p. m.	Cloudy; light west wind
24	64	64	82	56	.10	....	5.30–6.30 p. m.	Cloudy; light southwest wind
25	59	58	73	58	....	....	....	Clear; still
26	60	59	74	55	....	....	....	Clear; still
27	65	63	76	55	....	....	....	Clear; still
28	60	59	74	58	....	....	....	Clear; light west wind
29	60	59	70	56	....	....	....	Clear; still
30	62	58	72	55	....	....	....	Clear; still

Tr. = trace; Lgt. = light; TS = thunder showers.

1916 Weather records, Kendall orchard *Locality*, Kendall, N. Y.
Observer, F. N. Stevens

DATE	TEMPERATURE				RAIN			NOTES
July	8 p. m.	9 p. m.	Max.	Min.	Amt.	Evening	Approx. duration	Conditions at 8 p. m.
1	64	63	83	49	....	....	....	Clear; still. U. S. W. B. thermometers installed
2	63	65	83	60	.21	....	5–6 p. m.	Cloudy; brisk west wind
3	60	60	79	60	.08	....	2.30–5.30 p. m.	Cloudy; still
4	62	60	70	60	....	....	....	Clear; light northeast wind
5	62	60	79	58	....	....	....	Clear; still
6	70	67	86	55	....	....	....	Clear; light west wind
7	74	71	90	63	....	....	....	Clear; light west wind
8	65	64	75	65	....	....	....	Cloudy; still
9	65	66	71	60	....	....	....	Cloudy; light east wind
10	68	66	75	63	....	....	....	Clear; still
11	76	77	87	64	....	....	....	Clear; still
12	80	79	91	74	....	....	....	Clear; light west wind
13	70	69	85	70	.17	7.30–7.45 p. m.	....	Clear; still
14	66	65	76	62	....	....	....	Clear; still
15	78	77	85	62	....	....	....	Cloudy; light east wind
16	76	74	92	73	....	....	....	Clear; still
17	72	70	76	65	....	....	....	Clear; brisk northeast wind
18	79	76	89	65	....	....	....	Clear; light southeast wind
19	80	79	87	65	....	....	....	Clear; light southeast wind
20	76	73	91	71	....	....	....	Clear; still
21	75	74	95	66	....	....	....	Clear; still
22	74	72	85	65	....	....	....	Clear; still
23	76	74	88	65	....	....	....	Clear; still
24	74	72	88	65	....	....	....	Clear; still
25	77	74	87	68	....	....	....	Cloudy; brisk south wind
26	74	72	89	62	....	....	....	Clear; still
27	76	74	83	72	....	....	....	Cloudy; brisk northeast wind
28	67	65	78	67	....	....	....	Clear; still
29	82	81	93	62	....	....	....	Clear; light southwest wind
30	83	82	92	78	....	....	....	Cloudy; brisk west wind
31	74	74	88	74	....	....	....	Clear; still

1916 Weather records, Kendall orchard *Locality*, Kendall, N. Y.
Observer, F. N. Stevens

DATE	TEMPERATURE				RAIN			NOTES
Aug.	8 p. m.	9 p. m.	Max.	Min.	Amt.	Evening	Approx. duration	Conditions at 8 p. m.
1	62	57	74	62	....	....	....	Clear; still
2	65	62	81	47	....	....	....	Clear; still
3	76	74	86	61	....	....	....	Clear; still
4	......	79	89	67	....	....	....	Clear; still
5	79	77	88	69	....	....	....	Cloudy; still
6	69	68	79	69	....	....	....	Clear; still
7	79	77	97	64	....	....	....	Cloudy; still
8	72	71	88	72	Tr.	....	7.30 p. m.	Cloudy; strong northeast wind
9	69	68	80	64	....	....	....	Cloudy; still
10	68	67	80	64	....	....	....	Clear; still
11	72	71	75	64	0.99	....	11.30 a.m.–5.30 p. m.	Clear; still
12	68	67	80	64	....	....	....	Clear; strong northwest wind
13	62	62	78	52	0.43	....	Midnight–4 a. m.	Clear; brisk northwest wind
14	66	64	77	51	....	....	....	Clear; light west wind
15	64	62	78	54	....	....	....	Clear; still
16	67	66	78	55	....	....	....	Clear; still
17	71	69	86	57	....	....	....	Clear; still
18	71	69	87	61	....	....	....	Clear; still
19	72	70	86	61	....	....	....	Clear; still
20	79	77	90	67	....	....	....	Clear; still
21	80	78	95	72	....	....	....	Clear; still
22	83	81	98	64	....	....	....	Cloudy; light west wind
23	63	60	83	63	....	....	....	Cloudy; still
24	70	68	80	52	....	....	....	Clear; light west wind
25	61	59	77	60	0.22	....	12.30–1 a. m.	Clear; still
26	66	64	79	53	0.03	....	3 p. m.	Cloudy; still
27	59	59	69	57	0.18	....	9 a. m.–1 p. m.	Clear; still
28	55	53	71	55	....	....	....	Clear; still
29	60	59	80	50	....	....	....	Clear; light southwest wind
30	68	64	80	58	....	....	....	Clear; still
31	70	70	85	50	....	....	....	Clear; light southwest wind

Tr = Trace.

Evening temperatures, 1916

	NEWFANE		ALBION		LOCKPORT		HILTON	
	G. H. Stahler, *Observer*		Harold Snyder, *Observer*		L. F. Strickland, *Observer*		F. W. Curtis, *Observer*	
	8 p. m.	9 p. m.	8 p. m.	9 p. m.	8 p. m.	9 p. m.	8 p. m.	9 p. m.
June 1	......	......	......	......	......	......	52	52
2	67	65	......	......	......	......	58	58
3	58	56	......	......	......	......	52	52
4	63	61	......	......	......	......	*a*60	59
5	62	61	......	......	......	......	60	61
6	64	63	56	......	......	......	55	55
7	66	64	58	......	......	......	57	57
8	67	66	56	......	......	......	58	58
9	61	60	58	......	......	......	58	57
10	63	60	......	......	......	......	54	53
11	67	66	64	......	......	......	......	51
12	63	61	65	......	......	......	60	52
13	67	65	......	......	......	......	67	61
14	69	67	68	......	......	......	68	67
15	59	58	......	......	......	......	58	57
16	58	57	......	......	......	......	66	65
17	57	55	58	......	......	......	......	62
18	56	55	......	......	......	56	......	*b*59
19	57	55	......	......	56	56	55	54
20	57	54	......	......	55	54	*c*54	......
21	58	56	54	......	53	52	56	56
22	60	57	56	......	53	52	58	57
23	61	59	58	......	60	59	60	59
24	62	59	......	......	64	64	66	65
25	63	61	70	......	......	59	61	......
26	60	58	......	......	66	63	......	*d*61
27	59	57	72	......	......	65	69	68
28	64	61	74	......	62	60	65	63
29	67	65	......	......	......	62	62	61
30	68	67	62	......	63	59	65	64
July 1	68	65	......	......	......	64	......	......
2	69	66	......	......	64	......	88	87
3	68	65	......	......	62	62	......	63
4	71	68	70	......	......	......	62	61
5	70	67	......	......	......	64	63	61
6	71	69	68	......	......	68	64	63
7	72	70	......	......	......	......	72	70
8	73	71	68	......	......	......	72	72
9	......	......	64	......	......	67	65	64
10	......	......	......	......	72	69	......	*c*64
11	......	......	78	......	80	78	72	71
12	......	......	......	......	78	76	80	79
13	......	......	74	......	71	69	76	74
14	......	......	68	......	68	66	68	67
15	......	......	76	......	......	......	82	80
16	......	......	78	......	76	73	80	79
17	......	......	75	......	73	71	78	77
18	......	......	78	......	......	......	76	75
19	......	......	78	......	......	......	80	78

*a*Reading taken at 8.30; *b* at 10; *c* at 9.30; and *d* at 9.15.

Biological Observations

The season of 1916 was nearly two weeks later than that of 1915, and the cool, backward weather appears to have had an unfavorable influence upon the development of the codling moth, possibly checking to some extent, at least, the deposition of eggs.

On June 15th codling moth pupae but no adults were to be seen in and about Albion, according to Mr A. B. Buchholz. On July 6th he observed young larvae working in the apples to some extent and at that time no eggs were to be found. On the 7th, substantially the same conditions prevailed, and in this orchard a week later it was not difficult to find eggs. It was interesting to note in this connection that the Albion records showed evening temperatures at 8 p. m. of 70 to 74°; June 25th to the 28th, and again from July 4th onward, the evening temperatures ranging from 70° a little below and above. It is very probable that the eggs from which the larvae observed working July 6th hatched, were deposited during this first warm spell and that there was a subsequent increase in deposition during the next warm period. On July 10th Mr Buchholz again reported some larvae working on the sides of the apples, though there was not a large number. On July 14th he stated that eggs were not abundant, those found being practically all on the fruit, and added that there was a small deposition of eggs a short time ago and a much larger one the past week. These two periods coincide approximately with the higher evening temperatures mentioned above.

The conditions detailed above were substantially paralleled by those observed in and about Lockport by Mr Strickland, who reported a pupal exuvium July 1st, and on the 5th and 6th a few eggs. On July 12th he examined 127 apples at Orangeport and only three eggs and two egg shells were found. The eggs had probably been deposited on the 10th, except one which was in the black stage. On July 13th an examination of king apples in the Cowper orchard at Newfane resulted in finding nine eggs, eight egg shells and three side entrances on 297 apples and ten eggs, fourteen shells and six side entrances on 468 Baldwins. Very few of the nineteen eggs found in this orchard had been freshly deposited. On July 17th Mr Strickland found the following conditions in the orchard of Mr S. S. Hopkins, Youngstown; 235 apples bore six eggs, twelve shells and eighteen entrance holes, and the next day at Wright's Station, 335 apples yielded one egg, eight egg shells and two entrances. These show conditions very different from those that obtained in 1915.

An examination by the writer and Mr Buchholz on July 20th of an orchard belonging to Mr Samuel Smith, Albion, and located about $1\frac{1}{2}$ miles west on the state road, showed codling moth eggs, mostly in the black stage, and small numbers of egg shells. The total infestation was estimated at that time as approximately 3 per cent. There were very few or no recently deposited eggs. There were a few more codling moth eggs to be found in Mr Wellman's orchard at Kendall than in Mr Snyder's orchard at Albion, though by no means so many as in Mr Smith's orchard, and here likewise the eggs were mostly in the black stage or had hatched.

An examination the same day in Mr W. H. Cowper's orchard, Newfane, showed relatively few codling moth eggs and most of these had hatched; some, however, were in the red or black stage and a few had been recently deposited. One moth was seen and a nearly full-grown larva and several half-grown larvae were found in apples. These were undoubtedly from the earlier deposited eggs. The two check trees of last year showed an apparently greater infestation than elsewhere.

On July 22d an examination by Mr Strickland of 191 apples in a Lockport orchard resulted in finding no eggs and four egg shells. There were no side entrances. On July 24th, at Wright's Station Mr Strickland examined 38 apples on one branch and found four eggs, no egg shells and only one entrance, and a search of 171 leaves on the same branch disclosed but one egg and one egg shell. Furthermore, an examination of 342 apples from 25 branches in the same orchard resulted in finding six egg shells and only one egg. The next day in an Akron orchard he examined 303 apples and found one fresh egg, and in another orchard 182 apples showed no evidences of oviposition. The relatively large number of eggs found upon the fruit is probably to be explained by the large size and smoothness of the apples at the time the moths were ovipositing, since observations June 22d in a Hilton orchard showed that the Baldwins had a diameter of one-half to three-fourths of an inch and were still decidedly fuzzy, though this latter must have disappeared some time before there was any considerable egg laying.

Observations at Wright's Station August 1st, by Mr Strickland, of 779 apples resulted in finding one egg, fourteen egg shells and nine side entrances, indicating that oviposition had practically stopped although it had extended over as long a period as in 1913. On the 16th in the E. S. Gifford orchard at Gasport, and the R. E. Heard orchard at Lockport, a few larvae were leaving the apples to pupate, and on the 17th the first larva spinning a cocoon was observed by Mr Strickland at Barker. On August 22d many larvae were leaving apples to pupate at Youngstown, as observed by Mr Strickland.

The above records show a period of oviposition by the first brood extending from approximately the first of July to the first of August, and while the evening temperatures during this period were favorable for deposition, extensive egg laying did not occur during a limited period, as was the case in 1915. The most probable explanation for this discrepancy in behavior is that the earlier season of 1915 was favorable for the appearance of the moths before moderately high evening temperatures permitted a fairly uniform deposition of eggs, while during the past season emergence of the adults appears to have been delayed until evening temperatures were such that egg deposition was not prevented for periods of a few days to a week, as appears to have been true of 1915.

Spray Injury

Incidental to, and yet directly connected with the codling moth work, observations were made upon somewhat general and occasionally very severe leaf injury to Baldwins in particular. The damage was most pronounced in the case of orchards which were sprayed in early June, immediately following a period of unusual precipitation, and apparently had no relation to the brand of lime-sulphur nor arsenate of lead used. The injury was so marked in certain orchards that the foliage was badly spotted, turned yellow, and in some cases at least one-half to two-thirds of the leaves dropped. Similar though less serious damage occurred in a few places in the Hudson valley. It is probable that the foliage was extremely tender as the result of the rapid growth following frequent and copious rains, and the experience indicates that many are moderately close, if not too close, to the limits of safety and are using fungicides in particular, fully as strong as conditions warrant, especially during periods when there is a very rapid growth.

Another type of spray injury, namely the rusting of the fruit, appeared in the Newfane orchard and the amount is indicated in the tabulations relating to the experimental work. This damage undoubtedly dwarfed the development of the apples to some extent and on account of its unsightliness can not but exert a material influence upon the grade of the fruit.

Summary and Conclusions

The experience of the last two years in western New York leads us to emphasize the necessity of thorough work, especially with the spraying given just after the blossoms fall and widely known as the calyx spray or the codling moth spray. This is the treatment which gives by far the larger returns in preventing wormy apples. In our opinion a deficient or poor spraying at this time can not be made good by later treatments, though the latter are undoubtedly helpful. The equipment should be such that the trees can be thoroughly and quickly covered with the spray and the men doing the work should have a full appreciation of the difficulties and the possibilities. The last is by no means an insignificant factor in securing thorough work. A liberal application should be made at this time and the aim should be to fill every calyx cup with poison, since it is at this point that most of the killing occurs.

A comparison of results obtained in the Kendall orchard in 1915, and upon the same trees in 1916, shows a reduction of one-third to two-thirds in the amount of wormy fruit, and is striking evidence of the efficiency of thorough spraying and the results which may be expected the following season. Conditions such as obtained in this orchard in 1915 are, in our estimation, a most potent argument for thorough annual sprayings for the codling moth, since the experience of the past year indicates that the reduction in "side" or "shallow" injury is secured the year following the treatment.

The second application for the codling moth may be effective in reducing "side injury" to some extent, though conditions the past season made it impossible to test this out thoroughly and the results summarized under a comparison of percentages between wormy and "shallow" apples show a remarkable consistency in the proportions of "shallow" affected apples between those sprayed and unsprayed. This data, while not negativing the above, can hardly be considered encouraging.

Evening temperatures appear to have an effect upon the periodicity of oviposition, though climatic and other conditions were unfavorable for the obtaining of any sharply defined data the past season.

Both the second and third sprayings for the codling moth, even if they have comparatively little influence in reducing the numbers of this pest, are abundantly justified in localities or during seasons when scab is more or less prevalent, assuming of course that a fungicide is universally added to the poisoned spray.

The extensive and, in certain cases, very serious leaf injury to certain varieties following the application of the usual sprays, suggests that we are close to the margin of safety and raises a question as to the advisability of applying the fungicides, particularly in a somewhat greater dilution.

APPLE MAGGOT

Rhagoletis pomonella Walsh

The apple maggot or "railroad worm" appears to be coming to the front in New York State as a pest, particularly in portions of the Hudson valley where it has become so abundant in certain orchards as to render nearly worthless, early sweet and subacid varieties and seriously affect the winter fruit.

Habits. This pest is well known as a local form and among entomologists it has a reputation for erratic behavior. The parent flies may be found on the fruit from some time in late June or early July through to September, moving slowly about and occasionally depositing a minute, white egg just under the skin. The egg punctures are visible with the naked eye though not readily distinguishable without the aid of a hand lens, and in some varieties are accompanied late in the season by distinct depressions, simulating, to a certain extent, those produced by red bug injury. They may be found largely on the sides of the apple, rarely near the ends. Hatching occurs in from two to six days and the colorless maggots begin to make almost invisible trails, frequently beneath the skin and showing through as darkened areas, suggesting a railway line, hence the popular name. As the maggots increase in size the burrow is larger, and in the case of a serious infestation the interior of the fruit may be a brownish, decaying mass traversed by interlacing galleries. The maggots may attain full development in two weeks though in unripe fruit and especially during cool weather, feeding and growth may be considerably prolonged and cover a period of several months. The fully grown maggots leave the fruit through irregular holes and enter the soil to the depth of an inch or two for the final transformations, which latter may occur the same season, be deferred to the next or even delayed until the second summer. This delayed transformation or biennial habit may be more general than has been suspected hitherto. There is a generation in the early fruit, some of which at least may produce flies the same season. The flies also attack the later fall and winter apples, there apparently being some correlation between the appearance of the adults and the development of the fruit.

Food habits. The food habits of this common pest are somewhat more variable than is usually supposed, the insect having been reared from thorn apples or wild haws, huckleberries and blueberries, and there are also records of the pest attacking pears, though this latter appears to be exceptional.

It is well known that this insect displays a marked preference for the early sweet or subacid apples, such as the garden royal, Porter, August sweet, pound sweet, Hubbardston, to mention only a few, while it also occurs, though in much smaller numbers, in standard winter varieties, such as greening, Baldwin and russet. It is probable that almost any variety of cultivated apple would be injured to some extent under favorable conditions, though as stated above, the most serious damage is to the late summer and early fall apples.

Description of the fly. The parent of the apple maggot is a little smaller than the common house fly and may be most easily distinguished by its broadly, brown-banded wings and the dark body with the transverse white bands on the abdomen. Very rarely is any similar fly found upon apples during midsummer.

Occurrence of the flies. The time the parent flies appear is of importance. This may vary from the latter part of June into September. Observations were made during the past summer at Nassau, Ghent and Kinderhook. The first adult was found on a red astrachan at Nassau July 11th. No others were seen then and there were no signs of the deposition of eggs. July 27th Mr George T. Powell of Ghent reported flies as plentiful on sweet bough apples and on the 29th they were rather numerous on red astrachan and early harvest trees at Nassau. Some apples were infested at this time and a few nearly full-grown maggots were found. Two days later only one fly could be discovered on these trees.

August 8th flies were abundant at Ghent though none were to be found on the nearby Cox orange pippins. The flies were also numerous at this time at Kinderhook on both Baldwins and greenings, especially the latter, though none had been seen earlier in the season. August 15th pairing and the deposition of eggs were in progress on the greenings at Kinderhook and the flies appeared to be less numerous than they were on the 8th, and on the 24th their numbers had materially lessened. No flies were seen in either Ghent or Kinderhook orchards after this latter date, though occasional examinations were made till September 12th.

Poisoning flies. It is well known that fruit flies feed to some extent upon honeydew or sweetened materials, and the results secured with the Mediterranean fruit fly in Africa and cherry fruit flies in this country have led to various attempts to control this pest in the same way. Two infested orchards were put at our disposal for work against this pest and the poisoned spray was tested. The formula used follows: arsenate of lead, 3 ounces or 5 pounds; cheap molasess, 1 pint or 3 gallons; water, 4 gallons or 100 gallons.

The spray was thoroughly mixed and mostly applied here and there upon the trees without attempting to cover the entire leaf surface, since it was presumably sufficiently attractive to the flies so that they would find it if only small areas here and there were covered with the mixture.

The orchard of Mr Edward Van Alstyne of Kinderhook was one of the places selected for this cooperative work. The first application was made July 14th and the second the very last of that month or early in August. An examination of alternate sprayed and unsprayed sweet bough apple trees at picking time failed to disclose any well-marked difference between the two. The infested portion was so limited that it was impractical to use large plots or different orchards for the purpose of comparison.

The other orchard was that of Mr George T. Powell of Ghent. Mr Powell was much interested in the control of this insect, owing to his having lost, through its work, a large crop of Cox orange pippins in 1914 and a light crop in 1915. Owing to the value of the fruit he was willing to spray more frequently than would be practical with the average commercial grower. The formula given above was used and his record of treatments follows:

July 15, sprayed Cox orange pippins, no flies were visible.

July 16, sprayed experimental block of dwarf trees; on the 17th it rained most of the day and on the 19th one suspicious fly was found.

July 25, sprayed the Cox orange pippin trees and found a few flies, one dead on a leaf; rain occurred the next day.

July 27, sprayed the Cox orange trees very thoroughly, also sweet bough and McIntosh, found some dead flies on the sweet bough.

August 4, sprayed Cox orange trees, also the experimental block. Flies were seen only on the sweet bough, being plentiful.

August 6, sprayed Cox orange lightly on the tops and also the sweet bough and McIntosh trees.

August 19, sprayed the Cox orange trees and saw no flies. The weather was very hot and dry.

August 20, sprayed the McIntosh and also the fall strawberry nearby. The weather continued hot and dry.

Unfortunately, so far as the work at Ghent was concerned, the efforts were concentrated on the Cox orange pippin trees and it was not until after the season had advanced so far that special work with earlier varieties was out of the question that we could be certain there would be no serious infestation in this block, although Trypeta flies were moderately abundant on nearby sweet bough and McIntosh trees. Repeated examinations of the sprayed trees resulted in finding nothing very pronounced in the way of material benefit though some dead insects, including one Sarcophagid, were found upon the sprayed Cox orange trees, and Mr Powell stated that he or his foreman at various times had seen a few dead Trypetas. The number of these latter, however, was presumably far too small to be of any great importance. That there had been a very few Trypeta flies in this block of Cox orange trees sprayed as indicated above, was revealed by an examination made September 14th. The sprayed trees bore possibly two or three apples, each showing a few signs of maggot work, while the fruit on the tree check or unsprayed trees was presumably somewhat more maggoty though it was impractical to obtain the exact percentages. The conditions, so far as this one block is concerned, were much better than those obtaining the two preceding seasons, according to statements made by Mr Powell. This is probably to be explained in part at least by the small crop of last year affording so little food that comparatively few insects were able to mature and issue in 1916, though there is a chance that a considerable number of the insects remain quiescent through the summer and may appear next season, a biennial habit which has been referred to above.

Mr Powell was greatly encouraged by the results upon the nearby McIntosh trees which early in the season were infested by a number of flies. The fruit was quite free from maggots in mid-September, there certainly being no such infestation as upon the earlier varieties. Unfortunately here, where flies were somewhat abundant, there were no checks and accurate comparisons can not be made.

The work of Prof. L. Caesar in the province of Ontario, and that of Mr C. A. Good, assistant provincial entomologist of Nova Scotia, seem to indicate considerable benefit from the application of sweetened poisons. Mr Good[1] gives some data which suggest substantial control resulting from this method of treatment. These figures, taken from the same varieties but in different orchards, are certainly promising though in view of the fact, as noted above, that the apple maggot is such a local insect and, moreover, may have a marked biennial habit, we can not help thinking that if material benefits accrue from the use of this poison, they should be evident on nearby trees as well as apparent on trees in well-separated

[1] Ent. Soc. of N. S. Proc., p. 72, 1915.

orchards. The conservative scientist will at least insist on more data before recommending this treatment unreservedly.

Conclusion. Summarizing, we have been unable to demonstrate any very marked benefit from the use of a sweetened poison for the destruction of apple maggot flies, though more extended work may give very different results. Serious infestations by apple maggot can be controlled, so far as known, in no better way than by collecting and destroying the infested fruit before the maggots have an opportunity to escape. This work should be done, according to careful investigations carried out by Prof. W. C. O'Kane,[1] every three days in the case of the late summer and early fall varieties and once a week for the later apples. This is somewhat laborious unless live stock, such as sheep or hogs, can be allowed to run under infested trees. It is quite possible that a few varieties of early apples adjacent to commercial orchards, might be used as traps for the attracting of the flies and then the pest effectively checked through the destruction of the fruit as indicated above. The difficulty is that in many places the specially attractive trees are allowed to serve as breeding places and centers for dispersal instead of being employed as a valuable means for controlling this pest. Good orchard practice, both cultivation and spraying, is undoubtedly helpful and as a supplementary measure, in the case of bad infestations, some benefit should be derived from the use of the sweetened poison.

PEAR THRIPS

Taeniothrips pyri Daniel

The severe and local injuries by this pest have been very much the same as during the last two or three years. By far the greater damage has been in pear orchards in the immediate vicinity of Hudson and farther south, the extensive pear-growing section of Kinderhook and Muitzeskill being nearly, if not entirely, free from this destructive insect. In Germantown this pest is very local, being extremely severe in some orchards and hardly noticeable in others, though a portion of this is doubtless explainable by differences in treatment. Similar restricted outbreaks also occurred in the vicinity of Poughkeepsie.

This insect attacks by preference Seckle and Bartlett pear trees, though other varieties are occasionally badly damaged.

Signs of infestation. The most evident signs of this insect's presence are the sticky buds, the brown, blasted appearance of the

[1] N. H. Agric. Exp. Sta. Bul. 171, 1914.

blossom buds and the unusual drop of bud scales followed later by small, crinkled, spoon-shaped leaves. In the earlier stages of the attack a slender, dark-brown, apparently wingless insect, only one-twentieth of an inch long, may be seen upon the opening fruit buds and especially in crevices between the stems of the partly expanded fruit clusters. Sometimes it is easy, by drawing the loosely closed hand over a limb, to dislodge two or three of the thrips, a convenient method of detecting infestation prior to there being any material injury.

Habits of the insect. The thrips winter in the soil, appearing upon the trees as the young leaves push from the bud or even somewhat before, and feed by preference upon the more tender and essential parts of the fruit buds. They may be found crawling between the loosened bud scales, the partly opened leaves, and working their way to the base of clusters of fruit buds. Thickly infested buds become sticky, showing clear drops of sap, and in very serious infestations the branches and trunk may be wet with the exudation. The microscopic eggs are deposited in minute slits in the leaf and blossom stems. The whitish, red-eyed young soon appear and feed, like the darker parents, on the tender leaves for about two weeks, drop to the ground and remain in the soil unchanged till fall.

Food plants. This minute pest attacks a variety of our deciduous fruits, including the apple, apricot, cherry, fig, grape, peach, pear, plum, prune, quince and also English walnut; the principal damage, however, is to pear trees.

An unusual damage, at least for the Hudson valley, was observed on the farm of Mr William Albright, at New Baltimore, in the form of severe injury to apple buds in a gully below a rather extensive pear orchard. The location is such that it would seem as though the insects drifted with gentle breezes from the higher pear orchard down through the gully onto the apple trees. It was easy to find on the sunny side of the trees four or five thrips in a bud and in a few cases the numbers ran to ten or fifteen. The year preceding Mr Albright stated that ten to fifteen or even thirty thrips were found in individual buds.

Remedial measures. The small size, sudden appearance and insidious method of work makes this insect a very difficult one to control, and while spraying with contact insecticides, if timely, will quickly destroy the thrips, practically it is by no means easy to make the treatment at just the right time to secure satisfactory results. The application generally used is a tobacco extract, 40 per cent nicotine, at the rate of three-fourths of a pint to 100 gallons of water to which are added 4 to 6 pounds of soap, the latter being particularly valuable because it increases the spreading properties of the insecticide, or the tobacco may be added to the standard lime-sulphur wash, in which event soap is an undesirable addition. The most effective spraying is that given just before the buds have opened, because this means the destruction of the pest prior to its causing any material damage. The next best opportunity is just as the blossom buds have pulled apart and thus reduced the shelters of this insect to a minimum. A third treatment, if necessary, can be applied later after the leaves have partly expanded. This is directed largely against the young.

Experimental work. Owing to the very short time during which the above treatments can be made to advantage, there have been numerous failures in controlling the pest, which have resulted in experiments with a thick lime-sulphur wash composed of approximately 150 pounds of lump lime, 20 gallons of a standard lime-sulphur wash to 200 gallons of spray. This, in other words, is the usual lime-sulphur wash employed against San José scale, to which a considerable excess of lime has been added. There are practical difficulties in the preparation of this wash, owing to the large amount of lime used. One method of preparing is to slake, in a barrel, 75 pounds of good stone lime, starting with five or six pails and keeping the lime covered so as to prevent it from burning. Dilute as much as practical while still in the barrel and then strain through an ordinary mosquito wire netting. This latter is made easier by diluting the lime wash considerably, taking care not to exceed the ultimate proportions, and by starting the engine and using one spray nozzle to wash the somewhat glutinous lime through the screen. A very coarse grain sack can be used in place of the wire screen and lessens the probability of clogging the strainer on the suction hose. This latter should be large and accessible so that the pasty lime-sulphur compound can be easily and quickly removed.

Lime-sulphur wash prepared as above was applied April 19th to a young pear orchard belonging to C. H. Deuell & Son of Bangall. About fifty small pear trees, mostly Seckles, were thoroughly sprayed with 200 gallons of the insecticide. One man stood upon the spraying rig, the other working from the ground, and an attempt was made to cover all portions of each tree at one treatment. It was found in practice, however, that one corner of a tree or the under side of branches here and there were apt to be partly skipped, and a second application was made for the purpose of covering the trees thoroughly.

As a result the twigs and buds were very satisfactorily coated with a lime-sulphur wash; in some instances the crevices between the bud scales were full of the mixture.

An examination of this orchard on May 1st showed that the trees were very well covered with the wash, the trunks and branches being markedly whiter than those sprayed with an ordinary lime-sulphur wash and the buds were mostly well covered and decidedly later than was the case with unsprayed trees. There were a few dead buds on the treated trees, this being especially true of the smaller buds containing a single blossom. One or two insects were not uncommon in blossom clusters here and there, though the infestation was not nearly so serious as in a nearby orchard sprayed later with a lime-sulphur wash containing decidedly less lime. Later, May 10th, it was estimated that there was very little injury in this experimental orchard, probably 5 per cent of the buds being killed, certainly not over 10 per cent. Near a large apple tree and close to the experimental plot, there was one pear tree which, it was stated, had been sprayed as thoroughly as the others, though its appearance hardly bore out the contention. This tree showed a very serious infestation by thrips, over 90 per cent and perhaps 95 per cent of the buds having been killed. This tree was, however, hardly representative of the infestation of the experimental area.

Other experiments with this wash were started but the results were not decisive owing to the appearance of but small numbers of thrips.

Early spraying with a lime-sulphur wash containing a considerable excess of lime is one of the most promising methods of controlling pear thrips by one application. The treatment should be given before the buds have started or "cracked" to any extent, and an effort made to cover every bud thickly with the lime-sulphur wash. This seems not only to exclude the insects but to check the development of the buds until with warmer weather they unfold very rapidly and thus, in a measure at least, are able to outgrow thrip injury. An important advantage of this treatment is that it also controls San José scale though it is a little early for pear psylla. It can be supplemented, however, in case thrips are extremely abundant, by the application of the tobacco-soap preparation at the time the blossom clusters have separated.

NOTES FOR THE YEAR

The forest tent caterpillar occasioned no complaint and the elm leaf beetle caused very little damage, this latter being due in all probability to the frequent and rather heavy rains of the spring and early summer.

Incidental investigations in connection with the codling moth work showed that the leaf roller was not nearly so abundant in western New York as in 1915. The red-humped apple tree caterpillar, Schizura concinna Sm. & Abb., was unusually abundant on young apple trees in southern Rensselaer county. The gregarious habit of the caterpillars makes the work of this pest unusually conspicuous and is apt to excite apprehension out of proportion to the actual injury caused, particularly as most of the feeding comes so late in the season that the trees are rarely badly injured by the loss of foliage.

The reception of a horn-tail larva, possibly that of Adirus trimaculatus Say, boring in rose shoots at Woodhaven, was unusual and may mean the introduction of a new rose pest. The material was so scanty that positive identification was impossible.

The recently introduced European hornet, Vespa crabro Linn., has evidently become well established in the vicinity of New York City, and observations in midsummer on lilacs at Rye showed that a number of smaller twigs were partially girdled and that one or two bushes had lost leaders with a diameter of over one-half of an inch through the activities of this hornet. A somewhat extended account of this insect may be found in Museum Bulletin 180, pages 71–72.

The reception during the past season of tips infested by the pine twig moth, Evetria buoliana Schiff., from Buffalo and New York City, indicates the continued existence of this pernicious borer in widely separated localities. A detailed account of this species is given in Museum Bulletin 180, pages 39–42.

FRUIT TREE INSECTS

Apple tent caterpillar (Malacosoma americana Fabr.). Continued abundance of this common pest was noted in many localities though the injury was greatly lessened by the copious spring and early summer rains producing such a vigorous growth as to keep the trees in partial leafage in spite of the caterpillars. The pests were generally present and more or less destructive throughout the Hudson valley, this being particularly noticeable in southern Rensselaer and northern Columbia counties. An interesting condition obtained on the heavier soil of Dutchess county east of Poughkeepsie, the tree growth there being such as nearly to offset the feeding of the caterpillars, while south of Newburgh the lighter soil appears to have nullified to a considerable extent the value of the heavy rains, and in that section caterpillar depredations were decidedly more evident. The wild cherry trees in that locality were commonly defoliated, some apple trees were severely injured and there was considerable feeding on oak.

The elimination of the wild cherry and adequate care of orchard trees, either by systematic spraying or the early removal or destruction of the nests, are the most satisfactory methods of dealing with this pest.

Red bugs (Heterocordylus malinus Reut., Lygidea mendax Reut.). Red bugs appear to be increasing somewhat in numbers in certain Hudson valley orchards, and reports of serious injuries were received from some localities. This is probably due in part to an actual increase of the insects, and partly also to a more general recognition as to the cause of the trouble. These two insects appear to be increasing in numbers though relatively somewhat more slowly in orchards in the western part of the State, especially those of Monroe, Orleans and Niagara counties.

Reports received the past season indicate very satisfactory results from thorough and systematic spraying with a tobacco extract, 40 per cent nicotine, using 1 pint to 100 gallons of spray and applying it either with soap or in combination with the so-called deferred dormant spray. The latter may be held until the pink shows in the blossom and applied at winter strength without serious injury to the foliage. Spraying at this time seems to be fully as effective in controlling red bug as later applications, though in the case of serious infestation it is by all means advisable to add the nicotine to the codling moth spray and make the latter as soon as possible after the falling of the blossoms.

Pear psylla (Psylla pyricola Forst.). This serious pest of the pear grower was moderately abundant in many Hudson valley orchards, and in some decidedly injurious, especially about midsummer. Examinations of a number of orchards in northern Columbia county and near Athens and New Baltimore, Greene county, showed a comparatively light deposition of eggs, and the delayed dormant spray evidently destroyed so many eggs that there was but little trouble with the insects later in the season. This relative immunity early in the season was also favored doubtless by the rather low prevailing temperatures and unusual amount of rain.

Generally speaking, the delayed dormant spray of lime-sulphur wash at winter strength is one of the most effective checks the pear grower can use against this insect. This treatment should be supplemented where necessary, by a later spraying whenever the pest becomes sufficiently numerous, with a tobacco-soap preparation.

San José scale (A s p i d i o t u s p e r n i c i o s u s Comst.). The relative scarcity of San José scale continued in the Hudson valley. The conditions are fairly represented by the statement of Mr F. H. Lacy of the Dutchess county farm bureau to the effect that he had not observed or heard of any scale injury at all, though the insect was doubtless present in small numbers here and there in the county. Supplementing this, Mr W. H. Hart informs us that there was very little scale in a neglected, unsprayed portion of a Ben Davis orchard marked for cutting down the coming winter, and he adds that in handling apples, especially greenings from twenty-five or more orchards beside his own, he rarely saw a San José scale mark. Mr P. L. Huested, formerly horticultural inspector of the State Department of Agriculture, considers that parasites have been nearly plentiful enough to eliminate San José scale. He cites one peach orchard consisting of 2500 trees, planted in 1912 and among which stood a few old apple trees infested at that time. This orchard has never been sprayed and yet there has been nothing more than an occasional scale spot here and there, not a limb being crusted as was commonly the case in earlier years.

Mr A. E. Jansen of New Paltz states that a small amount of scale occurs in that section, though owing to the general spraying it is difficult to give any definite statements as to what might have occurred on unsprayed trees. Mr J. A. Hepworth of Milton is of the opinion that the scale is less abundant than in earlier years.

Observations in southern Rensselaer and northern Columbia counties show a comparative scarcity of San José scale, a portion of this undoubtedly being due to the activity of natural enemies, though unfavorable climatic conditions may have had an influence. Several growers have omitted the usual spraying for San José scale without untoward results, though this is a practice attendant with some risk and one which can not be unqualifiedly recommended at the present time.

Conditions in western New York appear to have been more favorable for the development of San José scale, though even there the insect was certainly no more abundant as a rule than in the last two or three years.

SHADE TREE INSECTS

Maple leaf-stem borer (Caulacampus acericaulis MacG.). A borer in the leaf stems of sugar and other maple trees has been reported from time to time and until within recent years it has been commonly supposed that one or two Microlepidoptera, namely Stenganoptycha claypoliana Riley and Proteoteras aesculana Riley, were responsible for most of the injury of this type. The investigations of Dr W. E. Britton, state entomologist of Connecticut, during the last decade have resulted in definitely associating injuries of this character with the above-named sawfly, and it is probable that considerable of the work attributed in earlier years to Lepidopterous borers is in reality the work of this species.

Observations the last of June on a sugar maple on the estate of Mr Helme Straiter, Rye, N. Y., showed it to be rather badly infested with this insect, some 30 per cent of the leaves on the south side of a tree with a trunk diameter of approximately 15 inches having been destroyed by this leaf stem borer. It was evident that the injury was restricted in a considerable measure to the lower branches and the sunny side of the tree. The foliage was noticeably thin and here and there were to be found the greater portion of the leaf petiole, the free part browned and shrunken, while the basal part was infested by a pale yellowish green larva about one-fourth of an inch long. The entire inside of these stems may be eaten out without deformation, aside from a perceptible swelling frequently caused by the interior being closely packed with borings.

The dropping of leaves late in May or early in June, with a piece of a leaf stem from one-fourth to one-half of an inch long attached to the blade, is a characteristic of infestation by this species. The remaining portion of the stem or leaf petiole remains upon the tree and is not shed for some ten days or two weeks. At the time of our examination, the last of June, a few of the injured leaf petioles remained upon the tree, though by far the larger proportion had dropped to the ground and it was comparatively easy to pick up hundreds upon the lawn, a small number of which were still inhabited by the borer. This species appears to be a very local one. There is but one generation annually. The eggs, according to the observations of Dr Britton[1], are deposited about the first week in May at the distal end of the leaf stem or at the base of the blade at the point where the chief veins branch from the stem. This leaf-stem borer has been recorded as attacking sugar, Norway and Sycamore maples.

The restriction of this leaf-stem borer to the lower branches would make it comparatively easy to pick off the infested leaf stems about mid-June and burn them; this might well be supplemented in the case of trees standing on closely clipped lawns, by picking up the infested stems as soon as they begin to fall in numbers and burning them with the contained larvae. This work can be done to the best advantage about the middle of June. It has also been suggested that spraying the ground under infested trees at about this time with a contact insecticide, such as kerosene emulsion, would doubtless destroy many of the borers. The tobacco-soap preparation used so generally against plant lice might be equally effective and less injurious to lawns.

Bleeding tree maggot (Mycetobia divergens Walk.). The exudation of sap and an accompanying discoloration of the bark below, the latter caused in part probably by precipitates, is more or less familiar to all conversant with trees, and is particularly likely to occur on sugar maples and American elms, though the Norway maple, birches and poplars are by no means exempt. Prof. O. A. Johannsen[2] informs us that he has reared the above-named species from peach gum as well as from bleeding elms and poplars, and an earlier account of work by presumably the same species, was given by the writer in 1913 in the Journal of Economic Entomology, 6:285–86, the species being provisionally referred to the genus Ceratopogon. There may be a number of causes for this trouble and yet, in an experience covering several years, we have been able in most cases carefully examined, to find slender, white maggots about one-fourth of an inch long and with brown heads, in the deepest portions of the wounds. These maggots have well-developed jaws and in several instances they were observed at work on the tender, bleeding tissues. It is our opinion that many of these wounds with their unsightly effluent moistening the bark below, are caused by the maggots of this species.

A technical description of the larva, the pupa and a brief characterization of the adult is given below.

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[1] Ent. News, 17:313–21, 1906.

[2] See also Me. Agri. Exp. Stat. Bul. 172, p. 223–24, 1909; Bul. 177, p. 31–32, 1910; Ill. State Lab. Nat. Hist. Bul. 11, art. 4, p. 321, 1915.

Larva. Length 6.5 mm, diameter .2 mm. Head light brown, the thoracic segments variably chitinized, the thickened portions reddish brown, the body segments whitish transparent.

The head has a diameter posteriorly equal to the thoracic segments and tapers anteriorly to an irregularly truncate apex bearing the mouth-parts, the length being a little greater than the diameter. Antennae short, stout, biarticulate, the basal segment with a length a little greater than its diameter, the distal segment button-shaped. The mandibles are decurved, moderately stout, triangular and with two obscure teeth basally; maxillae decurved, broadly rounded anteriorly and apparently with a series of four or five long, stout teeth; hypopharynx setose; basally and ventrally there is within the head a hyoidlike structure, the component rods being inserted at the posterio-ventral margin of the exoskeleton of the head, their point of origin marked by lenticular, dark brown thickenings.

The posterior two thoracic segments show clearly a median triangular dorsal incision in the thickened portion and sublaterally and ventrally, irregularly circular spots which are white; the chitinization of the anterior segment is less evident and more skeletal though otherwise not widely different. The spiracles on the anterior thoracic segment are circular and with approximately eleven radiating, nearly fused processes; the distal portion of the tracheae connecting with the spiracles shows a distinctly stronger, yellowish chitinization.

Abdominal segments 12, each with a length a little greater than the diameter and with the posterior third separated by a constriction as a subsegment; terminal segment more slender and tapering to a subtruncate apex bearing the submedian posterior spiracles, each circular and surrounded by a series of radiating hairs and, as in the case of the anterior spiracles, the distal portion of the tracheae is distinctly thickened and chitinized.

Numbers of larvae, presumably of the same species, were received the past summer from Mr F. C. Place, Baldwin, accompanied by the statement that they were the apparent cause of a considerable bleeding from Norway maples. The larger of these specimens have tridentate mandibles, the teeth being moderately long, broad, and obtusely rounded apically, with well marked sublateral ocular spots near the posterior third. The larvae, variable in size, show from 14 to 18 radiating processes in the anterior spiracles. These variations may be as in Muscid larvae characteristic of different larval stages.

Pupa. Length 4.5 mm, diameter .9 mm, a variable yellowish brown; eyes a pale yellowish red and portions of the anterior thoracic segments a variable dark reddish brown. Wing cases short, extending nearly to the second abdominal segment; leg cases whitish transparent and reaching to the posterior third of the second abdominal segment; the abdominal segments with a transverse row near the anterior third of approximately six stout subconical chitinized processes, and on the posterior third a similar row, these processes alternating with those of the anterior row and between each of them a series of three or four minute, chitinous points not present on the anterior row; posterior extremity slightly infuscated and with a series of irregular, tuberculate processes, modifications of the spines noted on the preceding segments.

The parent fly is a dark brown or blackish gnat or midge about one-tenth of an inch long and most easily recognized by the moderately short, black antennae and the long stem of the Sciara-like fork of the greatly reduced median wing vein. The venation is so peculiar as to admit of a ready identification of the species.

Attack by this species is probably favored by a slight wound or scar or even a small cavity following the healing over of a place where a limb has been removed and the presence of more or less dead organic matter, the latter keeping the deeper portion of the wound moist and presumably offering favorable conditions for the deposition of eggs and the development of the small maggots which, as they increase in size, attack adjacent tissues and soon produce the characteristic bleeding. The frequent precipitation in the early part of last season was favorable for the development of this insect and appears to have been accompanied by an unusual amount of injury. The recurrence of this trouble from season to season in no way invalidates the above, since with the approach of cold weather these insects would naturally suspend operations and there would be no breeding until the following spring. The discoloration of the bark and the sour odor may be easily explained by the precipitates, due to evaporation and fermentation caused by various organisms which establish themselves in collections of moisture containing various elements of food.

The most promising treatment for this type of injury is simply to remove the dead tissues, cut down to the healthy wood and provide adequate drainage for the cavity, if one of any size exists. The wound should then be dressed with some protective material, such as grafting wax, tar or paint.

Pigeon Tremex (Tremex columba Linn.). This species was reared in small numbers in midsummer, 1915, from a hickory log cut the previous February, and in the winter of 1916 fully developed living adults were found. These latter suggest a two-year life cycle for this species, since conditions were such that the initial infestation might well have occurred in 1913. The probabilities were decidedly against the Tremex larvae alive in the log in the winter of 1916 having developed from eggs deposited the preceding summer.

The larvae of the pigeon Tremex are rather common in dead, particularly fungous-affected wood of various trees, and on account of this insect restricting itself to dead or dying tissues, it can not be considered of much economic importance.

Norway maple aphid (Chaitophorus lyropicta[1] Kessler). This common plant louse on Norway maples is present almost every year and occasionally becomes excessively abundant, as was the case last summer with some Norway maples at Ogdensburg, the trees being so badly infested that the leaves were fairly smeared and almost dripping with the honeydew. This plant louse occurs in clusters on the under side of the leaves, usually along the veins. The young are pale greenish yellow with red eyes, while the fully grown plant lice are greenish with conspicuous irregular brownish red markings. Usually natural enemies, such as ladybeetles, both young and adults, and Syrphus or flower fly larvae, reduce the numbers of the insect so greatly by midsummer that there is very little injury thereafter. This aphid may be readily destroyed by thoroughly spraying the under side of the leaves with a nicotine-sulphate preparation, 40 per cent nicotine, used at the rate of three-fourths of a pint to 100 gallons of water and adding thereto 6 to 8 pounds of soap. One thorough treatment is usually sufficient to control the pest.

Magnolia scale (Eulecanium magnoliarum Ckll.). This large scale insect, previously unrepresented in the state collections, was received the latter part of July through Dr G. G. Atwood of the Department of Agriculture, accompanied by the statement that it occurred on some magnolia trees at Dansville. This species is one of the largest of our native scale insects, approaching closely the size of the much better known tulip tree scale, Toumeyella liriodendri Gmel., it being about one-third of an inch long, one-fourth of an inch wide and one-tenth of an inch high. The surface is a variable dark brown or blackish, more or less granular and with low, warty protuberances at intervals. A badly infested twig may have one side nearly covered with the insects, the scales being crowded together much as in the case of the tulip tree scale. Spraying as for the above-mentioned tulip scale would doubtless be very effective in checking this magnolia insect.

FOREST TREE INSECTS

Hickory bark beetle (Eccoptogaster quadrispinosa Say). Depredations by this well-known enemy of hickory trees have decreased markedly during the last two years, though an examination in mid-July of a wooded knoll east of Troy showed general

[1] Determined by Dr J. J. Davis. This is the Chaitophorus aceris of our earlier publications.

and rather serious injury to hickory foliage by this insect. From 25 to 50 per cent of the leaves were dropping or nearly ready to fall as a consequence, though there were comparatively few signs of the beetles actually having entered the trees. Some of the hickories were in an unhealthy condition though not markedly more so than the oaks and other trees.

The forested area upon which the above observations were made was typical of many of the thin-soiled ridges of southern Rensselaer county, and it is very probable that the numerous dead branches on some of the trees at least were an outcome of the severe droughts of earlier years, since there were no signs of general injury by one or more borers.

Red-shouldered limb borer (Sinoxylon basilare Say). Large numbers of this borer were reared from limbs of dying hickory trees which had succumbed to attacks by the hickory bark beetle or other causes. The borer is rather uncommon in New York State though it has been recorded as breeding in the limbs and twigs of a considerable variety of trees, such as persimmon, mulberry, apple, peach and also grapevine. Doctor Hopkins states that it infests most deciduous trees.

This borer appears to confine itself, so far as hickory is concerned, to the smaller, dead, apparently fungous-infected branches, rarely occurring in those with a diameter greater than 4 inches. It runs longitudinal galleries in the inner wood about one-twelfth of an inch in diameter and may nearly riddle the interior of the branch with a series of frequently contiguous, sawdust-filled galleries. The borings produced by this species are very fine, uniform and firmly packed in the galleries. The longitudinal workings evidently originate from a transverse gallery made by the adult, which is very apt to encircle the limb at an approximate depth of three-eighths of an inch below the surface. This gallery is enlarged here and there into a series of irregular chambers. Emergence is through circular galleries penetrating the wood at right angles to the surface.

The larvae of Sinoxylon resemble those of Eccoptogaster quadrispinosa Say superficially, the Sinoxylon larvae being almost invariably in deeper galleries than those made by the hickory bark beetle. There is also a more marked ventral flexing of the posterior abdominal segments, while the thoracic legs are long, slender and with the apical segment bearing a rather thick tuft of long, conspicuous setae, a marked difference from the rudimentary or absent thoracic legs of Eccoptogaster.

Neoclytus erythrocephalus Fabr. The small, reddish beetles with their three yellow, nearly transverse lines on each wing-cover, were reared in some numbers from a large hickory log collected in midwinter. The insects continued to emerge during the summer and one living specimen was found the following midwinter. The data indicate one generation annually for this species though there may be occasional specimens which would carry over to the second season. This borer has been reared from the dead wood of a considerable variety of trees.

GARDEN INSECTS

Box leaf midge (Monarthropalpus buxi Lab.). The receipt, through Thomas J. Wade, city forester, New Rochelle, N. Y., in early May, of a twig of box showing a serious infestation by this insect, indicates a gradual spread of the midge and accompanying injury. This is especially likely to occur in places where box is extensively used as an ornamental or hedge plant. The affected leaves contained numerous full-grown, yellowish maggots, a few transforming maggots and some recently transformed pupae, indicating that emergence would not be long delayed. The reception May 27th of infested box leaves containing pupae from Philadelphia, indicates that the flies are not likely to emerge along the Atlantic coast prior to the last of May or early in June. This matter is of some importance in connection with remedial measures.

The presence of this recently introduced enemy of box is indicated by more or less irregular, oval swellings on the leaves, each marking an eccentric, oval, clear space mined beneath by one or more pale, yellowish, white maggots about one-sixteenth of an inch long. There may be a very slight elevation of the leaf with an irregular, yellowish or brownish discoloration, the margin of the enlargement being indicated by darker green. This condition is most easily observed in September and later after the maggots are more than half grown. An infested leaf may contain only one or two of the miners and be injured to only a comparatively slight extent or there may be six or more of the maggots and a nearly total destruction of the leaf. Attack by this midge weakens the plants and results in the badly infested leaves dropping in the spring, leaving unsightly, bare stems with new leaves developing at the tip.

The known occurrence of this species at Newport, R. I., New Rochelle, Westchester county, Roslyn and probably other Long Island localities and Philadelphia, Pa., suggests that it is likely to appear in numbers in almost any place along the northern Atlantic coast, and there would seem to be no reason why it might not appear here and there in other places in the country, especially in localities to which there have been recent shipments of box plants. It has been received recently from California. The insect winters in the leaves and hence would be readily conveyed from place to place.

The most promising method of checking this insect appears to be repeated treatments with a contact insecticide at about the time the midges are beginning to issue, and distributed through the period of flight. Kerosene emulsion or a whale oil soap solution, as reported, have been used with excellent results though it is quite probable that the nicotine-soap combination so generally employed for the control of plant lice and some other soft-bodied insects would be equally effective and perhaps safer. In case of limited infestations where the plants are highly prized it might be advisable to make daily applications so long as any of the yellowish flies are noted issuing from the leaves or flying about the plants.

Columbine borer (Papaipema purpurifascia Gr. & Rb.). This insect belongs to a group commonly known as stalk borers and, like its associates, occasionally attracts attention by its work in plants.

The female, according to Mr Henry Bird, our American authority upon stalk borers, lives but a few days and deposits her eggs on the lower stems of the food plant in late August or early September, where they remain securely attached until the period of hatching, which, in the latitude of Rye, is between May 15th and 20th. The young borer usually ascends the flower stems and enters well up where the tissues are tender, working down by slow degrees and in about ten days enters the root. Some two months are required to complete its growth. The infestation of the stem is indicated by a general wilting and also the fine frass or borings which are thrown out through the small entrance hole near the top of the stem. After the borer enters the root another hole is made near the surface of the ground for the discharge of borings and the infested plants are usually marked by a circular mound of such rejecta, reminding one somewhat of grains of earth surrounding an ant burrow. The full-grown caterpillar inhabits the root. It measures from one and one-third to one and one-half inches in length, is naked, flesh-colored, with no stripes or mottlings. The head and thoracic shield are testaceous, shining, the latter margined with black on the side. The anal shield, spiracles and minute setigerous tubercles are black.

The above life history details, based on notes kindly placed at our disposal by Mr Bird, show that it is comparatively easy to check this pest by burning over infested beds any time after the foliage dies and before the appearance of a new growth in the spring. Mr Bird cites several instances in which this method has given excellent results.

An incipient infestation, if one recognizes the connection between wilting stems and later root injury, can be materially checked by cutting out the flower stalks containing the young borers and burning them. It is even possible to destroy larvae in the roots by injecting arsenate of lead into the burrow with a small syringe or oiling can.

Silver-spotted skipper (E p a r g y r e u s t i t y r u s Fabr.). The peculiar caterpillar of this butterfly is a well-known feeder on locust and wisteria and has been recorded from such a variety of leguminous plants that in the opinion of the late Doctor Scudder, the insect would probably feed on any of the Papilionaceous Leguminosae. The full-grown caterpillar is about one and one-half inches long, greenish or greenish yellow, with a dark-brown head bearing a pair of bright red, eyelike spots. The slender neck and somewhat sluglike shape of the body, in connection with the above characteristics, is sufficient for the identification of this caterpillar. Ordinarily it feeds within a partly folded leaf and therefore largely escapes observation. There is but one brood in the North and two or three in the South.

This insect was the cause of an unusual complaint the past summer on account of its feeding on wisteria and then making itself a nuisance by invading a sleeping porch partly sheltered by the vine and even soiling the bedding. The conditions were such that control by the applications of poisons could not be advised and, as a consequence, hand picking or the exclusion of the caterpillars by means of a fine screen were the only practical methods of eliminating the nuisance.

Spindle worm (A c h a t o d e s z e a e Harr.). Elder shoots infested by this caterpillar were received from Geneva, N. Y., in mid-June. This insect is a close relative to the more common and better known stalk borer, and the larva, like that of some of its allies, occurs in the stems of a variety of plants. It has been recorded from corn and dahlia, in addition to elder, and occasionally becomes somewhat abundant though it is rarely brought to the notice of the economic entomologist. The full-grown caterpillar is yellowish white, about an inch long, with a black head, thoracic and anal shields and a series of moderately conspicuous, black tubercles or spots on the body. Its work in elder twigs is marked by a wilting of the shoots, the tip hanging because the interior is gnawed away until only the thin bark remains. There is a similar record of this insect injuring corn in New England, though nothing of the kind appears to have been brought to notice in recent years. This borer completes its growth about the middle of June and consequently damage to corn, if it is inflicted, must occur while the plants are still small. The moths appear the latter part of June and have been taken in New York as late as mid-August. It is very probable, as in the case of some of the allied stalk borers belonging to the genus Papaipema, that the insect winters in the egg stage, the young caterpillars commencing operations shortly after growth starts in the spring. If this surmise as to its life history is correct, it is obvious that injury in corn fields must either be limited to the margins near wild growth or to fields which have been indifferently cultivated and infested with thick-stemmed plants which would prove attractive to the moth when ovipositing.

Gooseberry fruit worm (Zophodia grossulariae Pack.). This insect is so rare that it is seldom brought to the attention of the economic entomologist, especially in the eastern United States, and the opportunity is therefore taken of placing on record a few observations made upon infested plants near the southeastern border of the State. The larvae were rather abundant in a small gooseberry and currant patch at Stamford, Conn., June 29th. The pale green, indistinctly striped, brown-headed caterpillars, about three-fourths of an inch long when full grown, enter the gooseberries and devour the interior, causing the infested fruit to color prematurely and turn brown. There is usually more or less fungus accompanied by a slight webbed protection above the entrance to the fruit. It was not uncommon to find two or three injured gooseberries in close proximity, having been entered presumably one after the other by the caterpillar. In the case of the smaller currants several of the berries are drawn together in a webby mass, the caterpillar eating out the contents of a number. The infestation was such that 50 to 75 per cent of the gooseberry crop and an appreciable portion of the currants in a small planting were destroyed. The winter is passed in the pupal stage, the moths appearing shortly after the fruit has set.

Ordinarily this insect can not be considered a serious pest and hand picking or allowing poultry, when practical, to run among currant and gooseberry bushes, are the most promising methods of checking the insect.

Spraying with a poison, such as arsenate of lead, just as the webs are beginning to form has given excellent results, according to Professor Parrott.

Carrot rust fly (Psila rosae Linn.). A parsnip infested with the larvae of this insect was received from Hempstead, N. Y., the last of July. This pest was first brought to our notice December 30, 1901, and a detailed account of the insect will be found in Museum Bulletin 64, pages 99–103.

Apparently this species has not become excessively abundant, since it has been brought to attention only occasionally, though it has been reported during the last few years as being abundant and injurious in the vicinity of Rochester.

A rotation of crops planned so as to plant those susceptible to attack by this insect on ground remote from that which may have become infested in earlier years, is one of the best protective measures. This should be supplemented by late sowing whenever that is practical and, if necessary, the use of a repellent, such as a carbolic soap wash during June at the time the flies are abroad and deposit their eggs.

European mole cricket (Gryllotalpa gryllotalpa Linn.). A living specimen of this insect was received early in the spring, accompanied by the statement that it had been captured in the vicinity of Buffalo on a shipment of mixed ornamental shrubs from Holland. This is a well-known species recorded as occurring throughout Europe and being abundant in France, often causing considerable damage to gardens. It has recently become established in a New Jersey locality where similar shipments are received annually. The species was undoubtedly brought into New Jersey with imported nursery stock and has become so abundant locally that systematic efforts were necessary to reduce its numbers, 20,000, including eggs, having been destroyed in one year.

The European mole cricket is a moderately stout, dark brown, frequently wingless insect with a length about 1¼ inches and easily distinguished from our common crickets and their allies by the short legs and especially the heavy forelegs with the fingerlike extensions admirably adapting it to burrowing in the soil. It is very similar to our native northern mole cricket, Gryllotalpa borealis Burm., a species widely distributed and occasionally found in small numbers, especially in the moist soil along streams and ponds. This European pest is more likely to become abundant in moderately heavy, rich garden land. It is recorded as feeding upon vegetable matter and as causing considerable damage because of its cutting all roots that obstruct its search for food. The insect is rather slow breeded, and although one female may produce 200 eggs, it requires three years to complete the life cycle. It is stated that it takes twelve years for the pest to become so abundant as seriously to threaten cultivated plants.

The work of Messrs Worsham and Reed,[1] on an allied and destructive species in Georgia, has shown that plowing of breeding areas to destroy the eggs, the use of light traps at certain seasons and compost heap traps during winter, supplemented by distributing poisoned baits consisting of cotton seed meal and arsenicals and the use of sulphur and napthalene as repellents, are the most effective methods of checking the insect. It is probable that similar measures would be of value in any locality where this new European pest becomes troublesome.

GREENHOUSE PESTS

Florida fern caterpillar (Eriopus floridensis Guen.). Caterpillars of this southern species were received in June from Mr L. F. Strickland, nursery inspector, accompanied by the statement that they had ruined over 3000 ferns for Mr F. G. Lewis of Lockport. The pest displayed a marked preference for the Boston fern and the maiden-hair fern. An examination of conditions showed that the caterpillars fed here and there upon the leaves, eating the fronds in such a way that the plants developed in a very irregular, ragged manner, rendering them totally unsuitable for ornamental purposes. The pinnae of the fronds of the Boston fern are frequently eaten off about midway, while the leaflets of the maidenhair fern may be bitten off or the entire frond severed near the ground. Under greenhouse conditions, breeding is practically continuous throughout the year.

The full-grown caterpillars are nearly an inch long and vary greatly in appearance, there being two well-marked forms. Both have a moderate sized, reddish brown head. The body of the lighter colored caterpillar is mostly greenish, each segment being plainly marked by a broad, transverse, dark-brown band which extends to the sublateral areas and, in the case of the abdominal segments, is produced as a distinct lateral prolongation almost to the spiracular line; below the spiracles there is a whitish line bordered ventrally by an irregular dark-brown line. The dark caterpillars are nearly uniform, slightly mottled, dark brown, the younger of these with a well-marked, white spiracular line.

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[1] Ga. Exp. Sta. Bul. 101.

The small caterpillars are lighter and, like the full-grown ones, show two distinct types; the dark form with a conspicuous lateral white line, while the lighter form has a sublateral, pinkish line and a substigmatal, brownish line.

The moth is a moderately heavy insect with a wing spread of about $1\frac{1}{2}$ inches. The forewings are rather prettily and strongly marked with light gray reticulate lines and are produced in a distinct angle near the middle of the outer edge.

The caterpillars can be destroyed by the use of poisons, but unfortunately ferns are so sensitive that the application of a sufficient amount of Paris green is likely to result in severe burning, while the use of arsenate of lead renders the plants unsightly. Generally speaking, the probabilities are that in most cases there is no better method of controlling this pest than by systematic and thorough hand picking to destroy the caterpillars. It is a southern species which can not maintain itself in our northern latitude and this restriction would justify considerable expense, either for control measures or the adoption of special precautions, to prevent the insect becoming established in a greenhouse. This latter, in the long run, is probably the most practical method of avoiding trouble by this species.

Rose gall midge (Dasyneura rhodophaga Coq.). This serious pest of the indoor rose grower has been reported from Hudson river greenhouses in earlier years, though it seems to have caused little injury recently till it was again reported last fall as damaging roses near Blauvelt. It may well be considered a destructive insect, since if it becomes abundant it may be impossible to secure a crop of flowers. A few years ago it was estimated that this pest caused a loss of $10,000 annually in two Chicago greenhouses.

The rose gall midge attacks the young leaf or flower buds, preferably the latter, and causes various malformations at least, though frequently there is a browning and death of the affected parts. The parent insect is a very small, brownish, frail midge about one-twenty-fifth of an inch long, which deposits her eggs in the developing rose tips. The maggots are at first white, later becoming reddish. Breeding is continuous from May until October, and as only two weeks are required to complete the life cycle, the possibilities of injury are very great. The midge is known to attack the following varieties: Meteor, Wooten, La France, Madam Chatenay, Bride, Ivory and Golden Gate, and is said to be especially partial to all "Hybrid teas." It is not known to breed on hardy or outdoor roses.

Experience has demonstrated the impracticability of satisfactorily controlling this insect by fumigation with hydrocyanic acid gas, since it is impossible to destroy the maggots with a strength which can be used with safety and repeated fumigations are very apt to endanger the plants. A most satisfactory though drastic measure is to clean thoroughly the house during midwinter, at a time when the insects are dormant in the soil. This means the removal and destruction of the plants; the soil on the benches should be carted out for some distance so that there will be no danger of midges emerging with the coming of warm weather and making their way back to the house. The interior should be thoroughly cleaned so as to destroy any insects which might take refuge in loose accumulations of soil, cracks or crevices. If it is impractical to clean out such accumulations, a thorough spraying with a contact insecticide, such as kerosene emulsion, is advisable. The house, it is perhaps needless to add, should be restocked with clean plants and every effort made to avoid reinfestation.

Chrysanthemum gall midge (Diarthronomyia hypogaea H. Lw.). The reception of infested plants or midges from the states of Maine, Delaware, South Dakota and Washington and Victoria, B. C., during the past year indicates that this recently introduced pest is becoming widely disseminated, probably through the shipment of infested plants. It has been previously recorded by us from California, Michigan and Oregon, and also from eastern Canada. This is probably only a partial record of the distribution of this insect, a species which may produce numerous galls upon the leaves and stems of most cultivated chrysanthemums, and if there is a serious infestation the growth of young plants may be arrested and make them practically worthless for blossoming purposes. These facts justify a close watch on the part of chrysanthemum growers and the exercise of every reasonable precaution to prevent this insect obtaining a foothold in greenhouses previously uninfested.

More recently this insect has been reported from Cromwell, Conn., by Prof. G. W. Herrick, from Providence, R. I., and Fitchburg, Mass., by A. I. Bourne of the Massachusetts Agricultural College and from Swampscott, Mass., by W. S. Regan of the same institution.

One of the easiest methods of detecting the young, inconspicuous galls is to allow the leaf to slip through the loosely-closed fingers, a process which will readily disclose the presence of slight swellings. It is particularly desirable to recognize even the smallest galls if an attempt is made to prevent the introduction of the pest. The small, developing gall appears as a slight, nodular elevation with a darker center protected to some extent by an unusually abundant mass of short, white hairs, while the fully developed gall, about one-twelfth of an inch long, has comparatively few of these short hairs and the discolored apical portion makes it relatively inconspicuous. The galls containing insects nearly ready to escape may be recognized by the small, withered, discolored, free tip. Scattered galls may occur almost anywhere along the stem, on the petiole of the leaf, on the leaf surface, along the veins of the leaves and occasionally at the very tip of the lobe, and as they are only about one-twelfth of an inch long, it is very easy to overlook a few.

A detailed account of this insect is given in the report for 1915, New York State Museum Bulletin 186, pages 51 to 55, to which the reader is referred for additional details.

Thread scale (Ischnaspis longirostris Sign.). Specimens of this insect, previously unrepresented in the state collections, were received in early September from the western part of the State. This scale insect occurred on the Chinese fan palm and is recorded from a variety of plants, such as palms, palmetto, latania, magnolia, coffee, etc. It is a dark brown or blackish scale, one-twelfth to one-eighth of an inch long and easily distinguished from other scale insects by its extreme narrowness, it being about eight times as long as wide, and frequently more or less curved. This species is recorded by Newstead of England as being a difficult one to destroy, and the most promising method of controlling it, should this prove necessary, would be by thorough and repeated sprayings with nicotine-sulphate, 40 per cent nicotine, used at the rate of three-fourths of a pint to 100 gallons of water to which are added 6 to 8 pounds of any cheap soap. The probabilities are that breeding is nearly continuous throughout the year under greenhouse conditions, and consequently repeated applications might be necessary to control the pest.

GRASS AND CLOVER INSECTS

White grubs (Phyllophaga[1] fusca Frohl. and others). Injuries by white grubs in 1915 were extremely severe here and there in southern Rensselaer and northern Columbia counties in particular, though the damage was considerably lessened by an unusually abundant and well-distributed rainfall during the summer months.

[1] This is Lachnosterna of earlier publications.

The loss on the potato crop where planting was upon badly infested land, ranged from 30 to 75 per cent and under such conditions it was natural that there should be considerable apprehension in the spring of the past season. Our knowledge of this insect enabled the Entomologist to assure many farmers that there would be comparatively little danger in planting susceptible crops on land badly infested with nearly full-grown grubs, provided this planting was delayed until the middle or latter part of June. The great danger, as has been pointed out previously, is the putting of such crops in fields infested by numerous small, comparatively inconspicuous, partly grown grubs, since these are the ones which devour a large amount of vegetation during the season and cause by far the greater portion of the injury.

It is comparatively easy to make general recommendations which may be vitiated to some extent at least by unusual local conditions. By far the greater number of white grubs were in a partly grown stage in the spring of 1915 and therefore nearly full grown last spring, while in some fields there was a considerable abundance of young grubs in the spring of 1916. The Entomologist urged farmers to make examinations and plant in accordance with their findings. In one instance the Entomologist made an examination of recently plowed sodland which had been badly injured in 1915, and which it was proposed to plant to potatoes the past season. A very few small white grubs were to be found here and there and some nearly full-grown ones, the latter apparently much more abundant because of their greater size. The owner was advised to plant potatoes in spite of the presence of the small number of young grubs, and at the end of the season harvested a crop of 325 barrels, showing no injury whatever by white grubs. This instance is cited because it illustrates in a concrete manner the possibilities of avoiding, to a considerable extent, injury by these well-known pests, since it is extremely hazardous, if not unwise, to plant potatoes or other susceptible crops on ground infested with many small white grubs.

Next year, 1917, is the time for May or June beetles, the parents of the destructive white grubs, to appear in large numbers, and in localities where there is serious injury to the foliage of oak, maple and other trees, severe damage by the grubs may be expected in adjacent grasslands the following season. It is entirely practical for the farmer to judge somewhat of the abundance of the beetles by the extent of their work upon forest trees, and this alone will give some clue of the probabilities another year and, in a measure at least, serve as a guide as to the advisability of making more or less close examinations to determine whether grassland in which susceptible crops, such as potatoes, would normally be planted, should be used for such purposes or the rotation changed and some crop not liable to injury, such as rye, be substituted.

White grub robber fly (Promachus fitchii O. S.). The stout white maggots of this efficient natural enemy have been under observation for four seasons and conditions this year almost duplicate those observed in 1913, namely, a considerable abundance of these maggots in sodland which had been so injured by white grubs the preceding year that the grass was practically killed. Areas where these maggots were most abundant were characterized by a scarcity of white grubs, and conversely these pests of the farmer were more numerous in sodland where the predaceous maggot was relatively scarce. Conditions typical of this section are embodied in the following notes.

An examination May 8th of grass sod on the farm of Mr F. B. Smith, Schodack, revealed a moderate number of nearly full-grown white grubs, some decidedly yellowish and an almost equal number of the predaceous maggots of Promachus.

An investigation June 12th of a large plowed field belonging to Mr G. A. Hoyt, also of Schodack, resulted in finding very few full-grown white grubs, several half-grown white grubs and a number of Promachus larvae. This field was so badly infested by white grubs the previous year that considerable areas were torn up with a horserake and yet at the present time there are very few white grubs and considerable numbers of the maggots. There is no escaping the conclusion that Promachus larvae have been an important factor in controlling the pest, which is supported by the unusual abundance of the parent insects or robber flies.

The true character of these beneficial maggots should be more generally recognized. They are, when full grown, about an inch long, one-fourth of an inch in diameter, moderately firm or rather horny in texture, and invariably lay in a straight or nearly straight position and present a marked contrast to the half-curled, stouter and relatively shorter white grubs which, as most farmers know, lay upon their side. An abundance of the maggots, as previously stated, means relatively few white grubs and materially lessens the danger of injury from this destructive pest.

Grasshoppers (Melanoplus atlanis Riley and others). The season of 1916 opened with the appearance of many small grasshoppers here and there in localities where these pests were numerous two years previous. The most common species was, as in earlier seasons, the lesser red-legged grasshopper, Melanoplus atlanis Riley, while a number of the green-striped grasshopper, Chortophaga viridifasciata DeG., were rather common about mid-May in a field at Lewis, Essex county. This latter species, however, is not one which was particularly injurious earlier, and the probabilities are that it is almost negligible, economically speaking.

The indications of early spring were greatly modified by the frequent and abundant rains of the late spring and early summer producing such an abundant forage that most fields were able to maintain a fair to large grasshopper population without showing material injury. It is also very probable that many of the small grasshoppers succumbed to unfavorable climatic conditions and as a consequence the serious injuries of earlier years were confined to comparatively small areas here and there which were mostly in sections where there had been no earlier systematic effort to control the pests.

The developments of the last season have served to confirm earlier opinions in regard to the entire practicability of controlling these pests by the early and systematic distribution of a poisoned bait in badly infested fields, giving special preference to places where the insects are abundant. The formula for the so-called Kansas bait has been published repeatedly and directions for the preparation of this mixture can be easily secured by referring to earlier reports.

A modification of the Kansas bait worthy of mention was found very effective in Canada during 1915. It consists simply of the substitution in the Kansas formula, of 10 pounds of sawdust for an equal amount of bran, and in areas where this was used, 103 to 139 grasshoppers to the square yard were destroyed in pasture and oat fields, respectively. This preparation was apparently even more effective if all the bran was replaced by sawdust, though this seemingly anomalous result may have been explained in part by local conditions which may not have been fully appreciated at the time the tests were made.

Phytonomus meles Fabr. This is a moderately stout, variably-colored, grayish brown or greenish weevil with a length of approximately one-sixth to one-fifth of an inch. It appears to be a recent introduction, since there is no record of its capture prior to June 1907, at which time it was taken in New York by Mr R. E. Dow. It has been reared from clover collected in the vicinity of Albany. In the latter part of May 1912, weevils were observed in large numbers on red clover, at New Baltimore, N. Y., in association with a much smaller introduced form, Tychius picirostris Fabr. The two species caused considerable injury, partly riddling the leaves. This Phytonomus presumably has a general distribution in New York State, since it has been captured in several localities in the vicinity of New York City, and at Port Chester, West Point, New Baltimore and Albany. Messrs Blatchley and Leng record it as occurring from Canada, New England, New York and New Jersey, and state that it may be found all over Europe, excepting Spain, and also in parts of Asia and along the north coast of Africa. European authors have recorded this insect as feeding upon certain species of Medicago as well as Trifolium incarnatum, in addition to red clover. Titus has observed the deposition of eggs on and in the stems and leaf petioles of clover and alfalfa, and on the blossoms of clover. Five to seven eggs were deposited in the stems, while elsewhere they were placed singly. Ordinarily early cutting of clover for hay will prevent serious injury, though this method is impractical in localities where seed is grown. This is a recent introduction like the larger and much better known punctured clover leaf weevil, Hypera punctata Fabr., a species which in earlier years caused considerable apprehension in this country.

Tychius picirostris Fabr. A small, obscurely brown and black-marked beetle, only about one-eighth of an inch long and with a distinct, black-marked snout, was taken in considerable numbers May 20, 1910, on clover at New Baltimore, in association with the larger Phytonomus meles Fabr. This Tychius is a recent introduction which appears to have become well established in New York State, having been recorded from New Baltimore, Albany, Lake Champlain, Newport, Speculator, Gouverneur, Waterville, Oswego, Batavia, McLean and Ithaca. It was very abundant and injurious at New Baltimore and has been recorded by Casey as occurring in extraordinary numbers at Lake Champlain, while Knight reports it as common locally, especially on pear trees in western New York. It has also been reported from Maine, New Hampshire, and Massachusetts localities, and more recently as injuring clover in the province of Quebec, Canada, where it was recorded by Mr Du Porte as attacking both leaves and flower heads. In Europe it is known to injure red clover, Plantain and Genista.

It is very probable that repressive measures of value in controlling Phytonomus meles Fabr., noticed above, would be equally serviceable in checking this smaller clover pest.

Clover leaf midge (Dasyneura trifolii Lw.). This European midge was first recognized in America by Prof. J. H. Comstock in 1879, and appears to be somewhat widely distributed though there is a lamentable paucity of definite records. This deficiency has been supplied, in part at least, by incidental observations made during the summer, which have resulted in our finding the insect or its work at the following localities: West Nyack, West Haverstraw, Newburgh, Wappingers Falls, Ghent and Newfane. These brief records would indicate a wide and presumably somewhat general distribution in New York State. It is very probable that this insect will eventually establish itself in all sections where white clover is moderately abundant.

MISCELLANEOUS INSECTS

Cat and dog flea (Ctenocephalus canis Curtis). This insect is a very common one wherever the smaller domestic animals are found, and the dog or cat without a few fleas is exceptional. This pest not only occurs upon the animals, but the slender, active, white larvae feed upon organic matter in cracks and crevices and are most numerous about the sleeping places of their hosts. The flea is a prolific insect, as has been demonstrated frequently in the case of houses closed for a few weeks or months during summer. More than once returning householders have been surprised to find the home overrun by these active and annoying pests, they taking advantage of the abundant dust and comparative freedom from disturbance. This sometimes occurs in houses where no cats or dogs are kept, the insects entering from nearby shelters, such as piazzas, open sheds and the like.

A striking instance of the prolificacy of fleas and the annoyance and alarm which may be caused, was brought to our attention the past summer. The trouble occurred in a general grocery store in the Adirondack region, the cellar being badly infested, the insects even invading the stove and spreading to the upper floor. The fleas bred in the cellar which had a cemented floor and was filled promiscuously with boxes and bags, making anything like systematic cleaning very difficult if not impossible. The dry, almost undisturbed dust afforded nearly ideal conditions for the development of the young fleas. The proprietor was greatly concerned lest this be some new and dangerous insect, though investigation showed it to be the above named common species. Repeated fumigation with burning sulphur and the use of a liberal quantity of napthalene flakes resulted in the destruction of the pest.

Saw-toothed grain beetle (Silvanus surinamensis Linn.). This minute, brown grain beetle is a common species in cereal preparations and occasionally occurs in large numbers in grain bins. Such an instance was brought to our knowledge in August 1903, the insects being extremely abundant in a large bin filled with oats and, escaping from there, made nuisances of themselves in adjacent dwellings. Early in September of the past season our attention was called to a similar infestation in which oats were so badly infested that horses would not eat them. It was impossible to obtain any definite statements as to the earlier history of the grain though the probabilities are that the oats had been stored for some months in a badly infested bin. The obvious remedy is to thoroughly clean out granaries and grain bins every few months in order to prevent excessive multiplication of such insects, and these measures may well be supplemented in special cases by thorough fumigation with carbon bisulphide or, where conditions justify, treatment with hydrocyanic acid gas.

Barypeithes pellucidus Boh. This is a reddish brown or dark-brown, rather hairy, small weevil, about one-eighth of an inch long, which was found rather commonly under dead leaves in an apple orchard at Kendall, N. Y., May 22 and June 1, 1916. The weevils appeared to be feeding upon the dead foliage and attracted attention because of their being somewhat numerous. This inconspicuous European species appears to be a recent introduction which has been recorded from both Long and Staten Islands and Batavia, and also from Massachusetts, New Jersey and Ohio localities. It is credited with attacking strawberry plants in Europe, though nothing of the kind has been observed in America.

Sun-flower purse gall (Asphondylia globulus O. S.). A number of galls produced by this species and collected August 1, 1916, by Roy Latham, Orient, N. Y., enabled us to make a study of the structure of this deformity. The plants show that the galls may occur within 4 inches of the ground and from that to a considerable height, presumably 3 feet or more. There are several types of the deformity, evidently due to the same insect and explainable largely by variations in method of oviposition.

In the first place there are minor, less characteristic galls forming irregular, lobulate masses of the flower heads and terminal buds. These galls are more or less variable in shape and when in a group may form a mass not unlike that of A. conspicua O. S. and approximately three-fourths of an inch in diameter.

The typical gall associated with this species is a podlike, somewhat reniform stem enlargement with a length of approximately three-fourths of an inch, a major diameter of one-half of an inch and a minor diameter or thickness of three-eighths of an inch. It is very apt to show an irregular suture along the outer margin, suggesting a point of adherence, and on tearing the deformity open with blunt instruments or the fingers it is at once apparent that the larvae or pupae, as the case may be, occupy a somewhat regular, curved series of nearly uniformly spaced cells, each with a length of 6 or 7 mm, a diameter of 3 mm, separated from its fellow by a wall of tissue 1 to 3 mm thick and when containing pupae at least, lined with a whitish pubescence. The arrangement suggests very much the conditions obtaining in the grape apple gall of Schizomyia pomum Walsh & Riley, except that there is but one series of cells instead of a double row.

The occurrence of galls among the leaf and flower buds on the tips of these plants indicates that infestation occurs while the affected tissues are in a formative condition, and the probabilities are that the firmer and more characteristic enlargements of the stems also originate while the affected tissues are in a similar condition.

The following stages are described for the first time:

Larva. Length 3 mm, mostly whitish yellow, moderately stout and with a more or less distinct, usually quadridentate breastbone. The young larvae occurring in immature galls are more slender and apparently have a somewhat different breastbone from that of the older larvae found in association with recently transformed pupae.

Exuvium. A nearly uniform light yellowish brown.

Pupa. Length 4 mm, thoracic horns long, slender, the body mostly a dark reddish orange, the older pupae with the eyes, the wing and leg cases dark brown.

Periodical Cicada (Tibicen septendecim Linn.). A brood of this large, remarkable insect appeared in the western part of the State, and inasmuch as the life cycle is an extraordinarily long one and the species appears to be materially affected by natural enemies and changes incident to the clearing up and the settlement of the country, the persistence of this form is of more than usual interest. This brood was founded by Doctor Riley on records which run back to 1797.

The following records respecting the abundance and distribution of this insect have been brought together through the cooperation of a number of correspondents.

Cayuga county. The trees at the upper edge of the Great Gulley brook east from Farley's showed many dead branches caused by oviposition (C. R. Crosby, Ithaca).

Mapleton. A great number of nymphs were dug up on the farm of George Baylor near this place (C. R. Crosby, Ithaca).

The above records should be supplemented by those of V. H. Lowe [1] who recorded the species in 1899 from Union Springs and points extending about 3 miles north, 3 miles west and 7½ miles south of that locality.

Livingston county. Conesus lake. On the west side near Long pond there were great numbers of Cicadas. They were sufficiently numerous to keep up a continuous singing during the sunny hours (William T. Davis, New Brighton).

Geneseo. There were a few in the village and large numbers were to be found upon the estate of W. A. Wadsworth to the south and also north of the village in woods and fields where they were reported as being present by millions (William R. Houston). Supplementing the preceding, a colony was reported to be in a hedge row and neighboring woods west of the town. The Cicadas were said to have been destroyed soon after they made their appearance (P. J. Parrott, Geneva).

Groveland. The insects were reported as present and as having entirely disappeared by July 6th (P. J. Parrott, Geneva).

Mount Morris. A large colony was reported from the Conklin woods near the Craig Colony for Epileptics at Sonyea and another brood 5 miles west and near Geneseo (Frank George, Mount Morris).

Sonyea. A portion of the forest owned by the Craig Colony for Epileptics literally swarmed with Cicadas, they being so thick that one grab at the leaves of a young oak resulted in capturing twenty insects. No damage was reported (Truman L. Stone, Sonyea).

Monroe county. Irondequoit. The insects were reported from this locality (P. J. Parrott, Geneva).

West Webster. Cicadas appear to have been very abundant in this locality and their presence was recorded by several observers. A few adults were found in an orchard by Mr Eversley S. Ferris May 26th, and from June 4th to 14th. Both Mr Ferris and Mr George A. Franck of Rochester found the insects occurring by the thousands in the apple orchard on Mr Welcher's farm. Mr Franck stated that on June 5th he collected, with help, some 6000 specimens in four hours, taking fifteen males to one female; June 6th he found females more abundant though not nearly so numerous as the males; on June 8th he collected 1000 adults in three-fourths

[1] N. Y. Agric. Exp. Sta. Bul. 212, p. 13.

of an hour, the females then being very common and nymphs issuing from the ground in immense numbers; on June 14th the insects made such a din that they could be heard for almost a mile, and at that time no eggs had been deposited; June 18th the Cicadas were pairing, there were no signs of diminished numbers, and two or three collectors could have easily captured 20,000 specimens in a few hours. The work of natural enemies was very evident and in some places Cicada wings were so thick that they covered the ground. The branches of the trees were full of blackbirds, orioles, bobolinks and sparrows, which undoubtedly had been feeding on the insects, and hundreds of birds were to be seen flying over the orchard. June 25th the Cicadas had entirely disappeared and no evidences of oviposition in twigs or branches were to be found, this probably being due to the early destruction of the insects by birds, other natural enemies or possibly by the excessive rains.

Onondaga county. Onondaga Valley. Cicadas were reported by Mr Grant Hitchings as less numerous than during the past two visitations. They caused considerable injury in earlier years by depositing eggs in the smaller twigs, but there was little evidence of such damage the past season. The Cicadas were apparently much more numerous on the Indian reservation than any other area in this valley (P. J. Parrott, Geneva).

Syracuse. Prof. Charles W. Hargitt, of Syracuse University, states that in 1899 he had occasion to study with some care the local occurrence of the insect and then it seemed evident that the brood was declining in numbers and becoming more erratic in its distribution. This, he adds, was much more evident in 1916, the insects in and about Syracuse being one-tenth as numerous as in 1899.

Observations by Prof. W. M. Blackman and H. H. Stage, both of the State College of Forestry, Syracuse, may be summarized as follows:

Numerous nymphs were uncovered in the spring and early summer of 1915, when the College of Forestry built a road through the tract of woods at the experiment station near Rockwell Springs. The nymphs were so numerous that in places every shovelful of dirt taken from two to four feet below the ground contained from six to a dozen specimens. During field trips in early May 1916, nymphs were observed in their burrows and under large stones and logs. Emergence and transformation began the last week in June. At this time skins were becoming rather numerous on trees and shrubs in the region south of the city. Cicadas were reported as present in large numbers all through the Onondaga valley and the Indian reservation. They were also observed in considerable numbers in the vicinity of the Syracuse caves and in Oakwood cemetery. Oviposition commenced the last of June and every medium-sized tree showed from a dozen to twenty-five or more wilted twigs. The English sparrow was observed feeding upon the Cicadas, and near the Syracuse caves the wings of these insects were very numerous along the roadside.

Madison county. The Cicada was not reported from any Madison county localities the past summer, though it was recorded by V. H. Lowe in 1899 from Chittenango and vicinity.

Ontario county. Billsboro. The insect was reported from this locality (P. J. Parrott, Geneva) and was recorded from the same place by V. H. Lowe in 1899.

Holcomb. About two hundred acres of orchards were very thickly infested with Cicadas (W. D. Leonard, Ithaca).

Ionia. Cicadas were reported as very abundant in a woods one-half of a mile north of the village (P. J. Parrott, Geneva).

Manchester. After diligent inquiry in regard to this insect, no one seems to be aware of its presence this season in any locality and many believe that it has broken away from its old custom of reappearing every seventeen years (P. F. Lyman). The Cicada was reported from this place by V. H. Lowe in 1899.

Victor. Cicadas appeared in enormous numbers in several old apple orchards north of the village. Some growers state that this is the third appearance of the insects in their plantings. Nymphs began to emerge from the ground during the last days of May and were present in great numbers on June 7th. The trunks, large branches and water sprouts were literally covered with thousands of the moulted skins. A few nymphs were observed on June 23d, adults were very abundant June 7th and continued to appear as late as June 23d. Oviposition was most active from July 1st to 9th; by July 11th the Cicadas had practically disappeared. The insects were destroyed in a number of apple orchards by blackbirds, sparrows, chickens and ducks before there was an opportunity to deposit eggs. On the larger part of one twelve-acre orchard there was hardly a square foot of soil that did not show either the wings or front claws and head or last abdominal segment or the entire insect. In several instances as high as five or seven of the mutilated Cicadas were observed in a single square foot. This condition prevailed not only in the larger part of some of the orchards but to a distance of 50 or 60 feet to the south of the planting. On June 3d, when nymphs were most abundant on the trunks of the apple trees, neighboring farmers assisted one grower in an effort to free his orchard of the insects and as a result thousands of pupae were destroyed. It is certain that comparatively few Cicadas will appear in several apple orchards at the time of their next visitation. There was considerable oviposition in the orchard of C. C. Horton and on neighboring fruit trees along the highway, this being especially marked on water sprouts and twigs in the uppermost parts of the tree. Spraying with a whitewash containing large amounts of lime and copper sulphate to give increased adhesive properties did not prevent extensive oviposition. Some living Cicadas infected with the fungus, Massospora cicadina Pk., were found at Victor, in some instances the posterior portion of the body being badly disintegrated (P. J. Parrott, Geneva).

Mr C. C. Horton states that the infested area extends from Victor at least 3 miles east and is about 2 miles wide, covering the northern portion of the towns of Victor and Farmington. There is another belt in the southern part of the town and the northern part of the town of East Bloomfield; the section between these areas appears to be entirely free from Cicadas. He also states under date of June 17th, that the weather was so unfavorable that many insects were drowned and numerous others developed into ill-formed adults.

Tompkins county. Lake Ridge. Several specimens were taken June 16, 1916 by Mr Benjamin, who stated that the insects were abundant over a district about 10 miles in length and several miles in width, of which Lake Ridge seemed to be the center (C. H. Hadley, jr and Dr R. Matheson).

Yates county. Dresden. Cicadas were reported from Dresden and also from Earls (P. J. Parrott, Geneva), both localities recorded by V. H. Lowe, who gives in addition, May's Mills and states that the insect occurred at points between.

Japanese spotted camel cricket (Diestrammena marmorata Haan). These insects and their allies are ungainly creatures with long legs and antennae, suggesting crickets, though they are easily distinguished from their better known relatives by the absence of wings. The species named above and kindly identified by Mr A. N. Caudell through the courtesy of Dr L. O. Howard of Washington, was received from Mr J. B. Achilles in August, accompanied by the statement that large numbers occurred in a cellar connected with a greenhouse at Buffalo. The body length of this introduced camel cricket is about one-half of an inch, while the distance from the tip of the slender antennae to the extremity of the extended hind leg is 2½ to 3 inches. This Japanese species was recorded from Minnesota in 1898 and according to a communication from Doctor Howard, has also become established in Kansas, Ohio, Illinois, Rhode Island, Wisconsin and Canadian greenhouses, but has not heretofore been found in New York State.

The camel crickets are nocturnal in habit and in nature are usually

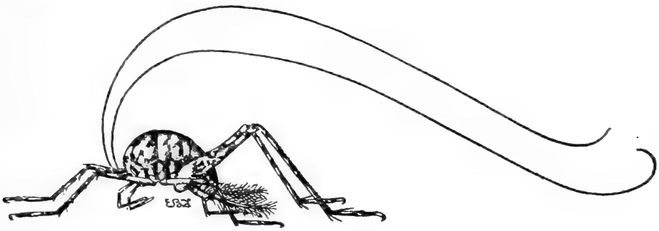

Fig. 1 Japanese spotted camel cricket, D i e s t r a m m e n a m a r m o r a t a , male (after Lugger)

found under logs and stones, along streams or in moist woodlands. Occasionally a few specimens may be captured in cellars. They are recorded as having nearly omnivorous habits, readily eating meat, fruit and vegetables. The probabilities of serious injury from this introduced species are not good, and where it becomes sufficiently abundant as to cause apprehension, as was the case at Buffalo, the judicious use of the Kansas bait is the most promising method of destroying the insects.

Carbon tetrachloride as a museum fumigant. This material was tested the past summer with very satisfactory results. It was used at the rate of approximately one-eighth of a pint to 2½ cubic feet of space. The insecticide was placed in a series of several watch glasses so as to secure a maximum evaporating surface and the case closed tightly for two or more days. There was no particularly obnoxious smell about the case though a distinct odor could be detected 48 hours after all the liquid had evaporated. Fumigation of this character killed beetles and larvae but apparently was ineffective against the eggs of the black carpet beetle, A t t a g e n u s p i c e u s Oliv. It is perhaps needless to add that carbon tetrachloride is much safer for general fumigation purposes than the more commonly used, somewhat obnoxious and explosive carbon bisulphide.

PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the Entomologist during the year 1916. The titles,[1] place of publication and a summary of the contents of each are given. Volume and page numbers are separated by a colon.

Soft Maple Leaf Midge, Rhabdophaga aceris Shim. Economic Entomology, Journal, 8:549–50, 1915

Notes on injuries and biology.

Gall Midges in an Orchard, Economic Entomology, Journal, 8:550, 1915

Observations on the abundance and habits of a species of Parallelodiplosis.

New South American Gall Midges. Psyche, 22:152–57, 1915

Ouradiplosis, Delphodiplosis and Epihormomyia are the new genera erected. The following new species are described: Porricondyla parrishi, Johnsonomyia braziliensis, Ouradiplosis aurata, Delphodiplosis cinctipes, Epihormomyia auripes and Lestodiplosis picturata.

30th Report of the State Entomologist on Injurious and Other Insects of the State of New York, 1914. New York State Museum, Bulletin 180, 1915 (issued December 14, 1915), p. 1–336, pls. 19, figs. 101

Contents

New Gall Midges. Canadian Entomologist, 48:29–34, 1916

The following new species are described: Dasyneura sassafras, D. gossypii, Walshomyia texana, Asphondylia sesami and Feltiella americana.

[1] Titles are given as published. In some instances articles appearing in a number of papers have been given different titles by the various editors.

The Pine Borer. Garden Magazine, February 1916, 23:50

A general account of Parharmonia pini Kell. with suggestions as to control methods.

Injurious Insects. New York State Department of Agriculture Circular 130, 1916, p. 169–72

Summary of results obtained in codling moth work in 1915 with observations on the apple maggot, San José scale and white grubs.

Tent Caterpillars. New York Farmer, February 10, 1916, p. 7

Brief warning notice with recommendations for control work.

Lasioptera fructuaria. Maine Agricultural Experiment Station Bulletin 244, p. 268–69, 1916

Technical description of the above-named species.

The Perils of Our Shade Trees. Country Life in America, March 1916, 29:42–43

Summary discussion of the shade tree problem with practical recommendations for the planting and care of trees.

Insect Enemies of Trees and How to Combat Them. Country Life in America, March 1916, 29:70, 72, 74, 76 and 78

Brief practical accounts of the elm leaf beetle, gipsy moth, brown-tail moth, white-marked tussock moth, leopard moth, hickory bark borer, two-lined chestnut borer, and the bronze birch borer.

Climate and Variations in the Habits of the Codling Moth. Economic Entomology, Journal, 9:107–9, 1916

A summary discussion of "side injury" by Carpocapsa pomonella Linn., and its apparent relation to cool evening temperatures retarding oviposition.

Side Worm Injury. Western New York Horticultural Society Proceedings, 61st Meeting, 1916, p. 55–60

A discussion of codling moth control, with special reference to "side injury," the work of Carpocapsa pomonella Linn.

Pear Thrips. Knickerbocker Press, April 17, 1916

Warning notice advising early and thorough treatment for this pest.

Side Injury by the Codling Moth. New York State Fruit Growers Association Proceedings, 15th Annual Meeting, p. 29–32, 1916

A discussion of the cause and control of "side injury" in western New York orchards, the work of Carpocapsa pomonella Linn.

Insect Problems of the Hudson Valley. New York State Fruit Growers Association Proceedings, 15th Annual Meeting, p. 200–7, 1916

A somewhat detailed account of the codling moth work with brief notices of the red bugs and the apple maggot.

Gall Midges of Certain Chenopodiaceae (Dipt.) Entomological News, 1916, 27:201–3

Observations on the midge fauna of the Chenopodiaceae with the erection of a new genus, Protaplonyx and the description of the type, P. hagani n. sp.

Tree Pests of Early Spring. Tree Talk, 3:104–5, 1916

The apple and forest tent caterpillars are briefly discussed together with other early leaf feeders, especially the elm leaf beetles.

The Gipsy Moth. Tree Talk, 3:111, 1916

A summary account of the habits and methods of control of Porthetria dispar Linn.

31st Report of the State Entomologist on Injurious and Other Insects of the State of New York, 1915. New York State Museum, Bulletin 186, 1916, p. 1–215, pls. 18, figs. 39 (mailed August 16, 1916)

Contents

Insects Particularly Affecting the Apple. (New York) Department of Agriculture, Bulletin 79, Part 1, p. 842–54, 1916

Brief accounts are given of the San José scale, Aspidiotus perniciosus Comst., oyster shell scale, Lepidosaphes ulmi Linn., and scurfy scale, Chionaspis furfura Fitch, aphids or plant lice, codling moth, Carpocapsa pomonella Linn., red bugs, Heterocordylus malinus Reut. and Lygidea mendax Reut., early leaf feeders, round-headed apple tree borer, Saperda candida Linn., and the fruit-tree bark beetle, Eccoptogaster rugulosa Ratz.

American Insect Galls. Ottawa Naturalist, June–July 1916, 30:37–39

General discussion of the relative abundance of the members of the various orders with some consideration of food habits.

Side Injury and Codling Moth. Entomological Society of Ontario, 46th Annual Report, 1916, p. 40–42

A brief discussion of side injury by young Carpocapsa pomonella Linn. larvae and its relation to evening temperatures.

ADDITIONS TO THE COLLECTIONS, OCTOBER 16, 1915–OCTOBER 14, 1916

The following is a list of the more important additions to the collections:

DONATION

Hymenoptera

Poecilostoma maculata Nort., black-marked strawberry slug on strawberry, May 30, A. M. Hollister, Saratoga Springs

Trichiosoma tibialis Steph., Hawthorn sawfly, cocoon, January 25, G. G. Atwood, Albany. Through State Department of Agriculture

Abia cerasi Fitch, cherry sawfly, cocoon on cherry, April 1, Nellie E. Squire, Canton

Cimbex americana Leach, elm sawfly, adults, July 24, Joseph Hamnow, Blue Ridge. Through State Conservation Commission

Pontania pomum Walsh, willow apple gall on Salix rostrata, June 6, S. H. Burnham, Hudson Falls

Kaliofenusa ulmi Sund., elm leaf miner, larvae on elm, June 17, A. P. Saunders, Clinton

Trichiocampus viminalis Fall., Poplar sawfly, larvae, September 1, N. M. Bump, Binghamton

Diprion abbotii Leach, Abbot's pine sawfly, larvae, September 29, T. F. Niles. Through State Department of Agriculture

Biorhiza forticornis Walsh, oak fig gall, February 14, R. W. Braucher, Kent, Ohio

Dryophanta palustris O. S., succulent oak gall on black oak, June 6, S. H. Burnham, Hudson Falls

Amphibolips confluens Harr., large oak apple on black oak, June 12, S. H. Burnham, Hudson Falls

Andricus futilis Bass., oak wart gall on white oak, June 6, S. H. Burnham, Hudson Falls

A. clavulus O. S., white oak club gall on white oak, June 12, S. H. Burnham, Hudson Falls

A. seminator Harr., wool sower, gall on white oak, June 12, S. H. Burnham, Hudson Falls

A. gemmarius Ashm., galls on pin oak, June 10, Mrs W. G. Drake, Newton, N. J.

A. petiolicola Bass., oak leaf stalk gall on black oak, June 12, S. H. Burnham, Hudson Falls

A. piperoides Bass., gall on red oak, September 29, Mrs E. P. Gardner, Canandaigua

Cynips frondosa Bass., oak rosette gall on oak, August 19, H. B. Weiss, Lakehurst, N. J.

Diastrophus fragariae Beutm., cylindrical strawberry gall on strawberry, June 29, E. L. Dickerson, Nutley, N. J.

Rhodites dichlocerus Harr., long rose gall on Rosa acicularis, November 9, S. H. Burnham, Hudson Falls

R. gracilis Ashm., galls, September 29, Mrs E. P. Gardner, Canandaigua

R. vernus O. S., knotty rose gall on rose, November 9, S. H. Burnham, Hudson Falls

R. bicolor Harr., spiny rose gall on Rosa humilis, June 12, S. H. Burnham, Hudson Falls. Same, on rose, July 3, Mrs E. P. Gardner, Canandaigua

R. rosae Linn., mossy rose gall on rose, August, O. Q. Flint, Athens

R. rosaefolii Ckll., rose blister gall on rose, September 5, H. R. Hagan, Boston, Mass.

?Pimpla rufopectus Cress., larva in spider cocoons, August, L. G. Vair, Roslyn

Pemphredon inornatus Harr., adult on rose, September 18, J. B. Collins, Woodhaven

Vespa crabro Linn., European hornet, work on lilac, June 17, F. A. Bartlett, Rye

Coleoptera

Brachytarsus sticticus Boh., adult on stinking smut of wheat, July 20, A. B. Buchholz, Albion

Phloesinus dentatus Say, red cedar bark beetle, adult, work in twigs, August 14, J. L. Richards, Brookline, Mass.

Phloeophthorus frontalis Oliv., mulberry bark beetle, work on mulberry, November 18, R. D. Adolph, Highland Falls

Eccoptogaster rugulosa Ratz., fruit tree bark beetle, work and adult on cherry, August 14, J. E. Dodge, Rochester. Same, adult, June 30, E. F. Herring, Nyack. Through State Department of Agriculture

Ips calligraphus Germ., coarse-writing bark beetle, work in Norway spruce, November 18, R. D. Adolph, Highland Falls

I. caelatus Eich., work in larch, September 18, C. H. Zimmer, Hicksville. Through State Department of Agriculture

Xyleborus dispar Linn., pear blight beetle, adult on maple, August 5, W. E. Britton, New Haven, Conn.

Pityophthorus minutissimus Zimm., work on red oak, July 3, J. L. Richards, Brookline, Mass.

Platypus sp., adult on Drepanocarpus lunatus, August, Dr Hermann Von Schrenck, Lower Amazon, Brazil

Pissodes strobi Peck, white pine weevil, work in spruce, July 17, Morris Rutherfurd, Warwick. Same, work in pine, August 25, Arthur Cowee, Berlin

Otiorhynchus sulcatus Fabr., adult, August 11, T. T. Neill, Westfield

Epicauta pennsylvanica DeG., black blister beetle, adult, August 16, Charles Goodyear, Bennington, Vt. Same, August 21, F. W. Kelley, Altamont. Same, August 28, G. G. Atwood, Albany

E. cinerea Forst., gray blister beetle, adult on potato, July 5, A. M. Hollister, Saratoga Springs

Nacerdes melanura Linn., adults, August, J. E. Barkley, Albany

Boletotherus bifurcus Fabr., forked fungus beetle, adults and work on fungus, February 7, Roy Latham, Orient

Tribolium confusum Duval, confused flour beetle, adult, November 30, W. R. Whitney, Schenectady

Epitrix cucumeris Harr., cucumber flea beetle, August 9, Charles Fremd, North Rose

Haltica chalybea Ill., grapevine flea beetle, injured Virginia Creeper buds, June 7, G. G. Atwood, Albany. Through State Department of Agriculture

Diabrotica vittata Fabr., striped cucumber beetle, grub in musk melon roots, July 29, L. Lundquist, Westbury

Oberea bimaculata Oliv., raspberry cane girdler on raspberry cane, April 23, S. H. Burnham, Hudson Falls

Urographis fasciatus DeG., beetle, July 18, J. L. Richards, Brookline, Mass.

?Goes pulverulenta Hald., larva on beech, July 31, J. L. Richards, Brookline, Mass.

Elaphidion villosum Fabr., maple and oak twig pruner, larvae in oak, July 10, C. I. Warren, Troy

Prionus laticollis Dru., broad-necked Prionus, larva on rambler rose roots, November 9, R. D. Adolph, Highland Falls

Euphoria inda Linn., bumble flower beetle, adult on pin oak, October 25, J. H. Putnam, Westbury

Cotalpa lanigera Linn., Goldsmith beetle, June 30, R. Gregg, Bridgehampton

Phyllophaga tristis Fabr., May or June beetle, adults on white birch, May 22, T. P. Williams, Troy. Same, adults on raspberry, June 15, Alyda R. Miller, East Greenbush. Injuring raspberries, both leaves and blossoms.

P. fraterna Harr., May or June beetle, adults on white birch, May 22, T. P. Williams, Troy

P. fusca Frohl., May or June beetle, adults on white birch, May 22, T. P. Williams, Troy

Agrilus anxius Gory, bronze birch borer on black birch, June 26, J. J. Levison, Brooklyn

Alaus oculatus Linn., eyed elater or owl beetle, adult, April 27, J. F. Rose, South Byron

Anatis ocellata Linn., 15-spotted ladybeetle, adult and larva on maple, July 13, T. J. Wade, New Rochelle

Silvanus surinamensis Linn., saw-toothed grain beetle, adults, September 1, D. B. Comstock, Albany. Bins of oats so badly infested that horses would not eat them. Same, adult, November 30, W. R. Whitney, Schenectady

Diptera

Mycetobia divergens Walk., larvae on Norway maple, May 15, F. C. Place, Baldwin, L. I. Same, larvae, July 20, L. E. Harrower, Amsterdam. Same, larva on black birch, September 5, J. J. Levison, Brooklyn

Sciara prolifica Felt, March 27, T. D. A. Cockerell, Boulder, Col.

Dasyneura communis Felt, galls on sugar maple, October 10, C. H. Hadley, State College, Pa.

D. rhodophaga Coq., rose midge, larvae and work on rose, October 26, Benjamin Hammond, Beacon

D. serrulatae O. S., alder bud midge, gall on alder, April 23, S. H. Burnham, Hudson Falls

Diarthronomyia hypogaea H. Lw., chrysanthemum midge, gall on chrysanthemum, February 23, A. L. Lovett, Corvallis, Ore. Same, galls and adults, April 14, H. C. Severin, Brookings, S. D. Same, adults on chrysanthemum, July 25, T. O. Morrison, Olympia, Wash. Through A. L. Melander. Same, galls on chrysanthemum, August 14, A. D. Borden, Milford, Del.

Ctenodactylomyia watsoni Felt, sea grape blister, galls and pupae on Coccolobus, April 17, Frederick Knab, Washington, D. C. Same, pupae and parasites on Coccolobus, August 11, R. H. Van Zwaluwenberg, Mayaguez, P. R.

Camptoneuromyia flavescens Felt, gall on Solidago canadensis, June 29, A. Cosens, Toronto, Ont.

Lasioptera lycopi Felt, gall on Lycopus, March 5, Roy Latham, Orient

Rhopalomyia hirtipes O. S., gall, September 29, Mrs E. P. Gardner, Canandaigua

R. racemicola O. S., beaked flower gall, on Solidago caesia, September 21, Mrs E. P. Gardner, Canandaigua Lake

Schizomyia petiolicola Felt, gall on grape, August 31, Mrs E. P. Gardner, Canandaigua

Asphondylia chrysothamni Felt, gall on Chrysothamnus, October 14, E. Bethel, Denver, Col.

A. globulus O. S., sunflower purse gall on Helianthus divaricatus, August 1, Roy Latham, Orient

A. shepherdiae Felt, galls, adults and parasites, July 10, E. Bethel, Denver, Col.

Contarinia negundifolia Felt, box elder leaf gall, July 8, J. M. Swaine, Winnipeg, Manitoba

Thecodiplosis liriodendri O. S., tulip spot gall on tulip tree, July 24, Mrs J. H. Ward, Cornwall-on-Hudson. Same, August 25, J. H. Livingston, Tivoli. Same, gall on tulip, September 21, Mrs E. P. Gardner, Canandaigua Lake

Monarthropalpus buxi Lab., box leaf midge, larvae on box, May 2, T. J. Wade, New Rochelle. Same, pupae in leaves of box, May 27, D. R. Fiske, Philadelphia, Pa.

Hormomyia crataegifolia Felt, thorn cockscomb gall on thorn, July 25, Stanley White, Lake Placid Club, Essex county

Caryomyia tubicola O. S., hickory tube gall, September 21, Mrs E. P. Gardner, Canandaigua Lake

Retinodiplosis resinicola O. S., pitch midge, work, September 4, H. O. Johnson, Mechanicville

R. taxodii Felt, cypress seed midge, on bald cypress, Taxodium distichum, from H. L. Sanford, Atlanta, Ga. Through E. R. Sasscer, U. S. Bureau of Entomology

?Retinodiplosis sp., work on Pinus taeda, March 13, from Biloxi, Miss., through Dr Hermann Von Schrenck

Lestodiplosis platanifolia Felt, August 14, E. L. Dickerson, Nutley, N. J.

Cecidomyia impatientis O. S., Touch-me-not gall on Impatiens, August 31, Mrs E. P. Gardner, Canandaigua

C. niveipila O. S., woolly fold gall on black oak and Q. prinus, June 6, S. H. Burnham, Hudson Falls

C. poculum O. S., oak spangles gall, August 24, Silas Wodell, Millbrook

Promachus vertebratus Say, robber fly, adults and pupae, March 7, J. J. Davis, West Lafayette, Ind.

Eristalis transversus Wied., flower fly, adult, August 31, N. H. Brown, Lafargeville. Through State Department of Agriculture

E. tenax Linn., drone fly, young larvae, July 20, L. E. Harrower, Amsterdam

Hypoderma lineata Will., warble-fly, maggots from stock, May 19, G. S. Graves, Newport

Pollenia rudis Fabr., cluster fly, adult, August 21, F. W. Kelley, Altamont

Lucilia caesar Linn., blue bottle fly, adult, July 19, Mrs Henry G. Reist, Schenectady

Psila rosae Linn., carrot rust fly, larva on parsnip, July 31, from Hempstead, through F. W. Eberle, Albany

Siphonaptera

Ctenocephalus canis Curt., cat and dog flea, adults, July 13, Miss Janette R. Mann, Albany. Same, July 21, N. Berman, Port Henry. Same, September 2, W. A. Denison, Star Lake

Lepidoptera

Papilio podolarius Lfn., butterfly on French pear seedlings, February, Schoharie. Through State Department of Agriculture

Euvanessa antiopa Linn., spiny elm caterpillar, larvae on elm, July 3, A. E. Keech, Clayton. Through State Conservation Commission. Same, September 1, C. E. Brisbin, Schuylerville

Aglais milberti Godt., Milbert's tortoise-shell, adult, March 11, Nellie E. Squire, Canton

Epargyreus tityrus Fabr., silver spotted skipper, larva on wisteria, September 14, Louise Gibb, Albany

Sphecodina abbotii Swain, Abbot's sphinx, larva on woodbine, July 18, C. E. Bailey, Albany. Through State Department of Agriculture. Same, larva, July 28, Clara A. Paddock, South Durham

Phlegethontius quinquemaculata Haw., tomato worm, larva on tomato, September 6, H. J. Kelley, Albany

Samia cecropia Linn., Cecropia moth, cocoon and parasites, May 16, Mrs C. L. Agan, Greenwich

Callosamia promethea Dru., Promethea moth, cocoon and moth on lilac, May 5, Aaron Keller, Albany

Tropea luna Linn., Luna moth, larva, August 3, J. P. Van Alstyne, Kinderhook

Estigmene acrea Dru., salt marsh caterpillar, larvae on canna, August, J. B. Achilles, Albion

Hyphantria textor Harr., fall webworm, larvae, September 8, Mrs William Carter, Kingston. Same, larvae, September 11, F. H. Lacy, Poughkeepsie

Diacrisia virginica Fabr., virgin ermine moth, adult, July 11, T. S. Bates, Hermon

Halisidota tessellaris S. & A., pale tussock moth caterpillar, August 21, J. J. de Vyver, Mount Vernon. Same, larva, September 20, Eliza S. Blunt, New Russia

H. caryae Harr., hickory tussock moth, larva, August 22, Dorothy G. Stewart, Westport. Same, larva, September 2, A. G. Clement, Albany. Same, larvae, September 12, C. W. Weiant, Troy

Alypia octomaculata Fabr., 8-spotted forester, larva on woodbine, July 11, L. Menand, Menands

Apatela americana Harr., larvae, September 12, C. W. Weiant, Troy

Peridroma margaritosa Haw., variegated cutworm, adult, July 17, Marguerite Robertson, Woodstock. Through State Department of Agriculture

Achatodes zeae Harr., larva in elder, June 15, B. D. Van Buren, Geneva

Euthisanotia grata Fabr., beautiful wood nymph, adult, July 11, J. S. Bartlett, Albany

Plusia balluca Geyer, July 18, Ila Fennessy, Newcomb

Eriopus floridensis Guen., Florida fern caterpillar, larvae on fern, June 20, 22, F. G. Lewis, Lockport

Catocala amatrix Hubn., Aug. 7, Charles Heidenrich, Albany

Datana integerrima G. & R., black walnut caterpillar, August 22, J. W. Canaday, Fultonham

D. ministra Dru., yellow-necked apple caterpillar on sumac, August 26, G. M. Tucker jr, Glenmont. Same, August 28, Frances Felton, Cementon

Schizura ipomoea D'l'd'y., larva on maple, September 6, C. W. Weiant, West Haverstraw

S. concinna S. & A., red-humped apple caterpillar, larvae on apple, August 3, J. P. Van Alstyne, Kinderhook. Same, August 19, G. E. Ward, Ravena. Same, August 30, Carrie Treff, Boonville. Same, September 2, A. G. Clement, Albany

Hemerocampa leucostigma S. & A., white-marked tussock moth, larva on rose, July 29, E. F. Hagedorn, Gloversville. Same, parasitized cocoon, October 28, A. O. Smith, Mount Vernon

Thyridopteryx ephemeraeformis Steph., bagworm, August 24, from York county, Pa., through H. G. Reist, Schenectady

Sibine stimulea Clem., saddle-back caterpillar, on pear, September 8, G. W. Blanchard, Highland Falls

Phobetron pithecium S. & A., hag moth, larva, September 6, C. W. Weiant, West Haverstraw. Same, larva on lilac, September 27, D. D. Taylor, Marlborough. Through A. W. Abrams

Prolimacodes scapha Harr., skiff moth, larva, September 6, 12, C. W. Weiant, West Haverstraw

Zeuzera pyrina Linn., leopard moth, larvae, July 29, J. M. Quinn, Richmond Hill

Synanthedon pyri Harr., pear sesian, work on mountain ash, July 3, J. L. Richards, Brookline, Mass. Same, larvae and pupa on apple, June 16, Fred Anderson, Albany

Synanthedon sp., larva on black birch, September 5, J. J. Levison, Brooklyn

Dioryctria abietella Denis & Schiffermuller, work on Austrian pine, November 3, G. G. Atwood, Rochester. Through State Department of Agriculture

Ephestia cautella Walk., fig moth, adults and larvae in flour, December 20, W. R. Whitney, Schenectady

Evetria buoliana Schiff., European pine shoot moth, larvae on Muhgo pine, May 3, J. B. Achilles, Lockport. Same, larva and work, May 19, J. B. Achilles, Albion. Same, adults, June 24, F. J. Seaver, New York City

E. comstockiana Fernald, pine twig moth, larvae, September 4, H. O. Johnson, Mechanicville

Ecdytolopha insiticiana Zell., locust twig gall on locust, September 29, Mrs E. P. Gardner, Canandaigua

Archips argyrospila Walk., V-marked Archips, egg masses, September 21, A. L. Schwoerbel, New York City

Gnorimoschema gallaesolidaginis Riley, elliptical goldenrod gall on goldenrod, September 29, Mrs E. P. Gardner, Canandaigua

Coleophora cornella Walshm., cornus casebearer on Cornus, July 3, Mrs E. P. Gardner, Canandaigua

Hemiptera

Tibicen septendecim Linn., periodical Cicada, oviposition scars on elm twigs, May 22, J. J. Levison, Brooklyn

Ormenis pruinosa Say, lightning leaf hopper, adult, August 12, Virginia Hastings, Albany

Aphalara calthea Linn., young on Polygonum leaves, July 25, S. H. Burnham, Hudson Falls

Pachypsylla gemma Riley, hackberry bud gall, galls and nymphs on Celtis, April 19, John Dunbar, Rochester

Phylloxera caryaecaulis Fitch, hickory gall aphid, galls on hickory, June 6, J. J. Levison, Brooklyn. Same, September 13, Mrs Samuel S. Spaulding Springfield Center

Hormaphis spinosus Shim., witch-hazel cone gall on witch-hazel, August 31, Mrs E. P. Gardner, Canandaigua

Pemphigus rhois Fitch, red pouch gall on sumac, September 29, Mrs E. P. Gardner, Canandaigua

Chaitophorus lyropicta Kessler, Norway maple aphid, adults on Norway maple, W. G. Kellogg, Ogdensburg

Mindarus abietinus Koch., balsam aphid on Scotch pine, June 1, T. F. Niles, Mount Kisco. Through State Department of Agriculture. Same, work on balsam, July 17, Morris Rutherfurd, Warwick

Gossyparia spuria Mod., elm bark louse, adults on Scotch elm, June 9, John Dunbar, Rochester

Phenacoccus acericola King, false maple scale, August 17, John Campbell, New York City

Pulvinaria innumerabilis Rathv., cottony maple scale, on Crataegus, July 6, Frank Dobbin, Shushan

Icerya purchasi Mask., cottony cushion scale, adult on grape fruit, March 10, F. J. Seaver, New York City

Toumeyella pini King, pine soft scale, on Pinus divaricatus, June 8, John Dunbar, Rochester

T. liriodendri Gmel., tulip tree scale, partly developed females on tulip, July 24, Mrs James H. Ward, Cornwall-on-Hudson

Eulecanium fitchii Sign., Fitch's scale, on blackberry, June 9, S. R. Smith, Syracuse

E. magnoliarum Ckll., Magnolia scale, adult on Magnolia, July 27, G. G. Atwood, Long Island City

E. nigrofasciatum Perg., terrapin scale, August 10, J. A. DeLong, Troy

Chionaspis pinifoliae Fitch, pine leaf scale, eggs on Muhgo pine, May 2, Mrs H. B. Boardman, Schenectady. Same, adults on pine, July 17, Morris Rutherfurd, Warwick

Diaspis carueli Targ., Juniper scale, adult on Cedar, March 29, J. J. Levison, Brooklyn. Same, adults and young on Arbor vitae, July 9, J. L. Richards, Brookline, Mass.

Ischnaspis longirostris Sign., adult on Chinese fan palm, August, J. B. Achilles, Albion

Emesa longipes DeG., thread-legged bug, adult, August 28, Frances Felton, Cementon

Orthoptera

Periplaneta americana Linn., American cockroach, adult, November 26, L. L. Woodford, Syracuse

Diapheromera femorata Say, walking stick, adult, August 23, W. J. Brennan, Albany. Same, September 25, E. J. Dawson, South Schodack

Scudderia curvicauda DeG., August 25, J. W. Crosier, Hall

Conocephaloides ensiger Harr., adult, August 22, L. F. Kaiser, Albany

Gryllotalpa gryllotalpa Linn., European mole cricket, adult, March 28, J. B. Achilles, Albion. A single specimen taken from a shipment of nursery stock and by no means indicating that this European species had established itself locally.

Thysanura

Thermobia furnorum Rov., silver fish, adult, October 18, I. L. Nixon, Rochester

Arachnida

Phyllocoptes quadripes Shim., bladder maple gall on soft maple, May 21, G. F. Hawkins, Bronxville. Same, May 22, H. W. Gordinier & Sons Co., Troy. Same, abundant infestation on soft maple, June 2, J. J. Levison, Brooklyn. Same, July 18, Munson-Whitaker Company, New York City

Eriophyes galii Karp., galls on Galium triflorum, June 19, S. H. Burnham, Hudson Falls

E. nyssae Trott., galls on sour gum, August 19, H. B. Weiss, New Brunswick, N. J.

EXCHANGE

Cynipidae from Paul B. Sears, Columbus, Ohio, December 3, 1915.

Rhodites ignotus *O. S.*
R. fusiformans *Beutm.*
R. variabilis *Bass.*
R. multispinosus *Gill.*
R. arefactus *Gill.*
R. fulgens *Gill.*
R. utahensis *Bass.*

Coleoptera from W. J. Chamberlin, forest entomologist, Corvallis, Oregon.

Dendroctonus monticola *Hopk.*
D. pseudotsugae *Hopk.*
D. valens *Lec.*
Pseudohylesinus sericeus *Swaine*
Hylurgops rufipennis *Lec.*
H. subcostulatus *Mann.*
Ips emarginatus *Lec.*
I. oregona *Swaine*
Pityophthorus pubipennis *Lec.*
Xyleborus dispar *Fabr.*

Diptera from J. R. Malloch, State Laboratory of Natural History, Urbana, Ill.

Deromyia winthemi *Wied.* Pupa
Hydrotaea dentipes *Fabr.*
Fannia scalaris *Fabr.*
F. canicularis *Linn.*
Hyetodesia umbratica *Meig.*
Spilogaster uliginosa *Fall.*
Dexiopsis lacteipennis *Zett.*
Lispa sociabilis *Loew*
L. albitarsis *Stein.*
L. nasoni *Stein.*
Ectecephala laevifrons *Beck.*
Diplotoxa versicolor *Lw.*
Chlorops palpalis *Adams*
Chloropisca glabra *Meign.*
Hippelates partitus *Beck.*
H. plebeius *Lw.*
H. flavipes var. pusio *Lw.*
Siphonella cinerea *Lw.*
S. abdominalis *Beck.*
Melanochaeta longula *Lw.*
Elachiptera costata *Lw.*
E. nigriceps *Lw.*
Oscinis frit *Linn.*
O. nitidissima *Meign.*
O. coxendix *Fitch*
O. umbrosa *Lw.*
O. minor *Adams*
Agromyza longipennis *Lw.*
A. pusilla *Meign.*
A. lateralis *Will.*
A. posticata *Meign.*
A. texana *Mall.*
A. virens *Lw.*
Phytomyza genalis *Mel.*

APPENDIX

A STUDY OF GALL MIDGES V

FAMILY ITONIDIDAE

TRIBE LASIOPTERIARIAE

Short-horned Gall Midges

Members of this group for the most part present a very characteristic appearance, since the abdomen, almost invariably thickly clothed with scales, is mostly dark brown or black, and in the majority of species with characteristic white spots or bands. Forms not presenting strongly contrasting colors are exceptional in this

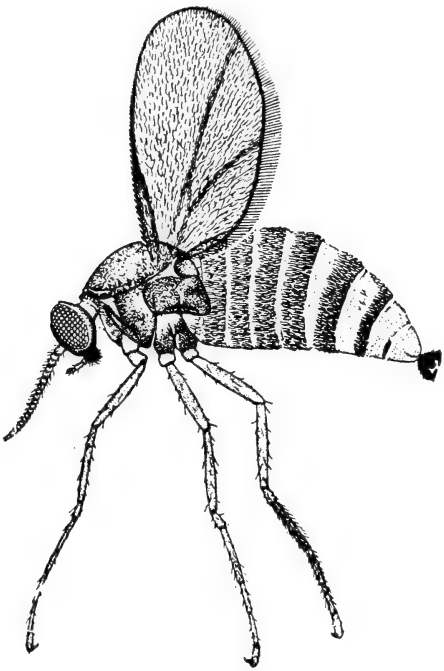

Fig. 2 Lasioptera vernoniae, side view of male, showing the general characters of Lasioptera, enlarged (original)

group. The antennal segments are cylindric, sessile in both sexes, vary greatly in number, and in most forms are relatively short. The wings have costa, subcosta and the third vein thickly scaled and in most species very close to the anterior border, except in the somewhat aberrant genera Trotteria and Camptoneuromyia. The claws are almost invariably unidentate and the pulvilli generally well developed.

A large proportion of the species breed in stem galls on woody or herbaceous plants, though the genus Asteromyia exhibits a marked preference for the characteristic and at one time supposedly fungous affected leaf blister galls of aster and Solidago. One Camptoneuromyia, C. adhesa Felt, inhabits the ovate galls between adherent leaves of Solidago canadensis or S. serotina and also occurs in a loose apical bud gall. The latter may possibly be only a modified form of the more common adherent gall which is also inhabited by Asphondylia monacha O. S. Another species, C. rubifolia Felt, has been reared from a marginal leaf roll on high blackberry. The transformations in this group appear to occur invariably in the tissues of the host plant. The forms producing stem galls winter as larvae, the adults appearing in the spring or early summer.

Key to genera

a Third vein very near costa and uniting therewith at or before the basal half, very rarely near the distal third
- *b* Mouth-parts and thorax normal, i. e. not greatly prolonged
  - *c* Third and fourth antennal segments not coalescent, at least separated by a distinct constriction; pulvilli sometimes small or rudimentary
    - *d* Palpi quadriarticulate; claws simple........Protaplonyx Felt
    - *dd* Palpi biarticulate; claws toothed or simple..Stefaniella Kieff.
    - *ddd* Palpi uniarticulate
      - *e* Mouth-parts distinctly produced; claws toothed................ Baldratia Kieff.
      - *ee* Mouth-parts not produced, normal; claws simple.............. Aplonyx Perez
  - *cc* Third and fourth antennal segments coalescent or closely fused; pulvilli always well developed
    - *d* Palpi with three or four segments
      - *e* Three long veins, the fifth forked some distance from its base.... Lasioptera Meign.
      - *ee* Four simple long veins................Neolasioptera Felt
    - *dd* Palpi with one or two (rarely three) segments..Asteromyia Felt
- *bb* Mouth-parts and thorax prolonged; antennal segments 10 to 13.......... Clinorhyncha H.Lw.

aa Third vein distinctly separated from costa and uniting therewith beyond the basal half
- *b* First antennal segment normal, not strongly produced; third vein strongly arched, it and the body not very thickly clothed with scales............ Camptoneuromyia Felt
- *bb* First antennal segment produced, with a length about three times its diameter, the third vein and the body thickly clothed with shining, frequently silvery scales; ovipositor aciculate........Trotteria Kieff.

STEFANIELLA Kieff.

1897 **Kieffer, J. J.** Syn. Cecid de Eur. & Alg., p. 55-56
1904 ———— Soc. Sci. Brux. Ann. 38:2
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:42
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 28

This rather anomalous form evidently belongs to the Lasioptera group though the somewhat stout, occasionally simple claws and the produced antennal segments suggest an affinity with Asphondylia. Members of this genus have the Lasioptera type of venation, the fifth vein simple, and are easily separated from allied forms by the free third and fourth antennal segments and the minute, biarticulate palpi. The ovipositor is short. Through the courtesy of Professor Kieffer, examples of the generic type, S. atriplicis Kieff., reared from enlargements of the stem of Atriplex halimus, have been placed at our disposal and the following description is drafted therefrom.

Stefaniella atriplicis Kieff.

Female. Length 2 mm. Antennae extending to the base of the abdomen; 12 segments, the first obconic, the second subglobose, the third and fourth free, the fifth cylindric, with a length two and one-half times its diameter and sparsely clothed with short hairs. Low circumfili occur at the basal and distal fourths and are united on one side much as in the female Asphondylia. Terminal segment produced, with a length five times its diameter. Palpi; first segment slender, with a length three times its diameter, the second somewhat dilated with a length four times its diameter. Wings; subcosta uniting with costa at the basal third, the third vein at the basal half, both thickly scaled, the fifth vein joining the posterior margin at the distal fourth, the sixth at the basal half. Claws rather stout, apparently simple, the pulvilli about half the length of the claws. Ovipositor about half the length of the abdomen, the terminal lobes long, narrowly oval and thickly setose.

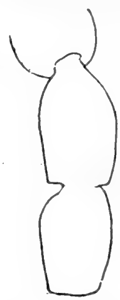

Fig. 3 Stefaniella atriplicis, third and fourth antennal segments of female, enlarged (original)

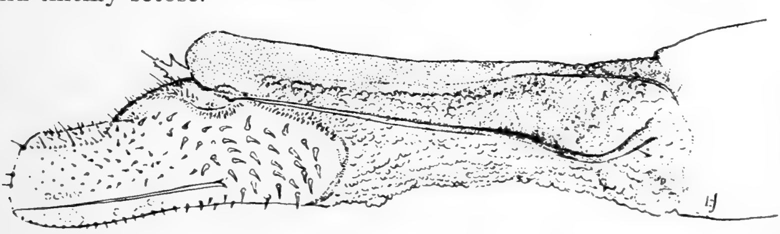

Fig. 4 Stefaniella atriplicis, side view of ovipositor, enlarged (original)

PROTAPLONYX Felt

1916 **Felt, E. P.** Ent. News, 27:202

The genus has the typical Lasioptera wing, the normal, short mouth-parts, 12 or 13 antennal segments, the third and fourth not coalescing or at least separated by a distinct constriction; quadriarticulate palpi, heavy simple claws and an aciculate ovipositor. Type P. hagani Felt.

Protaplonyx hagani Felt

1916 **Felt, E. P.** Ent. News, 27:202

This unique form was reared January 4, 1916, in large numbers from small, folded swollen leaflets of greasewood, Sarcobatus vermiculatus, by Mr Harold R. Hagan of the Agricultural Experiment Station, Logan, Utah, from material collected October 25, 1915 at Wellington, a locality near Price, Utah.

APLONYX Perez

1908 **Perez, T. De S.** Marcellia, 6:174–76
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:42
1913 **Kieffer, J. J.** Gen. Insect., fasc., 152, p. 20

This genus is easily differentiated from other gall midges by the Lasioptera-like wings, antennae and male genitalia, the biarticulate palpi, the simple claws and the cultrate ovipostor. It is allied to Stefaniella Kieff., an anomalous genus in which the claws may be either simple or toothed, and may be readily separated from Baldratia Kieff. by the mouth-parts not being produced and the simple claws. Type A. chenopodii Perez.

Aplonyx sarcobati Felt

1914 **Felt, E. P.** Pomona Jour. Ent. & Zool., 6:93–94

This species was reared in numbers December 23, 1913 from oval swellings on the leaves of greasewood, Sarcobatus vermiculatus collected at Canyon City, Col., November 23, 1913 by Prof. Ellsworth Bethel of Denver.

BALDRATIA Kieff.

1897 **Kieffer, J. J.** Meine Antwort a. d. H. Zeich. Rubsaamen u. H. Doc. F. Karsch, p. 7
1897 ———— Syn. Cecid. de Eur. & Alg., p. 4
1904 ———— Soc. Sci. Brux. Ann., 38:2
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:42
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 24

Representatives of this genus may be distinguished from Lasioptera and its close allies by the third and fourth antennal segments being free or nearly so, they and those distally being produced and with distinct tubercles as in Dasyneura, the simple fifth vein and the rudimentary pulvilli, in connection with the simple or but slightly toothed claws and the produced labium apparently bearing well developed labial palpi. The type species, B. salicorniae Kieff., was reared from enlargements of the stem of Salicornia fruticosa taken by Doctor Baldrati in Italy.

The following characters were drafted from types generously placed at our disposal by Professor Kieffer.

Baldratia salicorniae Kieff.

Male. Length 2 mm. Antennae extending to the base of the abdomen; 13 segments, the first obconic, the second slightly enlarged, globose, the third and fourth free, the fifth cylindric, with a length one-half greater than its diameter, a sparse subbasal whorl of short setae and a rather thick subapical whorl of longer, stout setae arising from distinct tubercles. Terminal segment somewhat produced, evidently two closely fused segments. Mouth-parts slightly produced, the labrum narrowly rounded, the labium distinct, divided,

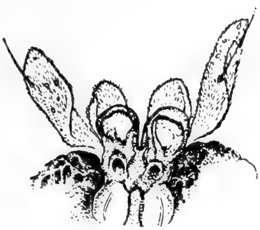

Fig. 5 Baldratia salicorniae, mouth-parts of male, enlarged (original)

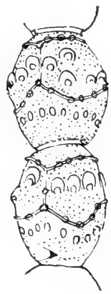

Fig. 6 Baldratia salicorniae, third and fourth antennal segments of male, enlarged (original)

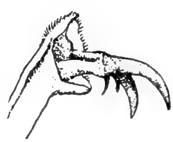

Fig. 7 Baldratia salicorniae, side view of claws of male, enlarged (original)

the lobes broadly rounded, labial palpi well developed, irregular, with a length twice the diameter; maxillary palpi slender, with a length six times their diameter. Wings nearly as in Lasioptera; subcosta uniting with the anterior margin at the basal third, the third vein at the basal half, both thickly scaled, the fifth vein joining the posterior margin at the distal fourth, the sixth at the basal half. Claws rather long, stout, unidentate, the tooth small, the pulvilli rudimentary. Genitalia; basal clasp segment stout; terminal clasp segment long, stout, curved; dorsal plate short, broadly tapering, broadly and roundly emarginate; ventral plate

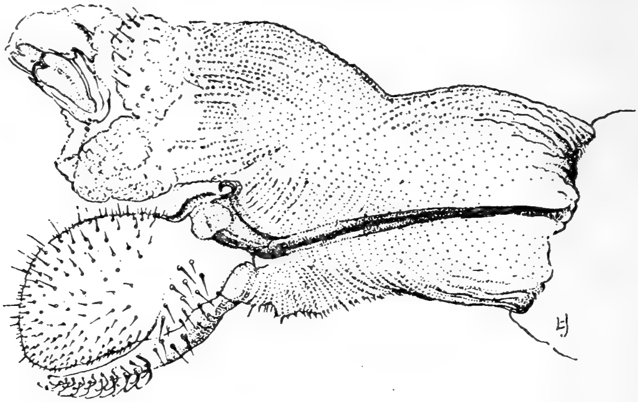

Fig. 8 Baldratia salicorniae, side view of ovipositor, enlarged (original)

short, tapering to a narrowly rounded apex. Harpes long, thickly setose, tapering to an irregular, tuberculate apex; style long, stout, narrowly rounded.

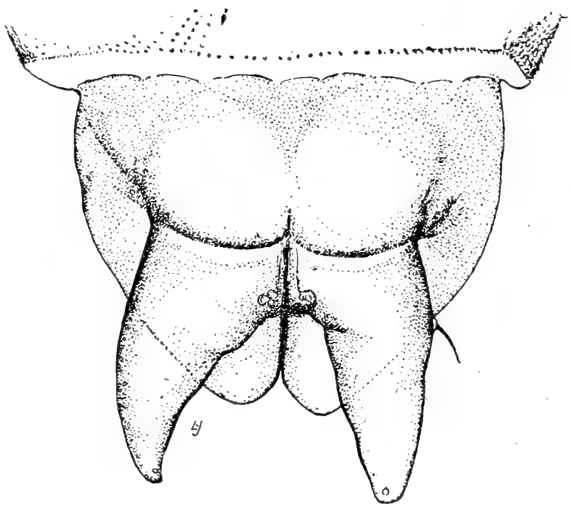

Fig. 9 Baldratia salicorniae, dorsal view of the last segment of the pupa, enlarged (original)

Female. Length 2.5 mm. Ovipositor stout, about one-fourth the length of the abdomen, the terminal lobes broadly ovate and thickly setose. Other characters nearly as in the opposite sex.

Pupa. Length 3 mm, rather slender; antennal cases short, stout, cephalic horns short, inconspicuous. Wing pads extending to the second abdominal segment, the legs to the fourth; terminal segment narrowly rounded and with a pair of stout, irregular, diverging, conic processes apically.

LASIOPTERA Meig.

1818 **Meigen, J. W.** Syst. Beschr., 1:88

1834 **Macquart, J. M.** Hist. Nat. Ins. Dipt., 1:162

1840 **Westwood, J. O.** Introduc. Class. Ins., 2, sup., p. 126 (D i o m y z a)

1853 **Winnertz, J.** Mon. Gallmücken, p. 191

1860 **Rondani, Camillo.** Soc. Ital. Sci. Nat. Milano Atti, 2:6

1862 **Osten Sacken, C. R.** Dipt. N. Am. Mon., 1:175

1864 **Schiner, J. R.** Fauna Austriaca Dipt., 2:406

1876 **Bergenstamm, J. E. & Low, Paul.** Syn. Cecidomyidarum, p. 24

1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 14

1888 **Inchbald, Peter.** Entomologist, 21:195

1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:127

1892 **Rubsaamen, E. H.** Berl. Ent. Zeitschr, 37:344–46

1892 **Theobald, F. V.** Acct. Brit. Flies, p. 50, 88

1897 **Kieffer, J. J.** Syn. Cecid. de Eur. & Alg., p. 2

1900 ———— Soc. Ent. Fr. Ann., 69:437

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 323

1911 ———— N. Y. Ent. Soc. Jour., 19:42

1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 30

The members of this genus present a wide range in the number of antennal segments, those of the female varying from 16 in the case of L. f l a v e s c e n s to 33 in L. q u e r c i f l o r a e. The Australian L. n o d o s a e Skuse is recorded as having 34 antennal segments in the female. The segments of the male antennae vary from 16 in L. l y c o p i to 21 or 22 in the male of L. d e s m o d i i. Some species have the same number of antennal segments in both sexes, while in the majority the female possesses two to four or five more than the male. There seems to be no law governing this variation. Certain of the females possess a group of heavy, stout, recurved, chitinous hooks on the dorsum of the lobes of the ovipositor. This peculiar structure is present in several rather widely separated forms. Type C e c i d o m y i a a l b i p e n n i s Meign.

The species belonging to this genus breed for the most part in more or less irregular subcortical galls on the stems of both herbaceous and woody plants. An interesting form, L. c a u l i c o l a, has been reared from apparently normal Diervilla stems. All species of this genus appear to winter in their galls. Those which live in herbaceous stems emerge, as a rule, in early spring, while the forms subsisting upon woody stems are more likely to fly during June. A few species appear to breed in leaf galls; for instance, L. corni in an ocellate, highly colored, blisterlike gall on the leaves of Cornus alternifolia; L. vitis inhabits the common tumid leaf or tendril gall on grape, while L. impatientifolia produces a somewhat similar gall on the under side of the leaf of the snapdragon (Impatiens fulva). Blackberry leaves frequently have near the base a hard, corky, warty gall caused by L. farinosa. Lasioptera excavata has a more singular habit, since the larvae occur in a true leaf mine in the foliage of Crataegus. The galls may be monothalamous or polythalamous, some of the latter being inhabited by a considerable number of larvae, as in the case of L. cylindrigallae and L. tumifica.

One fossil species, Lasioptera recessa Scudd.[1] has been described from the White river near the Colorado, Utah boundary. The specimen was in such poor condition that this reference can be regarded as tentative only. Scudder's description in connection with his figure of the antennal segments suggests that this species may be referable to Trotteria.

Key to species

a Abdomen dark brown
- *b* Abdomen unicolorous
  - *c* Mesonotum and abdomen fuscous
    - *d* Tarsi dark brown or black, antennal segments, female 18 ...... ventralis Say[2]
    - *dd* Tarsi a light yellowish basally, antennal segments, female 19 .... portulacae Felt, C. a 2113
  - *cc* Mesonotum and abdomen black, female with 18 antennal segments; bred from grass .... carbonitens Ckll.
  - *ccc* Mesonotum and abdomen dark brown
    - *d* Tarsi fuscous yellowish. Male with 16 antennal segments; reared from Oxybaphus.......... allioniae Felt, C. 2026
    - *dd* Tarsi dark brown, male with 16, female with 19 antennal segments; reared from Pentstemon... tibialis Felt, C. 2505
- *bb* Abdomen rather thickly clothed dorsally with silvery white scales
  - *c* Antennae and mesonotum dark brown; male with 16–17 antennal segments .... cinerea Felt, C. 73
  - *cc* Antennae light brown
    - *d* Mesonotum thickly yellow scaled; antennae, female, 22 segments; reared from Solidago.................................. argentisquamae Felt, C. a1568x

[1] 1877 Scudder, S. H. U. S. Geol. Geog. Surv. Terr. Bul. 3, p. 745–46; 1890 Tert. Ins. N. Am., U. S. Geol. Geog. Surv. Terr. Rep't, 13:600, pl. 5, fig. 29–31.

[2] Location provisional.

dd Mesonotum shining dark brown, antennal segments, male, 20; fifth with a length a little greater than its diameter; reared from oval, tendril or petiole gall on grape..................
riparia Felt, C. a1784a

bbb Abdominal segments variably margined anteriorly and laterally with yellowish white scales; antennae, female, 22 segments; reared from tumid leaf or tendril gall on grape...vitis O. S., C. a1165, a1146

bbbb Abdomen with the basal segment thickly clothed with silvery white or yellowish scales

c Second abdominal segment fuscous yellowish; antennae, female, 15 segments; ovipositor with hooks....basiflava Felt, C. 719

cc Second and following abdominal segments yellow

d Third vein uniting with costa at the basal third

e Female antennae with 18–19 segments; ovipositor with hooks; reared from blister gall on Cornus..............
corni Felt, C. 764, a1151, a1288

dd Third vein uniting with costa at the basal half

e Female with 23 antennal segments; no hooks present; reared from Rudbeckia..rudbeckiae Felt, C. a1697b

ee Male with ?16 antennal segments; female with 16 or 17 antennal segments; ovipositor as long as the body. Reared from heads and leaf sheaths of Muhlenbergia......
colorati n. sp., a2716

ddd Third vein uniting with costa at the distal third

e Female with 21 antennal segments; ovipositor with hooks; reared from apical, clavate twig gall on Cornus..........
clavula Beutm. C. a327

ccc Second and following abdominal segments without conspicuous white markings

d Fourth and fifth abdominal segments darker than others; mesonotum dark brown; male with 19 antennal segments; reared from Impatiens leaf gall...................................
impatientifolia Felt, C. a1166

dd Abdominal segments 2 to 6 unicolorous or nearly so; mesonotum reddish brown; male 18; female 20–23 segments; reared from Vernonia flower and leaf galls...........................
vernoniae Beutm., C. 1058, 1059, a2014, ?897

cccc Second and following abdominal segments with submedian silvery spots

d Third vein uniting with costa at the basal third

e Mesonotum reddish brown; female with 28 antennal segments; reared from a cortical oak gall................
querciperda Felt, C. 1054

ee Mesonotum dark brown, male 18–21 segments; reared from Vernonia flower and leaf galls.......................
vernoniae Beutm., C. 1050, 1059, a2014

eee Mesonotum dark brown

f Scutellum pale orange; female with 18 antennal segments.............consobrina Felt, C. 183a

ff Scutellum purplish brown; female with 22 antennal segments...........nassauensis Felt, C. 432

fff Scutellum yellowish; female with 16 antennal segments, fifth with a length three-fourths that of its diameter; reared from Danthonia............................
danthoniae Felt, C. a1925

ffff Scutellum fuscous, female with ?16 antennal segments, fifth with a length three-fourths that of its diameter; reared from Oxybaphus............................
allioniae Felt, C. a2026

fffff Scutellum reddish brown, female with 19 and male with 16 antennal segments; reared from Pentstemon....
tibialis Felt, C. a2505

eeee Mesonotum fuscous yellowish

f Scutellum yellowish; antennal segments, male, 16, fifth with a length three-fourths that of its diameter; reared from Danthonia............................
danthoniae Felt, C. a1925

dd Third vein uniting with the anterior margin at the basal half

e Legs and mesonotum dark brown; dorsal plate narrowly incised; male with 16 antennal segments; reared from Senecio............arizonensis Felt, C. 1062, 904

ee Legs mostly yellowish; mesonotum dark red; dorsal plate triangularly incised; male with 17 antennal segments.....
flavipes Felt, C. 612

eee Legs light yellowish or yellowish brown; mesonotum reddish brown, antennal segments, female, 33; reared from Quercus blossoms...............quercifloraе Felt, C. 900

eeee Legs white-banded, the fourth and fifth tarsal segments of the posterior legs white; mesonotum reddish brown; antennal segments, female, 16 or 17. Reared from heads and leaf sheaths of Muhlenbergia......................
colorati n. sp., a2716

ccccc Second and following abdominal segments margined posteriorly with silvery white[1]

d Third vein uniting with costa at the basal third; femora and tibiae unicolorous; antennal segments, male and female, 21–22; reared from fusiform stem gall on tick trefoil......desmodii Felt
C. 88, a1091, a1376, a1291, a1184

dd Third vein uniting with costa at the basal half

e Tarsi distinctly annulate with whitish

f Scutellum fuscous yellowish; antennal segments, female 23; reared from Diervilla stems....................
caulicola Felt, C. a1469a

ee Tarsi narrowly or indistinctly annulate with yellowish

f Scutellum reddish brown

g Antennal segments, male, 19, female, 23; second–fourth abdominal segments white margined, fourth palpal segment of female twice the length of the third; reared from warty leaf gall on blackberry................farinosa Beutm.
C. a1343, a1331, 1119

[1] L. ephedrae Ckll. and L. tertia Ckll. probably belong in this group.

gg Antennal segments, female, 25; second–sixth abdominal segments white margined, fourth palpal segment of female one-third longer than the third; reared from oval, tendril or petiole gall on grape. riparia Felt., C. a1784a

ff Scutellum fuscous yellowish; antennal segments, male, 19; female, 22; palpi three-segmented; reared from unknown stem gall.....spinulae Felt, C. 1056

eee Tarsi nearly unicolorous

f Scutellum dark brown; antennal segments, male 20; female, 25; reared from irregular subcortical gall on blackberry..................nodulosa Beutm. C. a1421, a1411, 803

ff Scutellum reddish brown; antennal segments, male 20; female, 25; reared from fusiform stem gall on aquatic weed..........palustris Felt, C. a1443, a1447

fff Scutellum fuscous yellowish; antennal segments, male 20; female, 23; reared from irregular subcortical stem gall on Lindera......linderae Beutm., C. a1417

ffff Scutellum pale yellowish; antennal segments, male 16; female, 21; reared from fusiform stem gall on Lycopus mitchellae Felt, C. a1369

fffff Scutellum yellowish brown; male with 15 or 16 segments, female with 16–20, the ovipostor with hooks. Reared from huckleberry.......fructuaria Felt, a2641

bbbb Basal segment (sometimes margined with white) and other abdominal segments with submedian whitish spots [1]

c Third vein uniting with costa at the basal third

d Tarsi annulate

e Tarsal segments 2 to 4 annulate basally; antennal segments, male 17; female, 20; reared from fusiform stem gall on Convolvulus............convolvuli Felt, C. a1465

ee Tarsal segments 2 to 4 annulate at both extremities; antennal segments, male 16; female, 18; reared from fusiform stem gall on Lycopus........lycopi Felt, C. a1348, a1339

cc Third vein uniting with costa at the basal half

d Tarsi nearly unicolorous

e Mesonotum dark brown, the submedian lines with long, golden hairs; antennal segments, male 21; female, 25; reared from enlarged stem gall on hop................ humulicaulis Felt, C. a1446

ee Mesonotum thickly clothed with bronzy scales; antennal segments, male 17; female, 19; reared from irregular stem gall on wild lettuce.....lactucae Felt, C. 1102, 1061

eee Mesonotum shining black; antennal segments, male 16, female, 20; reared from stems and crown of Echinochloa crusgalli.................echinochloa Felt, a2719

dd Tarsi annulate

---

[1] Lasioptera willistoni Ckll. probably belongs in this group.

e Mesonotum black

f Distal palpal segment one-half longer than the preceding; antennal segments, female, 21............... hecate Felt, C. 329

ff Distal palpal segment one-fourth longer than the preceding; antennal segments, female, 20, male, 14; reared from Verbena rostrata.....verbenae Felt, a2313

fff Distal palpal segment a little longer than the preceding; antennal segments, female, 18; reared from stem gall on Diplacus................diplaci Felt, a2314

ee Mesonotum dark brown

f Distal palpal segment twice the length of the preceding

g Antennal segments of female, ?18; oviposition on Panicum...............panici Felt, C. 403

gg Antennal segments of male 16, female, 18; reared from stem gall on Galeopsis tetrahit........... galeopsidis Felt, C. a1965

ff Distal palpal segment one-fourth longer than the preceding

g Abdomen purplish dark brown; antennal segments of male 18, female, 23; reared from a fusiform stem gall on Helianthus..................... weldi Felt, C. a1816

gg Abdomen black; antennal segments, female 18–19; reared from subglobose stem gall on Hypericum virginicum.......virginica Felt, C. a1915

ggg Abdomen black; antennal segments, male 16; female, 23; reared from irregular stem gall on Galeopsis tetrahit......................... galeopsidis Felt, C. a1965

eee Mesonotum shining reddish brown; distal palpal segment only a little longer than the preceding; antennal segments, female 22–23; reared from Lupine..................... lupini Felt, C. 1068

ccc Third vein uniting with costa at the distal third

d Mesonotum black; antennal segments, female, 22; palpi three-segmented; reared from subcortical twig gall on Ephedra..... ephedricola Ckll.

dd Mesonotum dark brown

e Mesonotum unicolorous; antennal segments, female 19; on cherry.......................serotina Felt, C. 79

ee Mesonotum distinctly bordered laterally and anteriorly with light scales

f Third vein uniting with costa a little before the distal third; ventral plate long, broadly rounded apically; antennal segments, male 15–17; female, 21–22; reared from long stem gall on Solidago................... cylindrigallae Felt, C. a1159, a1408

ff Third vein uniting with costa at the distal third *g* Ventral plate long, tapering, narrowly rounded apically; antennal segments, male, 17; female, 19–22; reared from stout, asymmetric stem gall on Solidago............s o l i d a g i n i s O. S. C. 846, a1360, a1470, a1060

gg Ventral plate long, slender, broadly rounded apically; antennal segments, male, 16; female, 17; reared from stem gall on Zizia................ z i z i a e Felt, C. a1817

bbbbb Basal and other abdominal segments white-margined posteriorly

c Basal and apical white bands on fifth abdominal segment; antennal segments, male, 20; reared from subcortical twig gall on Ephedra e p h e d r i c o l a Ckll.

cc Apical band only on the fifth abdominal segment

d Tarsi unicolorous

e Antennal segments, female, 18, the fifth with a length equal to its diameter, the ovipositor with a length one-half that of the abdomen...............h a m a t a Felt, C. 289

ee Antennal segments, female 18, the fifth with a length three-fourths its diameter, the ovipositor as long as the abdomen; reared from between leaves of Tripsacum......... t r i p s a c i Felt, C. a2013

eee Antennal segments, female 23–24; male 19; reared from sensitive plant.................c a s s i a e Felt, C. 901

dd Tarsi annulate with yellowish

e Antennal segments, female 23; reared from tumid leaf gall on Impatiens.....i m p a t i e n t i f o l i a Felt, C. a1166

ccc Apical bands on several abdominal segments

d Antennal segments, male 16; female 20; ovipositor one-half the length of the abdomen, reared from blackened leaf sheaths of Panicum virgatum..............i n u s t o r u m Felt, a2715

bbbbbb Abdomen with no conspicuous white markings

c Third vein uniting with costa at the basal third; tarsi annulate

d Scutellum reddish brown; antennal segments, female 23........ n e o f u s c a Felt, C. 82

dd Scutellum dark brown; antennal segments, female 21........... j u v e n a l i s Felt, C. 703

cc Third vein uniting with costa at the basal half

d Scutellum dark reddish brown; antennal segments, female 25; palpi quadriarticulate; reared from curled ash leaves......... f r a x i n i f o l i a Felt, C. a1546a

dd Scutellum shining dark brown; antennal segments, female 18; palpi triarticulate; reared from blister gall on aster.......... c l a r k e i Felt, C. a1901

ccc Third vein uniting with costa at the distal third

d Scutellum dark brown; antennal segments, female 21–22; palpi quadriarticulate; ovipostor with chitinous hooks............. a b h a m a t a Felt, C. 130

dd Scutellum dark brown; antennal segments, male 15; palpi triarticulate; reared from blister gall on aster.................. c l a r k e i Felt, C. a1901

aa Abdomen reddish, yellowish brown or pale orange
  b Third vein uniting with costa at the basal third
    c Abdomen nearly unicolorous; antennal segments, female 18.......... quercina Felt, C. 96
  bb Third vein uniting with costa near the basal half
    c Abdomen yellowish brown; antennal segments, male 18.......... viburni Felt, C. 186
    cc Abdomen yellowish orange; antennal segments, male 14, the fifth with a length one-half greater than its diameter; reared from blister gall on Spiraea............spiraeafolia Felt, C. a1860
    ccc Abdomen pale yellowish, second to sixth segments basally dark brown, antennal segments, female 26; reared from blister mine in crataegus leaf........................excavata Felt, a1576
  bbb Third vein uniting with costa at the distal third
    c Abdomen yellowish brown; antennal segments, male 17; reared from wild sunflower seeds.......murtfeldtiana n. sp., C. 902

Lasioptera portulacae Felt

1911 **Felt, E. P.** Psyche, 18:84–85

This midge was reared from a stem gall on purslane, Portulaca oleraceae Linn. by William H. Patterson, formerly of the Agricultural School, St Vincent, W. I.

Lasioptera ventralis Say

1824 **Say, Thomas.** Long's 2d Expedition, 2:357
1883 ———— Complete Writings, 1:242

There is no certainty as to the generic position of this species. We have provisionally referred it to the genus Lasioptera. It was captured in a garden at the University of Pennsylvania.

Lasioptera allioniae Felt

1911 **Felt, E. P.** Econ. Et. Jour., 4:482

This dark, white-spotted species with the third vein uniting with costa at the basal third, was reared in June 1908 by Mr E. Bethel from an irregular, subfusiform stem gall on Oxybaphus (Allionia) taken at Boulder, Col., and kindly placed at our disposal by Prof. T. D. A. Cockerell.

Gall. Length 1.5 to 2 cm, irregularly swollen and apparently always near a joint. The interior is spongy and presumably irregularly mined by the larvae. See above citation for description of the two sexes.

Lasioptera tibialis Felt

1914 **Felt, E. P.** Insecutor Inscitiae Menstruus, 2:119–20

The midges related to L. allioniae Felt were reared from a stem or branch gall on Pentstemon antirrhinoides collected by Mr E. P. VanDuzee near La Jolla, Cal.

Lasioptera carbonitens Ckll.

1902 **Cockerell, T. D. A.** Can. Ent. 34:183

The midge provisionally placed here produces an aborted shoot, somewhat like a long onion bulb, on an unknown grass collected at Las Vegas, N. M. The gall is characterized as being similar to that of Brachypodium sylvaticum figured by Rubsaamen in Ent. Nach., 21:16. See also under Asteromyia agrostis O. S.

Lasioptera cinerea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 104. Separate, p. 8
1908 ———— N. Y. State Mus. Bul. 124, p. 324

The midge was captured at Albany, N. Y., May 21, 1906, on black alder, Ilex verticellata.

Male. Length 1.5 mm. Antennae dark brown; 16 or 17 segments, the fifth with a length greater than the diameter; terminal segment subconical, slightly prolonged, obtuse. Palpi; the first segment short, swollen distally, the second subrectangular, one-half longer than the first, the third a little longer than the second, more slender, the fourth, one-fourth longer than the third, more slender. Mesonotum and scutellum dark brown, the latter silvery white apically; postscutellum very dark brown. Abdomen dark brown, rather thickly clothed dorsally with silvery white scales. Wings (pl. 5, fig. 4) hyaline, anterior veins reddish brown, the third vein uniting with the margin at the distal third. Halteres reddish yellow. Legs mostly dark brown, lighter ventrally; tarsi darker than femora and tibiae; claws stout, strongly curved. Genitalia (pl. 7, fig. 1); basal clasp segment long, slender; terminal clasp segment swollen basally; dorsal plate broad, deeply and roundly emarginate, the lobes narrowly rounded; ventral plate narrow, tapering, broadly rounded. Harpes subtriangular. Type Cecid. 73.

Lasioptera argentisquamae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324
1909 ———— Ottawa Nat., 22:248

This conspicuously marked form was reared from a considerable lot of Solidago taken at West Nyack, N. Y. and bearing the characteristic adhesive type of gall produced by Asphondylia monacha O. S. and Camptoneuromyia adhesa Felt.

Female. Length 2 mm. Antennae light brown, the basal segments yellowish; 22 segments, the fifth with a length about one-half the diameter; terminal segment greatly produced, acute. Palpi; the first segment short, stout, subrectangular, the second a little longer, stouter, the third a little longer and more slender than the second, the fourth one-half longer and more slender than the third. Face with patches of whitish scales above and below the antennae. Mesonotum thickly and evenly clothed with silvery yellowish scales. Scutellum pale yellowish. Abdomen thickly and evenly clothed with grayish silvery scales, the seventh segment fuscous, the ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein uniting with the anterior margin at the distal third. Pleurae and coxae silvery white; femora pale yellowish, fuscous apically, tibiae and tarsi dark brown; claws rather slender, long, strongly curved, the pulvilli a little longer than the claws. Ovipositor probably nearly as long as the abdomen, the distal portion slender. Type Cecid. a1568x.

Lasioptera riparia Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:287

This form was reared April 27, 1908 from an oval or fusiform, petiole or tendril gall on V i t i s b i c o l o r taken at Westfield, N. Y., October 16, 1907. The male may be distinguished from similarly marked individuals by the four basal segments being mostly yellowish and sparsely clothed with silvery scales, the fifth and sixth segments being dark brown and the seventh fuscous yellowish. The female has the basal segment white and the other segments narrowly margined with whitish markings, the latter produced laterally. The tarsi have the two basal segments mostly yellowish, the distal segments fuscous. This species evidently winters in the gall and presumably produces but one generation annually. Polygnotus sp. was reared from this gall.

Gall. This gall is monothalamous, narrowly oval, 1.5 cm long by .8 cm in diameter. It may occur on either the leaf or the petiole, almost invariably near the middle, and is a variable brown in color.

Larva. Length 2 mm, rather slender, deep orange. Head small, the antennae rather long, uniarticulate; breastbone slender, minutely tridentate, slightly expanded distally. Skin minutely shagreened; posterior extremity broadly rounded, ornamented with a few stout setae, anus slitlike. Probably the larva of this species.

Male. Length 1.75 mm. Antennae dark brown, the basal segments yellowish, 20 segments; the fifth with a length a little greater than its diameter, the last segment somewhat produced, narrowly rounded apically. Palpi; first segment presumably short, the second apparently narrowly oval, the third a little longer, more slender, and the fourth longer and more slender than the third. Mesonotum shining dark brown. Scutellum reddish brown, the postscutellum fuscous yellowish. Abdomen with the four basal segments mostly yellowish and sparsely clothed with silvery scales, the fifth and sixth segments dark brown, the seventh fuscous yellowish, all sparsely margined with fine setae. Wings hyaline, the third vein uniting with the yellowish discal spot near the basal half. Halteres pale orange. Coxae yellowish, femora and tibiae reddish brown, the extremity yellowish; tarsi with the first segment and the basal portion of the second yellowish, the remainder dark brown; claws stout, the pulvilli as long as the claws. Genitalia; basal clasp segment long; terminal clasp segment swollen basally, stout; dorsal plate deeply and narrowly incised, the lobes narrowly rounded, ventral plate long, tapering, broadly rounded. Harpes long, tapering, irregular; style long.

Female. Length 2 mm. Antennae colored as in the male, 25 segments; the fifth with a length about three-fourths its diameter. Palpi; the first segment short, stout, the second roundly quadrate, the third one-half longer, slender, the fourth one-third longer and more slender. Mesonotum shining black, the submedian lines sparsely haired. Scutellum reddish brown, rather thickly clothed with silvery scales. Abdomen dark brown, basal segment white, the others narrowly margined with white, the markings produced laterally and almost forming a white, lateral line; venter dark brown with a broad, median stripe of silvery white scales; ovipositor yellowish. Halteres yellowish transparent. Coxae, the extremity of femora and tibiae more or less yellowish, the middle portion of the latter two fuscous yellowish; tarsi with the two basal segments mostly yellowish, the distal segments fuscous. Ovipositor about half the length of the abdomen, the terminal lobes long, narrowly oval. Type Cecid. a1784a.

Lasioptera vitis O. S.

1862 **Osten Sacken, C. R.** Mon. Dipt. N. Am., 1:201–2

1869 **Walsh, B. D. & Riley, C. V.** Am. Ent., 1:247

1870 **Osten Sacken, C. R.** Trans. Amer. Ent. Soc., 3:59 (Callimome ebria O. S. reared)

1873 **Riley, C. V.** Ins. Mo. 5th Rep't, p. 117–18

1879 **Lintner, J. A.** Cultv. & Count. Gent., 44:407

1883 **Reed, E. B.** Ent. Soc. Ont., Rep't 13, p. 49

1883 **Saunders, William.** Ins. Inj. Fruits, p. 294

1888 **Lintner, J. A.** Cultv. & Count. Gent., 53:511

1888 **Lintner, J. A.** Inj. & Other Ins. N. Y., 4th Rep't, p. 63–67

1892 **Beutenmueller, Wm.** Am. Mus. Nat. Hist. Bul., 4:272

1900 **Smith, J. B.** Lists Ins. N. J., p. 621

1904 **Beutenmueller, Wm.** Am. Mus. Nat. Hist., Guide Leaflet 16, p. 32–33

1906 **Felt, E. P.** Inj. & Other Ins. N. Y., 21st Rep't, p. 119 (larva of Dasyneura vitis Felt described)

1907 **Smith, J. B.** N. J. Agric. Exp't Sta. Rep't, p. 528

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324

1908 **Jarvis, T. D.** Ent. Soc. Ont., 38th Rep't, p. 87

1909 **Felt, E. P.** Ent. Soc. Ont., 39th Rep't, p. 44

1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 44
1910 **Cook, M. T.** Mich. Geol. & Biol. Surv. Pub. 1, Biol. ser. 1, p. 31-32
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 44

The gall produced by this species and its associate, Dasyneura vitis Felt, is rather common on grape leaves and tendrils in various parts of New York State and probably in other portions of the country. It occurs on both cultivated and wild grape, being most abundant the latter part of July or in August. The relatively large, reddish galls attract considerable notice. A female was reared July 15, 1907, and, judging from observations, the species may appear from about that time till the latter part of August or even into September. The larvae desert the galls and transform in the earth, the later individuals presumably hibernating in their pupal chambers. Torymus? ebria O. S. was reared from this gall.

Gall. The gall is an irregular, frequently lobulated, succulent enlargement of the leaf stalk, portions of the leaf, particularly near the base, or even the tendrils. A serious infestation may result in an irregular, swollen mass two or three inches long, composed of a number of subglobular enlargements, each inhabited by a yellowish larva (pl. 3, fig. 1). Dasyneura vitis Felt apparently may be equally concerned in the production of this gall, as we have taken larvae of the last named form from what was supposed to be typical Lasioptera vitis O. S. galls.

This species is very subject to attack by insect parasites.

Larva. Length 3 mm, pale orange; head rather broad; antennae short, stout; breastbone bidentate, broad anteriorly, tapering posteriorly; skin coarsely shagreened; terminal segment broadly rounded. This larva is hardly a typical Lasioptera larva.

Female. Length 1.5 mm. Antennae dark brown, pale yellowish orange basally; 22 segments, the fifth with a length equal to its diameter; terminal segment somewhat produced, conic. Palpi; fuscous yellowish, the first segment subrectangular, with a length about one-half greater than its diameter, the second a little longer, rounded at the extremities, the third a little longer and more slender than the second, the fourth one-half longer and more slender than the third; face fuscous with a conspicuous patch of whitish scales. Mesonotum light brown, variably margined laterally and anteriorly with yellowish white scales, the submedian lines rather thickly clothed with yellowish hairs. Scutellum pale yellowish, postscutellum yellowish. Abdomen dark brown, with the segments broadly margined posteriorly and laterally with golden yellow; ovipositor pale yellowish; venter yellowish transparent. Wings hyaline, costa dark brown, the third vein uniting with the margin near the basal half. Halteres yellowish transparent; legs pale yellowish, the tarsi mostly dark brown; claws long, slender, strongly curved, the pulvilli nearly as long as the claws. Ovipositor about as long as the body, the terminal lobes long, slender and with a patch of heavy, recurved, chitinous processes near the distal third. Cecid. a1165.

Lasioptera basiflava Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324

A female representing this species was captured on grape at Albany, N. Y., July 30, 1906.

Female. Length 1 mm. Antennae dark brown; 15 segments, the fifth with a length a little greater than its diameter; terminal segment produced, narrowly oval. Palpi; the first segment short, stout, irregularly subquadrate, the second with a length about two and one-half times its diameter, narrowly oval, the third one-half longer and more slender, the fourth a little longer and more slender than the third; eyes black, margined posteriorly with silvery white scales. Mesonotum dark brown, the distinct submedian lines with yellowish white scales. Scutellum dark reddish, postscutellum dark brown. Abdomen a nearly uniform dark brown with the two basal segments fuscous yellowish. Wings hyaline, broadly oval, costa dark brown, the third vein uniting with the anterior margin near the basal half. Halteres pale yellowish; coxae and femora mostly pale yellowish, the distal portion of femora and tibiae reddish brown; tarsi dark brown, the distal segments almost black; claws long, slender, evenly curved, the pulvilli nearly as long as the claws. Ovipositor about as long as the body, the base with oval sublateral patches of stout, halberd-shaped scales; terminal lobes slender, narrowly rounded and basally a group of three or four stout, recurved, chitinous processes. Type Cecid. 719.

Lasioptera corni Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 107; separate, p. 11
1908 ———— N. Y. State Mus. Bul. 124, p. 324
1908 **Jarvis, T. D.** Ent. Soc. Ont., 38th Rep't, p. 86–87
1909 ———— Ent. Soc. Ont., 39th Rep't, p. 79
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 46
1912 **Cosens, A.** Can. Inst. Trans., 9:323

The bright, ocellate galls possibly producing this species are exceedingly common in the vicinity of Albany, N. Y., on the leaves of Cornus paniculata. They have also been observed in mid July at West Nyack, Ellenville and Catskill, and undoubtedly occur in most parts of New York State as well as in other localities where the food plant is abundant. The young galls are pale green, becoming ringed with bright red (for a colored illustration, see Museum Bul. 175, pl. 3, fig. 19) about the middle of July; adults were reared therefrom the latter part of August.

Larva. Length 3 mm, pale orange, slender; head small, antennae long, uniarticulate; breastbone bidentate, broad, chitinous apically, disappearing distally; skin coarsely shagreened; each of the abdominal segments at least, with a sparse row of long spines near the middle; terminal segment broadly rounded; a submedian pair of heavy, chitinous spurs, a pair of minor transparent processes and a sublateral pair of long, stout setae.

This larva does not appear like that of a typical Lasioptera, it may be a Dasyneura.

Female. Length .9 mm. Antennae brownish black; 18 or 19 segments, the fifth with a length a little greater than the diameter; terminal segment obconical, the apex rather obtuse. Palpi; the first segment subquadrate, the second a little longer, the third about as long as the second, both rather stout, the fourth one-half longer than the preceding, more slender. Mesonotum brownish yellow, yellowish posteriorly, submedian lines broad, narrowly separated, the median line shorter. Scutellum yellow, postscutellum yellowish. Abdomen dark brown with the first segment golden, the others yellow-banded apically, ovipositor yellowish. Wings hyaline, costa dark brown, thickly clothed with scales basally, the third vein uniting with the margin at the basal third. Halteres yellow, large. Coxae whitish transparent, femora pale, tibiae pale brownish above toward the apex, tarsi brown; claws rather slender, strongly curved. Ovipositor as long as the body, the terminal lobes slender, rather broadly rounded; a small group of curved, blunt hooks at the distal third. Type Cecid. a1151.

Lasioptera rudbeckiae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324

The female representing this species was reared September 11, 1907 from specimens of Rudbeckia lacineata bearing galls of Asphondylia conspicua O. S., and received from Highspire, Pa. A species of Torymus was also obtained.

Female. Length 1.5 mm. Antennae dark brown, the basal segments whitish; 23 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, broadly oval. Palpi; first segment short, stout, irregularly subquadrate, the second rather stout, with a length about three times its diameter, narrowly oval, the third one-third longer than the second, slender, the fourth about as long as the third. Face whitish. Mesonotum dark brown, variably margined anteriorly and laterally with silvery hairs, the submedian lines gray haired. Scutellum and postscutellum dark brown. Abdomen dark brown, the basal segment silvery white dorsally, the third and fourth segments narrowly margined posteriorly with silvery white, the markings obsolete laterally, venter silvery white; ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein uniting at the rather long, whitish discal spot just before the basal half. Halteres and coxae pale yellowish; femora and tibiae dark brown, yellowish at the extremities, especially the distal third of tibiae; tarsi dark brown, the first segment shaded with yellowish; claws long, slender, strongly curved, the pulvilli about as long as the claws. Ovipositor nearly as long as the abdomen, the terminal lobes long, rather slender, broadly rounded. Type Cecid. a1697b.

Lasioptera clavula Beutm.

1891 **Townsend, C. H. T.** Ent. Soc. Wash. Proc., 2:390–91
1892 **Beutenmueller, William.** Am. Mus. Nat. Hist. Bul., 4:269
1904 ———— Am. Mus. Nat. Hist., Guide Leaflet 16, p. 29
1905 **Cook, M. T.** Dep't Geol. & Nat. Res. Ind., 29th Rep't, p. 841
1906 **Felt, E. P.** Ins. Affec. Pk. & Wdld. Trees, N. Y. State Mus. Mem. 8, 2:736
1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul., 23:396
1907 **Jarvis, T. D.** Ent. Soc. Ont., 37th Rep't, p. 69
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324
1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 79
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 45

This gall appears to be rather common in the vicinity of Albany southward to New York City. It has been recorded from Indiana by Mr Cook and listed from Ontario by Mr Jarvis. The bright orange larvae, according to Beutenmueller, desert the galls in September and October and enter the ground, though we have found a few larvae in galls in the spring. This latter is presumably exceptional. The galls vary in color as they age from green to a variable red. A species of Polygnotus was also reared.

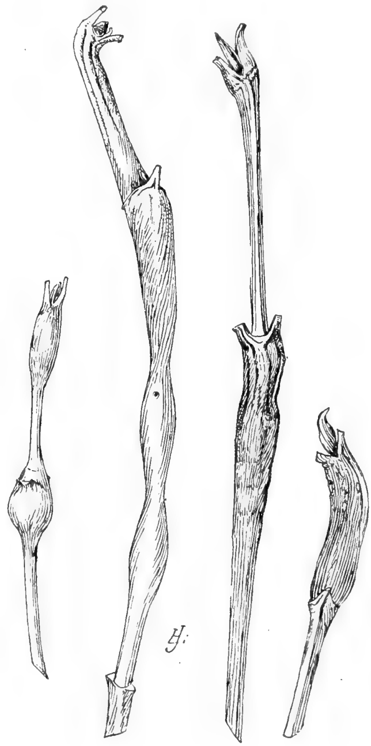

Fig. 10 Lasioptera clavula, various types of galls, about natural size (original)

Gall. The galls of this species are about 2.5 cm long and are invariably on the more tender twigs, usually near the extremity and more or less variable in form. As a rule they are somewhat produced and fusiform, occasionally being subglobular, and sometimes two or three may occur on a twig so near together as to almost fuse one with the other. This deformity is found only on the flowering dogwood (Cornus florida). The interior of the gall contains a long rather large central cavity.

Larva. Length 3 mm, pale orange. Head small, antennae long, uniarticulate; breastbone long, slender, obtusely bidentate, the head slightly expanded; skin coarsely shagreened; posterior extremity broadly rounded, a pair of submedian, chitinous hooks distally, the sublateral setae nearly obsolete.

Not a typical Lasioptera, probably Dasyneura.

Female. Head small, black, face whitish. Antennae short, black, with 21 segments; the fifth with a length about three-fourths its diameter. Thorax black with golden brown hairs and a white spot on each side anteriorly. Abdomen dark brown. The basal abdominal segment mostly whitish; the second to sixth segments narrowly margined posteriorly with whitish, the latter indistinct mesially and laterally. Venter yellowish brown covered with white scales. Wings long, slender, with a long yellowish discal spot at the distal third; the third vein yellowish and joining the margin at the distal third. Legs dark brown above; yellowish brown beneath. Ovipositor with sublateral oval patches of halberd-shaped scales; and heavy chitinous hooks. Characters drafted from the type and the original description.

Lasioptera impatientifolia Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 105–6; separate, p. 9–10
1907 **Jarvis, T. D.** Ent. Soc. Ont., 37th Rep't, p. 69
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 43
1912 **Cosens, A.** Can. Inst. Trans., 9:323

The gall of this species appears to be rather common about Albany on Impatiens fulva, touch-me-not or snapdragon in August. The adult was obtained August 10. Eupelmus dryorhizoxeni Ashm. was also reared from this gall.

Gall. The gall of this species is an oval, tumid fold along the midrib, about one-fourth of an inch long. It is green and shows upon the upper surface only as a brownish scar. The interior is filled with black carbonaceous matter.

Larva. Length 2.5 mm. Head small, antennae slender, unidentate; breastbone long, slender, heavily chitinized, bidentate, with a minute third tooth basally; head slightly expanded; skin rather coarsely shagreened; posterior extremity broadly rounded, unarmed.

Male. Length 1.6 mm. Antennae dark brown, yellowish basally; 19 segments, the fifth with a diameter about equal to its length. Palpi; the first segment rather short, stout, slightly expanded disttlly, second one-half longer than the first, stout, the third as long as tae second, slender basally, the fourth about twice the length of the hhird; face fuscous with a median white patch, eyes black, narrowly margined posteriorly with dull silvery scales, the head posteriorly dark brown. Mesonotum dark brown, thickly clothed with silvery and pale yellowish scales. In one specimen the mesonotum is entirely covered by scales. Scutellum dark brown with pale yellowish apically, postscutellum yellowish brown. Abdomen dark brown with the first segment clothed dorsally with silvery white scales, the fourth and fifth segments thickly clothed with dark brown scales and the others more sparsely clothed with scales of the same color, the posterior margin of the segments a dull yellowish orange, seventh and eighth segments mostly yellowish orange, the former narrowly margined posteriorly with dark brown. Genitalia dark brown; pleura dark brown, venter sparsely clothed with silvery white scales. Wings hyaline, costa dark brown, the third vein joining costa at the basal half; halteres pale yellowish. Coxae fuscous yellowish, femora and tibiae dark brown, pale yellowish apically, tarsi nearly uniform dark brown; claws rather heavy, strongly curved. Genitalia; basal clasp segment stout, terminal clasp segment stout, swollen basally; dorsal plate broad, deeply incised, the lobes broadly rounded; ventral plate broad, tapering to a broadly rounded apex. Harpes slender, stout, approximate, indistinctly dentate; style broadly rounded.

Female. Length 1.2 mm. Antennae dark brown; 23 segments, the fifth with a diameter one-half greater than the length. Palpi; the first segment short, rather broadly orbicular, second nearly twice the length of the first and broad, the third as long as the second, but more slender and the fourth one-half longer than the third. Face fuscous, eyes large, black and margined posteriorly with dull silvery scales, the head mostly dark brown posteriorly. Mesonotum a rich purplish brown, broadly margined laterally and anteriorly with dull silvery scales. Scutellum yellowish brown, postscutellum a little darker. Abdomen dark purplish brown, the segments narrowly margined posteriorly with dull silvery, that of the second and third apparently broadly interrupted along the median line, ovipositor pale orange. Wings hyaline, costa dark brown, the third vein unites with the yellowish orange discal spot at the basal half. Halteres yellowish basally, silvery white apically. Legs mostly a rich brown, the femora and tibiae annulate with light yellow at the articulations. Coxae a deep orange; claws moderately heavy, strongly curved. Ovipositor short, terminal lobes small, broadly orbicular. Type Cecid. a1166.

Lasioptera vernoniae Beutm.

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul., 23:389–90
1907 **Cook, M. T.** Acad. Sci. Proc., separate, p. 7–8
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124:324 (L. vernoniflorae)
1913 **Beutenmueller, William.** Can. Ent., 45:415

This species has been reared from flower and leaf galls on ironweed, Vernonia noveboracensis taken in Virginia and at Washington, D. C. Adults reared from Virginia material by the United States Bureau of Entomology, appeared September 23, 1885 and June 12, 1886. Both sexes were reared in this office in May 1910 from material collected by Miss E. G. Mitchell at Washington, D. C., September 3, 1909. It has also been recorded from North Carolina, Staten Island, New York City and Indiana.

Gall. The floral deformity occasioned by this species has not been described. The gall on the petiole and midrib is about 6 mm long, oval, greatly distending the midrib and showing above and below. It is green, sometimes tinged with red, fleshy within and contains one larva.

Larva. Length 2.5 mm, yellowish. Head small; antennae long, tapering; breastbone bidentate with a minute median tooth, becoming obsolete posteriorly. Skin coarsely shagreened, posterior extremity broadly rounded and with a few short, tapering spines.

Male. Length 1.5 mm. Antennae light brown; 18–21 segments, the fifth with a length a little greater than the diameter; terminal segment slightly produced, broadly oval. Palpi; the first segment short, stout, slightly expanded distally, the second subrectangular, with a length over twice its diameter, the third a little longer and more slender, the fourth one-half longer than the third, more slender, mouth-parts slightly produced. Mesonotum dark brown, the submedian lines indistinct. Scutellum and postscutellum reddish brown, basal abdominal segment white, the second to fourth segments rather broadly margined posteriorly with silvery white markings, produced laterally, the fifth and sixth segments narrowly margined posteriorly; genitalia fuscous. Wings hyaline, costa dark brown, the third vein uniting with costa at the basal half. Halteres yellowish white. Coxae, femora and tibiae mostly pale yellowish, tarsi mostly yellowish, the second and third segments brown apically, the fourth and fifth dark brown; claws long, slender, evenly curved, the pulvilli about as long as the claws. Genitalia; basal clasp segment long, terminal clasp segment with the basal third swollen; dorsal plate broad, deeply and triangularly emarginate, the lobes narrowly rounded, ventral plate short, broad, narrowly rounded. Harpes slender, tapering, tuberculate; style long, slender.

Female. Length 1.5 mm. Antennae light brown; 23–25 segments, the fifth with a length a little less than its diameter; terminal segment slightly produced, broadly oval. Palpi; the first segment short, stout, subquadrate, the second twice the length of the first, rather slender, the third a little longer and more slender than the second, the fourth longer and more slender than the third. Mesonotum shining, reddish. Scutellum and postscutellum fuscous yellowish. Abdomen presumably with the basal segment whitish, the others dark brown. Halteres fuscous yellowish. Legs a variable fuscous yellowish, apparently badly rubbed, the distal tarsal segment somewhat darker; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor about as long as the abdomen, the terminal lobes, narrowly oval. Type Cecid. 1058, 1059, a2014.

Lasioptera querciperda Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324
1910 ——— Econ. Ent. Jour., 3:354

These midges were reared at the United States Bureau of Entomology June 14 to 25, 1883 from twigs of white oak (Quercus alba) taken in Virginia. A number of parasites were obtained from June 14th to July 3d, as well as Cynipid flies.

Gall. Large, hard, uneven galls, length 4–6 cm, diameter 2 cm, somewhat resembling a potato. The galls, according to unpublished Bureau notes by Mr Pergande, were abundant on small oaks, all the young twigs on some of the larger branches being deformed (U. S. Bur. Ent. Notes).

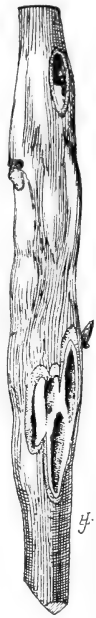

Fig. 11 Lasioptera querciperda, gall showing sections through several cells, enlarged (original)

Female. Length .75 mm. Antennae dark brown; basal segments fuscous yellowish; 28 segments, the fifth with a length slightly greater than three-fourths its diameter; terminal segment slightly produced, broadly oval. Palpi; the first segment short, stout, subrectangular, the second with a length about twice its diameter, narrowly oval, the third a little longer and much more slender, the fourth longer and more slender than the third; eyes large, black. Mesonotum reddish brown. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen dark brown, the dorsum of the first segment thickly clothed with silvery white scales, the second to fourth segments inclusive, with narrowly lunate, silvery white submedian markings; ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein uniting with the anterior margin at the basal half. Halteres pale yellowish. Coxae, femora and base of tibiae pale yellowish, the distal portion of tibiae and tarsi mostly reddish or dark brown; claws rather long, stout, strongly curved, the puvilli as long as the claws. Ovipositor about three-fourths the length of the abdomen; at the base a sublateral, oval group of halberd-shaped spines; terminal lobes tapering, with a group of three or four stout, recurved, chitinous processes. Type Cecid. 1054.

Lasioptera consobrina Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 104–5; separate, p. 8–9 (original description)
1908 ——— N. Y. State Mus. Bul. 124, p. 324

The female of this species was taken on maple-leaved arrow-wood (Viburnum acerifolium) at Albany, June 10, 1906.

Male. Length 1 mm. Antennae dark brown; 18 segments, the fifth with a length a little less than the diameter; terminal segment slightly prolonged, ovoid. Palpi; the first segment short, subquadrate, the second nearly twice as long, a little stouter, subrectangular, the third a little longer, more slender, the fourth longer, and more slender than the third, face yellowish brown with patches of whitish hairs, eyes large, black, margined posteriorly with silvery white hairs. Mesonotum dark brown, sparsely margined anteriorly and laterally with silvery white scales, posteriorly with a conspicuous patch of the same. Scutellum pale orange, apically with numerous whitish hairs, postscutellum dark orange. Abdomen dark brown, the first segment clothed with silvery white scales, the second, third and fourth segments, each with subquadrate submedian spots of yellowish white scales, fifth segment with a few whitish scales sublaterally, sixth with a few median ones along the posterior margin and a small lateral group of the same color. Wings hyaline, costa basally dark brown, the third vein uniting with the inconspicuous discal spot at the basal third. Halteres whitish transparent basally, yellowish apically. Legs a rather variable yellowish transparent with some dark brown dorsally, tarsi largely and irregularly tinged with carmine; claws stout, uniformly curved. Genitalia (pl. 7, fig. 2); basal clasp segment long; terminal clasp segment swollen at the basal fourth; dorsal plate broad, deeply incised, the lobes narrowly rounded; ventral plate narrow, broadly rounded. Harpes subtriangular; style short. Type Cecid. 183a.

Lasioptera nassauensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 324

The female representing this form was taken on a window at Nassau, N. Y., July 1, 1906.

Female. Length 1 mm. Antennae dark brown; 22 segments, the fifth with a length about three-fourths its diameter; terminal segment reduced, narrowly oval. Palpi; the first segment short, stout, swollen distally, the second a little longer, roundly rectangular, the third one-half longer than the second, more slender, the fourth one-half longer and more slender than the third. Face thickly clothed with yellowish hairs. Mesonotum dark brown, margined anteriorly and laterally with yellowish white. Scutellum purplish brown, postscutellum presumably dark brown. Abdomen dark purplish brown, the basal segment covered with silvery white scales, the others with indistinct silvery white submedian spots. Wings subhyaline, costa dark brown, the third vein uniting with costa at the basal third. Halteres yellowish orange basally, pale yellowish apically. Coxae pale yellowish orange, the femora mostly pale yellowish, the anterior tibiae dark brown, the middle and posterior tibiae with a line of dark brown, mostly yellowish; tarsi a nearly uniform dark brown; claws long, slender, strongly curved, the pulvilli about as long as the claws. Ovipositor about as long as the abdomen; terminal lobes long, slender. Type Cecid. 432.

Lasioptera danthoniae Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:287

This species was reared by Mr C. R. Crosby of the Cornell University Agricultural Experiment Station, from a bunch of Danthonia taken in the spring of 1908 on top of one of the high hills at White Church, N. Y.

Male. Length 1.5 mm. Antennae fuscous yellowish, the basal segments whitish; 16 segments, the fifth with a length about three-fourths its diameter; terminal segment greatly produced, broadly rounded apically. Palpi; the first segment short, stout, the second narrowly oval, the third one-half longer than the second, more slender, the fourth one-half longer than the third, slender. Mesonotum fuscous yellowish. Scutellum yellowish, postscutellum a little darker. Abdomen dark brown, the basal segment white, the second to fourth segments with conspicuous submedian, lunate, white spots, the sixth and seventh segments yellowish; venter dark brown, with irregular, whitish markings laterally. Wings hyaline, costa dark brown, the third vein uniting with costa near the basal third. Halteres yellowish, coxae and femora mostly yellowish white, the tibiae yellowish fuscous, the tarsi dark brown, the posterior legs with the segments broadly banded basally with white; claws rather stout, the pulvilli about three-fourths the length of the claws. Genitalia; fuscous yellowish, basal clasp segment short, stout, distal clasp segment somewhat swollen at the base, short, stout, dorsal plate triangularly incised, the lobes narrowly rounded, ventral plate long, slender, narrowly rounded. Harpes subtriangular, style long.

Female. Length 2 mm. Antennae about as in the opposite sex, except that the terminal segment does not appear to be so greatly prolonged. Scutellum yellowish, postscutellum dark brown. Abdomen dark brown, the basal segment white, the second to fourth segments with small, submedian, whitish spots; ovipositor yellowish, when extended about as long as the abdomen; terminal lobe rather short, broadly oval, nearly naked; minor lobe short. Legs about as in the male, except that the basal tooth of the claw is more distinct.

Described from alcoholic specimens, the female being provisionally associated with the male. Type Cecid. a1925.

Lasioptera arizonensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325
1911 ———— Econ. Ent. Jour., 4:482–83

This species was reared in the United States Bureau of Entomology May 1, 1899 from stems of S e n e c i o a r i z o n e n s i s taken at Oracle, Ariz., April 22d the same year. The larva is described by Pergande as reddish. There is no description of the gall.

Lasioptera flavipes Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325

This species was taken on white oak at Albany, N. Y., July 17, 1906.

Male. Length 2 mm. Antennae dark brown, the basal segments yellowish; 17 segments, the fifth with a length about one-fourth greater than its diameter; terminal segment somewhat produced, narrowly oval. Palpi; the first segment expanding distally and with a length over twice its diameter, the second longer than the first, roundly rectangular, the third presumably a little longer and more slender than the second, the fourth longer and more slender than the third; face yellowish; head clothed posteriorly with silvery white scales. Mesonotum shining black, sparsely ornamented with golden scales. Scutellum dark red, postscutellum fuscous. Abdomen deep red with the basal segment and small subquadrate submedian spots on the second, third and fourth segments yellowish white, the sixth segment margined basally with reddish and posteriorly with silvery white scales. Wings hyaline, costa yellowish brown and dark fuscous, the third vein uniting with the anterior margin just before the basal half. Halteres whitish transparent. Legs mostly pale yellowish, the distal tarsal segments somewhat darker; claws rather long, slender, strongly curved, the basal tooth very long, slender, the pulvilli a little longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment with the basal third swollen; dorsal plate long, broad, deeply and triangularly incised, the lobes narrowly rounded; ventral plate broad, narrowly rounded. Harpes short, stout, tapering; style short, stout. Type Cecid. 612.

Lasioptera querciflorae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325
1910 ——— Econ. Ent. Jour., 3:351

This species was reared from galls on blossoms of oak received June 9, 1882 from Mr H. K. Morrison of Fort Grant, Ariz. A number of flies issued in transit and others continued to appear until June 15th. We are indebted to the courtesy of Doctor Howard and the National Museum for an opportunity of studying this interesting form.

Female. Length 1.5 mm. Antennae dark brown; 33 segments the fifth with a length about three-quarters its diameter; terminal segment slightly produced, tapering to a broadly rounded apex. Palpi; the first and second segments, indistinct in the preparation, the third with a length four times its diameter, tapering at both extremities, the fourth a little longer and more slender than the third, eyes black. Mesonotum reddish brown, the submedian lines sparsely haired. Scutellum yellowish, postscutellum dark brown. Abdomen reddish brown, the basal segment and ovate submedian spots on the second to fifth segments silvery white, the sixth narrowly margined with silvery white scales, the ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein joining the rather long, yellowish discal spot at the basal half. Halteres fuscous yellowish. Legs mostly a light yellowish or yellowish brown, the distal tarsal segments somewhat darker; claws rather long, stout, strongly curved and armed with heavy, strongly curved teeth basally; pulvilli distinctly shorter than the claws. Ovipositor nearly as long as the abdomen, basally with oval patches of heavy, halberd-shaped scales; terminal lobes with a length about twice the width, densely clothed dorsally with a patch of unusually long, slender, recurved hooks. Type Cecid. 900.

Lasioptera colorati n. sp.

Numerous midges belonging to this species were reared by Mr C. N. Ainslie in the spring of 1914 from salmon-colored larvae found in the stems of Muhlenbergia collected at Elk Point, S. D. The larvae occur in tubular, silken cases in the concavities of the leaflets and at the base of the leaf sheath and occasionally in the stems, the very base of the leaf sheath showing brownish, dead tissues though no such carbonization as that produced by Lasioptera inustorum Felt in the leaf sheath of Panicum virgatum. Mr Ainslie recorded under date of March 2, 1914, that usually a single larva occupies one subhead but sometimes two occur side by side within a leaf sheath. The larvae are never contiguous but are always wrapped in a thin membrane and as many as four or five occur in a single stem of Muhlenbergia. April 9, 1914 the larvae showed some activity, moving the head slowly and apparently spinning a fine silk on the glass of the vial. The next day a change in color was noted from a uniform salmon to a lighter shade mottled with cream color, evidently a change prior to pupation. The species is so abundant that a few heads of Muhlenbergia collected by Mr Ainslie March 23, 1915, contained a half dozen full-grown larvae, the latter occurring under large leaf sheaths which appeared to occupy the place where subheads would have grown. There is a marked difference between this species and Asteromyia agrostis O. S., an inhabitant of the same food plant. The adults are easily separated from allied forms by the coloration of the abdomen and legs.

Larva. Length 4 mm, stout, a rather deep reddish orange, the head rather long, broad, subtriangular, the antennae long, tapering, apparently uniarticulate; breastbone more or less rudimentary, lance-shaped; skin coarsely shagreened, the posterior extremity produced as a pair of submedian, fleshy, irregularly conical, somewhat wrinkled processes.

Male. Length 1.5 mm. Antennae extending to the base of the abdomen, sparsely haired, grayish brown, the two basal segments whitish; probably 16 or 17 segments, the fifth with a length one-fourth greater than its diameter. Palpi; the first segment irregularly quadrate, the second one-half longer, broader, the third a little longer and more slender than the second, the fourth one-fourth longer than the third, somewhat dilated. Mesonotum reddish brown, sparsely haired. Scutellum fuscous yellowish, postscutellum yellowish brown. Abdomen mostly yellowish with a variable salmon tinge and very sparsely clothed with dark brown scales. Costa dark brown, the small stigmatal spot at the basal half; halteres whitish transparent. Coxae reddish orange; femora mostly whitish transparent, with sparse, fuscous scales apically; tibiae sparsely clothed with dark brown scales, the posterior thickly so apically, the anterior and midtarsi dark brown, the segments narrowly annulated basally with whitish, the posterior tarsi with the first segment white, the base of the second and third broadly annulate with white, the fourth and fifth white; claws unusually long, slender, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment moderately long, stout; terminal clasp segment long, greatly swollen basally; dorsal plate short, broad, triangularly emarginate; ventral plate long, deeply and roundly emarginate, the lobes rather slender and narrowly rounded.

Female. Length 2 mm. Antennae reddish brown, the two basal segments whitish; 16 or 17 segments, the fifth with a length about equal to its diameter, the terminal segment reduced. Scutellum yellowish brown, postscutellum reddish brown. Abdomen dark brown with submedian, triangular spots posteriorly on each segment and laterally a series of irregular similar spots. Halteres yellowish white. Ovipositor as long as the body, yellowish orange; terminal lobes slender, with a length six times the width and sparsely setose. Other characters as in the male. Type Cecid. a2716, Webster 11;838.

Lasioptera willistoni Ckll.

1898 **Cockerell, T. D. A.** Ann. & Mag. Nat. Hist., ser. 7, 2:327

This species, according to notes kindly placed at our disposal by Professor Cockerell, was taken on the college campus, Mesilla Park, New Mexico, December 19, 1899, at which time the immature larvae were extremely minute. The insect was reared by Professor Cockerell from an irregular twig swelling on Atriplex canescens. This species is tentatively assigned this position together with the two others described by Professor Cockerell in comparison with this form.

Gall. Length 1.5 mm, diameter 5 mm, a somewhat irregular twig swelling, tapering at both extremities and with one exit hole. Described from a specimen kindly sent by Professor Cockerell.

Larva. Length 6.5 mm, orange color, rather stout. Head small, triangular; antennae small, posterior extremity broadly rounded; breastbone dark, slender, minutely bidentate and in the mounted specimen apparently with a peculiar plate filling most of the emargination between the two teeth.

Fig. 12 Lasioptera willistoni, gall, natural size (original)

Fig. 13 Lasioptera willistoni, breastbone of larva, after Cockerell, enlarged (original from Cockerell)

Mesilla, New Mexico; also common on the campus of the Agricultural college, Mesilla Park, N. M.

The imago described emerged May 2, 1897; there appears to be a second brood, issuing in August. Great numbers of parasites, determined by Mr Ashmead as Polygnotus atriplicis Ashm., have been raised from the galls (collected at Mesilla Park) by Miss Ivah Mead and the present writer. When I first bred this species I was unable to identify it with anything described, so I sent a drawing of it to Doctor Williston, who informed me that it was a new Lasioptera without doubt. (Cockerell)

Lasioptera ephedrae Ckll.

1898 **Cockerell, T. D. A.** Ann. & Mag. Nat. Hist., ser. 7, 2:327–28

This insect produces a fusiform swelling on the twigs of Ephedra trifurca.

Gall. Length 12 mm, diameter 5 mm. This deformity is a fusi-

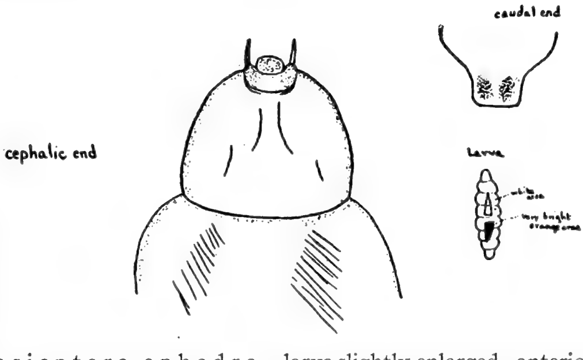

Fig. 14 Lasioptera ephedra, larva slightly enlarged, anterior and posterior extremities more enlarged, after Cockerell (original from Cockerell)

form swelling of the twigs with a depression on each side where the wall is thinner and through which the insect emerges.

Mesilla Park, N. M., abundant; also at Paraje, N. M., Prof. C. H. T. Townsend described the gall in Entomological News, September 1893, pages 242–43. (Cockerell)

Lasioptera tertia Ckll.

1898 **Cockerell, T. D. A.** Ann. & Mag. Nat. Hist., ser. 7, 2:328

Gall. A potato-shaped smooth swelling on the twigs of some asteroid composite. The galls are of various shapes, sometimes subglobular, 11 x 9 mm, or elongated, 17 mm long, constricted in the middle; they are always quite broad and more or less irregular.

Paraje, New Mexico; galls collected in April 1898. (Cockerell)

Lasioptera desmodii Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 106–7; separate, p. 10–11

1908 ———— N. Y. State Mus. Bul. 124, p. 325

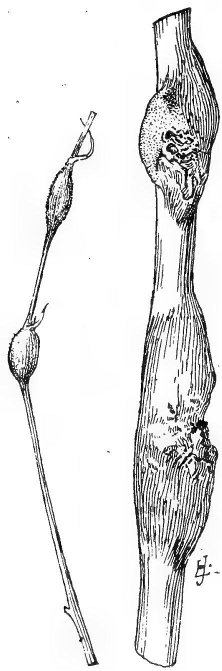

Fig. 15 Lasioptera desmodii, two types of gall (original)

The midge appears to be rather common in Albany and vicinity, as its galls were taken a number of times and the adults reared. The long, whitish larvae winter within the gall, the adults appearing early the following spring.

Gall. The gall is a slight enlargement on three sides of the stem, usually about 1.8 cm long. Most of the polythalamous galls appear to originate in a bud which seems to be the center of the swelling, though that part is no more enlarged than others. This gall occurs on several tick trefoils, Meibomia cuspidatum, M. canadensis, Desmodium acuminatum and D. ? canadense. Polygnotus species was reared from this gall.

Larva. Length 3 mm, slender, whitish. Head small; antennae long, slender; breastbone long, stout, bidentate, with a minute, median tooth; head slightly expanded; skin rather coarsely shagreened, posterior extremity broadly rounded, with a few minute setae.

Male. Length 1 mm. Antennae dark brown, basally yellowish transparent; 21–22 segments, the fifth with a length about three-fourths its diameter; terminal segment short, broadly rounded distally. Palpi; the first segment short, irregularly subquadrate, second broader, suboval, a little longer, the third more slender and longer, and the fourth one-fourth longer than the third; face yellowish brown, with a white patch on the front; eyes rather large, black. Mesonotum nearly uniform dark brown, margined anteriorly and laterally with silvery white hairs and with a sprinkling of the same on the margin of the nearly naked posterior median area. Scutellum brownish, rather thickly clothed with silvery white hairs, and a few longer apical whitish bristles; postscutellum dark brown. Abdomen dark brown, the first segment thickly clothed with snow-white hairs, the second, third and fourth segments broadly margined posteriorly with snow-white hairs, the bands being wider on the median line, the fifth narrowly margined with white, the seventh entirely brown, margined posteriorly with long, white bristles, the eighth yellowish and margined with long, white bristles; ventral surface dark brown, with a broad, median silvery white stripe; genitalia dark brown, tipped with silvery white. Wings hyaline, costa dark brown, the third vein uniting with the margin at the basal third. Halteres and coxae yellowish transparent; femora and tibiae dark brown, banded at the extremity with yellowish white; tarsi pale yellowish brown, darker distally; claws stout, strongly curved. Genitalia; terminal clasp segment with the basal fourth greatly swollen; dorsal plate broad, deeply and triangularly incised, the lobes broadly rounded; ventral plate broad, broadly rounded. Harpes subtriangular.

Female. Length 2 mm. Antennae dark brown, basally yellowish white; 23–24 segments. Coloration practically as in the other sex, except that the dorsal apical bands on the abdomen do not appear quite so broad and the terminal segments are yellowish; the broad, median stripe on the venter of the abdomen is not quite so wide as in the opposite sex. Ovipositor probably three-fourths the length of the abdomen, the terminal lobe slender. Type Cecid. 1376.

Lasioptera caulicola Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 162
1908 ———— N. Y. State Mus. Bul. 124, p. 325

A number of females of this species were reared June 3, 1907 from an apparently normal stem of bush honeysuckle taken in the vicinity of Albany. The stem was only 3 to 4 mm in diameter and showed no external sign of infestation, though a subsequent examination disclosed the fact that some seven or eight adults had emerged from a portion less than 3 cm long. The larvae appear to live just under the bark in a small cell hardly large enough to contain the full-grown insect.

Female. Length 2 mm. Antennae dark brown, the basal segments fuscous yellowish; 23 segments, the fifth with a length about three-fourths the diameter; terminal segment obpyriform. Palpi;

the first segment short, stout, subquadrate, the second one-half longer, stouter, the third a little longer, more slender, though swollen distally, the fourth about one-half longer than the third, strongly flattened. Face sparsely clothed with silvery white scales, the mouth-parts fuscous yellowish, the eyes rather large, faintly margined posteriorly with silvery white. Mesonotum dark brown, rather broadly margined laterally and anteriorly with silvery white, the submedian lines sparsely haired. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen dark brown, the basal segment silvery white dorsally, the third and fourth segments rather broadly margined along the median third posteriorly with silvery white, the second segment with an elongate, median silvery white dot on the posterior margin; ovipositor pale yellowish; venter sparsely clothed with silvery white scales. Wings hyaline, costa dark brown, the silvery white discal spot just before the basal half, the third vein uniting with the anterior margin just before the basal half. Halteres pale yellowish, apically a light salmon. Coxae fuscous basally, yellowish apically; femora and tibiae dark brown, irregularly and broadly banded at the extremities with silvery white, tarsi dark brown; claws long, slender, strongly curved, the pulvilli a little shorter than the claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobes slender, narrowly rounded. Type Cecid. a1469a.

Lasioptera farinosa Beutm.

1862 **Osten Sacken, C. R.** Dipt. N. Am. Mon., 1:204

1891 **Riley, C. V. & Howard, L. O.** Ins. Life, 4:126 (Polygnotus rubi Ashm. reared)

1892 **Beutenmueller, William.** Am. Mus. Nat. Hist. Bul., 4:273

1894 **Brodie, William.** Biol. Rev. Ont., 1:110 (Diplosis)

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul., 23:397-98

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325

1908 **Jarvis, T. D.** Ent. Soc. Ont., 38th Rep't, p. 88

1909 ———— Ent. Soc. Ont., 39th Rep't, p. 78

1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 35

This gall is a very characteristic, warty, usually pruinose, woody swelling at the base of the leaflets or midrib of the common blackberry. It was recognized by Osten Sacken as early as 1862. Messrs Riley and Howard in 1891 record rearing therefrom a parasite (Polygnotus rubi Ashm.) and it has been subsequently noticed by Beutenmueller and Brodie, the former obtaining the adult and describing the same in connection with the larva in 1907. The species is rather common in the vicinity of Albany and New York. It is evidently widely distributed, as there are specimens in the collections of the United States National Museum from Virginia, and Kirkwood, Mo., while Beutenmueller records it from North Carolina and Brodie from Toronto. The larvae winter in the galls on the ground, the adults appearing in the vicinity of Albany the latter part of June and in early July. Two specimens were also obtained October 2d but these latter must be regarded as abnormal.

Gall. This gall is more or less variable in appearance, attaining maturity the latter part of September or in early October. The individual galls are more or less irregularly ridged, light brown, about 1 cm long, sometimes two or three are fused together to form a more or less irregular mass 2 or 3 cm in length. The greater part of the swelling is on the under surface of the leaf and invariably along the midrib or occasionally on the lateral veins, the galls on the latter being decidedly smaller. The larger galls are .5 to .6 or .7 cm in diameter, about .5 cm in thickness and show on the upper surface as slight swellings accompanied by more or less distinct crumpling of the leaf and a rather characteristic purplish red discoloration. The larger galls are usually at the base of the leaflets and rarely or never occur on the petiole. (For a colored illustration see Museum Bul. 175, pl. 4, fig. 3, 3a)

Larva. Length 2.5 mm, slender, pale orange. Head small, antennae slender; breastbone stout, bidentate, tapering distally; skin rather coarsely shagreened; posterior extremity broadly rounded.

Male. Length 1.75 mm. Antennae dark brown; 18–19 segments, the fifth with a length slightly greater than the diameter; terminal segment somewhat produced, oval. Palpi; the first segment rather short, stout, oval, the second one-half longer, subrectangular, the third one-fourth longer than the second, more slender and the fourth one-half longer than the third, more slender, face fuscous, eyes large, black. Mesonotum very dark brown, the anterior margin, specially laterally, bordered with silvery white scales. Scutellum reddish brown, rather thickly clothed with yellowish setae, postscutellum a little darker. Abdomen dark brown, the basal segment clothed dorsally with silvery white scales, the second, third and fourth segments margined posteriorly with silvery white scales, which latter are somewhat produced on the median line and obsolete laterally. Wings hyaline, costa a rich dark brown with a whitish stigmatal spot near the middle, the third vein uniting with the margin at the basal half. Halteres yellowish basally, yellowish white apically. Legs dark brown with the distal extremity of the femora and the extremities of the tibiae narrowly banded with yellowish, the first segment, the basal three-fourths of the second and the basal portion of the third and fourth segments of the posterior tibiae yellowish, the distal tarsal segments brown. In another specimen the posterior tarsal segments are a nearly uniform light yellowish, except the last, which is dark brown; claws long, slender, evenly curved, with a long, well developed tooth basally, pulvilli as long as the claws. Genitalia; basal clasp segment long, slender, obliquely truncate; terminal clasp segment short, slender, tapering; dorsal plate short, broad, deeply and triangularly emarginate, the lobes narrowly rounded; ventral plate short, broadly rounded; harpes rather long, slender, tapering, style long.

Female. Size and general characters about as in the opposite sex. Antennae composed of 20–23 sessile segments, the fifth with a length a little less than the diameter; terminal segment short, broadly oval. Palpi; the first segment short, subquadrate, the second stout, more than twice the length of the preceding, roundly rectangular, the third slightly longer and more slender than the second, the fourth more slender and about twice as long as the third, the terminal segment, at least, with a few broad scales; ovipositor nearly as long as the abdomen, the terminal lobes slender. Type Cecid. a1343.

Lasioptera spinulae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325

Both sexes of this form were reared in the United States Bureau of Entomology June 16, 1883 from stem galls on an unknown plant taken at Fort Huachua, Ariz., May 17, 1883, by H. K. Morrison.

Male. Length 3 mm. Antennae dark brown; 19 segments, the fifth with a length nearly equal to the diameter; terminal segment slightly produced, broadly oval. Palpi; the first segment short, stout, irregularly subquadrate, the second stout, broadly oval, the third one-half longer than the second, swollen; eyes large, black. Mesonotum reddish brown. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen dark brown, the basal segment thickly clothed with silvery white scales, the second to fifth segments rather broadly and irregularly margined posteriorly with yellowish brown scales; genitalia dark brown. Wings hyaline, costa dark brown, the third vein uniting with the anterior margin at the basal half. Halteres pale yellowish basally, reddish brown apically. Coxae dark brown; femora mostly yellowish brown; tibiae and tarsi dark brown, the first and second segments on the posterior legs narrowly banded with silvery white; claws long, stout, strongly curved, the pulvilli shorter than the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment short, swollen basally; dorsal plate short, deeply and roundly emarginate, the lobes narrowly rounded; ventral plate short, stout, deeply and triangularly emarginate. Harpes short, stout, irregular.

Female. Length 3.5 mm. Antennae dark brown; 22 segments, the fifth with a length one-half its diameter; terminal segment produced, with a length over twice its diameter and variably ornamented with anastomosing circumfili. Palpi; the first segment short, stout, subquadrate, the second about as long, irregular, the third about twice the length of the second, greatly swollen near the middle and tapering at both extremities. Color characters and structure of wings and claws practically as in the opposite sex. Ovipositor about one-half the length of the abdomen, the terminal lobes slender, narrowly rounded. Type Cecid. 1056.

Lasioptera nodulosa Beutm.

1891 **Smith, J. B.** N. J. Agric. Exp't Sta. Bul. N., p. 13-14
1891 ——— N. J. Agric. Exp't Sta. 12th Rep't, 1892, p. 382-84 (L. farinosa)
1893 **Webster, F. M.** Ohio Agric. Exp't Sta. Bul. 45, p. 188-89 (L. farinosa)
1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul., 23:397
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325
1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 78
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 36

The gall produced by this insect is common in the vicinity of New York City and has erroneously been considered as the work of Lasioptera farinosa. It was first noticed and described by Dr J. B. Smith in 1891, and in 1892 Professor Webster found specimens of the gall quite abundant in the vicinity of Wooster, Ohio. Midges in the National Museum were reared May 24, 1883 from material taken at Cadet, Mo. Adults were reared and described by Professor Beutenmueller in 1897. This species makes a very characteristic gall on the smaller twigs of the high blackberry and is much more abundant in the vicinity of New York City than in the neighborhood of Albany. Galls of apparently the same species were taken on the stem of a trailing blackberry at Bath, N. Y., April 4, 1907. The work of this insect was very common at West Nyack, N. Y., in 1907. The larvae winter in the galls, the adults appearing the latter part of May. The midge may be distinguished from L. farinosa by its nearly uniform, dark brown tarsi and the larger number of antennal segments in both sexes. Reared specimens of this species and L. farinosa were submitted to L'abbe Kieffer, the distinguished European authority on this group. He states that this form is near the European Lasioptera rubi Heeg., which make a very similar gall on blackberry, and that the female of our American species differs therefrom in the absence of hooks on the lobes of the ovipostor. He also indicated several differences between L. farinosa and the species under discussion. Polygnotus rubi Ashm. and Torymus ostensackeni D. T. have been reared from this fly.

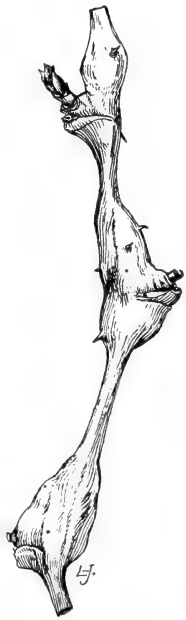

Fig. 16 Lasioptera nodulosa, a series of three galls, natural size (original)

Gall. The gall is an irregular, subfusiform or elongate swelling on the smaller branches of blackberry. It presents a somewhat general resemblance to the deformity produced by the gouty gall beetle (A g r i l u s r u f i c o l l i s Fabr.). The gall is hard, woody (usually of the same color as the adjacent bark) about 2 cm long and 1 cm in diameter, polythalamous and contains numerous pale yellowish larvae.

Larva. Length 2.5 mm, rather stout, pale orange. Head small; antennae rather short, stout; breastbone stout, slender, bidentate, with a minute median tooth; skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae dark brown, yellowish basally; 18–20 segments, the fifth with a length a little less than the diameter; terminal segment greatly produced, narrowly rounded distally. Palpi; the first segment irregularly subquadrate, the second longer, rather broadly rounded, the third a little longer and much more slender than the second, the fourth twice the length of the second, more slender; face with a conspicuous patch of white scales; eyes narrowly margined posteriorly with yellowish scales. Mesonotum dark brown, irregularly margined laterally and anteriorly with yellowish or yellowish white scales; submedian lines rather thickly clothed with short, golden yellow scales. Scutellum dark brown, with a few yellowish setae apically, postscutellum light reddish brown. Abdomen dark brown with the basal segment suffused with silvery white scales, the second to fifth narrowly margined posteriorly with whitish hairs, the sixth and seventh narrowly margined with yellowish hairs, the incisures deep red; genitalia fuscous, venter black with a broad median area suffused with silvery white scales, the seventh and eighth segments sparsely scaled and therefore showing a deep red. Wings hyaline, costa dark brown, the long whitish discal spot at the basal half; the third vein uniting with the margin near the basal half. Halteres pale yellowish basally, whitish transparent apically. Legs mostly a light fuscous yellowish; femora and tibiae irregularly and rather broadly banded near the middle with variable fuscous, the distal tarsal segments slightly darker; claws rather long, slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long; terminal clasp segment somewhat swollen at the base; dorsal plate broad, deeply and triangularly incised, the lobes narrowly rounded; ventral plate long, broadly rounded. Harpes long, tapering, obtuse, subapically a heavy subquadrate diverging process.

Female. Length 2 to 3 mm. Antennae dark brown basally, fuscous yellowish; 25 segments, the fifth with a length somewhat produced, obovate. Palpi; the first segment stout, irregularly subquadrate, the second about as long, rather broadly rounded, the third one-half longer than the second, much more slender, the fourth nearly twice the length of the preceding, more slender; face pale yellowish, sparsely clothed with light setae; eyes large, black. Mesonotum dark brown or black, broadly margined laterally and anteriorly with silvery white, the submedian lines sparsely clothed with short, golden yellow setae. Scutellum a reddish brown, postscutellum a reddish yellow. Abdomen dark brown, the first segment thickly clothed with silvery white scales, the second to fifth segments, narrowly margined posteriorly with silvery white. Wings hyaline, costa dark brown, the silvery white discal spot at the basal half; the third vein uniting with the margin near the basal half. Halteres yellowish basally, whitish transparent apically. Legs with the coxae and base of femora yellowish transparent, the other portions a variable fuscous yellowish; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes slender, narrowly rounded. Type Cecid. a1411.

Lasioptera palustris Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 162
1908 ———— N. Y. State Mus. Bul. 124, p. 325

The midges were reared from an irregular stem gall occurring upon a weed abundant in wet places at West Nyack, N. Y. Galls were first observed April 18th and adults obtained June 22d. Eupelmus dryorhizoxeni Ashm., Eurytoma, Polygnotus and Torymus species were reared from this gall.

Gall. Length .7 to 1.5 cm. It varies in form from subglobular to elongate, irregular, fusiform. The interior is hard, pithy, the larger ones at least are polythalamous.

Larva. Length 3 mm, slender, pale orange. Head small, antennae slender; breastbone slender, bidentate, with a minute median tooth; skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 1.75 mm. Antennae dark brown, basally yellowish; 20 segments, the fifth with a length a little greater than its diameter; terminal segment produced, obovate. Palpi; the first segment irregularly subquadrate, the second about twice as long, stouter, rounded apically, the third a little longer than the second, dilated apically, the fourth about twice the length of the preceding, more slender. Face fuscous yellowish with a rather conspicuous patch of silvery white scales, the black eyes narrowly margined posteriorly with silvery white. Mesonotum a dark reddish brown, variably margined laterally and anteriorly with silvery white, the submedian lines thickly clothed with golden yellow scales, the posterior median area reddish brown. Scutellum a pale reddish brown with a few yellowish setae apically, postscutellum pale orange. Abdomen dark brown, the basal segment silvery white, the second to fourth segments rather broadly and the fifth and sixth segments narrowly margined with silvery white, the latter obsolete laterally, the eighth segment pale orange; genitalia fuscous yellowish; venter dark brown with a broad median silvery white stripe. Wings hyaline, costa dark brown, the discal spot yellowish, the third vein uniting with the margin just before the basal half. Halteres pale salmon; legs mostly brown, the extremities of femora and tibiae variably annulate with light yellowish, the tarsi dark brown; claws rather long, slender, strongly curved, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment long; terminal clasp segment swollen basally; dorsal plate broad, deeply and triangularly incised; ventral plate long, roundly truncate. Harpes long, stout, obtusely rounded.

Female. Length 2 mm. Antennae dark brown, yellowish basally; 25 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, tapering to a broadly rounded apex. Palpi; the first segment irregularly subquadrate, the second twice the length of the first, stout, rounded distally; the third one-half longer, more slender, slightly expanded apically, the fourth nearly twice the length of the preceding, slender; face fuscous yellowish with a conspicuous patch of silvery white scales, eyes black, narrowly margined posteriorly with silvery white. Mesonotum a rich purplish brown, narrowly margined laterally and anteriorly with yellowish white, the submedian lines rather thickly clothed with short, yellowish setae, the median posterior area reddish brown. Scutellum reddish brown with numerous fine setae apically, postscutellum yellowish brown. Abdomen dark brown, the dorsum of the first segment silvery white, the second, third and fourth segments narrowly margined posteriorly with silvery white, the latter obsolete laterally; ovipositor pale orange, venter black with a broad median, silvery white stripe. Wings hyaline, costa dark brown, the third vein uniting with the margin just before the basal half. Halteres pale orange. Legs mostly brown, the extremities of femora and tibiae variably annulate with pale yellowish, the tarsi dark brown; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor about three-fourths the length of the abdomen, terminal lobe slender, narrowly rounded. Type Cecid. a1443.

Lasioptera linderae Beutm.

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul., 23:398-99

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325

1913 ——— Can. Ent., 45:415

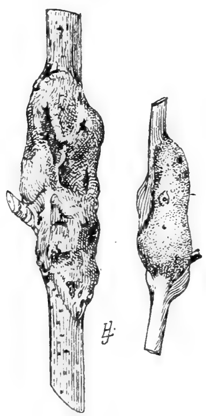

Fig. 17 Lasioptera linderae, two views of a gall, natural size (original)

The irregular, subcortical gall of this species occurs on spicebush, Lindera benzoin, and was first described together with the larva inhabiting the same, by Professor Beutenmueller in 1907. This insect is rather common in the vicinity of New York City. The larvae winter in the galls and adults may be obtained therefrom in the latter part of May to toward the end of June. A species of Torymus was reared from this fly.

Gall. The irregular, subcortical galls are from 2 to 5 cm in length and occur only on one side of the twig or smaller stems. They present a marked, general resemblance to similar deformities caused by N e o l a s i o p t e r a s a m b u c i Felt.

Larva. Length 2 mm, rather stout, pale orange. Head small; antennae slender; breastbone slender, bidentate, slightly expanded apically, subobsolete distally; skin finely shagreened; posterior extremity broadly rounded.

Male. Length about 2.5 mm. Antennae dark brown, basally yellowish; 20 segments, the fifth with a length a little less than the diameter; terminal segment produced, narrowly oval. Palpi; the first segment short, narrowly oval, the second one-half longer, a little stouter, the third a little longer and more slender than the second, the fourth one-half longer and more slender than the third. The markings of the male differ from those of the female in that the mesonotum is more or less suffused with silvery hairs. Coloration of the abdomen the same, except that the apical segments appear to have a row of shining gray hairs. Genitalia; basal clasp segment long, stout; terminal clasp segment swollen at the base; dorsal plate broad, deeply and narrowly incised; ventral plate long, narrow, broadly rounded. Harpes stout, tapering.

Female. Length 1.75 mm. Antennae dark brown, basally pale yellowish; 23 segments, the fifth with a length about three-fourths the diameter; terminal segment somewhat produced, narrowly rounded apically. Palpi pale yellowish, the first segment presumably short, stout, subquadrate, the second rather stout, with a length about one-half greater than its diameter, the third more slender and one-fourth longer than the second, the fourth more slender and one-half longer than the third. Face rather thickly clothed with silvery scales. Mesonotum dark brown, broadly and variably margined anteriorly with silvery white, the submedian lines sparsely clothed with fine hairs. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen dark brown, the first segment thickly clothed with silvery white scales, the second segment with a narrow median, triangular mark posteriorly of silvery white, the third and fourth broadly margined posteriorly with silvery white, the markings produced on the median line, obsolete laterally, the fifth and sixth very narrowly margined posteriorly with yellowish, the seventh and ovipositor mostly pale yellow, the venter dark brown with a broad median silvery white stripe. Wings hyaline, costa dark brown, third vein joining costa well before the basal half. Halteres yellowish transparent. Coxae pale yellowish; femora yellowish white, with a variable light brown band near the middle; tibiae dark brown basally, yellowish apically; tarsi a nearly uniform dark brown; claws long, slender, strongly curved, the pulvilli about as long as the claws. Ovipositor nearly as long as the abdomen, terminal lobes slender, broadly rounded apically.

Lasioptera mitchellae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325

The fusiform stem gall of this species was taken on Wolfsfang, Lycopus virginicus or L. sinuatus at Washington, D. C., by Miss E. G. Mitchell and transmitted to this office under date of March 23, 1907.

Gall. This fusiform stem gall is 1.5 to 2 cm long and .5 to .8 cm in diameter. The thickened portion is soft, spongy and near the center are two or three cells each containing a plump, whitish larva 2 or 3 mm in length.

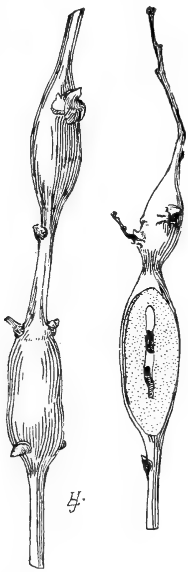

Fig. 18 Lasioptera mitchellae, gall about natural size (original)

Larva. Length 2 mm, pale orange. Head small; antennae slender; breastbone rather stout, slightly expanded apically, bidentate, with a minute median tooth; skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae dark brown, basally whitish; 16 segments, the fifth with a length a little greater than its diameter; terminal segment slightly produced, ovate. Palpi; the first segment short, stout, irregularly subquadrate, the second longer, roundly rectangular, the third one-fourth longer and more slender than the second, the fourth one-half longer and more slender than the third. Face with a conspicuous patch of whitish scales below the antennae. Mesonotum dark brown, variably margined laterally and anteriorly with silvery white, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum a little darker. Abdomen dark brown, the basal segment thickly clothed with silvery white scales, the second to seventh segments narrowly margined posteriorly with silvery white; ventral surface with a broad median, silvery white stripe. Wings hyaline, costa dark brown, the third vein uniting with costa near the basal half. Halteres whitish transparent. Legs a variable fuscous yellowish, the middle of the femora and tibiae darker; claws rather long, slender, strongly curved, the pulvilli about as long as the claws. Genitalia; basal clasp segment long, obliquely rounded; terminal clasp segment swollen at the base; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate broad. Harpes rather stout at base, tapering.

Female. Length 2 mm. Antennae dark brown, yellowish basally; 21 segments, the fifth with a length a little greater than its diameter; terminal segment somewhat produced, broadly obconic. Palpi; the first segment short, stout, subquadrate, the second one-half longer than the first, stout, rounded at the extremities, the third one-half longer than the second, more slender, slightly dilated apically, the fourth nearly twice as long as the third, more slender; face yellowish silvery. Mesonotum dark brown, variably margined laterally and anteriorly with silvery white, the general surface sparsely clothed with fine, yellowish hairs, the submedian lines rather thickly marked with silvery hairs. Scutellum pale yellowish orange, postscutellum a little darker. Abdomen dark brown, the basal segment thickly clothed with silvery white scales, the second to fourth segments rather narrowly margined with silvery white on the median third, the fifth with a few silvery hairs distally; ovipositor pale yellowish, the venter with the median third thickly clothed with silvery white scales. Wings hyaline, costa dark brown, the third vein uniting with costa near the basal half. Halteres pale yellowish orange. Legs dark brown, the apexes of coxae, the extremities of femora and tibiae a pale yellowish or whitish yellow; tarsi mostly a uniform dark brown; claws stout, strongly curved, the pulvilli nearly as long as the claws. Ovipositor probably over half the length of the abdomen, the terminal lobes long, slender, narrowly rounded. Type Cecid. a1369.

Lasioptera fructuaria Felt

1916 **Felt, E. P.** Me. Agric. Exp't Sta. Bul. 244, p. 268-69

The midges were reared from blueberries in June 1914 and 1915 by William C. Woods, Orono, Me. The species runs in the key to near L. mitchellae from which it is easily separated by colorational characters and also by the presence of well-developed hooks upon the ovipositor. A detailed description is given in the above citation.

Lasioptera convolvuli Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 149-50
1908 ———— N. Y. State Mus. Bul. 124, p. 326
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 47

The fusiform stem galls of this species were rather common on hedge bindweed (Convolvulus sepium) at Bath-on-the-Hudson, N. Y., in 1907. The gall was also taken by Mr L. H. Weld, at Evanston, Ill. The adults appear the middle of May.

Gall. The monothalamous fusiform stem gall inhabited by this species is some 1.5 cm in length and .5 cm in diameter. The gall has a longitudinal central channel about two-thirds the length of the swelling, the hypertrophied tissues being hard and corky.

Larva. Length 3.25 mm, slender, pale orange. Head small, antennae slender, tapering; breastbone slender, distinctly expanded apically, bidentate, with a minute median tooth; skin rather coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2.25 mm. Antennae dark brown, fuscous yellowish basally; 17 segments, the fifth with a length slightly greater than the diameter; terminal segment obovate. Palpi yellowish, the first segment irregularly subquadrate, the second somewhat produced, narrowly oval, the third a little longer, more slender, the fourth one-half longer than the third, more slender. Face rather thickly clothed with silvery white scales. Mesonotum dark brown, rather thickly and evenly clothed with yellowish white scales. Scutellum reddish brown with a few coarse setae apically, postscutellum darker. Abdomen a rich dark brown, the first segment rather broadly banded posteriorly with silvery white, the others with submedian rows of small, lunate, silvery white spots and sublateral rows of rather prolonged, silvery white spots, particularly on the second, third and fourth segments, venter suffused with silvery white, genitalia fuscous. Wings hyaline, costa dark brown, the yellowish white discal spot near the basal third, the third vein uniting thereat; halteres a nearly uniform yellowish orange. Legs mostly dark brown, the basal half of femora, the femoro-tibio articulation, the extremity of the tibiae and narrow basal annulations on the tarsal segments yellowish white, the latter broad on the posterior legs; claws long, strongly curved, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment long; terminal clasp segment swollen at the base; dorsal plate short, broad, deeply and narrowly incised; ventral plate long, stout, broadly rounded. Harpes long, broad at base, strongly constricted at the distal third.

Fig. 19 Lasioptera convolvuli, gall, enlarged (original)

Female. Length 2.5 mm. Antennae dark brown; basal segments fuscous yellowish; 20 segments, the fifth with a length a little greater than the diameter; terminal segment obovate. Palpi yellowish, the first segment irregularly subquadrate, the second stout, broadly oval, the third more slender, a little longer, the fourth one-half longer and more slender than the third. Face thickly clothed with silvery scales; eyes narrowly margined posteriorly with silvery scales. Mesonotum dark brown, sparsely margined laterally and anteriorly with rather long, yellowish hairs, the submedian lines rather thickly ornamented posteriorly with yellowish hairs. Scutellum reddish yellow with a few coarse setae apically; postscutellum fuscous yellowish. Abdomen dark brown, segments one to seven with submedian rows of small, lunate silvery white spots and with rudimentary sublateral longitudinal spots on the second, third, fourth and fifth segments; the sixth and seventh segments basally, and ovipositor more or less yellowish, ventral surface suffused with silvery white scales. Wings hyaline, costa dark brown, the discal spot yellowish white, the third vein uniting with costa near the basal third. Halteres semitransparent, light orange subapically. Legs dark brown, the basal half of femora, the articulations and the tarsal segments basally, narrowly banded with yellowish white, rather broadly so on the posterior legs; claws rather long, stout, strongly curved, the pulvilli nearly as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes rather long, broad. Type Cecid. a1465.

Lasioptera lycopi Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 152
1908 **Beutenmueller, William.** Can. Ent., 40:75
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 326
1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 78

The oval stem gall inhabited by the larva of this fly is rather common on bugleweed (L y c o p u s c o m m u n i s) in the vicinity of Albany and presumably in other localities in the Hudson valley, as specimens were taken at Shushan, N. Y., by Prof. C. H. Peck while Professor Beutenmueller records it from White Plains. The pale orange larvae winter in the gall, the adults appearing about the middle of May. E r i t r i s s o m e r u s n o v e b o r a c e n s i s Brues and a species of Torymus were reared from this midge.

Gall. The stem gall inhabited by this form is light green, round or subglobular, 8 to 10 mm long, 2.5 mm in diameter and within there is an elongate chamber containing the larva.

Larva. Length 3 mm, slender, pale orange. Head small, antennae stout; breastbone slender, distinctly expanded apically, minutely tridentate; skin rather coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2.25 mm. Antennae dark brown, basally yellowish; 16 segments, the fifth with a length about one-fourth greater than the diameter; terminal segment somewhat reduced, broadly oval. Palpi; the first segment short, stout, subquadrate, the second one-half longer, narrowly oval, the third slender, one-fourth longer than the second, the fourth about as long as the third, flattened, broader. Face rather thickly clothed with silvery white hairs, eyes black, narrowly margined posteriorly with silvery white. Mesonotum dark brown, variably margined laterally and anteriorly with silvery white, the submedian lines rather sparsely clothed with yellowish setae. Scutellum dark brown, a few coarse setae and whitish scales apically, postscutellum dark brown. Abdomen dark brown, basal segment broadly margined posteriorly with silvery white, the second to seventh segments with submedian lunate, silvery spots on the posterior margins of the segments and with smaller, oval spots laterally; genitalia fuscous, venter variably clothed with silvery scales, with irregular submedian dark brown spots on segments one to five, the sixth and seventh dark brown basally. Wings hyaline, costa dark brown, the whitish discal spot near the basal half; third vein unites with costa just before the basal half. Halteres whitish transparent, pale orange basally. Coxae dark brown, femora silvery white, broadly and variably banded subapically with dark brown, tibiae dark brown, the extremities narrowly banded with silvery; tarsi dark brown, the first segment basally, the extremities of the second to fourth tarsal segments and the base of the fifth segment variably banded with silvery, the basal annulations distinctly broader, particularly on the posterior legs; claws long, slender, strongly curved, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment long; terminal clasp segment slender; dorsal plate broad, broadly and triangularly emarginate; ventral plate long, slender, narrowly rounded. Harpes long, slender.

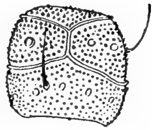

Fig. 20 Lasioptera lycopi, fifth antennal segment of female, enlarged (original)

Female. Length 2 mm. Antennae dark brown; 18 segments, the fifth with a length hardly equal to the diameter; terminal segment slightly produced, broadly rounded. Palpi; the first segment irregularly subquadrate, clavate, the second stout,

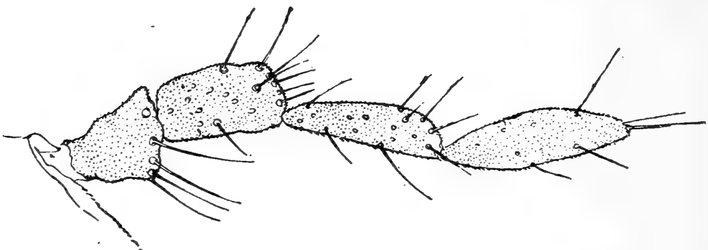

Fig. 21 Lasioptera lycopi, palpus of female, enlarged (original)

subrectangular, the third one-half longer than the second, much more slender, the fourth as long as the third, fusiform. Halteres pale yellowish salmon. Coxae and base of femora pale yellowish, distal portion of femora, tibiae and tarsi dark brown, the articulations marked by narrow, white annulations, the latter broader on the posterior tarsi. Ovipositor one-half the length of the abdomen, the terminal lobe rather long, stout, narrowly rounded. Other characters nearly as in the male. Type Cecid. a1348.

Lasioptera humulicaulis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 151
1908 ———— N. Y. State Mus. Bul. 124, p. 326

This species is remarkable in that the larvae appear to inhabit considerable lengths of the hop stem, producing a uniform swelling some 50 cm in length and about one cm in diameter. It was discovered by Henry Bird at Rye, N. Y., and a long gall containing numerous larvae was placed at our disposal April 17, 1907. The adults appear early in May.

Gall. The gall is a uniform swelling of the hop stem about one cm in diameter and ranging in length from 4 to 50 cm. The hollow dark, blackened interior is inhabited by long, pale yellowish larvae.

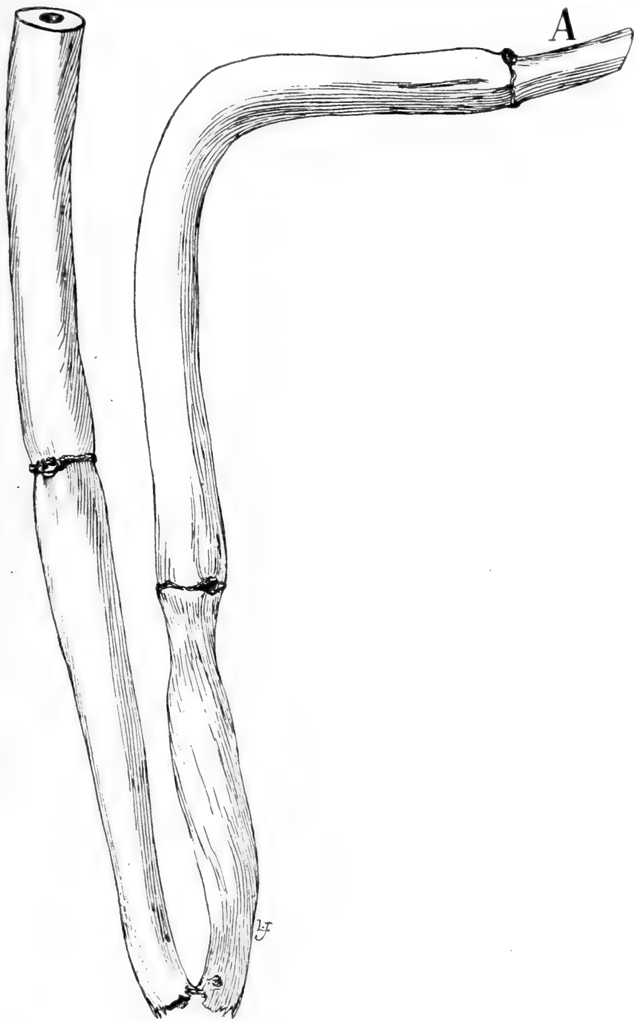

Fig. 22 Lasioptera humulicaulis, swollen hop stem, the normal size being indicated at A (original)

Larva. Length 4.25 mm, slender, pale orange. Head small, antennae rather slender; breastbone slender, distinctly expanded apically, bidentate with a small, median tooth; skin rather coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae dark brown, basally fuscous yellowish; 21 segments, the fifth with a length somewhat greater than the diameter; terminal segment reduced, irregularly subglobose. Palpi; the first segment irregularly subrectangular, the second about the same length, broader, irregularly suboval, the third a little longer and more slender than the second, the fourth about one-half longer than the third; face rather sparsely clothed with whitish scales, eyes rather small, distinctly and rather narrowly margined posteriorly with silvery white. Mesonotum dark brown, submedian lines thick with long, golden yellow scales; laterally there is a narrow margin of yellowish and silvery white scales, the remaining surface clothed with fine, yellowish scales. Scutellum dark brown, with rather numerous yellowish setae apically, postscutellum a pale orange. Abdomen dark brown with submedian rows of rather large, lunate, silvery white spots, each on the posterior margin of segments one to six, the seventh segment and genitalia yellowish orange. Wings hyaline, costa dark brown, except for the rather small, pale yellowish discal spot just beyond the middle, the third vein uniting with costa near the middle. Halteres semitransparent basally, pale orange distally. Legs with coxae and basal portion of femora pale yellowish, the remainder dark brown; the tarsi slightly darker; claws rather long, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment swollen basally; dorsal plate broad, broadly and roundly excavated; ventral plate broad, narrowly rounded; harpes long, stout, slender, distally.

Female. Length 3 mm. Antennae dark brown, basally yellowish; 25 segments, the fifth with a length scarcely equal to its diameter; terminal segment somewhat prolonged, broadly oval. Palpi; the first segment presumably short, subquadrate, swollen distally, the second stouter, broadly rounded basally, the third a little longer, more slender, the fourth one-third longer than the third. Face with a conspicuous patch of silvery white scales. Mesonotum dark brown, the submedian lines rather thickly clothed with golden yellow scales; yellowish and silvery white scales border the mesonotum laterally, the surface is sparsely clothed with fine, yellowish scales. Scutellum reddish brown, with a few yellowish setae apically, postscutellum deep red. Abdomen dark brown with submedian rows of rather large, lunate, silvery white spots on the posterior margin of each segment, the sixth segment with none, the seventh pale yellowish with a small fuscous spot dorsally, the ovipositor and venter pale yellowish, the latter suffused with silvery white scales. Wings hyaline, costa dark brown, the rather small, yellowish discal spot near the distal third, the third vein uniting with the margin near the middle. Halteres yellowish transparent basally, pale orange distally, the coxae and femora basally pale yellowish, the other portions of the legs mostly dark brown, the tarsi somewhat darker; claws rather long, stout, strongly curved, the pulvilli as long as the claws. Ovipositor as long as the abdomen; laterally an oval patch of stout, halberd-shaped spines; terminal lobes very long, slender, tapering, subacute, near the base five or six stout, recurved hooks. Type Cecid. a1446.

Lasioptera lactucae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 151-52
1908 ———— N. Y. State Mus. Bul. 124, p. 326

This species was originally reared by the late Dr M. T. Thompson of Clark University from irregular galls on the stalks of rabbit-weed or wild lettuce, L a c t u c a c a n a d e n s i s. They closely resemble the much more common galls made by A u l a x t u m i d u s Bass., though there was no trace of central cells and the rotten interior was filled with midge larvae. Doctor Thompson states that he has never found Itonid larvae in Aulax galls and he therefore believes this species to be a gall maker. We have repeatedly examined Aulax galls on this plant without finding any Lasioptera larvae. The female of this species was taken on wild lettuce at Karner, N. Y., July 5, 1906 and specimens apparently belonging to this form were reared by the United States Bureau of Entomology from a stem gall taken at Holderness, N. H., April 18, 1883. It also occurs in the Riley collection.

Gall. The gall has been characterized by Doctor Thompson as being exactly like that of A u l a x t u m i d u s Bass.

The larva of apparently this species has been described by Pergande in unpublished notes of the Bureau of Entomology as orange colored.

Male. Length 2 mm. Antennae, dark brown; 17 segments, the fifth with a length a little greater than the diameter; terminal segment slightly produced, broadly oval. Palpi; the first segment short, stout, almost subglobose, the second broad, somewhat produced, broadly rounded distally, the third as long as the second, more slender, the fourth more than twice the length of the third, more slender. Other color characters presumably as in the opposite sex; the single male obtained was badly rubbed. Wings hyaline, costa dark brown, the yellowish discal spot a little beyond the basal half, the third vein uniting therewith. Claws rather long, stout, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment swollen at the base; dorsal plate short, broad, broadly and triangularly emarginate; ventral plate long, broad, truncate. Harpes long, slender, tapering.

Female. Length 1.5 mm. Antennae, dark brown; 19 segments, the fifth with a length a little greater than the diameter; terminal segment somewhat reduced, tapering to a narrowly rounded apex. Palpi; the first segment short, stout, swollen distally, the second about as long, broadly oval, the third more slender and longer, and the fourth one-half longer and more slender than the preceding.

Mesonotum thickly clothed with bronzy scales. Scutellum yellowish with a few apical setae, postscutellum apparently dark brown. Abdomen dark brown or black, the segments with submedian rows of lunate, silvery white marks posteriorly; ovipositor yellowish. Legs fuscous yellowish, the tarsi brown, the distal segments darker. Ovipositor as long as the body; basally a large, oval group of halberd-shaped processes; terminal lobes long, slender, narrowly rounded, with numerous small, recurved setae and two or three heavy, recurved hooks. Type Cecid. 1102.

Lasioptera echinochloa Felt

1916 **Felt, E. P.** N. Y. Ent. Soc. Jour., 24:181

This species was reared in August and September 1915 by Mr C. N. Ainslie from injured or infested stems of crippled plants of Echinochloa crusgalli collected at Elk Point, S. D. The larvae are usually found in numbers in the fibrous, somewhat decayed stubs of the crown and were also taken from the lower and apparently normal portions of the stem. This midge is allied to L. lactucae Felt, from which it may be easily distinguished by the almost total lack of scales upon the mesonotum.

Lasioptera hecate Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 326

This species was captured on the office window, Albany, N. Y., June 19, 1906, and was presumably reared from some plant brought into the office.

Female. Length 2 mm. Antennae black; at least 21 segments, the fifth with a length about three-quarters its diameter. Palpi; the first segment broad, dilated distally, the second a little longer, the third one-half longer than the second, slender, the fourth one-half longer than the preceding, more slender. Head black, face silvery white. Mesonotum velvety black, with two narrow, white, submedian lines and a creamy white line on the anterior margin and extending laterally to the base of the wing. Scutellum silvery white apically and a black spot anteriorly. Abdomen velvety black, the basal segments with two submedian silvery spots, the next similarly marked, the third with two larger spots, the fourth with two still larger ones, each segment laterally with a white dash. Wings hyaline, costa fuscous, the third vein uniting with the whitish discal spot at the basal third. Halteres white. Femora yellow, the posterior with a black spot apically; tibiae and tarsi black, yellowish white ventrally; tarsi narrowly annulate with whitish; claws rather stout, evenly curved. Ovipositor nearly as long as the abdomen, terminal lobes long, slender, narrowly rounded. Type Cecid. 329.

Lasioptera verbenae Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:150–51

The midges were reared by Mr P. H. Timberlake, Whittier, Cal., from flower-stem galls on Verbena prostrata.

Lasioptera diplaci Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:151

This midge was reared by P. H. Timberlake from ovoid, stem galls on Diplacus longiflorus collected at Whittier, Cal.

Lasioptera panici Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 326

The female representing this species was taken at Albany, N. Y., June 27, 1906 as she was evidently about to oviposit on Panicum macrocarpa.

Female. Length 1.25 mm. Antennae dark brown; at least 18 segments, the fifth with length scarcely equal to the diameter. Palpi; the first segment rather slender, irregular, the second one-half longer, narrowly oval, the third a little longer, more slender, the fourth twice the length of the third. Mesonotum dark brown, evidently denuded. Scutellum and postscutellum concolorous. Abdomen thickly clothed with black scales, the first four segments with silvery white, submedian spots, those of the posterior segments smaller. Wings hyaline, costa dark brown, the third vein uniting therewith at the basal third. Halteres white. The anterior legs, femora and tibiae pale basally, fuscous apically, the last with a black line from the basal third, posterior legs with femora entirely pale, the tarsi white banded, the anterior narrowly so; claws rather long, stout, evenly curved. Ovipositor nearly as long as the body, terminal lobes long, slender, narrowly rounded. Type Cecid. 403.

Lasioptera galeopsidis Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:287

This species was reared in early June 1909 from irregular stem galls on the common hemp nettle, Galeopsis tetrahit, taken by Cora H. Clarke at Boston, Mass., May 21, 1908. Miss Clarke called our attention to the white, caplike structures over certain exit holes and we were fortunate enough to see a pale orange larva construct this peculiar shelter. The movement of the head was apparently as intelligent as the operations of one of our common caterpillars in shaping its more complex cocoon. The larva moved its head back and forth across the opening, carrying an irregular, pale, silken thread back and forth and attaching it to either side. The threads issued from its mouth or at some point near that cavity, possibly a minute spinneret. The woven cap was irregular in texture, due in part to irregularities in the width of the silken thread and probably somewhat to the larva making a thicker layer in some parts than in others.

Gall. The gall is a very irregular, frequently asymmetrical enlargement of the stem and having a diameter of .5 to 1.5 cm and a length of .5 to 2 cm or more. The interior is spongy and occupied by a number of silken chambers and apparently irregular galleries (pl. 4, fig. 1).

Larva. Length 1.5 mm, rather stout, pale yellowish. Head small; antennae short, stout; breastbone strongly chitinized, expanded apically, tridentate, the median tooth small. Skin finely shagreened, posterior extremity broadly rounded.

Male. Length 1.5 mm. Antennae short, dark brown, yellowish basally; 16 segments, the fifth with a length one-fourth greater than its diameter; terminal segment slightly produced, broadly oval. Palpi; first and second segments apparently very short, stout, the third somewhat longer and the fourth apparently twice the length of the third, very slender. Mesonotum shining dark brown, sparsely margined posteriorly and laterally with yellowish setae, the submedian lines indistinct. Scutellum dark brown, postscutellum fuscous. Abdomen dark brown, segments one to five with submedian lunate spots posteriorly, those on segments six and seven nearly obsolete. Wings hyaline, costa dark brown, the discal spot yellowish and a little before the basal half. Halteres pale yellowish. Coxae and femora basally fuscous yellowish, the distal portion of femora, tibiae and tarsi dark brown, the segments of the latter narrowly banded basally, the fourth and fifth with a yellowish cast, the posterior legs with the third to fifth segments broadly and indistinctly yellowish banded basally, the fourth and fifth mostly yellowish and only slightly fuscous apically; claws moderately stout, the pulvilli shorter than the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment swollen basally; dorsal plate short, deeply and narrowly emarginate; ventral plate long, broadly rounded. Harpes long, irregularly rounded.

Female. Length 2.5 mm. Antennae with 23 segments, the fifth with a length three-fourths its diameter; terminal segment slightly produced, narrowly oval. Palpi; first segment short, stout, the second with a length three times its diameter, stout, the third as long as the second, the fourth a little longer than the third. Mesonotum dark brown. Scutellum fuscous yellowish, postscutellum fuscous. Abdomen dark brown, segments one to six with submedian, lunate, white spots posteriorly and triangular, white marks at the postero-lateral angles; ovipositor yellowish, venter white. Halteres pale yellowish. Coxae and femora basally fuscous yellowish, the distal portion of femora, tibiae and tarsi dark brown, the latter narrowly banded basally with yellowish on the anterior and mid legs and the third to fifth segments broadly so on the posterior legs. Ovipositor about half the length of the abdomen, the terminal lobes narrowly oval. Type Cecid. a1965.

Lasioptera weldi Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 326

This species was reared in early May 1908 from a fusiform stem gall on Helianthus taken by Mr L. H. Weld at Evanston, Ill.

Gall. Length 3 cm, diameter .7 cm, fusiform; occurs on the stem, the interior being filled with a spongy matter inhabited by the pale yellowish larvae.

Larva. Length 3 mm, pale yellowish, rather stout. Head small, the antennae long, tapering, breastbone distinct, bidentate, with a minute median tooth, the posterior portion slender, terminating in a crescentic enlargement. Skin minutely shagreened. Posterior extremity broadly rounded with a few scattering fleshy processes.

Male. Length 3 mm. Antennae, fuscous yellowish, basally yellowish; 18 segments, the fifth with a length about three-fourths its diameter; terminal segment somewhat produced, subglobose. Palpi; first segment short, the second short, stout, irregular, the third with a length nearly twice its diameter, the fourth one-fourth longer, narrowly oval. Face yellowish. Mesonotum dark brown, the submedian lines thickly haired. Scutellum reddish brown, with numerous setae, postscutellum yellowish. Abdomen dark brown, the segments narrowly margined posteriorly with white, the latter broadly interrupted mesially and laterally, except on the basal segment, which has the white markings slightly produced anteriorly; genitalia fuscous yellowish. Wings hyaline, costa dark brown, the third vein uniting therewith at the rather long, yellowish orange discal spot beyond the basal half. Legs mostly dark brown, the articulations narrowly banded with white, the posterior tarsi broadly banded, the distal third of the third segment and fourth white; claws rather long, stout, strongly curved, the pulvilli shorter than the claws. Genitalia; basal clasp segment long, broad, terminal clasp segment stout, tapering. Dorsal plate short, broad, deeply and triangularly emarginate; ventral plate short, broad, broadly rounded. Harpes long, broad, irregularly and obliquely truncate.

Female. Length 2.25 mm. Antennae, dark brown; 23 segments, the fifth with a length about one-half its diameter; terminal segment broadly oval. Palpi; first segment short, subquadrate, the second broadly oval, the third narrowly oval. Face sparsely clothed with silvery scales. Mesonotum black, narrowly margined anteriorly and laterally with silvery scales, the submedian lines sparsely haired. Scutellum reddish brown, with numerous silvery scales apically, postscutellum dark reddish brown. Abdomen purplish dark brown, the segments narrowly margined posteriorly with silvery scales, the latter broadly interrupted mesially and narrowly so sublaterally on segments two to six. A broken sublateral line of silvery markings; venter suffused with silvery scales; costa dark brown, the third vein uniting with the whitish discal spot at the basal third. Halteres pale yellowish. Coxae fuscous, femora basally yellowish, the distal portion of femora, tibiae and tarsi dark brown or black, except for the narrow, white band on the anterior and mid and the broad band on the posterior tarsi, the distal half of the third and the fourth and fifth segments of the last yellowish white. Type Cecid. a1816.

Lasioptera virginica Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:287

This species was reared February 9, 1909 from a stem gall on marsh St. Johnswort, Hypericum virginicum.

Gall. Length 1 cm, diameter 8 cm, subglobose, monothalamous. The large, irregular central chamber is surrounded by rather thick walls, the outer part soft, the inner irregularly hardened and blackened. Taken by Cora H. Clarke at Magnolia, Mass., October 10, 1908. Numerous parasites were reared April 18, 1912.

Female. Length 2 mm. Antennae dark brown, 18 or 19 segments, the fifth with a length about three-fourths its diameter, the terminal segment slightly produced, narrowly oval. Palpi; the first segment presumably short, subquadrate, the second probably narrowly oval, the third slender, with a length about four times its diameter, the terminal segment one-fourth longer than the preceding. Mesonotum dark brown, margined laterally and anteriorly with silvery scales, the submedian lines sparsely haired. Scutellum reddish brown with a few white setae apically, postscutellum a little darker. Abdomen black, the segments with narrow submedian spots posteriorly, those of the first slightly confluent; ovipositor yellowish; venter suffused with silvery scales. Wings hyaline, costa black, the third vein uniting with costa a little before the basal half. Halteres yellowish whitish, slightly fuscous basally. Coxae and femora basally fuscous yellowish, the distal portion of femora, tibiae and tarsi black, the articulations narrowly annulate with white, the posterior tarsi broadly banded basally; claws stout, evenly curved, pulvilli as long as the claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobes long, narrowly oval. Type Cecid. a1915.

Lasioptera lupini Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 326

This species is represented in the collections of the United States National Museum by material reared from an undescribed lupine gall taken in California. Plymecus lupinicola Ashm., MS., (Insect Life, 4:125), may have been reared from this gall.

Female. Length 2 mm. Antennae dark brown; 22 to 23 segments, the fifth with a length about three-fourths its diameter; terminal segment somewhat reduced and partially fused with the preceding. Palpi; the first segment presumably short, stout, irregularly subquadrate, the second narrowly oval, with a length nearly three times its diameter, the third a little longer and much more slender than the second, the fourth a little longer and more slender than the third. Mesonotum shining dark reddish brown. Scutellum and postscutellum shining dark brown. Abdomen dark brown, segments one to five with submedian, suboval, silvery white spots posteriorly; ovipositor pale orange. Wings hyaline, costa dark brown, the third vein uniting with the margin near the basal half; halteres yellowish white. Legs mostly a dark brown, the tarsal segments faintly annulate basally with dull whitish; claws rather long, stout, strongly curved, the pulvilli about as long as the claws. Ovipositor presumably about as long as the abdomen. Type Cecid. 1068.

Lasioptera ephedricola Cockerell

1902 **Cockerell, T. D. A.** Can. Ent., 34:184
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 326

This species was reared by Professor Cockerell from a resinous, elongate, brown swelling on the twigs of Ephedra trifurca.

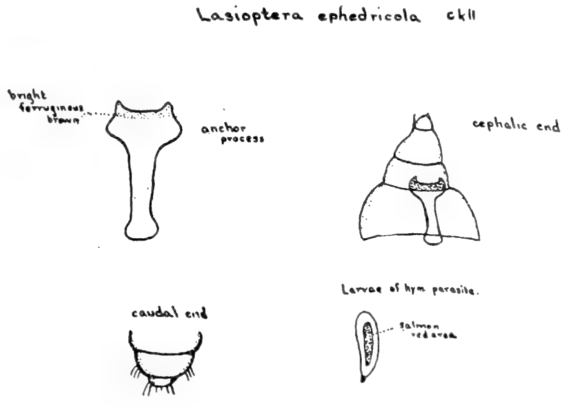

Fig. 23 Lasioptera ephedricola, larva anterior and posterior extremities, breastbone and larva of Hymenopterous parasite, after Cockerell, enlarged (original from Cockerell)

He states that this species is similar to L. ephedrae Ckll. but the abdomen has basal and apical white bands on the fifth segment, though otherwise hardly banded. Types were kindly loaned for study by Professor Cockerell and the following description is based thereupon.

Gall. The gall has been described by Professor Cockerell as resinous, elongate, lateral brown swellings on the twigs.

Male. Length 2.5 mm. Antennae dark brown; 20 segments, the fifth with a length more than twice the diameter; terminal segment reduced, subglobular. Palpi; the first segment greatly swollen, suboval, the second twice the length of the preceding, swollen, slightly dilated apically, the third longer than the second

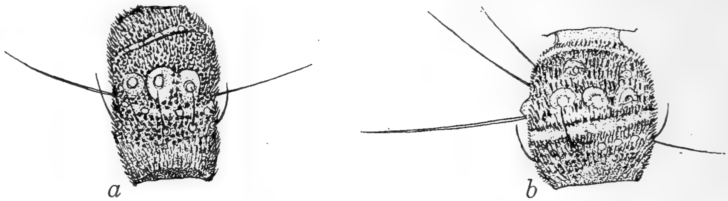

Fig. 24 Lasioptera ephedricol a, *a*, sixth antennal segment of male, *b*, sixth antennal segment of female, both greatly enlarged (original)

and more swollen. Face fuscous yellowish. Mesonotum black; abdomen dark brown or black with basal and apical white bands on the fifth segment, otherwise hardly banded. Wings hyaline, costa, subcosta and the third vein thickly clothed with dark brown scales the last uniting with costa at the distal third. Legs dark brown, claws long, stout, evenly curved. Genitalia; basal clasp segment long, slender; terminal clasp segment short, greatly swollen at the base. Dorsal plate very short, broad, broadly and triangularly incised; ventral plate broad, broadly rounded. Harpes broad at base, tapering, tuberculate.

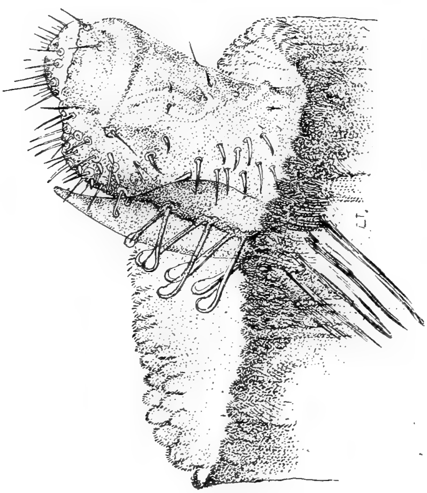

Fig. 25 Lasioptera ephedricola, ovipositor retracted, greatly enlarged (original)

Female. Length 2 mm. Antennae dark brown, sparsely haired; 22 segments, the fifth with a length about one-half greater than its diameter. Palpi; first segment short, quadrate, the second produced, incrassate, the third one-half longer than the second, slender. Mesonotum with three black vittae, united anteriorly. Abdomen with ten white spots, wings with a white discal spot. Ovipositor short, the terminal lobes short, broadly rounded; near the base a group of capitate processes, each with a length one-fourth the diameter of the terminal segment.

Described from types kindly loaned for study by Professor T. D. A. Cockerell. The color characteristics are taken from the original description.

Lasioptera serotina Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 326

This species was taken on chokecherry, Prunus virginiana, at Albany, N. Y., May 23, 1907 and may possibly cause the irregular subcortical galls on the small twigs of wild cherry.

Female. Length 2.5 mm. Antennae dark brown; 19 segments, the fifth with a length a little less than its diameter; terminal segment suboval. Palpi; the first segment subquadrate, the second a little stouter, rounded distally, the third more slender and a little longer than the second, the fourth a little longer and more slender than the third. Mesonotum dark brown with a golden luster. Scutellum dark, shining. Abdomen dark brown with a row of submedian white spots. Wings (pl. 5, fig. 1) hyaline, costa fuscous basally, the third vein uniting with the yellowish stigmatal spot at the distal third. Halteres yellowish. Coxae, femora and tibiae pale beneath, the tibiae above, and tarsi dark brown; claws stout. Ovipositor probably half the length of the abdomen; terminal lobes slender, acutely rounded, and with five or six heavy hooks. Type Cecid. 79.

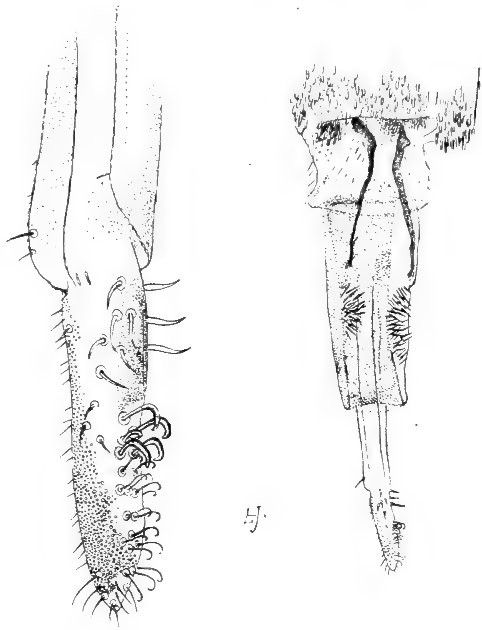

Fig. 26 Lasioptera serotina, terminal abdominal segment and ovipositor and the tip of the latter showing the peculiar chitinous hooks still more enlarged (original)

Lasioptera cylindrigallae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 150–51
1908 ——— N. Y. State Mus. Bul. 124, p. 326
1909 ——— Ottawa Nat., 22:249

The midges were reared in early May from a uniform enlargement of Solidago stems, the deformity being some 10 cm long and .7 cm in diameter, and occurring usually just below where the branches arise. The larvae winter in the enlarged central cavity. This gall is somewhat common on Staten Island and occurs sparingly at West Nyack, N. Y. Apparently the same gall was also observed at Nassau, N. Y., it occurring in this latter instance on Solidago graminifolia. Presumably the same species was taken by Mr J. R. Gillett on Mt Tom, Mass., July 22, 1906. A species of Polygnotus was reared from this midge.

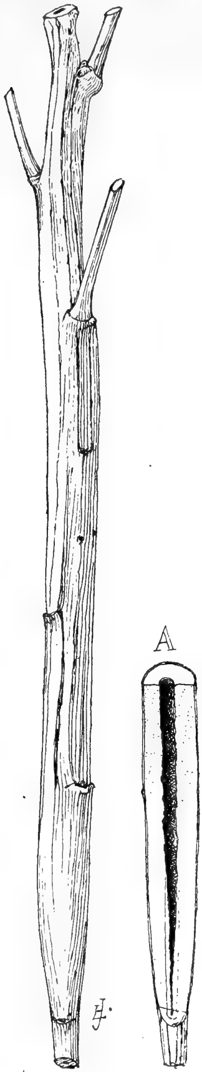

Fig. 27 Lasioptera cylindrigallae, swollen stem, *A*, portion in section, enlarged (original)

Gall. A uniform enlargement of the upper portion of Solidago stems. Length 10 cm, diameter .7 cm, the central cavity slightly enlarged and inhabited by a number of pale yellowish larvae.

Larva. Length 3.5 mm, rather stout, pale orange. Head small, antennae slender; breastbone slender, distinctly expanded apically, tridentate, the median tooth rather small; skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae dark brown, basally silvery white, 15 or 16 segments, the fifth with a length slightly greater than its diameter; terminal segment slightly produced, tapering to an obtusely rounded apex. Palpi fuscous yellowish, the first segment subquadrate, slightly swollen distally, the second about as long, irregular, the third one-half longer than the second, more slender, the fourth one-half longer than the third, more slender; face with a patch of silvery white. Mesonotum dark brown, variably margined laterally and anteriorly with silvery white and yellowish scales, the submedian lines rather sparsely clothed with golden yellow hairs, the median and sublateral areas rather uniformly clothed with short, golden yellow hairs. Scutellum dark brown with numerous yellowish setae apically, postscutellum dark brown. Abdomen dark brown with large, submedian rows of lunate, silvery white spots, the latter on the posterior margins of the segments and extending to the lateral line; genitalia dull yellowish, slightly fuscous apically; venter suffused with silvery white scales. Wings hyaline, costa dark brown, discal spot yellowish, the third vein yellowish, uniting with costa near the distal third. Halteres a nearly uniform pale yellowish. Legs with coxae mostly fuscous, the base of femora yellowish white, the distal portion of tibiae and tarsi dark brown, the latter darker; claws long, slender, strongly curved, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment swollen basally; dorsal plate broad, deeply and triangularly emarginate; ventral plate long, broadly rounded. Harpes long, narrow, tapering, obtuse.

Female. Length 2.5 mm. Antennae dark brown, basally fuscous yellowish, ventrally silvery white; 21 segments, the fifth with a length about equal to its diameter; terminal segment obpyriform. Palpi fuscous yellowish, the first segment subrectangular, slightly swollen distally, the second one-half longer, stouter, the third a little longer, more slender than the second, the fourth one-third longer and more slender than the third. Ovipositor probably as long as the abdomen, the terminal lobes long, narrowly rounded, and with five or six stout hooks. Type Cecid. a1408.

Lasioptera solidaginis O. S.

1863 **Osten Sacken, C. R.** Ent. Soc. Phil. Proc., 1:368–70

1874 **Glover, Townend.** MS. Notes From My Journal, p. 68 (Cecidomyia)

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 23, p. 394 (L. tumifica)

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 325 (L. dorsimaculata) p. 327 (L. tumifica Beutm.)

1909 ——— Ottawa Nat., 22:249 (L. tumifica)

1909 ——— Ent. Soc. Ont., 39th Rep't, p. 44 (L. tumifica)

1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 52 (L. tumifica)

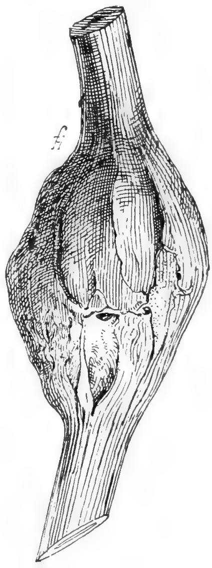
Fig. 28. Lasioptera solidaginis, gall, somewhat enlarged (original)

The rough eccentric stem gall of this species is rather common on the stems of Solidago rugosa in the immediate vicinity of New York City. It also occurs about Albany and has been taken at Worcester, Mass., and Boscawen, N. H. This insect winters as larvae in the deformity, the midges appearing in the spring. Polymecus canadensis Ashm. was reared from this gall.

A study of the types in the Museum of Comparative Zoology at Cambridge show that L. tumifica Beutm. and L. dorsimaculata Felt are identical with the above-named species. There is some variation in the white markings on the abdomen, though nothing to justify the recognition of more than one species.

Gall. Length and diameter about 2.5 cm. An irregular, subglobose or fusiform enlargement of the stem near the ground and almost invariably eccentric. The surface is usually somewhat roughened, hard, while the softer, pithy interior is inhabited by numerous larvae.

Larva. Length 3.5 mm, slender, pale yellowish gray. Head long, slender, tapering gradually to a narrowly rounded apex. Antennae stout, tapering, with a length two and one-half times the diameter. Breastbone stout, heavily chitinized, tridentate, the median tooth small, sometimes almost obsolete and about one-third the length of the heavy submedian, rather slender teeth; terminal segment broadly rounded posteriorly.

Male. With 17 antennal segments, the fifth with a length about one-half greater than its diameter, the fourth palpal segment one-half longer and more slender than the third; the pulvilli are shorter than the claws. Genitalia, basal clasp segment long, slender; terminal clasp segment swollen basally; dorsal plate short, broad, deeply and triangularly incised, the lobes widely separated, narrowly rounded distally; ventral plate long, tapering, narrowly rounded. Harpes long, slender, tapering, obtuse. Style a little longer, slender, broadly rounded.

Female. With 19 to 22 antennal segments, the fifth with a length about equal to its diameter; terminal segment slightly prolonged, narrowly oval. The wing is illustrated on plate 5, figure 2. Ovipositor nearly as long as the abdomen, the terminal lobes with a length four times their diameter, slender and with a sparse group of short, stout, lance-shaped scales and five or six stout, chitinous hooks.

Lasioptera ziziae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 327

This midge was reared in April 1908 from a fusiform stem gall on golden Alexanders, Zizia aurea, collected by Mr L. H. Weld at Evanston, Ill.

Gall. A fusiform stem swelling some 3 cm in length and .6 cm in diameter.

Larva. Length 3 mm, pale orange, rather stout. Head small, antennae slender, tapering; breastbone slender, distinctly expanded apically, bidentate, the teeth unusually long and between a minute median tooth; skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae fuscous yellowish, fuscous basally; 16 segments, the fifth with a length one-fourth greater than its diameter; terminal segment produced, with a length one-half greater than its diameter, broadly rounded apically. Palpi; the first segment short, stout, irregular, the second narrowly oval, the third a little longer, more slender, the fourth one-half longer and more slender than the second. Mesonotum dark brown, thickly yellow-haired, the submedian lines with long, yellowish setae.

Scutellum reddish brown, whitish scales apically, postscutellum darker. Abdomen dark brown with lunate, silvery spots on segments one to five and rudimentary markings on the sixth, venter suffused with silvery white scales; genitalia light fuscous yellowish. Wings hyaline, costa dark brown, the third vein uniting with the rather long, pale orange discal spot at the distal third; halteres yellowish orange. Coxae and base of femora fuscous yellowish, the femora distally and tibiae dark brown; tarsi nearly black; claws long, slender, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment stout, tapering; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate long, slender, tapering, broadly rounded. Harpes stout at base, tapering, irregularly obtuse; style long, rather stout, narrowly rounded.

Female. Length 2 mm. Antennae fuscous yellowish, the basal segments whitish; 17 segments, the fifth with a length about one-fourth greater than its diameter; terminal segment somewhat produced, with a length about twice its diameter, narrowly rounded. Palpi; the first segment short, stout, the second with a length one-half greater than its diameter, stout, the third one-half longer than the second, more slender and the fourth three-fourths longer than the third, more slender. Color as in the opposite sex. Wings a little broader and the discal spot less marked than in the male. Ovipositor with a length equal to the abdomen; basally an oval area with short, halberdlike spines; terminal lobes slender, with a length fully five times the diameter and five or six heavy, stout hooks. Type Cecid. a1817.

Lasioptera hamata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 107; separate, p. 11
1908 ———— N. Y. State Mus. Bul. 124, p. 327

This species was taken on Solidago at Nassau, N. Y., June 14, 1906. Nothing is known concerning its life history. The female may be recognized by the basal and abdominal segments being white-margined posteriorly.

Female. Length 1.5 mm. Antennae dark brown; 18 segments, the fifth with a length a little less than its diameter; terminal segment slightly prolonged, broadly rounded distally. Palpi; the first segment short, subquadrate, the second short, broadly oval, the third twice the length of the preceding, narrowly oval, the fourth one-fourth longer than the third, a little more slender; lower portion of face and base of antennae sparsely ornamented with white hairs; eyes large, black, margined posteriorly with a few white hairs. Mesonotum brownish black. Scutellum and postscutellum dark brown. Abdomen dark brown with the third, fourth and fifth abdominal segments margined posteriorly with sparse, whitish scales, terminal segments pale yellowish. Wings hyaline, costa light brown, the third vein uniting with the margin at the whitish stigma on the basal half, it and the base of costa thickly clothed with dark brown scales. Halteres whitish transparent. Coxae dark yellowish brown; femora pale yellowish, tibiae and tarsi slightly variable dark brown; claws rather stout, strongly and evenly curved. Ovipositor nearly as long as the body; basally, oval patches of halberd-shaped scales; terminal lobes long, slender, rather broadly rounded, with a group of pale, slightly curved rods and three heavy hooks. Type Cecid. 280.

Lasioptera tripsaci Felt

1910 **Felt, E. P.** Ent. News, 21:10

This dark brown, white-banded species was reared at Plano, Texas, August 12, 1909 from larvae occurring between the leaf blades of Gama or Sesame grass, Tripsacum dactyloides and transmitted to this office by Prof. F. M. Webster under the number 6011.

Lasioptera cassiae Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:287–88

This species was reared May 8 and June 16, 1883 from stem galls on the sensitive plant, Cassia nictitans, taken by H. K. Morrison at Fort Huachua, Ariz. We are indebted to the courtesy of Doctor Howard and the United States National Museum for an opportunity to describe this interesting form.

Gall. Length 3 cm, diameter 5 or 6 mm. This is an irregular, elongate, fusiform stem gall, purplish brown in color and evidently polythalamous, since circular exit holes occur here and there over its surface (Pergande, Bureau Notes).

The larva is described by Mr Pergande as bright orange with a brown breastbone.

Male. Length 1.5 mm. Antennae dark brown, 19 segments, the fifth with a length about equal to its diameter, the terminal segment slightly produced, broadly oval. Palpi presumably quadriarticulate. Mesonotum dark brown, the submedian lines thickly haired. Scutellum yellowish brown, rather thickly haired, postscutellum darker. Abdomen dark reddish brown, the segments rather narrowly margined posteriorly with silvery white. Wings hyaline, costa probably dark brown, the third vein uniting with the margin just beyond the basal half, the whitish stigmatal spot small; halteres pale yellowish. Legs a nearly uniform yellowish brown, the tibiae and the distal tarsal segment apically somewhat darker; claws stout, the pulvilli about half the length of the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, swollen at the base; dorsal plate short, broad, broadly and roundly emarginate; ventral plate short, broad, deeply and triangularly emarginate. Harpes long, stout.

Female. Length 2 mm. Antennae short, dark brown, composed of 23 to 24 segments, the fifth with a length about three-fourths its diameter; terminal segments indistinctly fused. Palpi; first segment probably short, stout, the second presumably narrowly oval, stout, the third subrectangular, with a length about twice its diameter, the fourth twice the length of the third, slender. Color and other characters about as in the male, except that the abdomen is somewhat lighter and with broader, white bands. Ovipositor half the length of the abdomen, the terminal lobes long, slender, narrowly oval. Type Cecid. 901.

Lasioptera inustorum Felt

1916 **Felt, E. P.** N. Y. Ent. Soc. Jour., 24:182

Midges were reared in May 1915 by Mr C. N. Ainslie from blackened leaf sheaths of Panicum virgatum collected at Elk Point, S. D. This species runs in our key to L. impatientifolia Felt, a form which also produces a carbonaceous discoloration of the vegetable tissues. The most striking difference between the two is in the much produced lobes of the ovipositor in the western midge. The leaf sheath of infested plants is marked by a diffuse blackening near the base. The affected area may have a length of 3 cm and extend more than half way around the stem, the latter being unaffected. Larval cells occur within the blackened tissues, the larvae sheltering in tubular, silk-lined cavities some 5 to 6 mm long.

Lasioptera neofusca Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 327

This insect was taken May 25, 1906 on a train entering Albany, N. Y.

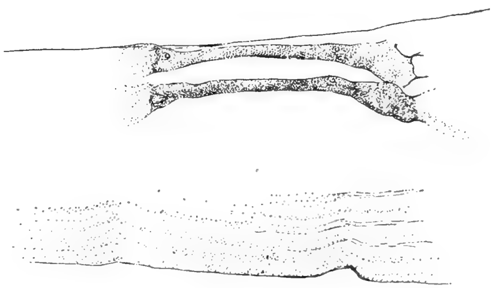

Fig. 29 Lasioptera neofusca, basal portion of ovipositor showing the dorsal chitinous bars, enlarged (original)

Female. Length 1.5 mm. Antennae dark brown; 22 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly prolonged, ovoid. Palpi; the first segment short, irregularly rectangular, slightly swollen distally, the second one-half longer than the preceding, the third more slender, slightly longer, the fourth one-third longer than the preceding, more slender; face yellowish brown, eyes large, black, margined on the sides posteriorly with silvery white. Mesonotum dark brown. Scutellum reddish brown, postscutellum a little darker. Abdomen sooty brown, rather thickly and irregularly clothed dorsally with dark brown scales. Wings hyaline, costa basally and the third vein thickly clothed with brownish scales, the third vein uniting with the margin at the basal third. Halteres reddish transparent basally, whitish transparent apically. Coxae reddish transparent, anterior and mid femora and tibiae sooty yellow, posterior femora whitish yellow, tibiae dark brown dorsally, lighter ventrally, tarsi dark brown, the second and third segments narrowly ringed basally with yellowish white; claws slender, uniformly curved. Ovipositor as long as the abdomen; terminal lobes long, tapering, obtusely rounded. Type Cecid. 82.

Lasioptera juvenalis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 327

This female was taken at Newport, N. Y., July 25, 1906 on bouncing bet, Saponaria officinalis.

Female. Length 1 mm. Antennae dark brown; 21 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, tapering to a narrowly rounded apex. Palpi; the first segment short, stout, somewhat expanded distally, the second narrowly oval, with a length about three times its diameter, the third a little longer and more slender, the fourth one-fourth longer than the third, more slender. Mesonotum dark brown. Scutellum dark brown basally, yellowish apically, postscutellum and abdomen dark brown, ovipositor pale orange. Wings hyaline, costa dark brown, the third vein uniting with the anterior margin at the basal third. Halteres pale orange basally, yellowish apically. Coxae and femora fuscous yellowish, narrowly clothed exteriorly with fuscous scales; tibiae and tarsi mostly dark brown, the latter narrowly ringed and indistinctly annulate distally with yellowish; claws long, slender, evenly curved, the pulvilli about half the length of the claws. Ovipositor about as long as the body; terminal lobes long, slender, narrowly rounded. Type Cecid. 703.

Lasioptera clarkei Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:287
1910 ———— Econ. Ent. Jour., 3:348

Several females of this species were reared January 18, 1909 from a whitish, circular, blister gall on the leaves of Aster macrophyllus collected by Cora H. Clarke at Magnolia, Mass., October 12, 1908.

Evidently this form winters in the gall, and from the character of its nidus we would be inclined to refer it to the genus Asteromyia.

The presence of but three palpal segments indicates a decided tendency toward reduction in these organs.

Gall. The galls formed by this species occur on the under side of the leaf, scarcely showing above. They are nearly circular, 2 to 3 mm in diameter, yellowish white and with an irregular, central, dark puncture.

Larva. Length 1.5 mm, pale whitish, stout, narrowly oval. Head small, the palpi short, stout, uniarticulate; breastbone short, broad, minutely and acutely bidentate, the lateral anterior angles somewhat produced; posterior extremity broadly rounded.

Exuviae. Length 2.5 mm, whitish and protruding from gall. The form is rather stout, antennal cases stout, strongly curved, with an inconspicuous chitinous tubercle at the internal basal angle. Wing cases extending to the third abdominal segment, the leg cases to the fifth and sixth abdominal segments, the dorsum of the latter thickly clothed with short, stout, brownish, chitinous spines; posterior extremity broadly rounded, unarmed.

Male. Length 2 mm. Antennae fuscous yellowish; 15 segments, the fifth with a length one-fourth greater than its diameter, the terminal segment produced, narrowly rounded apically and occasionally fused with the preceding. Palpi; the first segment short, stout, swollen distally, the second broadly oval, stout, the third one-half longer, narrowly fusiform. Mesonotum shining dark brown, sparsely haired. Scutellum dark brown, rather thickly clothed apically with yellowish setae, postscutellum yellowish brown. Abdomen a nearly uniform dark brown, the segments very narrowly lined posteriorly with whitish, the sixth, seventh and the terminal segment with a broad, naked, orange band; genitalia fuscous; venter sparsely clothed with fuscous scales. Wings hyaline, costa dark brown, the third vein uniting therewith at the distal third, the small stigma white. Halteres fuscous distally, white basally. Legs a nearly uniform dark brown, the tarsal segments very narrowly banded basally with whitish; claws stout, the pulvilli shorter than the claws. Genitalia; basal clasp segment stout, terminal clasp segment slightly swollen at the base, stout; dorsal plate broadly and triangularly emarginate, ventral plate long, tapering, broadly rounded. Harpes stout, tuberculate apically.

Female. Length 1.5 mm. Antennae fuscous yellowish, 18 segments; the fifth with a length slightly greater than its diameter; terminal segment produced, narrowly rounded apically and evidently composed of two segments. Palpi; the first segment long, swollen distally, the second broadly oval, the third one-half longer than the second, flattened. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum shining dark brown, postscutellum yellowish dark brown. Abdomen a uniform dark brown, the venter dark reddish brown and sparsely white-scaled mesially and laterally; ovipositor dull orange. Wings hyaline, costa thickly black-scaled, the third vein uniting with costa at the somewhat large, whitish discal spot near the basal half. Halteres fuscous apically, white basally. Legs dark brown, the tarsi black, the femora, tibiae and the tarsal segments very narrowly banded with white apically; claws stout, the pulvilli as long as the claws. Ovipositor about one-half the length of the abdomen; terminal lobes short, broadly oval. Type Cecid. a1901.

Lasioptera fraxinifolia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 327

The midge was reared in August 1907 from a jar containing ash leaves bearing a purplish green subglobular gall, the deformity Osten Sacken characterized under the name of Cecidomyia pellex. It is possible that this fly caused the deformity.

The gall is green or purplish green, subglobular, monothalamous, and about 5 mm in diameter. It occurs on the lateral veins, mostly on the upper surface of the leaf, its position being indicated on the lower surface by a slight swelling. This gall was observed at Westfield, Lake Onondaga, Poughkeepsie, Highland and New York City.

Larva. Length 2 mm, rather stout, pale yellowish. Head small, antennae short, stout; breastbone obsolete posteriorly, roundly bidentate and slightly expanded apically; skin coarsely shagreened; posterior extremity broadly rounded.

This is hardly a Lasioptera larva. The gall belonging therewith is probably not the work of Lasioptera.

Male. Length 1.5 mm. Antennae dark brown; 25 segments, the fifth with a length about three-fourths its diameter; terminal segment produced, tapering distally to a subacute apex. Palpi; the first segment short, stout, irregularly subquadrate, the second narrowly oval, with a length nearly three times its diameter, the third a little longer and more slender, the fourth one-half longer than the third, strongly compressed. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum dark reddish brown, postscutellum apparently dark brown. Abdomen apparently a nearly uniform dark brown. Wings hyaline, costa dark brown, the third vein joining the rather long, whitish discal spot near the basal half; halteres pale yellowish. Coxae yellowish; femora yellowish at the extremities, dark brown near the middle; tibiae dark brown, irregularly yellowish distally; tarsi dark brown; claws long, rather slender, strongly curved, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment long, swollen; dorsal plate long, broad, deeply and triangularly incised; ventral plate long, slender, tapering. Harpes long, slender, tapering; style long, slender, subacute distally. Type Cecid. a1546a.

Lasioptera abhamata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 108; separate, p. 11–12
1908 ———— N. Y. State Mus. Bul. 124, p. 327

This species was taken June 4, 1907 in general collecting at Karner, N. Y.

Female. Length 1.5 mm. Antennae dark brown; 21 or 22 segments, the fifth with a length about equal to its diameter; terminal segment slightly prolonged, obtusely rounded distally. Palpi; the first segment short, subquadrate, the second subrectangular, one-half longer than the preceding, the third one-half longer than the second and the fourth one-third longer than the third. Face dark brown, eyes large, black. Mesonotum dark brown, submedian lines sparsely clothed with fine hairs. Scutellum dark brown, postscutellum and abdomen nearly uniform dark brown. Wings (pl. 5, fig. 3) hyaline, costa dark brown, the third vein uniting with the margin just beyond the middle; halteres yellowish transparent basally, whitish transparent apically. Legs a nearly uniform dark brown, lighter ventrally, distal tarsal segment somewhat darker; claws stout, uniformly curved. Ovipositor probably nearly as long as the body, the terminal lobe long, slender, rather narrowly rounded and with a group of stout hooks. Type Cecid. 130.

Lasioptera quercina Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 108; separate, p. 12
1908 ———— N. Y. State Mus. Bul. 124, p. 327

The female representing this species was taken on white oak, Quercus alba, at Albany, N. Y., June 1, 1906.

Female. Length 1.5 mm. Antennae dark brown; 18 segments, the fifth with a diameter nearly twice its length. Palpi; the first segment short, subtriangular, expanded distally, the second nearly twice as long as the preceding, swollen basally, the third a little longer than the second, slightly enlarged distally, the fourth one-third longer than the third. Mesonotum dark brown. Scutellum and postscutellum very dark brown. Abdomen nearly uniform reddish brown, rather thickly clothed with ferruginous hairs. Wings hyaline, costa basally, subcosta and the third vein thickly clothed with dark brown or black scales except at the whitish discal spot, the third vein uniting with costa at the basal third; halteres yellowish transparent. Coxae yellowish or reddish yellow, transparent, femora and tibiae dark brown, lighter at articulations, tarsi dark brown; claws rather slender, uniformly curved. Ovipositor two-thirds the length of the abdomen, terminal lobes broad, narrowly rounded. Type Cecid. 96.

Lasioptera spiraeafolia Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:287

This small, yellowish species was reared July 16, 1909 from a somewhat conspicuous, yellowish brown blister gall on Spiraea salicifolia taken by Cora H. Clarke at Magnolia, Mass. Several shipments of this gall have been received and a number of parasites reared therefrom.

Gall. 3 mm in diameter. A yellowish, brown spotted blister on the leaves.

Larva. Length 1.5 mm, pale yellowish, rather stout. Head small; antennae short, tapering, uniarticulate; breastbone distinct, bidentate, the teeth triangular, well separated, the shaft tapering posteriorly. Skin coarsely shagreened, posterior extremity broadly rounded, slightly lobed and with the cuticular rugosities more pronounced.

Male. Length .75 mm. Antennae dark brown, yellowish basally; 14 segments, the fifth with a length one-half greater than its diameter, subbasal whorl sparse, subapical whorl rather thick, relatively long, circumfili at the basal half and apically; terminal segment narrowly oval, tapering distally, with a length twice its diameter. Palpi yellowish; first segment short, stout, second narrowly oval, with a length three times its diameter, the third a little longer, more slender, the fourth longer and more slender than the third. Mesonotum a light fuscous yellowish, the submedian lines sparsely haired. Scutellum and postscutellum yellowish orange. Abdomen yellowish orange, the segments slightly fuscous dorsally. Wings hyaline, the third vein uniting with the dark brown costa near the basal half. Halteres pale yellowish. Coxae, femora and tibiae mostly yellowish, the tarsi dark brown; claws long, slender, evenly curved, the pulvilli about half the length of the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment rather stout, curved; dorsal plate long, deeply and narrowly incised, ventral plate inconspicuous. Harpes expanded basally, tapering to a narrowly produced, irregular apex. Type Cecid. a1860.

Lasioptera viburni Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 104; separate, p. 8
1908 ——— N. Y. State Mus. Bul. 124, p. 327

This male was taken at Albany, N. Y., June 10, 1906 on maple leaved arrowwood, Viburnum acerifolium.

Male. Length 1 mm. Antennae dark brown; at least 18 and probably more segments, the fifth with a length a little greater than its diameter. Palpi; the first segment irregularly curved, subrectangular, with a length four times the diameter, the second shorter, narrowly oval, the third a little longer than the second, more slender, the fourth one-half longer than the third, more slender, curved; eyes margined posteriorly with silvery white. Mesonotum dark brown, margined laterally with yellowish, anteriorly with a few sparse, silvery white hairs, submedian lines yellowish. Scutellum and postscutellum nearly uniform fuscous orange. Abdomen yellowish orange, with irregular fuscous markings on the first, second, third and fourth abdominal segments, the markings nearly divided in the middle and slightly prolonged sublaterally. Genitalia shining brown. Wings hyaline, costa basally and the third vein thickly clothed with dark brown scales, the latter uniting with the margin at the distal third; halteres yellowish transparent. Coxae, femora and tibiae pale yellowish straw, tarsi nearly uniform dark brown; claws slender, long, strongly curved. Genitalia; basal clasp segment long, stout; terminal clasp segment with the basal fourth enlarged, tapering; dorsal plate broad, deeply incised; ventral plate roundly emarginate. Harpes narrowly subtriangular. Type Cecid. 186.

Lasioptera excavata Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 6
1908 ———— N. Y. State Mus. Bul. 124, p. 287, 327

This species was presumably reared from a blisterlike mine found rather commonly in the vicinity of Albany on species of Crataegus. The larvae occur in the mines about midsummer, the adults appearing August 17, 1907.

The blisterlike mine inhabited by this species is about 8 mm in diameter, pale green and surrounded by a broad, diffuse, reddish brown area, with diameter about three times that of the blister. The tints of the lower side of the leaf are much less striking than those above. One to three or six larvae may occur in a leaf. For a colored illustration of the gall see Museum Bulletin 175, plate 2, figure 11, 11a.

Larva. Whitish, moderately stout, the extremities rounded, length 2 mm; head rather small, rounded anteriorly, the antennae moderately long, stout, biarticulate, the terminal segment rounded apically; breastbone obtusely bidentate, shaft distinctly chitinized but more slender than the anterior portion; skin moderately smooth, posterior extremity roundly truncate and with a pair of fleshy, obtuse processes at each of the latero-posterior angles.

Female. Length 1 mm. Antennae black, basally yellowish; 26 segments, the fifth with a length a little greater than its diameter; terminal segment slightly produced, obpyriform. Palpi; the first segment rather long, narrowly oval, the second a little longer, stouter, oval, the third one-half longer than the second, broad, tapering at both extremities, the fourth a little longer and more slender than the third; face with a conspicuous patch of silvery white scales, head thickly clothed posteriorly with silvery white scales. Mesonotum narrowly dark brown, broadly and variably margined laterally and anteriorly with pale yellowish, the submedian lines broad, pale yellowish and sparsely haired. Scutellum pale yellowish, postscutellum pale orange. Abdomen mostly pale orange, the second to sixth segments variably marked basally with dark brown, the markings being almost obsolete on the second, nearly reaching the margin on the third and extending thereto on the fourth, fifth and sixth segments, ovipositor pale orange; venter pale yellowish, sparsely clothed with silvery scales. Wings hyaline, costa dark brown, no discal spot; the third vein uniting with the anterior margin near the basal half; halteres pale yellowish. Coxae, femora and tibiae mostly pale yellowish, the femora narrowly reddish brown apically, the tarsi black. Ovipositor as long as the abdomen, the terminal lobes long, slender, subacute and with three or four stout hooks. Type Cecid. a1576.

Lasioptera murtfeldtiana Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:288

Several specimens of this form were reared September 9, 1896 from seeds of sunflower taken at Kirkwood, Mo. Apparently the same or a closely allied insect was obtained from wild sunflower seeds August 25, 1884 from Ottawa, Kan. We are indebted to the courtesy of the National Museum for an opportunity of describing this species.

The sunflower seed infested by this insect appears to be normal, the adult escaping from the pupa after the latter was nearly free from the base of the seed.

Exuviae. Length 2.5 mm, semitransparent, except for the light brown dorsum of the abdominal segments; antennal sheaths short, with a short, obtuse, triangular process basally; dorsal horns short, rather stout. Wing pads extending to the third abdominal segment, leg cases to the fifth or sixth abdominal segment; dorsum of the abdominal segments thickly clothed with short, stout, chitinous spines; these evidently give the dark brown color mentioned above.

Male. Length 2 mm. Antennae short, dark brown, 17 segments; the fifth with a length about three-fourths its diameter, the terminal segment slightly produced, broadly rounded apically. Palpi; first segment rather long, rectangular, the second a little stouter and as long as the first, the third one-half longer and more slender than the second, the fourth nearly twice the length of the third, more slender. Mesonotum dark brown, the submedian lines thickly haired. Scutellum dark brown, yellowish brown apically. Postscutellum darker. Abdomen apparently a nearly uniform yellowish brown, the genitalia fuscous. Wings hyaline, costa mostly dark brown, the white discal spot apparently missing, the third vein uniting with costa at the distal third. Halteres reddish brown. Legs a nearly uniform dark brown, the femora and tibiae apically narrowly ringed with pale yellowish. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, swollen basally; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate long, tapering, broadly rounded. Harpes long, with a narrow, chitinous process apically. Type Cecid. 902.

Lasioptera centerensis n. sp.

This name is proposed for a yellowish orange larva inhabiting a double celled gall at the base of the stem of Impatiens aurea and taken at Karner, N. Y., September 6, 1906.

Gall. The gall is soft, green, one-half of an inch long, one-third of an inch in diameter, and is composed of two cells.

Larva. Length 3 mm, rather stout, yellowish orange, the breastbone linear, rather broad, tridentate. Head small. Antennae apparently uniarticulate, tapering. Skin coarsely shagreened; segmentation indistinct, posterior extremity broadly rounded and with a few small, scattering spines.

This larva is easily distinguished from that of L. impatientifolia by the tridentate breastbone. Type Cecid. a1166.

NEOLASIOPTERA Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 330
1911 ———— N. Y. Ent. Soc. Jour., 19:42
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 22

This genus is closely allied to Lasioptera. It is distinguished by the fifth vein forking at the extreme base of the wing or by the sixth being entirely independent of the preceding (pl. 5, fig. 8). This character, while not always determined with ease, affords a good basis for division, even though this latter may not be closely correlated with variations in habit. The female antennae may be composed of from 17 segments in the case of N. celastri to 29 segments in N. viburnicola, while the males may have but 12 segments in N. squamosa to 23 in N. cornicola. As in the genus Lasioptera, there is frequently a variation, apparently following no law, of four or five segments between the sexes.

The species of this genus, as in Lasioptera, inhabit largely subcortical stem galls on herbaceous and woody plants, most of the forms producing distinct enlargements, though the presence of N. hibisci is indicated only by a somewhat general enlargement of the stem. N. squamosa has been reared from grass, presumably a stem gall, while N. vitinea makes a characteristic conical gall on the grape petiole. Type Lasioptera vitinea Felt.

Key to species

a Abdomen dark brown or black
  b Abdominal segments nearly unicolorous
    c Tarsi dark brown; female antennal segments 17 .... celastri Felt, C. 598
    cc Tarsi dark brown, annulate with yellowish white; female antennal segments 12; reared from grass .... squamosa Felt
    ccc Tarsi reddish brown, female antennal segments 21; reared from stem gall on sunflower .... trimera n. sp., C. 907
    cccc Tarsi fuscous yellowish, antennal segments, female 24 .... major n. sp., C. 1253
  bb Basal abdominal segment whitish or yellowish white
    c Third vein uniting with costa at the basal third

d Abdominal segments 1 to 4 white; male antennae with ?20 to 22 segments; female, 24; reared from Eragrostis............. agrostis Felt, C. 1063

dd Third abdominal segment margined with silvery; female antennal segments, 25.............cinerea Felt, C. 341

ddd Second to fourth abdominal segments with submedian lunate spots

e Tarsi mostly dark brown

f Female antennal segments, 22; terminal lobes of ovipositor very slender (x 6)...................... tenuitas Felt, C. 1232

ff Female antennal segments, 24; male, ?20–22; terminal lobe of ovipositor rather stout (x 4); reared from Eragrostis...............agrostis Felt, C. 1063

ee Tarsi mostly yellowish; terminal lobes short, stout, thickly haired.......................hirsuta Felt, C. 908

cc Third vein uniting with costa at the basal half

d Third and fourth basal abdominal segments yellowish or whitish

e Distal abdominal segment pale orange; antennal segments, male, 14.....................basalis Felt, C. 739

ee Distal abdominal segments white; margined posteriorly; antennal segments, male, 20; female, 23–25; reared from conical petiole grape gall....................... vitinea Felt, C. a1415, 1065, 1118, c680

dd Second to fourth abdominal segments with submedian whitish spots

e Ventral plate rather broad, narrowly rounded distally; antennal segments, male, 18......................... sexmaculata Felt, C. 265, 589

ee Ventral plate broad, narrowly incised apically; antennal segments, male, 16.......tripunctata Felt, C. 427

ddd Second to third abdominal segments margined posteriorly with silvery white

e Legs mostly pale yellowish

f Male antennal segments 18......................... liriodendri Felt, C. 291

ee Legs mostly brown

f Antennal segments, female, 23; scutellum reddish yellow; reared from irregular stem gall on Solanum solani Felt, C. 903

ff Antennal segments, female, 26; scutellum dark brown; presumably forming a stem gall on Clematis...... clematidis Felt, a1596a

fff Antennal segments, male, 19; female, 23; scutellum dark brown; reared from irregular subcortical gall on Sambucus...........sambuci Felt, C. a1404

ffff Antennal segments, male, 20; female, 23–25; scutellum reddish brown; reared from conical petiole grape gall vitinea Felt, C. a1415, 1065, 1118

fffff Antennal segments, female, 24; reared from fusiform stem gall on Asclepias incarnata......
asclepiae Felt, C. a1401

ffffff Antennal segments, male, 22; female, 29; scutellum reddish brown; reared from irregular subcortical gall on Viburnum..................................
viburnicola Beutm., C. a1409

dddd Third and fourth abdominal segments margined posteriorly

e Antennal segments, male, 23; female, 27; third and fourth abdominal segments narrowly margined posteriorly; reared from irregular subcortical gall on Cornus
cornicola Beutm., C. a1423, a1363

ee Antennal segments, female, 23; third and fourth abdominal segments broadly margined posteriorly.................
hamamelidis Felt, C. 181

bbb Abdominal segments margined posteriorly with yellowish or whitish

c Tarsi banded; antennal segments, male, 18; female, 24; reared from oval stem gall on Eupatorium......perfoliata Felt, C. 1101

cc Tarsi with the distal segments of the posterior legs white; antennal segments, female 19..................albipes n. sp., C. 804

ccc Tarsi unicolorous; antennal segments, female 18; reared from Helianthus........................helianthi Felt, C. a1718x

bbbb Basal and other abdominal segments with conspicuous submedian markings

c Submedian spots straw yellow

d Female antennal segments 18..............................
flavomaculata Felt, C. 545

cc Third and fourth abdominal segments mostly whitish; antennal segments, male, 16; on basswood....tiliaginea Felt, C. 283

ccc Third and fourth abdominal segments not mostly whitish

d Tarsi unicolorous or nearly so

e Antennal segments of male, 18; female, 22; scutellum dark brown; reared from oval stem gall on tick trefoil......
hamata Felt, C. a1458

ee Antennal segments of female, 25; ovipositor lobes very long, slender..............coloradensis n. sp., C. 1350

eee Antennal segments, female, 17; scutellum black...........
albolineata Felt, C. 1234

dd Tarsi distinctly annulate

e Posterior tarsi with the fourth and fifth segments white in the female

f Antennal segments, male, 20; female, 24–25; the fourth palpal segment twice the length of the preceding; scutellum dark brown. Reared from ovate stem gall on Diplopappus...............................
albitarsis Felt, C. a1477, a1379

ee Posterior tarsi with the second to fourth segments banded at both extremities

f Antennal segments, male, 15–16; female, 23; scutellum dark brown, the third vein uniting with the costa at the basal third. Reared from swollen stems of Hibiscus............. hibisci Felt, C. a1410 *ff* Antennal segments, male, 19; female, 21; scutellum dark brown, the third vein uniting with costa near the basal half. Reared from a fusiform stem gall on aster branches............ramuscula Beutm. C. a1361, a1397, a1500, 1107

eee Posterior tarsal segments white-banded basally

f Antennal segments, male, 14; female, 16; palpi three — four-segmented, the distal segment one and one-half to two and one-half times the length of the preceding; scutellum dark brown. Reared from fusiform bud gall on Erigeron.................... erigerontis Felt, C. a1427a, a1302, 1064

ff Antennal segments, female, 17–18; male, 15; fourth palpal segment one-half longer than the preceding; scutellum dark brown; reared from stems of giant ragweed, Ambrosia trifida........................ ambrosiae Felt, C. a1926

fff Antennal segments, female, 18; scutellum reddish brown, the fourth palpal segment one and one-third the length of the preceding, the costal spot obscure. Reared from stem gall on Mimulus................. mimuli Felt, C. 1052

ffff Antennal segments, male, 17; female, 23; scutellum dark brown, the distal palpal segment with a length one and one-fourth that of the preceding; ovipositor slender, as long as the abdomen. Reared from stem gall on Eupatorium.. eupatorii Felt, C. a1413

fffff Antennal segments, male, 17; female, 22–25; the fourth palpal segment with a length three-fourths to twice that of the preceding; scutellum dark brown, the ovipositor stout, with a length one-half that of the abdomen. Reared from Mint stem.............. menthae Felt, C. a1823

aa Abdomen a pale or reddish brown

b Mesonotum light brown; antennal segments, male, 12; bred from grass... squamosa Felt, C. 909

bb Mesonotum dark brown; antennal segments, female, 16–19........... flavoventris Felt, C. 478, 480, 672

Neolasioptera celastri Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 330

This species was taken on climbing bitter-sweet, Celastrus scandens at Albany, N. Y., July 17, 1906. It may be the species causing the subcortical stem gall on this vine.

Female. Length 2 mm. Antennae dark brown, basally yellowish; 17 segments, the fifth with a length nearly equal to its diameter; terminal segment greatly produced, evidently composed of two or three closely fused, distally tapering to a narrowly rounded apex.

Palpi; the first segment long, expanding distally and with a length over twice its diameter, the second narrowly oval, with a length over twice its diameter, the third a little longer and more slender than the second, the fourth longer and more slender than the third; face fuscous yellowish, eyes large, black. Head posteriorly clothed with silvery white scales. Mesonotum shining dark brown. Scutellum and postscutellum dark reddish brown. Abdomen shining dark brown, ovipositor yellowish. Wings hyaline, costa light brown, the third vein uniting with the margin just before the basal half. Halteres whitish transparent. Legs a nearly uniform dark brown, except for the yellowish coxae and femora; claws rather slender, stout, strongly curved, the pulvilli a little longer than the claws. Ovipositor probably about two-thirds the length of the abdomen; terminal lobes long, slender, narrowly oval. Type Cecid. 598.

Neolasioptera squamosa Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:483–84

The midges were reared from grass, presumably a gall, collected at Cadet, Mo.

Neolasioptera trimera Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:484

Females of this species were reared July 8–16, 1882 from a stem gall on sunflower taken by Mr H. K. Morrison at Fort Grant, Ariz. A number of undetermined parasites were reared from this gall fly.

Neolasioptera major n. sp.

This giant species was taken in August at Colorado Springs, Col., at an elevation of 5915 feet, by Mr E. S. Tucker. It is also numbered 126.

Female. Length 3 mm. Antennae dark brown, 24 segments, the first broadly obconic, the second subglobose, the third and fourth free, the fifth with a length about three-fourths its diameter, the terminal segment somewhat produced, narrowly oval. The circumfili are remarkably high for a Neolasioptera, producing distinct ridges. Palpi; first segment obconic, the second stout, with a length about two and one-half times its diameter, the third one-half longer, more slender, the fourth a little longer and more slender than the second. Mesonotum shining dark brown. Scutellum a little lighter, postscutellum nearly concolorous. Abdomen a shining reddish dark brown; ovipositor deep orange. Wings hyaline, costa yellowish transparent, probably badly rubbed, the third vein uniting with the margin near the basal half. Halteres yellowish basally, slightly fuscous apically. Coxae dark brown, femora mostly fuscous yellowish, tibiae yellowish brown, tarsi fuscous yellowish, the segments somewhat darker distally. Ovipositor hardly half the length of the abdomen; terminal lobes large, broadly oval. Type Cecid. 1253.

Neolasioptera agrostis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 331
1911 ———— Econ. Ent. Jour., 4:483

This species, loaned for study by the United States National Museum, was reared from E r a g r o s t i s p o a c o i d e s, adults issuing in September 1885.

Neolasioptera cinerea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 111; separate, p. 15 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 331

This species was taken at Albany, N. Y., June 21, 1906.

Female. Length 2 mm. Antennae dark brown; 25 segments, the fifth with a diameter one-half greater than its length. Palpi; the first segment short, obconic, second one-half longer, subcylindric, the third very long, about three times the combined length of the two preceding, irregular, the basal portion stout, the apical part slender. Mesonotum dark brown, submedian lines with grayish hairs. Scutellum dark brown with sparse apical setae, postscutellum dark brown. Abdomen dark brown, incisures and pleurae pale whitish orange; basal segment thickly clothed with silvery scales, the posterior margin of the third abdominal segment sparsely ornamented with scales of the same character, terminal segments pale orange. Wings subhyaline, costa dark brown, the third vein uniting with the margin at the whitish stigma on the basal third. Halteres pale yellowish basally, yellowish white apically. Coxae dark yellowish, femora yellowish straw with a more or less broad, fuscous band near the middle. Anterior and mid tibiae fuscous dorsally, pale yellowish ventrally, posterior tibiae pale yellowish; tarsi fuscous, lighter ventrally; claws moderately stout, strongly curved. Ovipositor moderately long, the lobes long, broadly rounded. Type Cecid. 341.

Neolasioptera tenuitas Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 331

This species was taken on the office window at Albany, July 30, 1907, presumably having been reared from material brought into the office.

Female. Length 1.5 mm. Antennae dark brown, basally yellowish; 22 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, broadly oval. Palpi; first segment rather long, slender, slightly expanded distally, the second a little longer and broader than the first, the third about as long as the second, more slender, the fourth one-third longer than the third, more slender. Mesonotum shining dark brown, variably margined laterally and anteriorly with silvery yellowish scales.

Scutellum and postscutellum dark brown. Abdomen dark brown, the basal segment thickly clothed with silvery white scales, the second, third and fourth segments with lunate, submedian, silvery white spots on the posterior margin; on the second and third segments there are also narrow, linear, silvery white markings laterally; ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein uniting therewith near the basal third. Halteres pale orange basally, yellowish transparent apically. Coxae, femora and the base of tibiae mostly pale yellow, the distal portions of tibiae and tarsi dark brown. Claws long, stout, strongly curved, the pulvilli about as long as the claws. Ovipositor probably nearly as long as the body, the terminal lobes long, slender, narrowly rounded. Type Cecid. 1232.

Neolasioptera hirsuta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 331

This species, loaned by the United States National Museum for study, was reared May 17, 1883, from stem galls on an unknown plant taken at Fort Huachua, Ariz.

Female. Length 2 mm. Antennae reddish brown; 22 segments, the fifth with a length about three-fourths its diameter; terminal segment somewhat reduced, broadly oval. Palpi; first segment rather long, narrowly oval, the second a little longer, stouter, the third a little longer and about as stout as the second, the fourth one-half longer than the third, more slender. Mesonotum dark reddish brown, variably margined laterally and anteriorly with long, silvery scales, the submedian lines thickly clothed with golden yellow setae. Scutellum dark brown, postscutellum a little darker. Abdomen dark brown, the basal segment thickly clothed with silvery scales except for a narrow median line, the second to sixth segments with submedian subquadrate silvery spots posteriorly, the seventh segment rather broadly margined posteriorly with silvery white, ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein uniting therewith at the basal third. Halteres mostly pale yellowish. Legs mostly fuscous yellowish, distal portion of tibiae and the apexes of the third to fifth tarsal segments inclusive, a light brown; claws rather long, stout, the pulvilli a little shorter than the claws. Ovipositor as long as the abdomen, the lobes short, broad, tapering, narrowly rounded.

This species appears to be quite close to Cecid. 1232, differing therefrom particularly in the lighter color of the legs, especially that of the tarsi and in the shorter, stouter, thickly haired terminal lobes of the ovipositor. Type Cecid. 908.

Neolasioptera basalis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 109; separate, p. 13 (Choristoneura)

1908 ———— N. Y. State Mus. Bul. 124, p. 331

This species was taken on hazel, Corylus americana, at Albany, N. Y., August 6, 1906. Nothing is known of its life history.

Male. Length 1.5 mm. Antennae dark brown, probably composed of 14 segments, the fifth with a length about one-half greater than its diameter. Palpi probably quadriarticulate. Face fuscous yellowish, eyes large, black. Mesonotum dark brown, submedian lines sparsely ornamented with yellowish hairs. Scutellum yellowish brown, postscutellum yellowish. Abdomen with the four basal segments yellowish white, the distal segments pale orange dorsally, sparsely clothed with fuscous and yellowish scales, genitalia fuscous. Wings hyaline, costa dark brown, the third vein uniting therewith at the whitish discal spot on the basal half. Halteres and coxae pale yellowish, femora yellowish basally, dark brown distally, tibiae and tarsi dark brown; claws moderately heavy, strongly curved. Genitalia; basal clasp segment stout, terminal clasp segment stout, tapering. Dorsal plate broad, deeply emarginate, ventral plate broad, short, acutely rounded. Harpes convolute, stout and with two subtriangular, truncate teeth. Type Cecid. 739.

Neolasioptera vitinea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 153 (Lasioptera)
1908 ———— N. Y. State Mus. Bul. 124, p. 331

The midge was reared June 15, 1907 from a conical petiole gall on grape, collected on Staten Island, N. Y. The gall is quite common in the vicinity of New York City, also at West Nyack, N. Y. It was found on Isabella grape by Mrs M. Archer Shee, Highland Falls, N. Y., and taken on grape at Albany, N. Y. The species was reared by the late Dr M. T. Thompson, Worcester, Mass., and presumably at Washington, D. C., as specimens dated April 28, 1888 are in the collections of the National Museum. Trichasis virginiensis Ashm. was reared from this gall.

Gall (pl. 3, fig. 2). This is an obpyriform or slightly curved conical petiole gall on grape. The enlargement is about 1.5 cm long and .5 cm in diameter. Each gall contains 2–4 larvae in a long central chamber.

Larva. Length 3.5 mm, stout, whitish or pale yellowish. Head small; antennae uniarticulate; breastbone linear, bidentate, with a minute median tooth and tapering slightly distally; skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 2.5 mm. Antennae dark brown, basally yellowish; 20 segments, the fifth with a length about three-fourths its diameter; terminal segment greatly prolonged, subconic with a length fully twice its diameter, the base slightly rounded, the apex obtuse. Palpi fuscous yellowish, the first segment stout, subquadrate, slightly swollen distally, the second a little longer than the first, stout, roundly rectangular, the third more than twice the length of the second, tapering, obtuse; face sparsely clothed with silvery white scales. Mesonotum dark brown, variably and diffusely margined laterally and anteriorly with silvery white, the submedian lines rather thickly clothed with silvery white scales, the sublateral areas sparsely clothed with short, whitish hairs. Scutellum fuscous yellowish, clothed with a few coarse setae apically, postscutellum a little darker. Abdomen dark brown, the first segment rather thickly clothed with silvery white scales, the second, third and fourth nearly so, except for a variable, diffuse median fuscous spot, the sixth, seventh and eighth segments dark brown, thickly margined posteriorly with silvery, incisures and apex of abdomen fuscous yellowish, genitalia fuscous; venter with a broad median stripe, thickly clothed with silvery white scales, the sublateral areas dark brown. Wings hyaline, costa dark brown, the long, whitish discal spot at the basal half; the tip of the third vein uniting therewith; halteres pale yellowish. Coxae and femora mostly pale yellowish, the latter with a variable median band of light fuscous, tibiae light fuscous, narrowly banded at the extremities with pale yellowish, the first and second tarsal segments mostly light yellowish, darker distally, the third, fourth and fifth mostly dark brown; claws long, slender, strongly curved. Genitalia; basal clasp segment long, stout; terminal clasp segment long, stout basally, tapering; dorsal plate long, broad, deeply and narrowly incised; ventral plate shorter, broad, broadly rounded; harpes stout at base, tapering.

Female. Length 2 mm. Antennae dark brown, basally yellowish; 23 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, obovate. Palpi fuscous yellowish, the first segment irregularly subquadrate, swollen distally, the second one-half longer, narrowly oval, the third more slender and one-fourth longer than the second, the fourth more slender and one-half longer than the third; face thickly white-scaled. Mesonotum dark brown, variably margined with silvery white scales, submedian lines thickly yellow-haired. Scutellum reddish brown, sparsely clothed with whitish hairs, postscutellum yellowish. Abdomen dark brown, the basal segment thickly silvery white-scaled, segments two to six narrowly margined posteriorly with silvery white, these markings continued laterally to form a crenulate lateral line; wing, see plate 5, figure 8; ovipositor pale yellowish; venter dark brown with the median third rather sparsely white-scaled. Tarsi a nearly uniform dark brown, the first segment narrowly annulate with whitish. Ovipositor about one-half the length of the abdomen, the lobes long, tapering, narrowly rounded. Type Cecid. a1415.

Neolasioptera sexmaculata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 331

This species was taken at Nassau, N. Y., June 14, 1906, probably on cherry and again captured July 17th of the same year on a house window.

Male. Length 2 mm. Antennae dark brown, basally with silvery hairs; 18 segments, the fifth with a length about three-fourths its diameter; terminal segment nearly twice the length of the preceding, broadly rounded. Palpi; the first segment short, subquadrate, second a little longer, swollen distally, the third narrowly oval, the fourth about two and one-half times the length of the third. Mesonotum dark brown with a darker median line, anteriorly and laterally with a broad band of silvery scales; there are also a few posteriorly on the median line. Scutellum dark brown, a few whitish scales subapically; postscutellum dark brown. Abdomen dark brown with the basal segment and small subdorsal spots on the second, third and fourth segments, white; laterally, larger, more diffuse, whitish spots, on the second, third, fourth and fifth abdominal segments; subterminal segments pale orange; genitalia fuscous yellowish, basally on the dorsal aspect with silvery white. Wings subhyaline, costa dark brown, a small, yellowish stigmatal spot at the basal half, the third vein uniting therewith; halteres pale yellowish basally, whitish transparent apically, anterior coxae pale yellowish, posterior coxae dark brown, variably clothed laterally with silvery white scales; femora mostly silvery white with variable fuscous markings, tibiae silvery yellow basally, a variable brown distally, lighter ventrally, tarsal segments dark brown, variably annulate basally with yellowish white, the annulations broader on the posterior legs, nearly rudimentary on the anterior ones; claws slender, evenly curved. Genitalia; basal clasp segment rather long, stout; terminal clasp segment greatly swollen basally, tapering; dorsal plate broad, deeply and triangularly incised; ventral plate broad, tapering, narrowly rounded. Harpes stout, subtriangular, a narrow, subquadrate tooth internally and a shorter, stouter one externally. Type Cecid. 265.

Neolasioptera tripunctata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 331

This species was taken on a house window at Nassau, N. Y., June 30, 1906. Nothing is known concerning its life history.

Male. Length 1 mm. Antennae dark brown, yellowish basally; 16 segments, the fifth with a length but a little greater than its diameter; terminal segment subglobular. Palpi; the first segment short, subquadrate, the second rather stout, narrowly oval, the third a little longer, more slender, the fourth one-half longer than the third. Face yellowish. Mesonotum dark brown, submedian lines distinct, thickly clothed with fine, yellowish hairs and with a slightly broader stripe of similar hairs along the antero-lateral margin. Scutellum dark brown, postscutellum reddish brown. Abdomen dark brown with the basal segments mostly yellowish, the second with three subquadrate yellowish spots, one median the others nearly lateral, the third and fourth segments, each with a pair of submedian subquadrate spots, terminal segments bordered posteriorly with yellowish white scales, ventral surface pale yellowish. Wings hyaline, costa with dark brown scales, third vein uniting with costa at the basal third; halteres pale reddish basally, whitish apically. Coxae pale yellowish, femora mostly pale yellowish, tibiae yellowish ventrally, with some dark brown dorsally, tarsi dark brown, the segments narrowly annulate with light reddish yellow basally; claws rather long, slender, evenly curved, the tooth long. Genitalia (pl. 7, fig. 4); basal clasp segment long, obliquely truncate; terminal clasp segment swollen at the base, tapering. Dorsal plate broad, very deeply and triangularly incised, ventral plate broad. Harpes stout, subtriangular, obtusely rounded. Type Cecid. 427.

Neolasioptera liriodendri Felt

1907 **Felt, E. P** N. Y. State Mus. Bul. 110, p. 109–10; separate, p. 13 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 331

This species was taken on a tulip tree, Liriodendron tulipiferae, at Albany, N. Y., June 8, 1906. The tree was more or less infested by Thecodiplosis liriodendri Jack, a species producing the characteristic purplish blister galls on the leaves.

Male. Length 2.5 mm. Antennae dark brown, lighter basally; 18 segments, the fifth with a length scarcely greater than its diameter; terminal segment suboval, sometimes free and occasionally fused with the preceding. Palpi; the first segment short, irregularly quadrate, slightly swollen distally, the second a little longer, narrowly oval, the third more slender, the fourth twice the length of the third. Head small, dark. Mesonotum dark brown, shining, clothed with long, white hairs, more abundant anteriorly and seen from the side, appearing like a collar, submedian lines rather abundantly clothed with fine hairs. Scutellum and postscutellum reddish. Abdomen with the basal segment covered with white scales, the second black basally, the dark color with three distal prolongations, that on the median line extending across the segment; the third segment has the three dark points extending across the segment, the fourth is decidedly reddish yellow, the fifth narrowly so at the base and clothed with a patch of dark scales. Wings hyaline, costa thickly clothed with dark brown scales basally, the third vein uniting with costa at the basal third (pl. 5, fig. 6); halteres white. Legs pale yellow, with the tarsi slightly darker at the tips of the segments; claws rather long, stout, uniformly curved. Genitalia (pl. 7, fig. 3); basal clasp segment long, obliquely truncate; terminal clasp segment swollen at the base. Dorsal plate broad, deeply and triangularly incised, ventral plate broad, broadly rounded: Harpes stout, irregularly subtriangular. Type Cecid. 291.

Neolasioptera solani Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 164 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 331

This species, loaned by the United States National Museum, was reared April 16–22, 1896 from a stem gall on Solanum carolinense, taken at Ivy City, D. C. The gall referred by us to this species was very common at Asheville, N. C., September 1906. The larvae winter in the gall, the adults appearing in the spring.

Gall. An irregular stem swelling 3.75 to 5 cm in length and with a diameter of about 1.75 cm. It is usually mostly on one side of the stem and spined.

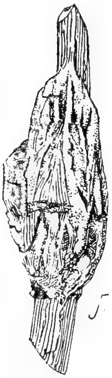

Fig. 30 Neolasioptera solani, gall, natural size (original)

Larva. Length 2.5 mm, rather stout, pale orange. Head rather broad; antennae uniarticulate, slender, tapering; breastbone rudimentary, unidentate; skin smooth; posterior extremity broadly rounded. Larva probably young.

Female. Length 1.5 mm. Antennae dark brown; 23 segments, the fifth with a length about equal to its diameter; terminal segment reduced, subglobose. Palpi; the first segment small, subquadrate, the second short, dilated, a little longer than the first, the third a little longer than the second, narrowly rounded, the fourth nearly twice the length of the third, slender. Mesonotum dark reddish brown, broadly and irregularly margined with yellowish white, the submedian lines thickly clothed with short, yellowish setae. Scutellum reddish yellow, a few small setae apically, postscutellum reddish brown. Abdomen dark brown, the first abdominal segment yellowish-white scaled, the second to fifth segments narrowly margined posteriorly with silvery white, broadly interrupted along the median line, ovipositor pale yellowish; venter thickly suffused with silvery white scales. Wings hyaline, costa dark brown, the silvery white discal spot near the basal half, the third vein uniting with costa just before the basal half. Halteres pale yellowish transparent. Coxae and base of femora mostly a pale yellowish, the other parts of the legs a variable dark brown, the tarsi lighter; claws long, slender, strongly curved, the pulvilli about as long as the claws. Ovipositor about two-thirds the length of the abdomen, basally oval patches of stout, halberd-shaped spines, the terminal lobe long, tapering, and with a group of dark, stout hooks. Type Cecid. 903.

Neolasioptera clematidis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 287–88, 331

The female was observed at Newport, N. Y., July 17, 1907 as she was attempting to oviposit in a small slit in the stem of Clematis. The egg is about .1 mm in length and with a diameter of .02 mm, reddish brown, slightly darker at one extremity. There were at least three eggs in this crevice. The gall, presumably made by this species, is ovate, reddish brown, about 4 mm long, 3 mm in diameter and occurs at the base of the tendrils.

Female. Length 1.5 mm. Antennae dark brown; 26 segments, the fifth with a length about three-fourths its diameter; terminal segment somewhat produced, narrowly obovate. Palpi; the first segment short, stout, subquadrate, the second over twice the length of the first, rather stout, the third as long as the second, more slender, the fourth one-fourth longer than the third, more slender; face thickly clothed with silvery scales. Mesonotum dark brown, apparently margined laterally and anteriorly with silvery white scales, the submedian lines sparsely haired. Scutellum and postscutellum dark brown. Abdomen dark brown, the dorsum of the first abdominal segment thickly clothed with silvery white scales, second, third and fourth abdominal segments narrowly margined posteriorly with silvery white markings, obsolete laterally. Wings hyaline, costa dark brown, the whitish discal spot near the basal half; the third vein uniting therewith. Halteres yellowish basally, whitish apically. Coxae and extremities of femora and tibiae broadly and variably yellowish, the middle dark brown, tarsi dark brown, the distal segments yellowish, the latter possibly denuded; claws rather short, stout, strongly curved, the pulvilli nearly as long as the claws. Ovipositor probably two-thirds the length of the abdomen, the terminal lobes long, slender, slightly expanded distally. Type Cecid. a1596a.

Neolasioptera sambuci Felt

1906 **Felt, E. P.** N. Y. State Mus. Bul. 104, p. 131 (Cecidomyia)
1907 **Beutenmueller, William.** Amer. Mus. of Nat. Hist. Bul. 23, p. 396
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 331
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 48

The irregular subcortical gall of this species is somewhat common on elder, Sambucus canadensis, at Nassau, N. Y., and vicinity and near New York City. Midges were reared by the late Dr M. T. Thompson at Worcester, Mass. The irregular galls vary greatly in size and may contain a considerable number of larvae, the flies appearing early in June. A Torymid was reared from this midge. The gall of this species is an irregular swelling usually on one side of the smaller elder stems. It ranges in length from 2 to 4 cm and has a diameter of nearly 2 cm.

Larva. Length 3 mm, yellowish red, rather stout. Head rather large; antennae uniarticulate, slender; breastbone linear, slightly enlarged apically, bidentate, with a rudimentary median tooth; skin smooth; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae light brown, basally yellowish; 19 segments, the fifth with a length a little less than its diameter; terminal segment slightly prolonged, broadly rounded distally. Palpi; the first segment narrowly oval, with a length about one-half greater than the diameter, the second one-half longer than the first, somewhat stouter, subrectangular, the third a little longer and more slender than the second, the fourth one-half longer than the third, compressed and somewhat dilated apically; face fuscous yellowish with a conspicuous patch of silvery white scales. Mesonotum dark brown, broadly and irregularly margined laterally and anteriorly with silvery white, the submedian lines thickly clothed with short, yellowish setae. Scutellum dark brown, naked, postscutellum dark brown. Abdomen dark brown, the basal segments naked and pale salmon basally, broadly margined distally with silvery white, the second, third and fourth segments narrowly margined posteriorly with silvery white. Genitalia fuscous yellowish; venter sparsely clothed with silvery white scales. Wings hyaline, costa dark brown, the whitish discal spot just before the basal half; the third vein uniting therewith just before the basal half; halteres pale orange. Coxae and base of femora pale yellowish, the femoro-tibio articulations irregularly yellowish transparent, the other portions of femora and tibiae a variable brown, the tarsi dark brown; claws rather long, stout, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, roundly truncate; terminal clasp segment slightly swollen at the base, dorsal plate broad, broadly and deeply incised; ventral plate short, broad, broadly rounded. Harpes short, stout, tapering.

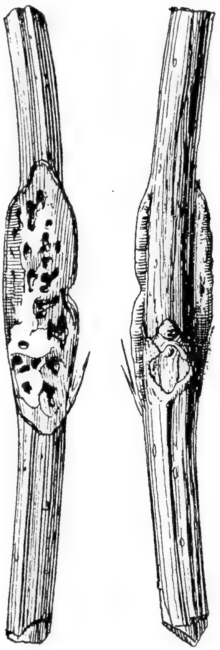

Fig. 31 Neolasioptera sambuci, galls about natural size, one mostly eccentric and the other sectioned (original)

Female. Length 2 mm. Antennae dark brown, basally yellowish; 23 segments, the fifth with a length about one-half its diameter; terminal segment somewhat produced, obpyriform. Palpi yellowish fuscous distally, the first segment irregularly subquadrate, slightly swollen distally, the second one-half longer, stout, the third one-half longer than the second, more slender, the fourth twice the length of the third, more slender. Abdomen dark brown, the first segment thickly clothed with silvery white scales, the second to fourth segments inclusive rather broadly margined posteriorly with silvery white scales, sixth, seventh and eighth very narrowly so; venter fuscous with a broad, median stripe of silvery white scales, ovipositor pale yellowish. Wings hyaline, costa dark brown, the whitish discal spot at the basal half, the third vein uniting with costa just before the basal half; halteres pale salmon. Coxae and femora basally and apically, the tibiae apically pale yellowish, the remainder of the legs a variable brown, tarsi dark brown; the pulvilli nearly as long as the claws. Ovipositor about one-half the length of the abdomen, terminal lobes rather long, broad, tapering, narrowly rounded. Type Cecid. a1404.

Neolasioptera asclepiae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332

This specimen was reared at Albany, N. Y., from an elongate fusiform swelling on the stems of swamp milkweed, A s c l e p i a s i n c a r n a t a, adults appearing June 20, 1907.

Gall. This species was reared from an elongate fusiform swelling on the stem of A s c l e p i a s i n c a r n a t a. It occurs invariably at the joint and on that account presents a symmetrical appearance, which at first sight appears normal. The galls usually contain two larvae, one on each side of the septum of the joint.

Larva. Length 2.5 mm, rather stout, pale orange. Head small; antennae uniarticulate; breastbone linear, bidentate, with a small median tooth and slightly expanded distally; skin minutely shagreened; posterior extremity broadly rounded.

Fig. 32 N e o - l a s i o p t e r a a s c l e p i a e, two enlarged nodes, natural size (original)

Female. Length 1.25 mm. Antennae black, basally fuscous yellowish; 24 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, obovate. Palpi; the first segment short, rectangular, with a length about one-half greater than the diameter, slightly dilated apically, the second stout, narrowly oval, a little longer than the first, the third one-half longer and more slender than the second, the fourth about as long as the third, somewhat more dilated. Face whitish. Mesonotum black, margined anteriorly and laterally with silvery hairs. Abdomen dark brown, the first segment covered with yellowish white scales, the second narrowly bordered posteriorly with silvery white, the third and fourth more broadly margined with silvery white posteriorly, remaining segments with a scattered row of silvery hairs along the posterior margin; ovipositor pale yellowish. Wings hyaline, costa dark brown, the white discal spot almost at the basal third, the third vein uniting with the costa a little beyond the basal third. Halteres whitish transparent, anterior legs dark brown, the femora basally white or pale, the posterior with a dark brown band near the middle and silvery apically; tibiae dark, nearly to the base, the apical third silvery, tarsi black; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor nearly as long as the abdomen, the terminal lobes long, slender, narrowly rounded. Type Cecid. a1401.

Neolasioptera viburnicola Beutm.

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 23:398 (Lasioptera)

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332

The irregular, subcortical galls of this species occur on the larger branches of arrowwood, V i b u r n u m d e n t a t u m, and closely resemble those produced by N. s a m b u c i Felt on elder. It is rather common in the vicinity of New York City. The larvae winter in the gall, the adults appearing the latter part of May.

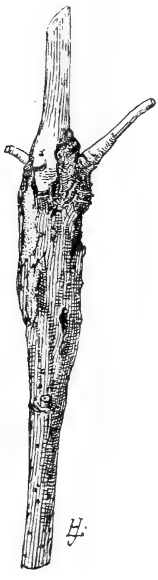

Fig. 33 N e o l a s i o p t e r a v i b u r n i c o l a, gall, enlarged (original)

Gall. An irregular, subcortical swelling from 2 to 5 or 6 cm in length, and approximately 5 cm in diameter.

Larva. Length 3 mm, rather slender, pale orange. Head small; antennae uniarticulate, slender; breastbone linear, bidentate, with a minute median tooth; skin rather coarsely shagreened; posterior extremity broadly rounded.

Male. Length 1.5 mm. Antennae dark brown, fuscous yellowish basally; 22 segments, the fifth with a length about three-fourths its diameter; terminal segment tapering to a broadly rounded apex. Palpi; the first segment irregularly subquadrate, the second rather stout, rounded, with a length about twice its diameter, the third a little longer, more slender, slightly dilated apically, the fourth one-half longer than the third, more slender; face with a patch of silvery white. Mesonotum dark brown, broadly margined laterally and anteriorly with silvery white, the submedian lines rather thickly clothed with light yellowish hairs. Scutellum reddish brown, postscutellum dark brown. Abdomen dark brown, the basal segments silvery white, the second to fourth segments margined posteriorly with silvery white, the latter obsolete laterally, the fifth, sixth and seventh segments with the posterior margin sparsely clothed with long, silvery setae; genitalia fuscous; venter dark brown with a broad, median, white stripe. Wings hyaline, costa dark brown, discal spot pale yellowish, the third vein uniting therewith. Halteres pale salmon basally, semitransparent apically. Legs a variable brown, coxae and extremities of femora and tibiae pale yellowish, the tarsi dark brown; claws rather long, stout, strongly curved, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment slightly swollen basally; dorsal plate broad, broadly and triangularly incised; ventral plate broad, broadly rounded. Harpes long, stout, tapering, obtuse.

Female. Length 2 mm. Antennae dark brown, fuscous basally; 29 segments, the fifth with a length three-fourths or one-half its diameter; terminal segment somewhat produced, tapering to an obtusely rounded apex. Palpi; the first segment short, stout, irregularly subquadrate, the second about twice as long, stout, subrectangular, the third a little longer and more slender than the second, somewhat dilated subapically, the fourth about twice as long as the third, more slender; face with a patch of silvery white scales. Mesonotum dark brown, variably margined laterally and anteriorly with silvery white, the submedian lines sparsely haired posteriorly. Scutellum dark brown with numerous whitish setae apically, postscutellum dark brown. Abdomen dark brown, the basal segments silvery white dorsally, the third and fourth rather broadly margined posteriorly with silvery white, obsolete laterally, the second very narrowly so along the median line; ovipositor pale yellowish; venter black with the broad median area silvery white. Legs mostly dark brown, the extremities of the femora and tibiae variably annulate with whitish or yellowish; tarsi darker; the pulvilli as long as the claws. Ovipositor about as long as the abdomen; terminal lobes long, slender, narrowly rounded.

The above descriptions were drafted from material reared from galls taken in the vicinity of New York City. Type Cecid. a1409.

Neolasioptera cornicola Beutm.

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 23:394–95 (Lasioptera)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332
1909 ———— Ent. Soc. Ont., 39th Rep't, p. 44

The gall is common on dogwood, Cornus stolonifera, in the vicinity of New York City, occurs at West Nyack, N. Y., and is abundant at Nassau, N. Y. It is presumably found in other sections of the State. It is an extremely variable subcortical swelling which resembles that produced by N. sambuci Felt on elder. The larvae winter in the gall, adults appearing in early May in the latitude of Albany, N. Y., and from March to June in the vicinity of Washington, D. C. A Polygnotus species was reared from this gall.

Gall. An irregular, nodular, polythalamous, woody gall on the small twigs, the larger branches and the old stems of Cornus stolonifera. It varies in length from 1 to 2 cm, is very irregular and is confined as a rule to one side of the twig.

Larva. Length 2.5 mm, rather stout, pale orange. Head small; antennae uniarticulate, small; breastbone linear, bidentate, with a rudimentary median tooth, tapering and almost obsolete basally; skin nearly smooth; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae dark brown, basally yellowish, silvery scales ventrally; 25 segments, the fifth with a length about three-fourths the diameter; terminal segments somewhat produced, narrowly obovate. Palpi yellowish, fuscous apically, the first segment short, broadly oval, the second a little longer, rather stout, the third longer and more slender than the second, the fourth fully one-half longer than the third, more slender. Face thickly clothed with silvery scales. Mesonotum dark brown or black, broadly margined laterally and anteriorly with silvery white scales, the submedian lines faintly indicated by a few silvery scales. Scutellum dark brown, with a few silvery setae apically, postscutellum dark brown. Abdomen dark brown, the basal segment thickly clothed dorsally with silvery white scales, the second narrowly margined posteriorly on the median line and the third rather broadly and the fourth narrowly margined with silvery white scales, the bands on the two latter obsolete distally, eighth and sometimes the seventh segment fuscous yellowish; genitalia fuscous; venter black with a broad median white stripe. Wings hyaline, costa dark brown, the third vein uniting with the white discal spot near the basal half. Halteres pale silvery yellowish. Legs with the extremities of femora, the distal extremity of tibiae and the first tarsal segment a variable silvery yellowish, the other portions of the legs dark brown, tarsi slightly darker; claws rather long, slender, strongly curved, the pulvilli hardly as long as the claws. Genitalia; basal clasp segment long, slender, the obtusely rounded terminal clasp segment somewhat swollen basally. Dorsal plate broad, tapering, deeply and triangularly incised; ventral plate long, tapering, broadly rounded. Harpes long, slender, tapering, obtuse.

Fig. 34 Neolasioptera cornicola, swellings on larger cornus twigs (original)

Female. Length 2 mm. Antennae dark brown, yellowish white basally; 27 segments, the fifth with a length hardly half its diameter; terminal segment produced, obpyriform. Palpi; yellowish white, slightly fuscous apically, the first segment quadrate, the second a little longer, narrowly oval, the third about as long and more slender than the second, the fourth one-half longer than the third. Ovipositor pale yellowish; venter black, with a broad median stripe of silvery white scales. Wings hyaline, costa dark purple, the third vein uniting with the small, white discal spot near the basal third. Femora and tibiae dark brown, narrowly annulate with yellowish and white at the extremities; tarsi dark brown. Ovipositor as long as the abdomen, terminal lobes very long, slender, narrowly rounded. Type Cecid. a1423.

Neolasioptera hamamelidis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 111–12; separate, p. 15–16 (Choristoneura)
1908 ——— N. Y. State Mus. Bul. 124, p. 332

This species was taken on witch-hazel, Hamamelis virginica, at Albany, N. Y., June 10, 1907. Nothing is known concerning its life history.

Female. Length 2 mm. Antennae dark brown; 27 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly prolonged, the 27th suboval. Palpi; the first segment short, swollen distally, the second a little longer, narrowly oval, the third more slender, the fourth one-half longer than the third, more slender; face dark brown, with patches of whitish scales. Mesonotum shining black, margined anteriorly and laterally with silvery white and with submedian lines ornamented with pale hairs. Scutellum dark brown, silvery white apically, postscutellum nearly uniform dark brown. Abdomen a rich dark brown with the dorsum of the first abdominal segment, a minute median spot on the second, a broad apical band on the third and fourth segments, the latter two not extending to the margin, silvery white; terminal segment pale orange. Wings hyaline, costa a rich brown, the third vein uniting with the margin at the basal half; halteres yellowish transparent basally, whitish transparent apically. Coxae and extremities of femora and tibiae yellowish transparent, tarsi nearly uniform dark brown, lighter ventrally; claws rather stout, strongly curved, ovipositor probably two-thirds the length of the abdomen; terminal lobes narrowly lanceolate. Type Cecid. 181.

Neolasioptera perfoliata Felt

Boneset Stem Gall

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 156–57 (Choristoneura)
1908 ——— N. Y. State Mus. Bul. 124, p. 332
1908 **Jarvis, T. D.** Ent. Soc. Ont., 38th Rep't, p. 88
1909 ——— Ent. Soc. Ont., 39th Rep't, p. 78
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul., 2:49
1912 **Cosens, A.** Can. Inst. Trans., 9:323–24

The midges were first reared by the late Dr M. T. Thompson of Clark University, Worcester, Mass., from an oval stem gall on boneset, Eupatorium perfoliatum. This gall is rather common at Springfield, Mass., at Nassau, N. Y., and has been observed in the vicinity of Buffalo as well as in other sections of the State. It is fairly common in Ontario, Canada. The larvae winter in the gall, the adults appearing probably in May. Several parasites were obtained, namely, Eupelmus dryorhizoxeni Ashm., Platygaster obscuripennis Ashm., Polygnotus sp. and Torymus sp.

Gall. This species was reared from an oval or fusiform stem gall ranging in length from 1 to 1.5 cm, and with a diameter of about .5 cm. It is green and hairy like the stem. The long, central chamber within is inhabited by a larva. For a colored illustration, see Museum Bulletin 175, plate 4, figure 19.

Male. Length 2 mm. Antennae dark brown; 18 segments, the fifth with a length less than its diameter; terminal segment slightly produced, broadly rounded. Palpi; the first segment short, the second broadly oval, the third a little longer, more slender than the preceding and swollen distally, the fourth as long and more slender than the third. Mesonotum dark brown, the submedian lines thickly yellow haired. Scutellum yellowish brown, sparsely setose apically, postscutellum fuscous yellowish. Abdomen dark brown, the segments narrowly margined posteriorly with silvery, the eighth mostly pale yellowish. Gentalia fuscous. Wings hyaline, costa dark brown, the third vein uniting with costa at the basal half. Halteres yellowish basally, slightly fuscous apically. Legs dark brown, the anterior and mid tarsi narrowly, and the posterior tarsi broadly banded with cinereous; claws long, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment greatly swollen basally; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate long, narrow, narrowly rounded. Harpes long, tapering.

Female. Length 2 mm. Antennae dark brown; 24 segments, the fifth with a length less than its diameter. Palpi; the fourth segment nearly twice the length of the third. Mesonotum dark brown or black. Scutellum dark reddish brown, postscutellum yellowish brown. Abdomen dark brown, the second, third and fourth segments with submedian, lunate, silvery spots posteriorly, the fifth, sixth and seventh segments narrowly margined posteriorly with silvery. Ovipositor one-half the length of the abdomen, the terminal lobes long, slender. Type Cecid. 1101.

Neolasioptera albipes n. sp.

This species was taken at Riverton, N. J., October 1, 1904 by Prof. C. W. Johnson.

Female. Length 2 mm. Antennae dark brown or black, 19 segments; the fifth with a length about three-fourths its diameter; terminal segment produced, broadly rounded distally. Palpi; first segment short, stout, the second broadly oval, the third a little longer, more slender, the fourth nearly twice the length of the third, slender. Mesonotum dark brown, sparsely and uniformly clothed with short, golden yellow setae. Scutellum dark brown with a few yellowish setae apically, postscutellum reddish brown. Abdomen a rich dark brown, the first to fourth abdominal segments brokenly and narrowly margined with pale yellowish scales, the bands broadly interrupted in the middle, narrowly so laterally. The following segments are ornamented with a broad, median, pale yellowish band;

ovipositor orange yellow. Wings hyaline, costa dark brown, the third vein uniting with the margin near the distal third, the discal spot small, white. Halteres yellowish orange, slightly fuscous apically. Coxae and femora mostly pale golden yellow, the tibiae and tarsi a rich brown, except for the snow-white distal portion of the third, the fourth and fifth tarsal segments of the posterior legs; claws stout, the pulvilli as long as the claws. Ovipositor about half the length of the abdomen, the terminal lobes long, narrowly oval. Type Cecid. 804.

Neolasioptera helianthi Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 7, 8 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 288–89 (Choristoneura), p. 332

This species was reared September 3, 1907 from Helianthus strumosus, taken at Highland, N. Y., and supposed to bear only the galls of Asphondylia globulus O. S.

Female. Length 2.75 mm. Antennae dark brown, basally silvery white; 18 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, broadly oval. Palpi; first segment rather stout, with a length more than twice its greatest diameter, the second about as long as the first, much stouter, the third one-fourth longer than the second, much more slender and the fourth one-half longer than the third, more slender; face silvery white. Mesonotum dark brown, mostly denuded, the submedian lines dark. Scutellum ornamented with numerous silvery hairs, postscutellum with silvery hairs laterally. Abdomen black, the segments narrowly margined posteriorly with silvery white, the latter interrupted at the middle, venter silvery white. Wings hyaline, costa dark brown, the third vein uniting with the anterior margin near the distal third. Halteres fuscous, lighter basally. Coxae black with silvery hairs, the anterior and mid femora gray to the apical third, the posterior lighter at the base, all black distally and with the incisures clothed with silvery white scales; tibiae black with the articulations clothed with silvery scales; tarsi black, gray ventrally; claws long, rather stout, strongly curved, the pulvilli as long as the claws. Ovipositor probably nearly as long as the body, terminal lobes long, rather broad, tapering, narrowly rounded. Type Cecid. a1718x.

Neolasioptera flavomaculata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332

This form was taken on a window July 11, 1906 at Albany, N. Y.

Female. Length 1.6 mm. Antennae dark brown, basally pale straw; 18 segments, the fifth with a length a little less than its diameter, terminal segment produced, apparently composed of two closely fused, subacute. Palpi; probably quadriarticulate; face pale yellowish. Mesonotum black, the submedian lines and the lateral and anterior margins rather thickly clothed with yellowish setae. Abdomen black with triangular submedian straw yellow spots on segments one to six; laterally the abdomen has the straw yellow line slightly interrupted at each segment; below this there is a dark line separating it from the white ventral surface. Wings hyaline, costa black, the third vein uniting with the costa near the basal half. Halteres yellowish at the base, fuscous apically. Legs black, the anterior femora with a black line above, pale beneath, the anterior and mid tarsi narrowly annulate with whitish, the posterior tarsi broadly so, the fourth and fifth segments entirely white; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor about two-thirds the length of the abdomen; terminal lobes rather long, slender, narrowly rounded. Type Cecid. 545.

Neolasioptera tiliaginea Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332

This species was taken on basswood, Tilia americana, at Nassau, N. Y., June 14, 1907 and may be the species responsible for the destruction of many buds on this tree.

Male. Length 1.25 mm. Antennae dark brown; 16 segments, the fifth with a length one-fourth greater than its diameter; terminal segment suboval. Palpi; the first segment short, stout, subquadrate, the second rather broadly oval, the third a little longer, more slender, the fourth one-half longer than the third, more slender. Face pale yellowish brown. Mesonotum dark brown, a conspicuous patch of yellowish white hairs on a broadly crescentic area posteriorly. Scutellum dark brown, pale yellowish apically, postscutellum dark brown. Abdomen a nearly uniform dark brown with the entire lateral portions of the first segment, and lateral subquadrate spots on the second, and nearly the entire anterior portion of the third and fourth segments, yellowish white; the following segments narrowly ringed with pale orange, the color of the incisures. Wings (pl. 5, fig. 7) hyaline, costa dark brown with a whitish stigmatal spot at the basal third, the third vein uniting with the margin at the basal third. Halteres pale yellowish orange. Legs pale yellowish orange basally, dark brown apically, terminal segments slightly darker; claws rather long, slender, evenly curved. Genitalia; basal clasp segment long, slender; terminal clasp segment swollen at the base. Dorsal plate broad, broadly and triangularly incised; ventral plate narrow, narrowly rounded. Harpes stout, irregularly triangular, slightly prolonged. Type Cecid. 283.

Neolasioptera hamata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 155 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 332

The midges were reared the last of April and in May 1907 from an oval stem gall on an unknown weed taken at Albany, N. Y. The larvae winter in the gall.

Gall. An oval, polythalamous stem enlargement some 2 cm in length and .5 cm in diameter. The gall closely resembles that of Lasioptera desmodii Felt. The larvae tunnel the cork-like tissues.

Larva. Length 2.5 mm, rather stout, pale orange; head small; antennae uniarticulate, tapering; breastbone expanded apically, bidentate and with a small median tooth, subobsolete basally; skin nearly smooth; posterior extremity broadly rounded.

Male. Length 3 mm. Antennae dark brown; 18 segments, the fifth with a length slightly greater than its diameter; terminal segment short, broadly oval. Palpi; the first segment subquadrate, expanding distally, the second stout, broadly oval, the third a little longer, more slender, the fourth more than twice the length of the preceding, slender, tapering; face fuscous with a few whitish scales. Head posteriorly rather thickly clothed with pale yellowish scales. Mesonotum dark brown, sparsely margined laterally and anteriorly with yellowish hairs, submedian lines rather thickly clothed with the same. Scutellum dark brown with a few whitish scales, postscutellum dark brown. Abdomen dark brown or black with submedian rows of conspicuous lunate, silvery spots, a pair on the posterior margin of each segment; genitalia fuscous yellowish, venter suffused with silvery scales. Wings hyaline, costa dark brown, the third vein uniting with the margin at the distal third. Halteres a pale yellowish. Legs a variable brown, the tarsi dark brown; claws long, stout, strongly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment long, rather slender; terminal clasp segment somewhat swollen at the base; dorsal plate broad, broadly and triangularly incised; ventral plate long, narrow, narrowly rounded. Harpes long, narrow, tapering.

Female. Length 2.75 mm. Antennae dark brown; 20-22 segments, the fifth with a length about equal to its diameter; terminal segment slightly prolonged, broadly rounded distally. Palpi; the first segment short, stout, greatly swollen distally, the second stouter, subrectangular, the third a little longer, more slender, the fourth fully one-half longer than the third, more slender; face with patches of silvery white scales, mouth-parts fuscous yellowish. Mesonotum dark brown, variably marked laterally and anteriorly with yellowish or whitish scales, the submedian lines thickly clothed with yellowish setae. Scutellum reddish brown with a few yellowish setae apically; ovipositor pale yellowish; venter suffused with silvery scales. Wings hyaline, costa dark brown, discal spot yellowish, the yellowish brown third vein joining the costa near the basal half. Halteres a pale yellowish. Legs a variable brown, the tarsi dark brown, the pulvilli about as long as the claws. Ovipositor about as long as the abdomen, with oval patches of stout, spear-shaped spines; terminal lobe long, slender, narrowly rounded, with a group of heavy, recurved hooks. Type Cecid. a1458.

Neolasioptera coloradensis n. sp.

This species was taken by Prof. T. D. A. Cockerell at Boulder, Col., May 12, 1909.

Female. Length 2 mm. Antennae dark brown; 25 segments, the fifth with a length equal to its diameter, the terminal segment with a length twice its diameter and evidently composed of two closely fused segments. Palpi; first segment stout, incrassate, the second as long as the first, narrowly oval, the third and fourth subequal, each about one-half longer than the third and slender. Mesonotum dull dark brown, the submedian lines sparsely haired. Scutellum dark brown, sparsely clothed with silvery setae apically, postscutellum dark brown. Abdomen dark brown, segments one to six with small, submedian, silvery spots posteriorly; venter fuscous; ovipositor pale orange. Wings hyaline, costa dark brown, subcosta uniting therewith before the basal third, the third vein before the basal half, the discal spot long, whitish. Halteres yellowish basally, whitish apically. Coxae fuscous; femora, tibiae and tarsi mostly dark brown, the latter almost black, claws moderately stout, long, the pulvilli shorter than the claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobe extremely slender, with a length about six times its width. Type Cecid. 1350.

Neolasioptera albolineata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332

This species was taken on the office window at Albany, N. Y., August 5, 1907, presumably having been reared from some material.

Female. Length 2 mm. Antennae dark brown, the basal segments reddish yellow; 17 segments, the fifth with a length about three-fourths its diameter; terminal segment greatly swollen, broadly oval and tapering slightly to a narrowly rounded apex. Palpi; the first segment, short, stout, expanded distally, the second long, narrowly oval, the third one-half longer, more slender, the fourth one-half longer than the third and more slender; face with a patch of silvery scales. Mesonotum shining black, variably margined laterally with silvery white scales, the submedian lines broadly clothed posteriorly with silvery white scales. Scutellum black, with numerous silvery scales apically, postscutellum fuscous. Abdomen black, the segments posteriorly with submedian, lunate, silvery white spots and laterally with subquadrate, silvery white spots, forming an almost unbroken, lateral line; ovipositor pale salmon; venter thickly clothed with silvery white scales, except for the narrow, sublateral black lines. Wings hyaline, costa dark brown, the third vein uniting with the anterior margin at the basal fourth; halteres yellowish basally, reddish brown apically. Legs mostly a uniform dark brown. The two distal segments of the posterior tarsi silvery white; claws long, stout, evenly curved, the pulvilli as long as the claws. Ovipositor nearly as long as the abdomen, the terminal lobes narrowly oval. Type Cecid. 1234.

Neolasioptera albitarsis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 153-54 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 333
1910 ———— Econ. Ent. Jour., 3:350

This species was reared May 18 and 21, 1907 from galls on Diplopappus cornifolius, taken at Nassau, N. Y. This gall resembles rather closely that made by Lasioptera desmodii Felt, and is quite common in places where its food plant occurs. The larvae winter in the galls, adults appearing the latter part of May.

Gall. The gall produced by this species is a greenish brown, more or less fusiform, irregular swelling on the stem, at or near the base of the leaf. It is about 1 cm long by .6 cm in diameter, and occasionally two are fused to form an irregular swelling some 2.5 cm long.

Male. Length 2.5 mm. Antennae dark brown, yellowish basally; 20 segments, the fifth with a length hardly equal to its diameter; terminal segment slightly produced, broadly oval. Palpi; the first segment irregularly subquadrate, somewhat dilated apically, the second stout, subrectangular, the third one-half longer and more slender than the second, the fourth over twice the length of the third, more slender. Mesonotum a shining dark brown. Scutellum and postscutellum dark brown. Abdomen evidently badly denuded, a deep salmon, with numerous dark brown or black scales dorsally; probably the segments are margined posteriorly with silvery white, genitalia fuscous. Wings hyaline, costa dark brown, the third vein uniting with costa at the basal half. Halteres yellowish transparent, femora and tibiae a variable fuscous yellowish, tarsi dark brown, the segments annulate basally with silvery white. Color characters from a badly rubbed specimen. Claws long, slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout, terminal clasp segment short, greatly swollen basally; dorsal plate broad, broadly and triangularly emarginate; ventral plate shorter, tapering, narrowly rounded, apex setose. Harpes long, stout, tapering, obtuse.

Female. Length 3 mm. Antennae sparsely haired, dark brown, basal segments fuscous yellowish; 24 to 25 segments, the fifth with a length about three-fourths the diameter; terminal segment somewhat produced, broadly rounded apically. Mesonotum dark brown or black, broadly margined laterally and anteriorly with silvery white, the submedian lines rather thickly clothed with yellowish scales. Scutellum dark brown, thickly clothed apically with whitish scales, postscutellum dark brown. Abdomen dark brown or black with submedian rows of lunate, silvery white spots. Ovipositor pale orange, venter mesially suffused with silvery white. Wings hyaline, costa dark brown, the third vein uniting with the margin just before the basal half. Halteres pale orange basally, light yellowish apically. Legs mostly dark brown, the articulations narrowly annulate with silvery white, those on the posterior tarsi broad, the most of the fourth and fifth segments yellowish white. Ovipositor about one-half the length of the abdomen; terminal lobes long, narrowly rounded. Type Cecid. a1477.

Neolasioptera hibisci Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 155–56 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 333

This brightly marked midge was reared April 25, 1907 from slightly enlarged stems of the rose marshmallow, Hibiscus moscheutos, taken on Staten Island, N. Y. The larvae occur singly or in numbers in the pith, and occasionally in the outer portions of the tissues. One stalk may be inhabited by only a few larvae, or may contain 50 to 100 or more.

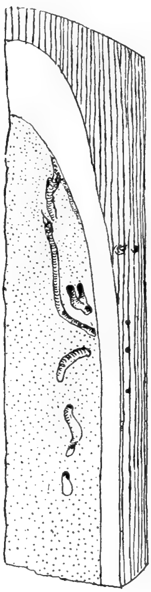

Fig. 35 Neolasioptera hibisci, portion of swollen stem, showing larval galleries and exit holes, enlarged (original)

Gall. Infested stems can usually be discerned by a somewhat abnormal thickening, though occasionally a badly infested stem may be nearly twice the usual size. The female appears to deposit eggs in a small slit in the stem, the larva usually tunneling the pith and frequently excavating a channel just beneath the surface, figure 35.

Larva. Length 4 mm, rather stout, light yellowish. Head small; antennae uniarticulate, slender, tapering; breastbone stout, somewhat expanded apically, bidentate and with a rudimentary median tooth; skin finely shagreened; posterior extremity broadly rounded.

Male. Length 1.75 mm. Antennae dark brown; 16 segments, the fifth with a length a little less than its diameter; terminal segment slightly produced, subglobose. Palpi; the first and second segments irregularly subquadrate, slightly swollen distally, the third a little longer, narrowly rounded, the fourth twice the length of the preceding, more slender; face fuscous with a patch of silvery scales. Mesonotum dark brown, narrowly and irregularly margined laterally with golden yellow scales, the submedian lines rather thickly clothed with golden yellow hairs. Scutellum dark brown, scatteringly ornamented with silvery white scales and with a few long setae apically, postscutellum dark brown. Abdomen a dark brown or black with submedian rows of somewhat irregular, sublunate, silvery white spots, a pair on the posterior margin of segments one to six or seven, those on the distal segments smaller and less distinct. Wings hyaline, costa dark brown, the third vein uniting with the margin at the basal third. Halteres pale salmon basally, whitish transparent apically. Legs mostly dark brown, the articulations annulate with white, the bands broader on the posterior tarsi; claws long, slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment somewhat swollen at the base; dorsal plate broad, deeply and triangularly emarginate; ventral plate long, slender, narrowly truncate or slightly emarginate. Harpes long, stout.

Female. Length 2.75 mm. Antennae dark brown; basal segments fuscous yellowish; 23 segments, the fifth with a length about three-fourths its diameter; terminal segment somewhat produced, obtusely rounded. Palpi; first segment rather long, narrowly oval, swollen distally, second a little shorter, stouter, the third a little longer than the second, more slender, the fourth nearly twice the length of the third, more slender. Mesonotum a rich dark brown, the anterior lateral angles narrowly margined with silvery white, the submedian lines sparsely clothed with light golden yellow scales and with broad, submedian golden yellow vittae anteriorly. Scutellum dark brown or black, rather thickly clothed with silvery white scales, postscutellum dark brown. Ovipositor pale yellowish, the venter suffused with silvery white scales, except rather indistinct yellowish submedian lines. The white scales on the under surface are prolonged laterally along the margins of the segments and form a series of triangular marks. Wings (pl. 5, fig. 5) hyaline, costa dark brown, the third vein uniting with the margin just before the middle. Ovipositor about as long as the abdomen, the terminal lobes long, broad, narrowly rounded. Type Cecid. a1410.

Neolasioptera ramuscula Beutm.

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 23, p. 392 (Cecidomyia)

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 333

1910 ———— Econ. Ent. Jour., 3:349

1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul., 2:53–54 (Cecidomyia strobiligemma)

1913 **Beutenmueller, William.** Can. Ent., 45:416 (Cecidomyia, in part)

This species is a rather common inhabitant of fusiform stem galls on several species of aster. It was originally reared by Professor Beutenmueller from material taken in North Carolina. It has been reared repeatedly from galls collected in the Hudson valley, while the late Dr M. T. Thompson of Clark University, Worcester, Mass., also reared this species. The gall of apparently this species has been recorded by the late Dr William Brodie[1] under the name of Diplosis punicei on Aster puniceus. It is probably widely distributed. The larvae winter in the galls, adults appearing about

[1] Can. Ent., 41:150–51, 1909.

the middle of May. Eurytoma and Polygnotus species were reared from this gall.

Gall. The more usual form of gall is fusiform, about 1 cm long and about .4 cm in diameter. It occurs rather commonly on the smaller branches of several species of aster. The galls are monothalamous with a narrow central cavity extending the greater portion of their length. They are usually single though occasionally two may be confluent, or there may be two on the same branch, an inch or more apart.

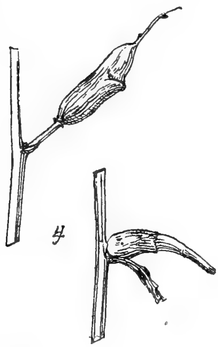

Fig. 36 Neolasioptera ramuscula, two galls on smaller twigs, natural size (original)

Larva. Length 4 mm, rather stout, yellowish. Head small; antennae uniarticulate, slender, breastbone stout, slightly expanded apically, bidentate; skin nearly smooth; posterior extremity broadly rounded.

Male. Length 2.75 mm. Antennae, dark brown, basally yellowish, ventrally with silvery scales; 19 segments, the fifth with a length slightly greater than its diameter; terminal segment slightly prolonged, narrowly oval. Palpi fuscous, the first segment very short, broad, the second twice its length, broadly oval, the third a little longer than the second, much more slender, the fourth twice the length of the third and more slender. Face with a patch of silvery scales. Mesonotum dark brown, rather broadly and irregularly margined laterally and anteriorly with silvery white scales, a cluster of yellowish scales at the base of the wings, submedian lines sparsely clothed with short, yellowish scales. Scutellum dark brown, with sparse silvery scales and with a few yellowish setae apically, postscutellum dark brown. Abdomen dark brown with submedian rows of small, silvery spots on segments one to seven, incisures deep red; venter black with a broad median white stripe; genitalia fuscous. Wings hyaline, costa dark brown, the third vein uniting with the margin at the basal half. Halteres mostly pale yellowish. Legs mostly dark brown, the extremities of femora and tibiae narrowly annulate with yellowish white, the tarsal segments narrowly annulate basally with yellowish white, except the three distal ones on the posterior legs, which are broadly annulate basally, the second, third and fourth also narrowly annulate distally; claws long, slender, strongly curved, a little longer than the pulvilli. Genitalia; basal clasp segment long, slender, terminal clasp segment swollen basally; dorsal plate broad, broadly and triangularly emarginate; ventral plate short, broad, angularly rounded. Harpes short, stout, obtuse.

Female. Length 2.75 mm. Antennae dark brown; basally fuscous yellowish; 21 segments, the first broadly obconic, the second slightly flattened, subglobose, the third and fourth closely fused, the fifth with a length scarcely equal its diameter; terminal segment somewhat produced, broadly oval. Abdomen; seventh segment narrowly margined posteriorly with silvery white, the eighth segment and ovipositor fuscous yellowish; venter black with a broad median white stripe. Legs dark brown, femora, tibiae and the tarsal segments narrowly annulate with silvery, except the third to the fifth posterior tarsal segments, which are broadly annulate basally, the second, third and fourth also narrowly annulate distally; the pulvilli as long as the claws. Ovipositor probably one-half the length of the body, the terminal lobes, short, broadly oval. Cecid. a1361.

Neolasioptera erigerontis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 163 (Choristoneura)
1907 **Cook, M. T.** Dav. Acad. Nat. Sci. Proc., separate, p. 10 (Lasioptera)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332
1913 **Beutenmueller, William.** Can. Ent., 45:414 (L. podagrae)

This species was reared in some numbers from a fusiform gall on horseweed, Erigeron canadensis. It is hardly the same as the species described by Brodie[1] as Cecidomyia eregeroni, since he clearly states that the larvae forsake the galls, a habit we have never observed in the Lasiopterariae. The larvae of this insect winter in the gall, the adults appearing the latter part of May. This species is presumably widely distributed, as it undoubtedly occurs in Ontario, various portions of New York State, and specimens were found in the collections of the late C. V. Riley. Adults in the National Museum were bred May 1, 1895 from galls taken at Washington, D. C., and July 8, 1893 from material taken in Missouri. This species was also reared by Mr Beutenmueller, the host being erroneously identified as aster and the insect described by him as L. podagrae. Polygnotus angulatus Ashm., Torymus ostensackenii D. T. and a Eurytoma species were reared from this gall or that of the associated Asteromyia modesta Felt.

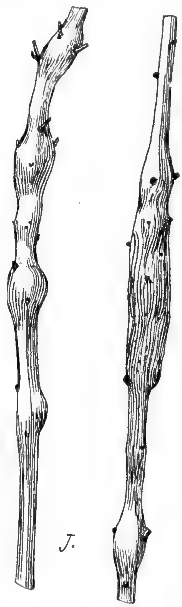

Fig. 37 Neolasioptera erigerontis, two infested stems, natural size (original)

Gall. The gall produced by this insect is simply a slight enlargement on the stem, a rather evident fusiform enlargement near the base of the branches,

[1] Brodie, William. Biological Review of Ontario, 1:13–15 (Gall described and noticed, as Diplosis). 1894.

or it may possibly produce the small arrested budlike galls along the side of the stem.

Larva. Length 2 mm, slender, whitish. Head small, broad; antennae uniarticulate; stout; breastbone greatly dilated apically, quadridentate, the submedian teeth slightly smaller, distal portion subobsolete; skin coarsely shagreened; posterior extremity broadly rounded, minutely papillate. Probably a Neolasioptera though the quadridentate breastbone suggests Asphondylia.

Male. Length 2.25 mm. Antennae dark brown, yellowish basally; 14 segments, the fifth with a length a little less than its diameter; terminal segment slightly reduced, obovate. Palpi; the first segment very short, stout, irregularly subquadrate, the second narrowly oval, more slender, the third two and one-half times as long as the second, slender, tapering distally to an obtuse apex; face with a conspicuous patch of silvery white scales. Mesonotum dark brown, the submedian lines sparsely clothed with yellowish setae. Scutellum dark reddish brown, postscutellum dark brown. Abdomen a dark brown with rather large, submedian lunate white spots on the posterior margin of each segment, incisures pale salmon; genitalia fuscous; venter suffused with silvery scales. Wings hyaline, costa dark brown, discal spot silvery, the third vein uniting with the anterior margin just before the basal half; halteres pale salmon. Legs mostly a variable dark brown, the basal two-thirds of femora yellowish, tibiae and the first and last tarsal segments banded basally, and the others narrowly annulate basally and apically with silvery white, the annulations broader on the posterior legs; claws long, slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment swollen at the base; dorsal plate long, slender, deeply and narrowly incised; ventral plate long, slender, narrowly rounded. Harpes short, stout, tapering, broadly obtuse.

Female. Length 2.5 mm. Antennae dark brown, basally yellowish, silvery white scales ventrally; 16 segments, the fifth with a length about three-fourths its diameter; terminal segment produced, apparently composed of two fused, slightly constricted near the middle, broadly rounded apically. Palpi; the first segment irregularly subtriangular, greatly expanded distally, the second a little longer, stout, slightly tapering apically, the third longer and more slender than the second, the fourth one-half longer and more slender than the third; face with a conspicuous patch of silvery white scales, eyes margined posteriorly with silvery white. Mesonotum dark brown, variably margined laterally and anteriorly with silvery white, the submedian lines rather thickly clothed with yellowish hairs. Scutellum and postscutellum dark brown. Abdomen a dark brown with submedian, lunate, silvery spots on the posterior margins of the segments, ovipositor light fuscous yellowish; venter suffused with silvery scales. Wings hyaline, costa dark brown, the small discal spot silvery white, the third vein uniting with the margin just before the basal half; halteres pale salmon. Legs mostly black, the basal half of femora yellowish;

tibiae and the first and last tarsal segments banded basally, and the others narrowly annulate basally and apically with silvery white, the annulations broader on the posterior legs; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor about two-thirds the length of the abdomen; terminal lobes long, slender, narrowly rounded. Type Cecid. a1427a.

Neolasioptera ambrosiae Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:288

This form was reared by Mr C. R. Crosby in January 1909 from stems of the giant ragweed, Ambrosia trifida, taken at Ithaca, N. Y., in midwinter. There was no evidence of a gall. The larva has been observed in giant ragweed in the vicinity of Albany but no adults have been reared.

Male. Length 2 mm. Antennae dark brown; 15 segments, the fifth with a length one-fourth greater than its diameter, the terminal segment slightly reduced, narrowly rounded apically. Palpi; the first segment short, irregular, the second narrowly oval, the third a little longer, more slender, the fourth fully one-half longer than the third. Mesonotum reddish brown, the submedian lines sparsely haired. Scutellum dark brown, postscutellum reddish brown. Abdomen dark brown, segments one to eight with small, white, submedian spots; venter suffused with silvery scales. Wings hyaline, costa dark brown, the third vein uniting therewith a little before the basal half, the discal spot whitish. Halteres pale orange basally, yellowish apically. Legs mostly dark brown, the tarsal segments banded basally with white, the posterior tarsi broadly so; claws long, rather stout, the pulvilli as long as the claws. Genitalia fuscous, basal clasp segment slender, terminal clasp segment slightly swollen basally; dorsal plate short, deeply and broadly incised, ventral plate long, slender, narrowly rounded distally. Harpes slender, irregular apically.

Female. Length 2.25 mm. Antennae with 17 to 18 segments, otherwise as in the opposite sex. Palpi; the first segment short, irregular, the second narrowly oval, with a length over three times its diameter, the third as long, more slender, the fourth one-half longer, somewhat more slender. Color characters practically as in the opposite sex, except that the banding of the posterior tarsi may be a trifle broader, the most of the fifth segment being yellowish in a few cases. Ovipositor pale orange, unusually slender, with a length two-thirds that of the abdomen; terminal lobes with a length fully three times the diameter. Type Cecid. a1926.

Neolasioptera mimuli Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 332

This form, loaned for study by the United States National Museum, was reared November 10, 1885 from twigs of Mimulus glutinosus taken by A. Koebele at Alameda, Cal. Bracon cecidomyiae Ashm. (Insect Life, 2:348) has been reared from this gall.

Gall. A simple, more or less elongate swelling at the tips of branches containing a long cell inhabited by one to four orange colored larva. (Pergande, Bureau Entomology.)

Female. Length 1.25 mm. Antennae dark brown; 18 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, broadly oval. Palpi; the first segment short, stout, subquadrate, the second stout, with a length about twice its diameter, the third as long as the second, much more slender; the fourth one-third longer and more slender than the third. Mesonotum shining dark brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum a little darker. Abdomen dark brown, the first to fifth or sixth segments with submedian, lunate, silvery white spots on the posterior margin; ovipositor pale yellowish, venter suffused with silvery white scales. Wings hyaline, costa dark brown, the third vein uniting with the anterior margin at the basal half. Halteres yellowish transparent, slightly fuscous apically. Legs a nearly uniform dark brown, the tarsal segments narrowly banded basally with silvery white markings, those on the posterior legs broader; claws rather long, stout, strongly curved, the pulvilli hardly as long as the claws. Ovipositor scarcely half the length of the abdomen, terminal lobes long, narrowly oval. Type Cecid. 1052.

Neolasioptera eupatorii Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 154 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 333

The midge was reared May 2, 1907 from oval or subglobular swellings on white snake root, Eupatorium urticaefolium, taken on Staten Island, N. Y.

Gall. The gall is about 1.5 cm long by 1 cm in diameter, and usually occurs near the upper part of the stem. The walls are thin and the interior is thickly packed with larvae in closely webbed cocoons.

Larva. Length 3 mm, rather stout, pale orange. Head rather broad; antennae uniarticulate, rather stout; breastbone slender, slightly expanded apically, bidentate, with a rudimentary median tooth; skin finely shagreened; posterior extremity broadly rounded.

Male. Length 1.75 mm. Antennae dark brown, basally with silvery scales; 17 segments, the fifth with a length a little greater than its diameter; terminal segment much reduced, subglobose. Palpi; the first segment short, irregularly subquadrate, expanded distally, the second short, stout, suboval, the third a little longer, broadly rounded, the fourth one-fourth longer than the third, subfusiform, acute distally; face sparsely clothed with silvery scales.

Mesonotum dark brown or black, the submedian lines sparsely clothed with fine hairs. Scutellum dark brown, postscutellum yellowish or fuscous brown. Abdomen dark brown with submedian rows of small, lunate, silvery white spots, the markings being on the posterior margin of the first to sixth segments, the posterior segments fuscous yellowish, the venter suffused with silvery scales. Wings hyaline, costa dark brown, discal spot white, the third vein uniting with the margin near the basal half. Halteres pale yellowish. Legs dark brown, the first tarsal segment and narrow basal annulations on the second to fifth, white; claws rather long, stout, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long; terminal clasp segment strongly swollen basally; dorsal plate broad, tapering, broadly and triangularly emarginate; ventral plate narrow, tapering, narrowly rounded. Harpes long, narrow, tapering, subacute, dentate.

Female. Length 2.5 mm. Antennae dark brown, basally silvery white; 23 segments, the fifth with a length a little less than its diameter; terminal segment somewhat produced, broadly obovate, color as in the opposite sex. Ovipositor about two-thirds the length of the abdomen, terminal lobe narrowly oval. Type Cecid. a1413.

Neolasioptera menthae Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:288

This species was reared May 13 and 19, 1908, by Mr L. H. Weld from a polythalamous gall taken on a mint stem in the vicinity of Chicago.

Gall. The gall is from 6 to 12 mm long, somewhat oblong, polythalamous and pithy and contains orange colored larvae some 3 mm long.

Male. Length 1.5 mm. Antennae dark brown, yellowish basally, 17 segments, the fifth with a length nearly equal its diameter; terminal segment slightly reduced, broadly oval. Palpi; the first segment short, stout, irregular, the second narrowly oval, the third a little longer, more slender, the fourth one-half longer than the third, slender. Mesonotum dull brownish black, the submedian lines sparsely haired. Scutellum dark brown, sparsely clothed apically with silvery white scales, postscutellum dark reddish brown. Abdomen dark brown, the segments broadly margined posteriorly with silvery white scales, the markings on the second to seventh segments broadly interrupted mesially; venter with a broad, median, silvery stripe, the segments laterally margined posteriorly with silvery. Wings hyaline, costa dark brown, the third vein uniting with costa near the basal third, the discal spot yellowish. Halteres pale yellowish. Coxae and femora basally mostly yellowish, the distal portion of femora, tibiae and tarsi dark brown, the articulations narrowly white-banded, those of the posterior legs broadly so; the basal half of the second to fifth tarsal segments of the latter yellowish white; claws long, stout, the pulvilli as long as the claws.

Genitalia; basal clasp segment stout; terminal clasp segment swollen at the base, long; dorsal plate broad, deeply and narrowly incised, ventral plate tapering to a narrowly rounded apex. Harpes stout, irregularly tuberculate.

Female. Length 2.75 mm. Antennae black, fuscous yellowish basally; 25 segments, the fifth with a length about three-fourths its diameter; terminal segment reduced, narrowly oval. Palpi; the fourth segment nearly twice the length of the third, slender; face thickly clothed with white scales. Mesonotum shining black, bordered laterally and anteriorly with silvery white scales, the approximate submedian lines so thickly clothed with golden haired scales as to appear like a broad, median stripe. Scutellum dark brown with a few whitish scales apically, postscutellum dark brown. Abdomen dark brown with submedian silvery spots and lateral subtriangular marks on segments one to six, those on the first segment narrowly united, the seventh segment mostly fuscous orange with inconspicuous white markings posteriorly; venter suffused with white scales; ovipositor fuscous yellowish. Coxae fuscous yellowish, femora yellowish basally, fuscous apically, the tibiae and tarsi dark brown, the segments of the first and second pair of legs narrowly annulate with white, those of the posterior legs broadly so, the basal half of the third, the fourth and fifth being yellowish white. Ovipositor about half the length of the abdomen, the terminal lobe narrowly oval. Type Cecid. a1823.

Neolasioptera squamosa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 333

The midges, loaned for study by the United States National Museum were reared from grass (presumably a gall) August 11, 1891, taken at Cadet, Mo.

Male. Length 1.25 mm. Antennae light brown; 12 segments, the fifth with a length a little greater than its diameter; terminal segment produced, tapering, narrowly oval, slightly fused with the preceding segment. Palpi; the first segment short, stout, narrowly oval, the second a little longer, stouter, the third slender and with a length more than twice the second; eyes large, black, the occiput thickly clothed with silvery white scales. Mesonotum reddish brown, the submedian lines very thickly clothed with divergent, yellowish white scales. Scutellum and postscutellum pale yellowish. Abdomen apparently a yellowish brown, there being rudiments of submedian silvery markings, possibly an interrupted line of the same. Genitalia pale yellowish. Wings hyaline, rather long, narrow, costa dark brown, the third vein uniting with costa near the basal third. Halteres pale yellowish. Coxae and the femora mostly pale yellowish, the latter with a narrow, dark brown line dorsally; tibiae and tarsi dark brown with the first tarsal segment and the extremities of the others, except the distal one of the fifth, rather broadly banded with yellowish white; claws rather long, slender, evenly curved, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment long; terminal clasp segment with the basal third somewhat swollen; dorsal plate long, broad, deeply and narrowly incised; ventral plate rather long, slender, narrowly rounded. Harpes short, stout, tapering. Type Cecid. 909.

Neolasioptera flavoventris Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 333

This form appears to have a marked preference for pine, as three individuals were captured at Karner, N. Y., flying about hard pine, Pinus rigida, in July 1906.

Male. Length 1 mm. Antennae dark brown, fuscous yellowish basally; 16 segments, the fifth with a length a little greater than its diameter; terminal segment slightly prolonged, narrowly rounded distally. Palpi; the first segment short, subquadrate, the second about twice as long, a little stouter, the third a little longer, more slender, the fourth one-half longer than the third, more slender. Face fuscous yellowish. Mesonotum dark brown with distinct, narrow submedian lines, thickly ornamented with pale hairs and with a sublateral yellowish patch on the anterior angle. Scutellum dark reddish, postscutellum dark brown. Abdomen reddish brown, sparsely clothed with yellowish setae, ventrally pale yellowish. Wings hyaline, costa light brown, the third vein uniting with costa at the basal half. Halteres yellowish basally, whitish apically. Coxae dark brown, posterior and mid femora and tibiae yellowish brown, annulate with fuscous distally, other portions of legs nearly uniform dark brown; claws rather long, stout, uniformly curved. Genitalia; basal clasp segment long, terminal clasp segment short, swollen basally. Dorsal plate broad, long, deeply and narrowly incised, ventral plate long, narrow, broadly rounded. Harpes broad at base, obtuse, dentate. Type Cecid. 478.

ASTEROMYIA Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 328 (Baldratia Felt, not Kieffer)

1909 ———— Ent. Soc. Ont., 39th Rep't, p. 44 (Baldratia Felt, not Kieffer)

1909 ———— Ottawa Nat., 22:248 (Baldratia Felt, not Kieffer)

1909 ———— Econ. Ent. Jour., 2:286–87 (Baldratia Felt, not Kieffer)

1910 ———— Econ. Ent. Jour., 3:348 (genus erected)

1911 ———— N. Y. Ent. Soc. Jour., 19:42

1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 27

This new genus was erected for certain species previously supposed to be referable to Baldratia Kieff. A study of the types of both Baldratia and Stefaniella show that our American forms can not be referred to either.

Asteromyia is closely related to Lasioptera, having the alar and antennal characters of this genus, though it is easily distinguished therefrom by the uniarticulate or biarticulate palpi. The fused third and fourth antennal segments, the invariably unidentate claws and the well developed pulvilli prevent the reference of these forms to either Baldratia or Stefaniella. Furthermore, numerous rearings in this group have shown that the species breed almost exclusively in leaf tissues and generally in the peculiar, apparently fungous affected spots on the leaves of aster and goldenrod. Type L a s i o p t e r a c a r b o n i f e r a Felt.

Key to species

a Tarsi distinctly white or yellow-banded

b All the tarsal segments with bands basally

c Tarsal bands yellowish white, the fifth tarsal segment of the posterior legs yellowish; male and female with 16 antennal segments; palpi biarticulate, the third vein uniting with costa near the basal half. Reared from oval, black blister galls on Solidago graminifolia......................c a r b o n i f e r a Felt, C. a1354

cc Tarsal bands white; 15 antennal segments; palpi biarticulate; the third vein uniting with costa near the distal third. Reared from oval, black thickenings on the flower stems of Gutierrezia sarothrae g u t i e r r e z i a e Felt, C. 1623

bb Posterior tarsi only narrowly annulate basally with whitish

c Female with 22 antennal segments; palpi probably biarticulate. Reared from a rosy blister gall on Solidago rugosa............ r o s e a Felt C. a1474

aa Tarsi unicolorous or nearly so

b Abdomen conspicuously yellowish or orange in part at least

c Abdomen light fuscous yellowish; antennae with 13 segments; palpi uniarticulate. Reared from Solidago.................... s o c i a l i s Felt, C. a1568 1

cc Abdomen with the basal segment fuscous yellowish, male with 13–14 antennal segments; terminal segment compound, composed of two closely fused; palpi uniarticulate. Reared from Erigeron.... m o d e s t a Felt, C. 1427, a1427x, a1666, a1666a

ccc Abdomen with the basal four segments fuscous, the distal segments yellowish brown; antennal segments, male, 13; female, 18; palpi uniarticulate. Reared from greenish or blackish blister galls on Grindelia......................g r i n d e l i a e Felt, C. a2319

cccc Abdomen mostly deep orange, segments one to five sparsely clothed with dark brown scales and narrowly margined with a few white scales; antennal segments, male, 14; the terminal segment simple; palpi uniarticulate. Reared from oval swelling on aster leaves.. v e s i c u l o s a Felt, C. a1884

ccccc Abdomen a nearly uniform yellowish brown; antennal segments of the male, 16 or 17; the fifth with a length three-fourths its diameter; palpi probably uniarticulate. Reared from Chrysothamnus leaflets....................c h r y s o t h a m n i Felt, C. a2055 *bb* Abdomen dark brown or at least mostly so

c Abdomen dorsally with scattering white scales; palpi uniarticulate; antennal segments of male, 14. Reared from yellowish or brown blister galls on aster......p a n i c u l a t a Felt, C. 757, a1167

cc Distal abdominal segments reddish; palpi uniarticulate; male antennae with 12 segments, those of the female with 13 or 14. Reared from an oval, blackish blister gall on Aster undulatus.... r e d u c t a Felt, C. a2056

ccc Abdomen dorsally reddish brown or brownish black. Palpi biarticulate. Male and female antennae with 16 segments, reared from a circular brownish or yellowish blister gall on Aster cordifolius........................s y l v e s t r i s Felt C. a2585

cccc Abdomen a uniform black; palpi triarticulate; antennal segments of the male, 17. Reared possibly from inconspicuous blister gall on hazel leaves....................n i g r i n a Felt, C. a1780b

bbb Abdomen dark brown or black

c Basal abdominal segment yellowish or silvery white

d Second to sixth abdominal segments margined posteriorly; female antennae with 26 segments; palpi uniarticulate; reared from a grape petiole gall.......................... p e t i o l i c o l a Felt, C. 877

dd Third to sixth abdominal segments margined posteriorly; female antennae with 18 segments; palpi uniarticulate....... f l a v o s c u t a Felt, C. 1228

cc Abdominal segments with whitish submedian spots

d Segments 1 to 6 or 7 spotted

e Male antennae with 14 segments, 14th compound; palpi uniarticulate; reared from small pustulate gall on aster stem...................p u s t u l a t a Felt, C. a1520

ee Female antennae with 18 segments; palpi biarticulate; taken on Solidago.................................. a l b o m a c u l a t a Felt, C. 758, a1584, a1598

eee Female antennae with 18 segments, palpi uniarticulate; reared from blister gall on Grindelia.................. g r i n d e l i a e Felt, a2319

eeee Female antennae with 15 segments; palpi uniarticulate; reared from oval swelling on aster leaves.............. v e s i c u l o s a Felt, C. a1884

dd Abdominal segments 2 to 7 spotted; female with 19 antennal segments; palpi biarticulate; reared from a purplish and white blister gall on aster....s q u a r r o s a e Felt, C. a1594

ddd Abdominal segments 1 to 4 spotted

e Male with 18 to 19 antennal segments; palpi biarticulate.. c a n a d e n s i s Felt, C. 74

dddd Abdominal segments 1 and 2 white margined posteriorly, 3 to 5 spotted; female antennae with 17 segments; palpi uniarticulate; reared from a yellowish blister gall on aster...... p a n i c u l a t a Felt, C. a1167 (m a r g i n a t a Felt)

ccc Abdominal segments white margined posteriorly

d Palpi uniarticulate

e Mesonotum black; male antennae with 13 to 14 segments; female with 18; reared from Erigeron leaf............ modesta Felt, C. a1427, a1666

ee Mesonotum dark brown

f Female antennae with 13 segments, abdominal segments sparsely margined with white; reared from an oval, brown, blister gall on aster.............. dumosae Felt, C. a1870a

ff Female antennae with 16 segments

g Posterior wing margin even; reared from yellowish blister gall on aster......................... flavomaculata Felt, C. a1361a

gg Posterior wing margin distinctly emarginate at apex of fifth vein..abnormis Felt, C. 676

dd Palpi biarticulate

e Mesonotum dark brown or black

f Female with 16 antennal segments, the fifth with a length three-fourths that of its diameter; mesonotum black; reared from dark white-ringed blister gall on aster.. asterifoliae Beutm., C. a1550, a1662

ff Female with 19–20 antennal segments, male, 18; the fifth with a length one and one-fourth that of its diameter; mesonotum dark brown or black; reared from fusiform stem gall on grass................ agrostis O. S., C. 770, 1206

fff Female with 18 antennal segments, male, 16; the fifth with a length three-fourths that of its diameter; mesonotum dark brown; reared from brown, yellow-ringed blister gall on aster....................... waldorfi Felt, C. a1824, a1829

ffff Female with 21 antennal segments, the fifth with a length three-fourths that of its diameter; mesonotum dark brown; reared from large, shiny, yellowish blister gall on aster......nitida Felt, C. a1820

eee Mesonotum reddish brown; female antennae with 18 segments; reared from a gray, yellow margined blister gall on Solidago.......flavoanulata Felt, C. a1568k

cccc Abdomen nearly unicolorous dorsally

d Third vein uniting with the anterior margin near the distal third

e Scutellum yellowish brown, anterior tibiae yellowish; female antennae with 18 segments; palpi uniarticulate; reared from Solidago....convoluta Felt, C. a1307

ee Scutellum reddish brown; tibiae dark brown; male antennae with 14 to 15 segments; palpi biarticulate; reared from a yellowish, brown margined blister gall on Solidago.... rubra Felt, C. 650, 1067, a1586 (650b), a1768 (650bx)

dd Third vein uniting with the anterior margin at or near the basal half *e* Tarsi yellowish; male antennae with 14 segments; palpi uniarticulate; reared from whitish blister gall on Aster laevis........laeviana Felt, C. a1287, ?a2440

ee Tarsi black..

f Female antennae with 21 segments; palpi biarticulate; reared from a lunate, yellowish, marginal blister gall on Solidago......flavolunata Felt, C. a1430

ff Female antennae with 16 segments; palpi uniarticulate; reared from blister galls with pinkish aureola on Aster divaricata..divaricata Felt, C. a1787

Asteromyia carbonifera Felt

1862 **Osten Sacken, C. R.** Dipt. N. A. Am. Mon., 1:195 (Cecidomyia)
1874 **Glover, Townend.** MS. Notes From My Journal Dipt., p. 7, pl. 12, fig. 29 (Cecidomyia)
1880 **Riley, C. V.** Am. Ent., 3:278 (Cecidomyia)
1884 **Trelease, William.** Psyche, 4:196, 199, 200 (Cecidomyia)
1892 **Beutenmueller, William.** Am. Mus. Nat. Hist. Bul. 4, p. 271 (Cecidomyia)
1900 **Smith, J. B.** List Ins. N. J., p. 621 (Cecidomyia)
1906 **Felt, E. P.** Inj. & Other Ins. 21st Rep't, p. 116–19 (Lasioptera)
1908 ———— N. Y. State Mus. Bul. 124, p. 328 (Baldratia)
1909 ———— Ottawa Nat., 22:248 (Baldratia)
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 50 (Baldratia)

The oval, blisterlike gall of this species is exceedingly common upon the leaves of the narrow leaved Solidago, Solidago graminifolia, throughout New York State and presumably in most sections of the country where this species or its close allies occur. It appears to have been tacitly assumed that most blister galls occurring on Solidago might be referable to the gall described under this name by Osten Sacken. An examination of his type in the Museum of Comparative Zoology at Cambridge, Mass., shows that our identification is presumably correct. The characteristic blister galls produced by this and allied forms are usually filled, or nearly so, with a black carbonaceous matter, suggesting that the tissues have become badly infected by fungus. This material is almost invariably present in many galls. Professor Peck states that after repeated examinations he has failed to observe any evidence of the characteristic fruiting bodies of fungus, and consequently we must assume this malformation to be independent of fungus infection and produced by the activities of the larva. Doctor Trelease, writing in 1884, states that some of these blister galls occur in the herbaria of mycologists, under the name of Rhytisma solidaginis and R. asteris.

The galls of this species are well developed the latter part of

June, at which time adults may be obtained in considerable numbers. It is presumable that the insects continue to develop upon the young foliage at least, till the latter part of summer.

Gall. The galls of this species are oval, about 4 or 5 mm long, usually somewhat thickened and when well developed dark brown or even jet black. Several dull orange larvae occur in a gall. For a colored illustration, see Museum Bulletin 175, plate 1, figure 16.

Larva. Length 1.25 mm, stout, pale yellowish. Head small, narrowly rounded apically; antennae small, uniarticulate, slightly swollen distally; breastbone stout, bidentate, broadly expanded subapically, slightly so distally; skin smooth; posterior extremity broadly rounded, unarmed.

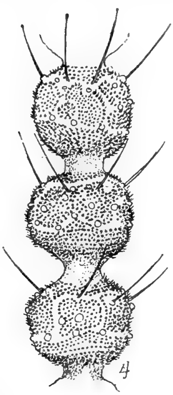

Fig. 38 Asteromyia carbonifera, antennal segments of male, greatly enlarged (author's illustration)

Male. Length 1.5 mm. Antennae light brown; 16 segments, the fifth with a length about three-fourths its diameter; the two distal segments frequently fuse to form a nearly oval, deeply constricted double segment. Palpi; basal segment short, subquadrate, the second three times as long, conical. Mesonotum dark brown or black, narrowly margined anteriorly and laterally with yellowish white, sparsely yellow haired posteriorly. Scutellum thickly clothed with short, yellowish scales; postscutellum dark brown, lighter anteriorly. Abdomen dark brown with the segments sparsely and irregularly margined posteriorly with whitish scales. Wings hyaline, costa dark brown, the third vein uniting with costa at the middle. Halteres light brown. Anterior legs; coxae light yellowish, dark brown ventrally, tibiae and tarsi dark brown, the segments of the latter yellowish white basally; the middle legs similar except for the well defined basal band on the tibiae; the posterior legs with the first tarsal segment white, the second to fourth segments narrowly banded, the fifth yellowish; claws stout, strongly curved. Genitalia; basal clasp segment short, stout, terminal clasp segment long, slender. Dorsal plate short, broad, deeply and rather broadly emarginate; ventral plate narrow, narrowly rounded. Harpes stout at base, tapering, narrow.

Female. Length 1.5 mm. Antennae light brown; 16 segments, the fifth with a length about three-fourths its diameter; terminal segment slightly produced, narrowly oval. Palpi; the basal segment fusiform, the second slightly longer, tapering, subacute. Ovipositor short, the terminal lobes strongly constricted basally, suborbicular. Color and other characteristics as in the opposite sex. Redescribed from the types. Type Cecid. a1354.

Asteromyia gutierreziae Felt

1916 **Felt, E. P.** N. Y. Ent. Soc. Jour., 24:179

This species was reared by Mr P. H. Timberlake in May and June 1914 from black, blisterlike galls on the slender flower stems of Gutierrezia sarothrae collected near Salt Lake City, Utah. The gall is very similar to that of Asteromyia carbonifera Felt and the adult presents many characters in common with this widespread eastern species, from which it is most readily separated by the third vein uniting with costa near the distal third and the moderately stout, obtuse harpes with a conspicuous, eccentric, quadrate, chitinous tooth. The eastern C. carbonifera has the third vein uniting with costa near the basal half, while the harpes taper to a decidedly slender apex bearing a conspicuous quadrate tooth.

Asteromyia rosea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 152–53 (Lasioptera)
1908 ———— N. Y. State Mus. Bul. 124, p. 328 (Baldratia)
1909 ———— Ottawa Nat., 22:248 (Baldratia)

This fly was reared from a presumably typical oval, blister gall on a leaf of Solidago rugosa, collected in October 1906, the adult appearing May 16, 1907. The species probably winters within the gall. Species of Torymus and Polygnotus were reared from this gall.

Gall. Oval, blisterlike and nearly 1 cm in diameter. Earlier, it was presumably brightly ornamented with yellowish and shades of pink or reddish. For a colored illustration, see Museum Bulletin 175, plate 1, figure 11.

Female. Length 2 mm. Antennae dark brown; 22 segments, the fifth with a length slightly greater than its diameter, the two distal segments closely fused, subcylindric, broadly rounded apically; palpi two-segmented; face rather thickly clothed with whitish scales. Mesonotum dark brown, the submedian lines with the lateral and anterior margins rather thickly clothed with golden yellow scales. Scutellum brownish black, yellowish apically, postscutellum dark brown. Abdomen dark brown or black, the segments narrowly margined posteriorly with silvery white; ovipositor pale orange; venter irregularly suffused with silvery white scales, there being suggestions of submedian and sublateral whitish patches on each segment. Wings hyaline, costa dark brown, the third vein uniting with costa at the basal half. Halteres a pale yellowish orange. Legs a nearly uniform dark brown or black, the posterior legs with narrow, white annulations at the base of the first tarsal segment; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes rather short, broadly rounded. Type Cecid. a1474.

Asteromyia socialis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 328 (Baldratia)
1909 ———— Ottawa Nat., *22*:248 (Baldratia)

A male referable to this species was reared at Albany, N. Y., July 26, 1907 from a jar containing Solidago canadensis leaves bearing a number of adherent type of galls inhabited by Asphondylia monacha O. S. and Dasyneura adhesa Felt.

Male. Length 1.25 mm. Antennae light yellowish; 13 segments, the fifth with a length a little greater than its diameter; terminal segment produced, sometimes fused with the preceding, narrowly rounded. Palpi; one small, narrowly oval segment; face light yellowish. Mesonotum light fuscous yellow, the submedian lines sparsely haired. Scutellum and postscutellum light fuscous yellow. Abdomen light fuscous yellow, the distal segments light orange, sparsely and irregularly clothed dorsally with dark brown scales; genitalia yellowish transparent. Wings hyaline, costa dark brown, the third vein uniting with costa at the basal half; halteres yellowish basally, light fuscous apically. Coxae and femora mostly pale yellowish; tibiae and tarsi a variable dark brown; claws long, slender, evenly curved, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment short, broad; terminal clasp segment swollen at the base; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate short, broad, narrowly rounded. Harpes slender, short. Type Cecid. a1568.

Asteromyia modesta Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 163 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 328 (Baldratia)

This species was repeatedly obtained at Albany, N. Y., from small, oval swellings appearing much like arrested buds on the stems of horseweed, Erigeron canadensis. One adult was reared August 6th and the exuviae found protruding from an apparently normal leaflet. Polygnotus angulatus Ashm., Torymus ostensackenii D. T. and Eurytoma species were reared, possibly from this gall midge.

Exuviae. Length 2 mm, rather stout, mostly whitish transparent, the short, stout antennal cases and the ventral plates at their base somewhat fuscous. The antennal cases are rather strongly bidentate at the internal basal angles.

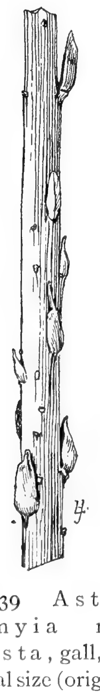

Fig. 39 Asteromyia modesta, gall, natural size (original)

The wing cases extend to the third abdominal segment, the leg cases to the fifth; dorsum of the abdominal segments with a broad middle band of short, stout, chitinous points. Posterior extremity rather broadly rounded and slightly bilobed.

Male. Length 1.25 mm. Antennae pale yellowish orange, yellowish basally; 12 segments, the fifth with a length a little greater than its diameter; terminal segment greatly produced, broadly rounded distally. Palpi composed of one stout, fusiform segment. Face fuscous yellowish. Mesonotum reddish brown, the submedian lines sparsely haired. Scutellum fuscous yellowish, postscutellum darker. Abdomen fuscous, the basal segments dorsally fuscous, yellowish ventrally, the distal segments deep carmine. Genitalia fuscous. Wings hyaline, costa dark brown, the third vein uniting with costa near the basal half. Halteres light fuscous yellowish. Coxae and base of femora pale yellowish, the distal portion of femora, tibiae and tarsi dark brown; claws long, stout, strongly curved, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment short; terminal clasp segment short, greatly swollen basally; dorsal plate short, broad, deeply and broadly incised; ventral plate short, broad, tapering, narrowly rounded. Harpes very broad, tapering, irregularly serrate.

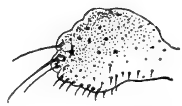

Fig. 40 Asteromyia modesta, palpus of female, enlarged (original)

Female. Length 2 mm. Antennae brown, lighter apically; 18 segments, the fifth with a length hardly equal its diameter; terminal segment produced, broadly rounded distally. Palpus composed of one fusiform segment. Face sparsely clothed with light scales. Mesonotum black, sparsely margined laterally and anteriorly with pale setae. Scutellum lighter than the mesonotum. Abdomen black, the segments narrowly margined with light scales, interrupted mesially. Halteres whitish, fuscous subapically. Legs black, lighter beneath. Ovipositor about one-half the length of the abdomen, the terminal lobes narrowly oval. Type Cecid. a1427.

Asteromyia grindeliae Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:149
1916 ———— N. Y. Ent. Soc. Jour., 24:180

This insect was reared July 27, 1911 by Mr P. H. Timberlake from blister leaf galls on Grindelia robusta collected near Santa Barbara, Cal., and again October 20, 1915 from a greenish or blackish, oval blister gall on G. cuneifolia collected in a salt marsh at Millbrae, Cal.

Asteromyia vesiculosa Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:286 (Baldratia)
1910 ———— Econ. Ent. Jour., 3:349

This species was reared September 24, 1908 from oval swellings on the leaves of an aster collected at Magnolia, Mass., by Mrs H. M. Tower.

Gall. The gall (pl. 4, fig. 2) from which this species was reared is simply an oval, green swelling about 2 mm long and 1.5 mm in diameter on the under side of a blue-flowered aster having rough, cordate leaves. There is no discoloration of the injured tissues.

Male. Length 1.75 mm. Antennae dark brown; 14 segments, the fifth with a length one-half greater than the diameter; face yellowish. Mesonotum shining dark brown, the submedian lines thickly clothed with yellowish scales. Scutellum dark brown with numerous setae apically, postscutellum dark orange. Abdomen mostly deep orange, the dorsal sclerites of segments one to five sparsely clothed with dark brown scales and scatteringly margined with silvery scales, the distal segments nearly naked. Genitalia fuscous yellowish; venter mostly pale yellowish, the distal segments deep orange, all sparsely clothed with silvery scales. Wings hyaline, the third vein uniting with costa at the basal half; halteres and coxae pale yellowish, the femora distally, tibiae and tarsi dark brown. Genitalia; basal clasp segment stout, terminal clasp segment stout at base; dorsal plate long, broad, broadly and triangularly emarginate; ventral plate short, broad, narrowly rounded. Harpes subtriangular, irregular, dentate.

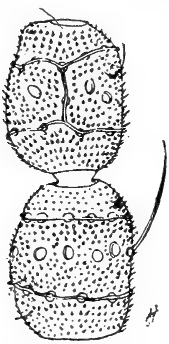

Fig. 41. Asteromyia vesiculosa, fifth and sixth antennal segments of male, enlarged (original)

Female. Length 2 mm. Antennae with 15 segments, the fifth with a length one-third greater than its diameter, the 15th compound. Palpi uniarticulate. Mesonotum dark brown, the submedian lines thickly yellow-haired. Scutellum dark brown with sparse, whitish setae apically, postscutellum dark orange. Abdomen dark brown with small, narrowly lunate, silvery submedian spots, those on the fifth and sixth segments nearly confluent, each segment laterally with a subtriangular, whitish spot near the posterior margin. Ovipositor pale orange; venter suffused with silvery scales. Wings about as in the male, the white discal spot larger. Halteres pale orange basally, fuscous yellowish distally. Coxae fuscous yellowish; femora basally yellowish, the distal portion of femora, tibiae and tarsi dark brown, almost black. Ovipositor short, the lobes broadly oval. Type Cecid. a1884.

Asteromyia chrysothamni n. sp.

This species was reared from a narrow leaflet of Chrysothamnus collected by Mr E. Bethel near Boulder, Col., and transmitted by Prof. T. D. A. Cockerell under date of June 30, 1910. It was also reared in May 1914 by Mr P. H. Timberlake from some swollen leaves of Chrysothamnus graveolens, collected at Salt Lake City, Utah.

Gall. The narrow leaflet is slightly enlarged or swollen, and in the specimen submitted by Professor Cockerell, the interior was lined with a thin, carbonaceous matter similar to that found so abundant in the gall of Asteromyia carbonifera Felt. Length of gall 5 mm, diameter 1 mm.

Male. Length 1.5 mm. Antennae dark brown, 16 or 17 segments, the fifth with a length about equal, sometimes a little greater or a little less than its diameter, the terminal segment with a length over twice its diameter, narrowly rounded and variably fused with the penultimate segment. Palpus consisting of one broadly oval segment, the length being scarcely twice its width. Mesonotum rather dull dark brown, sparsely setose, the submedian lines indistinct. Scutellum dark brown, postscutellum a little darker. Abdomen sparsely haired, a nearly uniform yellowish brown. (Timberlake characterizes the mesonotum as black and the dorsum of the abdomen as black, with submedian white marks on the posterior margin of each segment, except the last two, which latter are white; venter suffused with white). Wings hyaline, the third vein uniting with costa just beyond the basal half; halteres yellowish, (costa and subcosta yellowish, Timberlake). Legs a nearly uniform yellowish brown, the tarsal segments somewhat lighter. (Timberlake characterizes the legs as brownish black, becoming gradually paler or more yellowish distally; coxae, femora, tibiae and first two tarsal segments covered with white scales, especially on the upper side). Claws stout, strongly curved; the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment swollen basally; dorsal plate short, very broadly, roundly and triangularly emarginate; ventral plate short, broadly rounded.

Female. Very similar (Timberlake) in coloration to the male, but the submedian white markings are slightly wider next the black median line. Ovipositor short, stout, with a length about one-third that of the abdomen, the terminal lobes orbicular and sparsely setose. Type Cecid. a2055, Cecid. 1640.

This species approaches Aplonyx with the greatly reduced basal teeth on the tarsal claws and also on account of the short, stout ovipositor.

Asteromyia nigrina Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:481

The fuscous species described earlier was reared in May 1909 from a jar containing inconspicuous blister galls on the leaves of witch-hazel, Hamamelis virginica. The material was collected at Magnolia, Mass., the preceding October by Cora H. Clarke. It is possible that this unique form inhabits these blister galls though the evidence does not warrant a positive statement. The nearly free third and fourth antennal segments indicate a relationship to the European Baldratia and Stefaniella, while the triarticulate palpi show a connection with Lasioptera. Despite these anomalies we have tentatively referred the species to the above named genus.

Gall. This simply shows as a rounded, greenish spot on the upper side of the yellow leaves in the fall. The lower epidermis is slightly raised. The solitary whitish larva in the gall has a length of 2 mm.

Asteromyia reducta Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:481

This species was reared in considerable numbers from an irregularly oval, blackish blister gall with a diameter of about 4 mm on Aster undulatus. The material was collected at Magnolia, Mass., July 26–28, 1910 by Cora H. Clarke.

Gall. Diameter 4 mm, irregularly oval, blackish.

Asteromyia sylvestris Felt

1915 **Felt, E. P.** Can. Ent., 47:228–29

The yellowish or brownish blister leaf galls of this species were very abundant October 22, 1914 on Aster cordifolius at Mount Kisco, N. Y. This species is most easily distinguished from its near allies by the reddish brown or brownish black abdomen, the biarticulate palpi and the 16 antennal segments in both sexes.

Asteromyia paniculata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 109; separate, p. 13 (Choristoneura)

1908 ——— N. Y. State Mus. Bul. 124, p. 328, 329 (Baldratia, B. marginata)

1910 ——— Econ. Ent. Jour., 3:349 (A. marginata)

1911 ——— Econ. Ent. Jour., 4:454 (A. marginata)

This species was reared at Albany August 10, 1907 from a yellowish or brownish, oval blister gall on the leaves of Aster paniculata. A species of Polygnotus was reared.

Gall. The blister gall producing this form is irregularly oval, about one-quarter of an inch in diameter and is yellowish or brownish, the upper surface sometimes light brown, irregularly encircled with yellowish white; the under surface is a nearly uniform, yellowish white. The gall is distinctly thicker than the normal leaf, it projecting about equally on both surfaces. For a colored illustration see Museum Bulletin 175, plate 1, figure 14.

Male. Length 2 mm. Antennae dark brown; 14 segments, the fifth with a length about one-half greater than its diameter; terminal segment narrowly oval. Palpus; one short, stout segment, dilated apically. Mesonotum dark brown. Scutellum dark brown, slightly yellowish apically, rather thickly clothed with golden yellow hairs, postscutellum dark brown. Abdomen a dark purplish brown, badly rubbed and the markings, therefore, indistinct. Wings (pl. 6, fig. 3) hyaline, costa with dark brown scales, the third vein joining the margin just before the distal third; halteres pale yellowish basally, slightly fuscous apically. Coxae fuscous yellowish, laterally with irregular patches of silvery white scales; distal portion of femora, tibiae and tarsi a nearly uniform purplish brown, the base of the second and the third tarsal segments on most of the legs deep crimson. Genitalia; basal clasp segment long, stout; terminal clasp segment greatly swollen at the base; dorsal plate long, broad, deeply and narrowly incised; ventral plate short, broadly rounded. Harpes short, stout, irregular. Type Cecid. a1167.

Female. Length 2 mm. Antennae dark brown, yellowish basally; 17 segments, the fifth with a length a little greater than its diameter, the two distal segments fused, the latter about twice the length of the former. Palpus; one segment. Face fuscous yellowish, with patches of silvery white scales. Mesonotum dark brown, thickly clothed along the antero-lateral margin with golden yellow hairs, submedian lines broad, thickly clothed with golden yellow hairs. Scutellum dark brown, slightly yellowish apically, rather thickly clothed with golden yellow hairs, postscutellum dark brown. Abdomen dark purplish brown, the first and second segments margined posteriorly with reddish orange, the third, fourth and fifth segments narrowly margined posteriorly on each side of a broad lateral line with silvery white scales; sixth segment with dorsal sclerites small, dark brown, margined laterally and posteriorly with silvery white. Ovipositor fuscous yellowish or pale orange, pleurae and venter suffused with silvery white scales. Wings hyaline, costa purplish brown, discal spot yellowish white, the third vein at the distal third (pl. 6, fig. 2); halteres pale yellowish basally, slightly fuscous apically. Coxae fuscous yellowish laterally with irregular patches of silvery scales, distal portion of femora, tibiae and tarsi a nearly uniform purplish brown; claws heavy, strongly curved distally, the pulvilli a little longer than the claws. Ovipositor moderately long, the terminal lobes broadly orbicular.

Another female bred from the same material differs in that the basal antennal segments and face are fuscous, while the markings on the posterior portion of the head and mesonotum are much less pronounced; the base of the second and third tarsal segments on most of the legs is a deep crimson, otherwise about as described above. Cecid. a1167.

Asteromyia petiolicola Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 228 (Baldratia)

This species, kindly loaned for study by the United States National Museum, was reared May 2, 1882 from an oblong, ovate swelling on the basal portion of a grape petiole. Unpublished notes, kindly placed at our disposal by Doctor Howard of the Bureau of Entomology, give a number of records of this gall or that of a closely allied form being found on petioles of wild grapevines in Virginia and Missouri. There is also a record in these notes of Proctotrypids having been reared from such galls.

Gall. The gall and the following description of the larva from which this species was presumably reared, have been drafted by Mr Pergande in the unpublished notes mentioned above, substantially as follows: This gall is an oblong, ovate swelling on the basal portion of the petiole and has a diameter about five or six times that of the petiole. Its length varies from 1.3 to 2 cm. It has the same color as the vine or the petiole. The tissues surrounding the cell, which latter is nearly as long as the entire gall, are woody and rather hard.

Larva. Length 4 mm, milk white with a dark brown breastbone, the forked apex of the latter protruding from the second segment.

Female. Length 2.25 mm. Antennae reddish brown, basally yellowish; 28 segments, the fifth with a length less than its diameter. Palpus, one short, stout segment, obtusely rounded distally. Mesonotum deep reddish brown, evidently denuded. Scutellum yellowish brown, postscutellum a little darker. Abdomen dark reddish brown, the basal segment yellowish or possibly thickly clothed with silvery white scales, the second to sixth segments narrowly margined posteriorly with a fringe of rather long, silvery white scales, ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein uniting with costa at the distal third; halteres slightly fuscous basally, yellowish white apically. Legs nearly uniform yellowish straw, possibly denuded, the distal segments fuscous; claws long, stout, strongly curved, the pulvilli as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes long, narrowly rounded. Type Cecid. 877.

Mr Pergande, in unpublished notes placed at our disposal, has characterized the adult, presumably from life, as being dark orange, the mesonotum black with silvery hairs anteriorly and yellowish hairs between the wings. The dorsum of the abdomen is black, the first abdominal segment red, being covered entirely with silvery hairs and segments two to six with black hairs, the latter narrowly margined posteriorly and broadly so laterally with silvery hairs; the venter broadly margined laterally with black hairs.

Asteromyia flavoscuta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 328 (Baldratia)

These midges were taken July 16, 1907 on the office window, Albany, N. Y., presumably having been reared from some recently collected material.

Female. Length 1.5 mm. Antennae pale yellowish, apical segments tinged with carmine; 18 segments, the fifth with a length a little greater than its diameter; terminal segment somewhat enlarged, subglobose, evidently composed of two closely fused. Palpus; one stout, narrowly ovate segment, sparsely setose; face yellowish, a patch of whitish scales above the mouth. Mesonotum probably dark brown, thickly clothed with golden yellow scales, the submedian lines broad, pale yellowish, rather thickly clothed with short scales and sparsely so with long setae. Scutellum fuscous yellowish with numerous setae apically, postscutellum pale yellowish. Abdomen dark brown, the basal segments silvery, the third to sixth with narrow, submedian lines of silvery on the posterior margin, the seventh segment mostly silvery white; pleurae thickly clothed with silvery scales; venter with a broad median band of silvery scales. Wings subhyaline, costa dark brown, the third vein uniting with costa near the basal half; halteres yellowish basally, whitish transparent apically, fuscous subapically. Coxae and base of femora silvery white, the distal portion of femora, tibiae and tarsi dark brown or black, the femora and basal segment of the tarsi narrowly annulate with pale yellowish; claws long, stout, slightly curved, the pulvilli nearly as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes short, stout, broadly rounded. Type Cecid. 1228.

Asteromyia pustulata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 328 (Baldratia)
1910 ———— Econ. Ent. Jour., 3:349

This form was reared at Albany, N. Y., June 13, 1907 from a small, pustulate gall on an aster stem.

Gall. The gall from which this species was obtained is a small, pustulate swelling on the side of aster stems, the enlargement being about 4 mm long and 2 mm in diameter and differing but slightly in color from the normal stem.

Male. Length 2 mm. Antennae dark brown, basally fuscous yellowish; 14 segments, the fifth with a length a little greater than its diameter; terminal segment produced, nearly twice the length of the preceding, obtuse apically. Palpus, one rather large, irregularly fusiform segment, subacute distally and bearing several stout setae; face with a patch of whitish scales. Mesonotum dark brown, variably margined anteriorly and laterally with yellowish white scales, the submedian lines rather thickly clothed with yellowish hairs. Scutellum black with a few whitish setae apically, postscutellum fuscous yellowish. Abdomen dark brown with lunate, silvery white submedian spots on the posterior margins of segments one to seven and laterally longitudinal silvery white spots on each segment, incisures dark salmon, genitalia fuscous reddish; venter sparsely suffused with silvery white scales. Wings hyaline, costa dark brown, the third vein uniting therewith just beyond the basal half. Halteres pale salmon, fuscous subapically.

Legs dark brown; claws long, stout, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment greatly swollen at the basal third; dorsal plate short, very broad, broadly and roundly emarginate; ventral plate a little longer, narrow, broadly rounded. Harpes short, stout, tapering, apex irregular. Type Cecid. a1520.

Asteromyia albomaculata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 111; separate, p. 14–15 (Choristoneura)
1908 ——— N. Y. State Mus. Bul. 124, p. 328 (Baldratia)

This species was captured on Solidago at Albany, N. Y., August 14, 1906 and was reared July 15th from a small, blister gall on aster taken at Jamesburgh, N. J., and from a blister gall on Solidago taken at Westfield, N. Y., July 18, 1907.

Gall. The blister gall on aster leaf producing this species, is 3 to 4 mm in diameter, a diffuse yellowish, with a dark center and a narrow, dark margin.

Female. Length 2 mm. Antennae pale yellowish; 18 segments, the fifth with a length a little less than its diameter, the two terminal segments partly or completely fused. Palpi; the first segment short, stout, greatly expanded distally, the second more slender, elongate. Mesonotum black with a median pale line. Scutellum black. Abdomen black, segments one to three with submedian white spots; incisures reddish yellow; ovipositor yellowish. Wings subhyaline, costa dark brown, discal spot whitish, the third vein uniting with costa at the basal half; halteres slightly yellowish, nearly covered with black scales. Coxae yellowish with a few white scales and the anterior and mid pair with long, black setae anteriorly; femora with the basal two-thirds whitish, the remainder black; tibiae and tarsi black; claws stout, strongly curved. Ovipositor moderately long, the terminal lobes rather long, broadly rounded. Type Cecid. 758.

Asteromyia squarrosae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 329 (Baldratia)
1909 ——— Ottawa Nat., 22:248 (Baldratia)

The species was reared July 20, 1907 from irregular blister galls on S o l i d a g o s q u a r r o s a taken at Rhinecliff, N. Y., July 17th. It was also reared by Dr A. Cosens from S. s e r o t i n a and S. s q u a r r o s a collected at Toronto, Canada, in June, 1914.

Gall. A grayish brown, black-margined, irregular blister gall about 3 mm in diameter.

Female. Length 1.5 mm. Antennae dark brown; 19 segments, the fifth with a length about three-fourths its diameter; terminal segment produced, broadly oval. Palpi; the first segment short, stout, slightly expanded distally, the second one-half longer than the first, narrowly oval. Mesonotum dark brown, variably margined laterally and anteriorly with dull reddish brown scales, the submedian lines sparsely clothed with similar hairs. Scutellum reddish brown, postscutellum a little darker. Abdomen dark brown, the second to seventh segments narrowly margined posteriorly with silvery white, the markings obsolete laterally; venter thickly clothed with silvery white scales. Wings hyaline, costa dark brown, the third vein joining costa near the basal fifth; halteres yellowish basally, fuscous apically. Coxae and base of femora a variable fuscous yellowish, the remainder of the legs dark brown, the tip of femora and tibiae narrowly annulate with white on the posterior legs; claws long, rather stout, strongly curved, the pulvilli a little shorter than the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes short, stout, broadly rounded. Type Cecid. a1594.

Asteromyia canadensis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 105; separate, p. 9 (Lasioptera)

1908 ———— N. Y. State Mus. Bul. 124, p. 329 (Baldratia)

The midge was captured May 21, 1906 sweeping blueberry, Spiraea or possibly Cornus at Albany.

Male. Length 1.5 mm. Antennae dark brown; 18 or 19 segments, the fifth with a length less than its diameter; terminal segment suboval. Palpi; the first segment with a length four times its diameter, subrectangular, the second over twice the length of the first, slender. Mesonotum dark brown, ornamented with fragmentary submedian lines of whitish scales posteriorly and a somewhat broken patch of the same on the lateral posterior area near the base of the wings. Scutellum dark brown, rather thickly ornamented with silvery white scales, postscutellum dark brown. Abdomen dark brown, the four basal segments each with submedian, quadrate, silvery spots. Wings hyaline, costa dark brown, the third vein joining the costa at the basal half; halteres pale orange basally, silvery white distally. Legs mostly pale yellowish straw, tarsi with reddish or dark brown on the distal segments. Genitalia; basal clasp segment long, irregularly truncate; terminal clasp segment swollen at the basal fourth; dorsal plate broad, deeply emarginate; ventral plate narrow, broadly rounded. Harpes subtriangular, tapering. Type Cecid. 74.

Asteromyia dumosae Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:286 (Baldratia)

1910 ———— Econ. Ent. Jour. 3:348

This species was reared July 30, 1908 from Aster dumosus taken by Cora H. Clarke at Annisquam, Cape Ann, Mass., apparently coming from an inconspicuous blister gall. Polygnotus species was reared, probably from this midge.

Gall. The blister gall from which this species was presumably reared is yellowish brown, narrowly oval, nearly 4 mm long and 2 mm in diameter.

Female. Length 1.75 mm. Antennae dark brown; 13 segments, the fifth with a length one-third greater than its diameter, the 13th compound, nearly twice the length of the preceding, irregularly rounded. Palpi; uniarticulate. Mesonotum dark brown, anteriorly and laterally rather thickly clothed with short, golden yellow scales. Scutellum dark reddish brown, postscutellum yellowish brown. Abdomen dark brown, the segments narrowly margined with white, the latter interrupted laterally and mesially. Ovipositor fuscous yellowish. Wings hyaline, the third vein uniting with costa a little before the basal half, the white discal spot small; halteres yellowish transparent, fuscous subapically; coxae and femora basally fuscous yellowish, the distal portion of femora, tibiae and tarsi dark brown. Ovipositor moderately short, terminal lobes narrowly oval. Type Cecid. a1870a.

Asteromyia flavomaculata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 329 (Baldratia)
1910 ———— Econ. Ent. Jour., 3:349

This species was reared from a blister gall on a leaf, presumably aster, taken at Albany, N. Y., March 16, 1907. Polygnotus species and Eurytoma were reared, probably from this midge.

Gall. Length 2 cm, diameter 1.2 cm. It is a clouded, sooty, blister gall, yellow beneath and dirty whitish above. It looks much like the large blister gall commonly found on aster.

Female. Length 2 mm. Antennae dark brown; 16 segments, the fifth with a length scarcely equal to its diameter; terminal segment slightly produced, obtusely rounded distally. Palpi, one somewhat irregular, prolonged segment, swollen distally; face fuscous with yellowish white hairs ventrally. Mesonotum dark brown, the submedian lines rather thickly clothed with golden yellow scales, an inconspicuous patch of the same at the anterior margin and a larger one in front of the humeri. Scutellum a dark brown, postscutellum fuscous yellowish. Abdomen black, the second to eighth segments narrowly margined posteriorly with silvery white, the markings broadly interrupted on the median line; ventral surface suffused with silvery white scales. Wings hyaline, costa dark brown or black, discal spot yellowish white, the third vein uniting with costa near the basal half; halteres a variable yellowish, fuscous subapically. Coxae and base of femora fuscous yellowish, other portions of legs a nearly uniform dark brown or black; claws rather long, strongly curved, pulvilli as long as the claws. Ovipositor about one-half the length of the abdomen, the distal lobes broadly rounded. Type Cecid. a1361a.

Asteromyia abnormis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 110; separate, p. 14 (Choristoneura)
1908 ——— N. Y. State Mus. Bul. 124, p. 329 (Baldratia)

This species was taken at Albany, N. Y., July 24, 1906 on Solidago.

Female. Length 2 mm. Antennae dark brown; 16 segments, the fifth with a length a little greater than its diameter; terminal segment twice the length of the preceding, broadly rounded. Palpi, one segment with a length about three times its diameter, slightly dilated, broadly rounded apically. Mesonotum, scutellum and postscutellum dark brown. Abdomen presumably a nearly uniform dark brown with irregular patches of whitish scales on the pleurae. Wings hyaline, costa dark brown, discal spot whitish, the third vein uniting with costa at the basal half; halteres pale orange. Legs mostly dark brown; claws stout, slightly curved. Ovipositor probably about one-third the length of the body; terminal lobes short, broadly rounded distally and thickly setose.

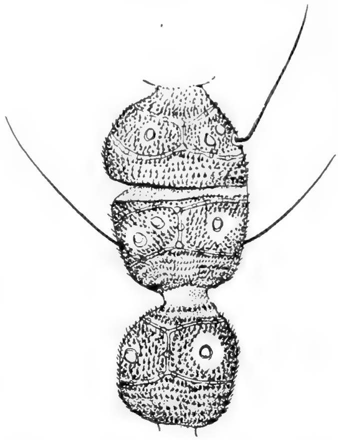

Fig. 42 Asteromyia abnormis, seventh, eighth and ninth antennal segments, the latter two partly fused, greatly enlarged (author's illustration)

This specimen is abnormal, since the ninth and tenth segments on one antenna and the tenth to thirteenth on the other were more or less irregularly fused. Type Cecid. 676.

Asteromyia asterifoliae Beutm.

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 23, p. 395–96 (Lasioptera)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 288 (Choristoneura helena Felt), p. 329 (Baldratia fuscoanulata)
1909 ——— Ottawa Nat., 22:248 (Baldratia fuscoanulata)
1910 ——— Econ. Ent. Jour., 3:349
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 53 (Lasioptera)

This species was reared by Professor Beutenmueller from aster leaves taken in the valley of the Black mountains, North Carolina. Apparently the same form has been reared by us from a circular blister gall on Aster lateriflorus collected at Highland, adults being obtained June 26, 1907. Presumably the same form was reared from a blister gall on what is probably Aster laevis, midges appearing July 25, 1907.

Gall. The gall on Aster lateriflorus producing this form, is round, about 3 mm in diameter and with a dark center encircled by a white ring, the portions of the leaf adjacent being more or less suffused. The gall on what we take to be Aster laevis, is oval, 4 to 6 mm in diameter, yellowish white and dark margined. For a colored illustration see Museum Bulletin 175, plate 2, figure 5.

Female. Length 2 mm. Antennae brown, basally fuscous yellowish; 18 segments, the fifth with a length three-fourths its diameter; terminal segment partly fused with the preceding, somewhat prolonged, narrowly rounded. Palpi; the first segment short, stout, subquadrate, the second twice the length of the first, irregularly subfusiform. Face with a white patch of silvery white scales. Mesonotum black, sparsely margined laterally with silvery white. Scutellum nearly the same color as the mesonotum. Abdomen black, the incisures dark reddish, each segment sparsely margined posteriorly with silvery white, the venter a uniform silvery gray. Wings (pl. 5, fig. 9) hyaline, costa dark brown, the third vein uniting with costa at the basal half; halteres pale. Legs black, coxae, the extreme base of the femora and articulations of the tibiae more or less pale; claws rather long, strongly curved, the pulvilli as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes short, broadly oval.

Male. Antennal segments 16, the fifth with a length three-fourths its diameter; the abdomen and the legs a uniform dark brown, the venter pale yellowish; otherwise as in the female. The characters of the male are from the type. Cecid. a1550.

Asteromyia agrostis O. S.

1847 **Fitch, Asa.** N. Y. State Agric. Soc. Trans., 6:351–52

1862 **Osten Sacken, C. R.** Dipt. N. Am. Mon., 1:204 (Cecidomyia agrostis)

1893 **Marten, John.** Ohio Agric. Exp't Sta. Techn. ser. 1, no. 3, p. 155–56 (Lasioptera muhlenbergiae)

1893 **Webster, F. M.** Ohio Agric. Exp't Sta. Techn. ser. 1, no. 3, p. 154–55 (Lasioptera muhlenbergiae)

1902 **Cockerell, T. D. A.** Can. Ent., 34:183 (Lasioptera carbonitens)

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 329 (B. muhlenbergiae)

1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 85 (B. muhlenbergiae)

The gall and pupa of this species were described by Fitch without a name in 1847. Later Osten Sacken proposed the scientific name for this form, which breeds in a prolonged, fusiform enlargement at the basal portion of the stem of Muhlenbergia mexicana. Lasioptera carbonitens Ckll. is probably a synonym. Polygnotus species was reared from this gall. The species breeds in a prolonged, fusiform enlargement at the basal portion of the stem of Muhlenbergia mexicana. It was first reared by Mr Marten at Champaign, Ill., adults appearing from May 9 to June 10, 1902. There is but one generation annually, the larvae wintering in the gall. We have received examples of this form from Prof. Cyrus R. Crosby of Ithaca, N. Y., who reared the insect from grass collected in that vicinity.

Gall. The gall has been described by Mr Marten as cone-shaped and produced by the abortion of a branch and the consequent approximation of the leaves. He states that the peculiar yellowish larvae lie singly or several together on the inner bases of the leaves, thus producing the gall.

The pupa he describes as reddish yellow, becoming darker reddish or even orange color with age. When ready to pupate, the old larval skin is pushed down to the tip of the abdomen, where it remains adhering to the last segment.

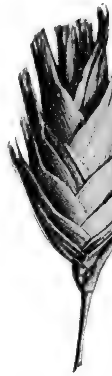

Fig. 43 Asteromyia agrostis, gall, natural size (original)

The following descriptions have been drafted from specimens kindly contributed by Prof. H. A. Gossard of the Ohio Agricultural Experiment Station. The anatomical characters are from these specimens, the color features from Mr Marten's descriptions.

Gall. Length about 3 cm, diameter nearly 1 cm. This gall is a long, stout, fusiform swelling evidently caused by the dwarfing of the young shoot leaves growing close together and the larvae occur here and there at the base of the inner leaves.

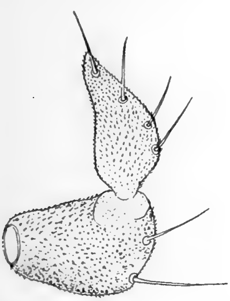

Fig. 44 Asteromyia agrostis, palpus of female, enlarged (original)

Larva. Length 2 mm, pale yellowish white, breastbone not evident. The larvae occur in numbers irregularly located between the inner leaves of the gall.

Female. Length 3 to 3.5 mm. Antennae black, fading to dusky toward the tips, yellowish brown basally; 19 segments, the fifth with a length about one-half greater than its diameter; terminal segment reddish, suboval. Palpi; the first segment irregularly obconic, the second irregularly conic, greatly swollen basally; face tinged with yellowish brown and having a silvery white reflection in certain lights; it also has a few scattering black hairs. Eyes rather small, black. Mesonotum shiny pitchy black with some reddish brown about the base of the wings and on the posterior angles of the mesothorax. Scutellum black with reddish brown margins, somewhat transparent in appearance; metathorax and pleurae reddish brown, the latter with a black spot commencing anterior to the base of the wing and reaching with a slight interruption to the middle coxa. Abdomen reddish brown distally, covered with pitchy black scales, the latter less dense on the venter. Ovipositor reddish yellow, becoming pale yellow, almost white at the tip. Wings dusky, costa black, the third vein uniting with costa at the distal third; halteres yellowish with the capitate portion and upper part of the stem covered with pitchy black scales. Coxae and femora yellowish, the distal half of the femora covered with black scales, becoming more dense toward the apex; tibiae and tarsi black; claws long, stout, strongly curved. Ovipositor probably nearly as long as the body; terminal lobes long, slender, broadly rounded.

Male. About as the female, more slender and not so black, but smoky or brown-black with a pitchy reflection. Antennae with 16 to 18 segments. Palpi; short, inconspicuous, apparently composed of two segments, the first irregularly oval, deeply divided near the middle, the second consisting of a transverse oval basal portion and a long, slender, tapering distal part, the latter with a length fully five times its diameter. Wing (pl. 6, fig. 1) with thick, black scales on the costa not extending beyond the point where the third vein unites with the border. Genitalia (pl. 8, fig. 1); basal clasp segment long, stout, obliquely truncate; terminal clasp segment short, greatly swollen basally; dorsal plate short, broad, deeply and triangularly incised; ventral plate broad, broadly rounded. Harpes broad at base, dentate.

Described from specimens received from the Ohio Agricultural Experiment Station December 1906, presumably reared by Marten. They bore only the number 1571. Cecid. 770.

Asteromyia waldorfi Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:286 (Baldratia)
1910 ——— Econ. Ent. Jour., 3:348

Several midges were reared in early May 1908 from a small, brownish, blister gall on a somewhat hairy unknown species of aster found at Karner near the Waldorf station in early April.

Gall. The gall is about 3 mm in diameter, circular, brownish and with a more or less distinct yellowish ring.

Male. Length 2 mm. Antennae yellowish brown; 16 segments, the fifth with a length about three-fourths its diameter; terminal segment produced, compound. Palpi; the first segment subquadrate, the second longer, broadly oval. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum dark brown, postscutellum fuscous yellowish. Abdomen dark brown, the segments narrowly margined posteriorly, the latter interrupted mesially; the sixth and seventh segments mostly orange. Wings hyaline, costa dark brown, the third vein uniting with costa at the basal half, the discal spot large; halteres a variable yellowish. Coxae and basal portion of femora yellowish, the distal part of femora, tibiae and tarsi dark brown; claws long, slender, strongly curved, the pulvilli shorter than the claws. Genitalia; basal clasp segment stout; terminal clasp segment stout; dorsal plate short, broad, triangularly incised; ventral plate short, broad, broadly rounded. Harpes tapering, obtuse, tuberculate.

Female. Length 2.25 mm. Antennae with 18 segments, the fifth with a length about three-fourths its diameter; terminal segment produced, evidently composed of two closely fused, broadly rounded distally. Palpi; basal segment slender, obconic; terminal segment longer, tapering, subacute. Colorational and other characters probably as in the opposite sex. Ovipositor about half the length of the abdomen; terminal lobes short, broadly oval.

A very similar and probably identical species was reared May 5th from a slightly different gall taken in the same vicinity and numbered a1829. Type Cecid. a1824.

Asteromyia nitida Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:286 (Baldratia)
1910 ——— Econ. Ent. Jour., 3:348

This species was reared April 17, 1908 from a shining, yellowish gall on the basal leaves of aster collected at Meadowdale near Albany, N. Y., October 23, 1907.

Gall. The gall is large, smooth, slightly glossy, yellowish, oval and 6 to 7 mm in diameter. It is found on the long, often purplish basal leaves.

Female. Length 2 mm. Antennae dark brown, the basal segments yellowish; 21 segments, the fifth with a length three-fourths its diameter; terminal segment produced, compound, broadly rounded apically. Palpi biarticulate. Face yellowish. Mesonotum dark brown, the submedian lines and lateral margins clothed with yellowish scales. Scutellum dark brown with white scales apically, postscutellum dark reddish brown. Abdomen dark brown, the segments narrowly margined with silvery white scales, the latter interrupted laterally and mesially. Venter clothed with silvery white scales. Wings hyaline, the third vein uniting with costa just beyond the basal half; halteres yellowish basally, fuscous apically. Coxae and base of femora a variable yellowish, the remainder of the legs dark brown. Ovipositor short, terminal lobes broadly oval. Type Cecid. a1820.

Asteromyia convoluta Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 110 (Choristoneura)
1908 ——— N. Y. State Mus. Bul. 124, p. 329 (Baldratia)
1909 ——— Ottawa Nat., 22:246 (Baldratia)

This species was reared from a loose, convolute tip gall on Solidago, which was taken at Albany, N. Y., August 11, 1907.

Gall. This species appears to have been reared from a loose, convolute apical gall having an approximate diameter of 6.5 mm. It is composed of a thick mass of long, aborted, more or less curled leaves. There were no indications of blister galls on any of the leaflets.

Female. Length 1 mm. Antennae light brown, fuscous basally; 17 segments, the fifth with a length less than its diameter; terminal segment twice the length of the preceding, subconical. Palpus, one elongate segment, slightly enlarged distally; face fuscous, eyes black, large. Mesonotum dark brown, submedian lines ornamented with sparse, yellowish setae. Scutellum and postscutellum pale yellowish brown. Abdomen nearly uniform dark brown, ovipositor pale orange. Wings hyaline, costa dark brown, yellowish basally, the third vein uniting with costa just beyond the basal half. Halteres yellowish basally, whitish apically, base of club fuscous. Legs mostly uniform dark brown with irregular, yellowish markings; anterior tibiae yellowish, tarsi yellowish, the segments tinged with reddish brown distally; mid and posterior tarsi mostly yellowish with a faint brown annulation on the second segment, distal segment dark brown; claws rather stout, strongly curved. Ovipositor moderately long, terminal lobes acutely rounded. Type Cecid. a1307.

Asteromyia flavoanulata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 329 (Baldratia)

The small, marginal blister gall on Solidago canadensis from which this species was reared, was taken at West Nyack, N. Y., the adults appearing July 25, 1907.

Gall. A marginal, circular, golden gray blister gall with a diameter about 3.5 mm and with the under surface narrowly margined with pale orange. There is apparently but one insect in a gall.

Female. Length 1.5 mm. Antennae dark brown; 18 segments, the fifth with a length about one-fourth greater than its diameter; terminal segment distinctly enlarged, produced, broadly rounded. Palpi; the first segment short, stout, broadly oval, the second about as long, much more slender; face fuscous. Mesonotum reddish brown, the lateral and anterior margins and submedian lines thickly yellow-haired. Scutellum dark brown, postscutellum a little lighter. Abdomen dark brown, the segments narrowly margined posteriorly by silvery white lines, the latter interrupted in the middle and laterally; ovipositor pale orange. Wings hyaline, costa dark brown, the third vein uniting with costa at the basal half; halteres yellowish basally, fuscous apically. Coxae dark brown, femora light yellowish basally, the distal portion and tibiae and tarsi dark brown; claws rather long, stout, evenly curved, the pulvilli nearly as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes short, oval, broadly rounded. Type Cecid. a1568k.

Asteromyia rubra Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 103; separate, p. 7 (Lasioptera), p. 103-4 (L. tuberculata)
1908 ———— N. Y. State Mus. Bul. 124, p. 329 (Baldratia)
1908 **Jarvis, T. D.** Ent. Soc. Ont., 38th Rep't, p. 88 (Choristoneura flavolunata in error)
1909 **Felt, E. P.** Ottawa Nat., 22:248 (Baldratia)
1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 81 (Choristoneura flavolunata in error)

This form was reared from a more or less variegated blister gall occurring on the leaves of Solidago rugosa, adults appearing July 21, 1906. Apparently the same species occurs in the collection of the United States National Museum, having been reared from blister galls taken July 21, 1877 in the Illinois bottom and from others taken at St Louis, Mo. Unpublished notes by Mr Pergande, kindly placed at our disposal by Doctor Howard of the Bureau of Entomology show that galls of apparently this species occurred June 18, 1884 in the vicinity of the fair grounds, Washington, D. C., and were quite abundant at Cabin John Bridge, Maryland, June 25, 1899. Galls of apparently the same species were received June 27th of the same year from George Caswell, Dayton, Ohio. It is apparently this form which is recorded as common at Guelph, Ontario, by Jarvis. It is probable that the individuals described by us under the name of Lasioptera tuberculata[1] are referable to this species.

Gall. This form was reared from a variegated blister gall varying in diameter from about 3 to 6 mm. The smaller, older galls appear to be mostly black, while the larger and perhaps younger galls have the edge margined with purple, the outer part being pale yellowish olive with a darker, slightly elevated central part or nipple. For a colored illustration see Museum Bulletin 175, plate 1, figures 9, 9a, 13, 15, 15a, and 20.

Male. Length 1.25 mm. Antennae yellowish brown; 14 to 15 segments, the fifth with a length a little greater than its diameter; terminal segment produced, subcylindric, broadly rounded. Palpi; the first segment short, stout, slightly expanded distally, the second short, broadly oval. Mesonotum dark brown, the submedian lines sparsely clothed with yellowish setae. Scutellum and postscutellum reddish brown. Abdomen mostly a reddish brown, the distal segments lighter and apparently narrowly banded basally with silvery white scales; genitalia yellowish. Wings hyaline, costa dark reddish brown, the third vein uniting with costa at the distal third; halteres pale yellowish. Legs mostly fuscous yellowish, the distal tarsal segments reddish brown; claws long, slender, strongly curved, the pulvilli about two-thirds the length of the claws. Genitalia (pl. 8,

[1] Felt, E. P. N. Y. State Mus. Bul. 110, p. 103-4 (separate, p. 7). 1907

fig. 2) basal clasp segment short, stout; terminal clasp segment with the basal two-thirds greatly swollen; dorsal plate short, stout, deeply and triangularly emarginate; ventral plate short, stout, narrowly rounded. Harpes short, stout, tapering, irregularly dentate.

Female. Length 2 mm. Antennae dark brown; 18 segments, the fifth with a length a little greater than its diameter; terminal segment broadly oval. Palpi; the first segment short, irregularly subquadrate, the second a little longer, swollen at the basal third, broadly rounded. Mesonotum dark brown with submedian lines sparsely clothed with silvery hairs. Scutellum dark reddish brown, postscutellum and abdomen dark brown, incisures deep carmine, ovipositor pale orange. Pleurae brokenly clothed with quadrate patches of silvery white scales separated by small patches of dark brown ones, venter suffused with silvery white scales; halteres fuscous yellowish basally, stem pale yellowish, club fuscous basally, semitransparent apically. Coxae dark brown, clothed laterally with silvery white; femora pale yellowish basally, fuscous apically, tibiae dark brown, narrowly ringed with pale yellowish apically, tarsi with the basal segments dark brown, the distal ones lighter. Ovipositor probably about two-thirds the length of the body, the terminal lobes short, stout, broadly rounded. Type Cecid. 650.

Asteromyia laeviana Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 108–9; separate, p. 12 (Choristoneura)
1908 ———— N. Y. State Mus. Bul. 124, p. 330 (Baldratia)
1910 ———— Econ. Ent. Jour., 3:349
1915 ———— Econ. Ent. Jour., 8:406

The midge was reared at Albany, N. Y., from a yellowish blister gall on the leaves of Aster laevis, the adults appearing the latter part of September 1906.

Gall. A greenish yellow blister gall about 1.75 cm in diameter, the under surface is papery white. For a colored illustration see Museum Bulletin 175, plate 1, figures 12, 12a and 19.

Larva. Length 2 mm, stout, pale orange. Head small, tapering; antennae small, uniarticulate; breastbone rudimentary or wanting; skin finely shagreened; posterior extremity broadly rounded, finely papillate.

Male. Length 1.6 mm. Antennae dark brown; 14 segments, the fifth with a diameter equal to its length, the two terminal segments fused, separable only by a light constriction. Palpi; one elongate segment, obliquely truncate apically; face reddish brown, eyes black, large, margined posteriorly with pale yellowish scales. Mesonotum dark brown with broad, submedian stripes thickly clothed with short, yellowish scales. Scutellum dark brown, postscutellum reddish brown. Abdomen dark brown with the incisures and pleurae pale yellowish red, genitalia dark brown. Wings hyaline, costa dark brown, the third vein uniting with the ccsta at the basal half; halteres pale yellowish basally, whitish transparent apically.

Legs mostly dark brown, the tarsal segments a variable pale yellow or reddish; claws strongly curved. Genitalia (pl. 8, fig. 3); basal clasp segment stout; terminal clasp segment broad at base; dorsal plate deeply incised; ventral plate short, broadly rounded. Harpes subtriangular, tapering, a long, curved apical spur and several recurved spines. Type Cecid. a1287.

A female, provisionally referred to this species, was reared from a similar gall on Aster saggittifolius July 15, 1913, by Dr A. Cosens, Toronto, Canada. The description follows:

Female. Length 1 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; at least 14 and probably 15 or 16 segments, the fifth with a length about equal to its diameter. Palpi invisible in the preparation, probably uniarticulate. Mesonotum shining black, the submedian lines sparsely haired. Scutellum shining dark brown, sparsely haired apically, postscutellum yellowish brown. Abdomen a nearly uniform black, the third to sixth abdominal segments narrowly margined posteriorly with whitish scales. Wings hyaline, the third vein uniting with the margin near the basal half. Halteres yellowish, the club narrowly fuscous basally. Coxae reddish brown; femora yellowish basally, fuscous apically. Tibiae and tarsi fuscous. Ovipositor about half the length of the abdomen, stout, the terminal lobes orbicular, minor lobes linear, both thickly setose. A2440.

Asteromyia flavolunata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 154–55 (Choristoneura)
1908 ——— N. Y. State Mus. Bul. 124, p. 330 (Baldratia)
1909 ——— Ottawa Nat., 22:248 (Baldratia)
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 53 (Baldratia)

This species was reared from a semioval, yellowish, marginal gall on Solidago leaves taken at Albany, N. Y., March 19, 1907, the adults appearing April 16th. It appears to be widely distributed, having been taken in several localities in New York State and also at Asheville, N. C.

Gall. A characteristic marginal, semioval gall on the leaves of Solidago, probably S. canadensis. The galls are about 1 cm in the greatest diameter, are invariably on the margin of the leaf, lunate in form and usually approximately equidistant. For a colored illustration, see Museum Bulletin 175, plate 1, figures 8 and 10.

Female. Length 2.5 mm. Antennae dark reddish brown; 21 segments, the fifth with a length scarcely equal to its diameter; terminal segment slightly produced, broadly rounded apically. Palpi; the first segment short, stout, almost subglobular, the second a little longer, slender, subfusiform, subacute distally; face reddish brown, with sparse, whitish scales, the tip of the mouth-parts fuscous. Mesonotum dark brown, almost black, the base of the wing insertions reddish. Scutellum dark brown with a few yellowish setae apically, postscutellum and abdomen dark brown, almost black, the incisures of the latter a dusky reddish, the dorsum of the eighth segment and the ovipositor fuscous yellowish; laterally, though hardly ventrally there is a broken band of five somewhat conspicuous subquadrate patches of silvery white scales; venter sparsely clothed with silvery white scales. Wings hyaline, costa black, the third vein uniting with costa near the middle. Legs black; claws long, stout, strongly curved, the pulvilli as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes rather short, broad, broadly rounded. Type Cecid. a1430.

Asteromyia divaricata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 330 (Baldratia)
1910 ——— Econ. Ent. Jour., 3:348

This species was reared April 6, 1908 at Albany from a large blister gall on the leaves of A s t e r d i v a r i c a t a. The larvae winter in the galls. One leaf may produce 18 to 20 adults. The white exuviae contrast strongly with the blackened leaves.

Gall. The blister galls from which this species was reared are large and oval, about 1.2 cm in diameter and with a pinkish tinged aureola, especially on the under surface. In the spring they are much darker and nearly unicolorous.

Female. Length 2 mm. Antennae dark brown, yellowish basally; 16 segments, the fifth with a length about twice its diameter, the terminal segment produced, with a length about three times its diameter. Palpus, one rather stout, fusiform segment having a length about twice its diameter. Face fuscous yellowish. Mesonotum dark reddish brown and rather thickly and evenly clothed with yellowish setae. Scutellum reddish brown with whitish setae apically; postscutellum fuscous yellowish. Abdomen dark brown, each segment sublaterally with silvery white spots and rudimentary white markings posteriorly; pleurae a variable reddish brown; ovipositor a pale orange; venter clothed with silvery scales. Wings hyaline, costa black, discal spot whitish, the third vein uniting with costa near the basal half; halteres yellowish, fuscous subapically. Coxae and base of femora fuscous yellowish; femora distally, tibiae and tarsi a nearly uniform dark brown; claws long, slender, evenly curved, the pulvilli distinctly shorter than the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes short, broad, suborbicular.

Male. Length 2 mm. Antennae fuscous yellowish; 16 segments. Palpi uniarticulate, fusiform, with a length over twice the diameter. Mesonotum dark brown, with scattering, yellowish setae upon its surface, the submedian lines thickly clothed with yellow setae. Scutellum dark brown, with a few white scales apically, postscutellum light fuscous yellowish. Abdomen dark brown, the basal segment laterally and posteriorly sparsely margined with white scales, the distal segment nearly naked, deep orange and with a few dark brown, scattering, silvery white scales dorsally; pleurae yellowish;

genitalia fuscous yellowish, the venter yellowish basally, deep orange distally, sparsely clothed with silvery white scales; halteres yellowish transparent. Genitalia; basal clasp segment long, slender; terminal clasp segment stout at base; dorsal plate long, broad, deeply and triangularly incised; ventral plate short, stout, broadly rounded. Harpes short, stout, truncate, minutely dentate. Type Cecid. a1787.

CLINORHYNCHA Loew

1850 **Loew, H.** Dipt. Beitr., 4:21
1860 **Rondani, Camillo.** Soc. Ital. Sci. Nat. Milano Atti, 2:287
1863 **Schiner, J. R.** Fauna Austriaca Dipt., 2:409
1876 **Bergenstamm, J. E. & Low, Paul.** Syn-Cecidomyidarum, p. 23
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:40, 44, 133
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 27:341
1895 **Kieffer, J. J.** Wein. Ent. Zeit., 14:3–4
1897 ——— Syn. Cecid. de Eur. & Alg., p. 4
1904 ——— Soc. Sci. Brux. Ann., 28:2
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 333
1911 ——— N. Y. Ent. Soc. Jour., 19:42
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 19

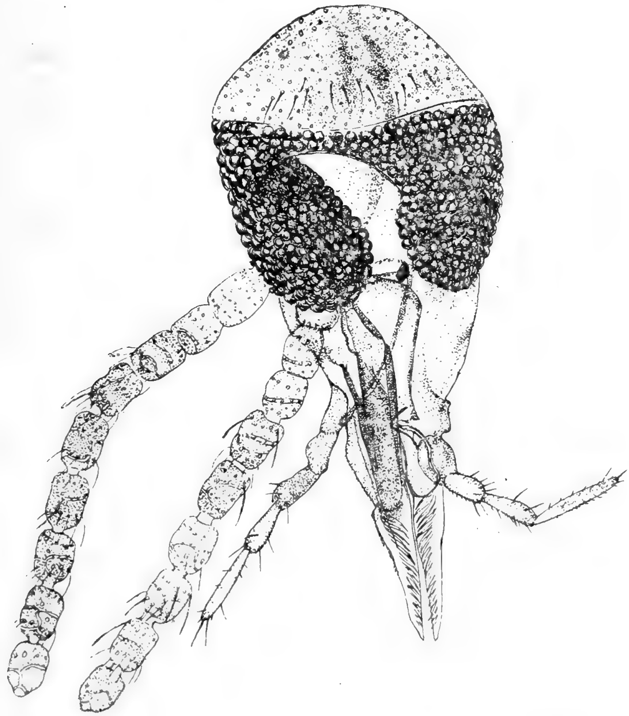

Fig. 45 Clinorhyncha filicis, head and appendages, note the relatively short antennae, the well developed palpi and the greatly produced mouth-parts, enlarged (orignial)

This genus, first recognized in America by the author, comprises an assemblage of extremely interesting forms which may be distinguished at once by the great prolongation of the mouth-parts and the 10 to 12 antennal segments. The European C. chrysanthemi H. Lw., the type of the genus, has 13 antennal segments in both sexes. The wings are small, rather narrow and with the venation greatly reduced (pl. 6, fig. 8); claws unidentate. The species are all small, being only about 1 mm in length. It is very probable, as stated elsewhere, that this genus is a synonym of Acorhynchus Rond. The four European species were all reared from the enlarged akenes of such composites as Anthemus, Chrysanthemum, Achillea and Tanacetum. The additional American species, C. eupatoriflorae, was reared from the florets of thoroughwort, Eupatorium perfoliatum. It is probable that the other species known to occur in this country have similar habits, though C. karnerensis was taken on willow.

Key to species

a Second to fifth abdominal segments reddish brown; female with 10 antennal segments, the fifth with a length one-third greater than its diameter....... filicis Felt, C. 386

aa Abdomen unicolorous

b Abdomen of the female dark brown, that of the male fuscous yellowish, antennal segments 10, the fifth in the male with a length twice its diameter, that of the female with a length one-fourth greater than its diameter, the three distal palpal segments successively longer, the fourth one-fourth longer than the third. Reared from yarrow........ millefolii Wachtl., C. 1236

bb Abdomen of female dark brown, antennal segments 10, the fifth with a length one-half greater than its diameter, the three distal palpal segments equal......................karnerensis Felt, C. 488

bbb Abdomen reddish, antennal segments of male 12, female 11, the fifth of the male with a length one-half greater than its diameter, that of the female with a length one-fourth greater. Reared from flowers of thoroughwort, Eupatorium perfoliatum................ eupatoriflorae Felt, C. a1689

Clinorhyncha filicis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 108; separate, p. 12
1908 ———— N. Y. State Mus. Bul. 124, p. 333

This species was taken on fern at Nassau, N. Y., June 24, 1906. Apparently the same form was reared from willow bearing the galls of Hormomyia verruca Walsh, collected by Cora H. Clarke at Magnolia, Mass.

Female. Length 1 mm. Antennae dark brown; 10 segments, the fifth with a length one-third greater than its diameter; terminal segment short, broadly rounded distally. Palpi; the first segment rather long, irregular, the second a little shorter, the third nearly twice the length of the preceding, more slender, the fourth a little longer and more slender than the third. Mesonotum dark brown, submedian lines yellowish, thickly clothed with fuscous yellowish hairs. Scutellum dark brown, postscutellum brown. Abdomen dark brown basally, with the second to fifth segments reddish brown, terminal segments yellowish. Wings hyaline, costa dark brown, discal spot whitish, the third vein uniting with costa at the basal half, the fifth vein forking near the middle, unites with the posterior margin at the distal third, its branch at the basal third. Halteres reddish yellow. Legs a nearly uniform dark brown, lighter ventrally; claws rather stout, strongly curved. Ovipositor probably nearly as long as the body, the terminal lobe long, broad, narrowly rounded, at the base a group of four or five heavy, stout, strongly recurved, obtuse spurs and scattering groups of straight spines. Type Cecid. 386.

Clinorhyncha millefolii Wachtl.

1884 **Wachtl, F. A.** Wien. Entomol. Zeit., 3:161, tab. 2, fig. 3–5
1908 **Felt, E. P.** Econ. Ent. Jour., 1:19
1908 ———— N. Y. State Mus. Bul. 124, p. 333
1909 ———— Ent. Soc. Ont., 39th Rep't, p. 44

This European species was reared during August 1907 in considerable numbers from the florets of yarrow, Achillea millefolium, taken in the vicinity of Albany. Our provisional determination of this form has been confirmed by the distinguished European specialist on this group, L'abbe Kieffer. This species has presumably become well established in this country and it is rather surprising that its presence has not been detected earlier. The wing of the female is shown on plate 6, figure 8.

Larva. Length 1 mm, yellowish, rather stout, the segmentation rather distinct; head small, with a diameter about one-fourth that of the body, tapering to a broadly rounded apex. The one antennal segment is cylindric, with a length about four times its diameter. Breastbone apparently wanting, skin smooth, the posterior extremity broadly rounded, smooth; anus slitlike.

The above described specimen is probably partly grown.

Clinorhyncha karnerensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 333

This form was taken on willow at Karner, N. Y., July 5, 1906.

Female. Length 1.25 mm. Antennae dark brown; 10 segments, the fifth with a length about one-half greater than its diameter, the terminal segment slightly reduced. Palpi; the first segment rather long, expanded distally, the second slender, tapering at the extremities and with a length about three times its diameter, the third a little longer and more slender than the second, the fourth longer and more slender than the third. Mesonotum dark brown, the submedian lines indistinct. Scutellum dark brown, postscutellum yellowish brown. Abdomen a nearly uniform dark brown, the segments margined posteriorly with rather abundant short, silvery setae. Wings hyaline, costa dark brown, discal spot white, the third vein uniting with costa a little before the basal half, the fifth at the distal fourth, its branch near the basal half. Halteres yellowish basally, silvery white apically. Legs a nearly uniform fuscous brown, the posterior ones a little lighter; claws long, slender, strongly curved distally, the pulvilli as long as the claws. Ovipositor probably about as long as the body, basally with a patch of stout, halberd-shaped processes; terminal lobe long, broad, irregularly rounded, at the base a group of five or six stout hooks. Type Cecid. 488.

Clinorhyncha eupatoriflorae Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 6 (Lasioptera)
1908 ——— N. Y. State Mus. Bul. 124, p. 287, 333 (Lasioptera)
1909 ——— Ent. Soc. Ont., 39th Rep't, p. 44
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 49 (Cecidomyia)

The midge was reared in late August from yellowish larvae, about 2 mm long, in apparently normal florets of thoroughwort, Eupatorium perfoliatum, taken at Albany, N. Y.

Male. Length 1.25 mm. Antennae dark brown, the basal segments pale reddish; 12 segments, the fifth with a length about one-half greater than the diameter; terminal segment somewhat produced, narrowly rounded distally. Palpi; the first segment short, stout, narrowly oval, the second one-half longer and more slender; the third a little longer and more slender than the second; the fourth longer and more slender than the third; face pale reddish. Mesonotum fuscous, the submedian lines indistinct. Scutellum and postscutellum reddish. Abdomen reddish. Wings hyaline, costa dark brown, the third vein uniting with costa before the basal half, the fifth joining the posterior margin at the distal fourth, its branch near the basal half; halteres and coxae pale reddish, the femora yellowish at the base, brownish apically; tibiae and tarsi brownish; claws rather long, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long; terminal clasp segment long, swollen near the basal third; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate short, broad, truncate. Harpes long, stout, tapering, dentate.

Female. Length 1.5 mm. Antennae sparsely haired, dark brown, basal segments pale reddish; 11 segments, the fifth with a length about one-fourth greater than the diameter; terminal segment produced, tapering distally to a narrowly rounded apex. Palpi;

the first segment short, stout, truncate distally, the second a little longer, narrowly oval, the third as long as the second, more slender, the fourth one-half longer and more slender than the third. Face pale reddish. Pronotum fuscous. Mesonotum slightly fuscous, the submedian lines indistinct. Scutellum and postscutellum reddish. Abdomen reddish. Halteres and coxae pale reddish; femora yellowish at the base, brownish apically; tibiae and tarsi brownish. Ovipositor longer than the body, basally with halberd-shaped spines and recurved hooks; the terminal lobes long, slender, tapering, narrowly rounded. Type Cecid. a1689.

CAMPTONEUROMYIA Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 322, 334
1911 ———— N. Y. Ent. Soc. Jour., 19:43
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 26

This genus was erected for a very well-marked type which may be recognized by the broadly oval wings having the third vein strongly arched, rather well separated from costa and uniting therewith near the distal third (pl. 6, fig. 5). The antennae are sessile in both sexes, the segments ranging in number from 14 to 22. The individual segments are longer than in Lasioptera and its close allies and do not have the thick, heavy circumfili usually observed in this tribe. Furthermore, the whorl of minute hairs is more marked in Camptoneuromyia than in allied genera. The male genitalia have somewhat the same structure as obtains in Dasyneura, the ovipositor of the female is rather short and thick. The vestiture of the anterior wing veins is not so heavy as in Lasioptera, though approaching that type. The legs are usually very thickly covered with scales, and in some species this clothing is so abundant as to practically obscure the basal tooth on the unidentate claws. Type Dasyneura virginica Felt.

Several species have been reared. The best known form is C. adhesa Felt. It breeds mostly in an oval adherent gall between apposed Solidago leaves. Another species, C. rubifolia Felt, has been reared from a marginal leaf roll on high blackberry. A West Indian form, C. meridionalis Felt[1] was reared from Ipomoea, probably the deformed flower buds infested by Schizomyia ipomoeae Felt.

Key to species

a Antennae with 14 segments
  b Abdomen dark brown, scutellum reddish brown; the fifth antennal segment with a length one-half greater than its diameter, female . . brevicauda Felt, C. 751

[1] Ent. News, 21:269–70. 1910.

aa Antennae with 15 segments

b Abdomen dark brown, scutellum fuscous yellowish; the fifth antennal segment with a length one-half greater than its diameter, male.... virginica Felt, C. 238b

aaa Antennae composed of 16 segments

b Abdomen yellowish brown, scutellum fuscous yellowish; the fifth antennal segment with a length about three-fourths its diameter, female.................................fulva Felt, C. 461

bb Abdomen light yellowish, scutellum pale orange; fifth antennal segment with a length one-third greater than its diameter, female.... flavescens Felt, C. a1583b

aaaa Antennae with 18 segments

b Abdomen dark brown, scutellum a variable fuscous; the fifth antennal segment with a length one-fourth greater than its diameter, male.. hamamelidis Felt, C. 238a

aaaaa 20 to 22 antennal segments

b Abdomen dark brown, scutellum fuscous yellowish; the fifth antennal segment of the male with a length one-fourth greater than its diameter, that of the female with a length three-fourths its diameter. Reared from an oval, adherent gall between Solidago leaves...... adhesa Felt, C. a1568, a1583

bb Abdomen dark brown, the basal and distal segments yellowish; the fifth antennal segment in both sexes with a length one-fourth greater than its diameter. Reared from marginal leaf roll on high blackberry....................rubifolia Felt, a1866, ?a1869

Camptoneuromyia virginica Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 115; separate, p. 19 (Dasyneura)

1908 ———— N. Y. State Mus. Bul. 124, p. 334

The species was taken on witch-hazel, Hamamelis virginiana, at Albany, N. Y., June 12, 1906.

Male. Length .75 mm. Antennae dark brown, 15 segments, the fifth with a length about one-half greater than its diameter; terminal segment suboval. Palpi; the first segment short, stout, irregular, the second narrowly oval, a little longer, the third as long as the second, more slender, the fourth nearly twice the length of the third, more slender. Mesonotum nearly uniform dark brown, lighter posteriorly, submedian lines lighter, sparsely haired. Scutellum variably fuscous basally, pale yellowish and with sparse setae apically; postscutellum dark brown. Abdomen dark brown, the sixth and seventh segments pale yellowish orange. Wings (pl. 6, fig. 5) hyaline, costa black, the third vein uniting with costa at the distal third. Halteres yellowish transparent. Legs light brown, lighter ventrally, tarsi slightly darker; claws long, slender, uniformly curved. Genitalia; basal clasp segment long, slender; terminal clasp segment short, stout; dorsal plate broad, deeply and triangularly emarginate. Harpes subtriangular, stout, irregularly dentate. Type Cecid. 238b.

Camptoneuromyia brevicauda Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 343 (Dasyneura)

This species was taken in July and August 1906, at Nassau, and also at Albany, N. Y.

Female. Length .75 mm. Antennae dark brown; 14 segments, the fifth with a length one-half greater than its diameter. Palpi; the first segment rather long, slender basally, expanded distally, the second one-fourth longer than the first, stout, the third about equal to the second and the fourth one-half longer than the third, all sparsely clothed with coarse setae and broad scales; eyes large, black. Mesonotum dark brown. Scutellum reddish brown, postscutellum and abdomen dark brown, ovipositor pale yellowish. Wings (pl. 6, fig. 7) hyaline, costa dark brown, the third vein uniting with costa at the distal fifth; halteres yellowish basally, whitish apically. Coxae fuscous yellowish, trochanters deep carmine, base of femora yellowish, other portions of legs dark brown; claws slender, strongly curved. Ovipositor one-fourth the length of the body, the terminal lobes long, slender, tapering, broadly rounded. Type Cecid. 340.

Camptoneuromyia fulva Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 334

This midge was taken on Cornus, probably C. stolonifera, at Albany, N. Y., July 3, 1906.

Female. Length .75 mm. Antennae dark brown, basally yellowish; 16 segments, the fifth with a length about three-fourths its diameter, tapering slightly distally; terminal segment reduced, subconical. Palpi; the first segment long, subrectangular, the second a little longer than the first, stouter, the third one-half longer and more slender than the second, the fourth one-half longer and more slender than the third; face yellowish, eyes black. Mesonotum thickly clothed with golden yellow setae, submedian lines reddish brown, naked. Scutellum fuscous yellowish, postscutellum pale yellowish. Abdomen yellowish brown, thickly yellow haired. Wings hyaline, costa dark brown, the third vein uniting with costa near the distal third. Halteres pale yellowish; coxae, femora and tibiae mostly pale yellowish; tarsi fuscous yellowish, dark brown distally; claws long, slender, curved, the pulvilli nearly as long as the claws. Ovipositor nearly as long as the abdomen, terminal lobes slender, with a length about three times their diameter, tapering. Type Cecid. 461.

Camptoneuromyia flavescens Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 327 (Lasioptera)
1909 ———— Ottawa Nat., 22:247

This form was apparently reared from a closely adherent pyriform apical leaf gall on Solidago graminifolia very similar in appearance to that made by Asphondylia monacha O. S. Galls were taken at Jamesburgh, N. J., and West Nyack, N. Y., the latter half of July 1907, adults being reared the 29th and 30th. Some leaves in this material were rolled and it is possible that this species came from these rather than from the galls described below. Apparently the same gall on S. canadensis was collected by Dr A. Cosens June 29, 1916 at Toronto, Can.

Gall. The gall from which this species may have been reared is a closely adherent pyriform apical leaf gall 1 x .5 cm and identical in every appearance with that commonly producing Asphondylia monacha, presumably the normal inhabitant of this type of gall.

Female. Length 1 mm. Antennae brown, basally yellowish; 16 segments, the fifth with a length about one-third greater than its diameter; terminal segment produced, slender, tapering to a narrowly rounded apex. Palpi; first segment short, stout, subquadrate, the second nearly twice as long as the first, narrowly oval, the third as long as the second, slender, the fourth one-half longer than the third, slender; face fuscous yellowish. Mesonotum pale orange. Scutellum and postscutellum pale orange. Abdomen light yellowish, the segments sparsely clothed dorsally with fuscous setae, venter pale yellowish. Wings hyaline, costa dark brown, the third vein uniting with costa at the distal fourth. Halteres yellowish transparent. Coxae pale orange, femora mostly light yellowish, tibiae and tarsi mostly dark brown; claws rather long, slender, strongly curved, the pulvilli a little longer than the claws. Ovipositor about as long as the abdomen, the terminal lobes long, slender, narrowly rounded. Type Cecid. a1583b.

Camptoneuromyia hamamelidis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 116–17; separate, p. 20 (Dasyneura)

1908 ———— N. Y. State Mus. Bul. 124, p. 334

The single male representing this species was captured on witch-hazel, Hamamelis virginiana, at Albany, N. Y., June 12, 1906.

Male. Length .75 mm. Antennae dark brown; 18 segments, the fifth with a length about one-half greater than its diameter; terminal segment slightly prolonged, subovoid. Palpi; the first segment short, irregularly subquadrate, the second short, broadly oval, the third a little longer, slender, the fourth one-half longer than the third, more slender. Face presumably dark brown. Mesonotum nearly uniform dark brown, somewhat lighter posteriorly, submedian lines rather distinct and ornamented with pale hairs. Scutellum a variable fuscous basally, pale yellowish and with sparse setae apically, postscutellum dark brown. Abdomen nearly uniform dark brown. Wings (pl. 6, fig. 4) hyaline, costa dark brown or black, the third vein uniting with costa at the distal third. Halteres yellowish transparent. Legs nearly uniform light brown, lighter ventrally, tarsi slightly darker; claws rather slender, uniformly curved. Genitalia; basal clasp segment stout; terminal clasp segment swollen at the base. Dorsal plate broad, deeply and broadly emarginate; ventral plate narrow, deeply incised. Harpes rather stout, subtriangular, irregularly dentate. Type Cecid. 238a.

Camptoneuromyia adhesa Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 291; separate, p. 10 (Dasyneura)
1909 ——— Ottawa Nat. 22:248

A number of specimens of this peculiar form were reared in July 1907 from an oval cell formed by the adhesion of two Solidago leaves about an injured area. Two species at least, develop in this type of gall, the above named form and Asphondylia monacha O. S. The exuviae of the latter form was found near a large exit hole, while the Camptoneuromyia emerges through a smaller orifice. Representatives of both genera were reared from different lots of galls and in one case the puparium of an Asphondylia was observed within the deformity. A peculiar larva, probably a Lestodiplosis, was taken from one gall.

The formation of this gall is interesting. It evidently originates in the closely appressed terminal leaves of growing buds. The female presumably inserts her long ovipositor between the young leaves, deposits an egg there and the irritation caused by the developing larva results in the leaves adhering, even after subsequent growth of the plant has separated the bases of the two leaves an inch or more. Interesting gradations showing the development of the gall of this somewhat local species were observable at West Nyack, July 17, 1907. This gall has been observed at Nassau, N. Y., and by Prof. J. G. Needham in the Adirondacks.

Gall. The gall produced by this species is an irregular, subglobular swelling involving both leaves. It is approximately oval in shape, about 2 mm in diameter and may contain one or two whitish larvae.

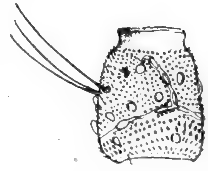

Fig. 46 Camptoneuromyia adhesa, fifth antennal segment of the male, enlarged (original)

Larva. Length 2.5 mm, whitish or yellowish white, slender, smooth; head small; antennae minute. There is no breastbone visible in the mounted specimens, possibly due to a recent molt or to the larva being in an early stage. Terminal segment broadly rounded, with a pair of submedian, stout, irregular tubercles and a long, slender, lateral seta near the middle of each segment.

Male. Length .75 mm. Antennae dark brown, basally yellowish; 21 segments, the fifth with a length about one-fourth greater than its diameter; terminal segment somewhat produced, narrowly

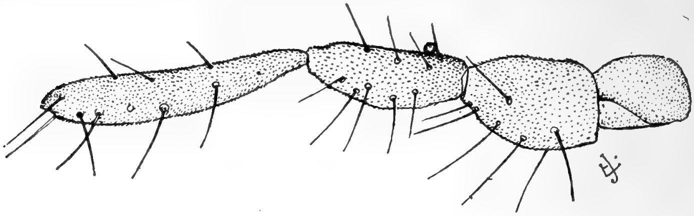

Fig. 47 Camptoneuromyia adhesa, palpus of male, enlarged (original)

oval. Palpi; the first segment short, stout, subquadrate, the second a little longer and stouter, narrowly oval, the third a little longer and more slender, the fourth nearly twice the length of the third, more slender. Face fuscous yellowish. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum dark brown. Abdomen dark brown, the segments rather sparsely margined posteriorly with yellowish hairs; genitalia fuscous, pleurae and venter fuscous yellowish. Wings hyaline, costa dark brown, the third vein uniting with costa at the distal third. Halteres whitish transparent. Coxae fuscous yellowish, femora and tibiae pale yellowish, narrowly annulate distally with dark brown or reddish brown, tarsi brown, the distal segments darker; claws very long, slender, strongly curved, the pulvilli shorter than the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment short, stout, slightly swollen basally; dorsal plate short, broad, deeply and narrowly incised; ventral plate long, narrowly rounded. Harpes stout at base, tapering and curving distally, apex irregularly rounded.

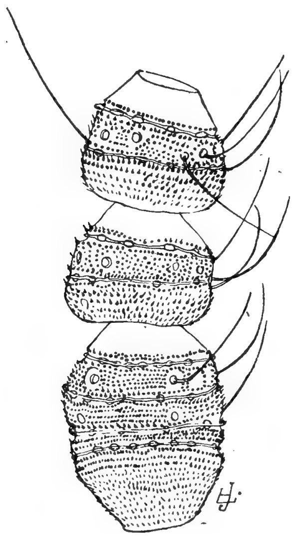

Fig. 48 Camptoneuromyia adhesa, third, fourth and fifth antennal segments of female, enlarged (original)

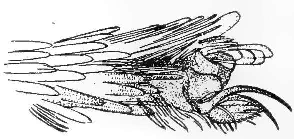

Fig. 49 Camptoneuromyia adhesa, anterior claw of male, greatly enlarged (original)

Female. Length .75 mm. Antennae dark brown, basally yellowish; 22 segments, the fifth with a length about three-fourths its diameter; terminal segment somewhat produced, broadly obovate. Palpi; one segment, probably the second, short, stout, narrowly oval, the next a little longer, broader, somewhat irregular, the distal one-half longer than the preceding and more slender. Face fuscous. Mesonotum dark brown, the submedian lines rather thickly haired. Scutellum and postscutellum light fuscous yellowish. Abdomen a nearly uniform dark brown, the basal segments yellowish, the others narrowly margined posteriorly with yellowish, pleurae and

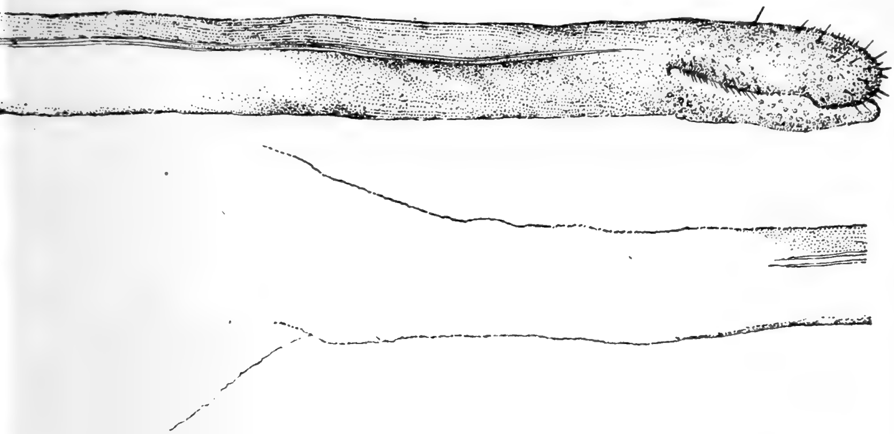

Fig. 50 Camptoneuromyia adhesa, ovipositor of female, enlarged (original)

venter yellowish; in some specimens the venter appears to be thickly clothed with silvery scales. Wings (pl. 6, fig. 6) as in the male. Halteres yellowish transparent. Coxae, femora and tibiae mostly pale yellowish, the femora narrowly and variably annulate distally with fuscous, tarsi dark brown. Ovipositor about one-half the length of the abdomen, terminal lobes rather long, stout, broadly rounded. Type Cecid. a1568.

Camptoneuromyia rubifolia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 334

This species was reared July 30, 1908 from a corrugated marginal leaf roll on high blackberry discovered by Cora H. Clarke at Magnolia, Mass., July 20th. Apparently one female (a1869) of this species was reared August 1, 1908 from oval, blisterlike spots on the leaves of Smilax rotundifolia collected by Cora H. Clarke at Magnolia, Mass., July 23d, though there is no undoubted evidence to show that this latter specimen came from the smilax leaves.

Gall. The gall inhabited by this species is a corrugated marginal leaf roll on high blackberry some 10 to 15 cm long and 1.5 cm in diameter. The larvae are yellowish and whitish.

Larva. Length 3.5 mm, yellowish or whitish, rather stout, the segmentation distinct, head small. Antennae small, the basal segment short, very broad, with a length less than one-half its diameter; terminal segment slender, with a length nearly three times its diameter. Breastbone bidentate, the lobes broadly rounded, basal portion of the breastbone indistinct. Skin nearly smooth, naked; terminal segment with submedian and sublateral stout, tubercular elevations, the sublateral ones larger; on the latero-posterior angle there is a long, slender seta arising from a stout base.

Male. Length .75 mm. Antennae fuscous yellowish; 21 segments, the fifth with a length about one-fourth greater than its diameter; terminal segment broadly oval or slightly fused with the penultimate. Palpi; the first segment short, stout, the second narrowly oval, with a length nearly three times its diameter, the third slender, one-fourth longer than the second, the fourth a little longer than the third, more dilated. Mesonotum reddish brown, the submedian lines yellowish. Scutellum and postscutellum fuscous yellowish. Abdomen sparsely haired, the dorsum dark brown, except the yellowish basal and apical segments; venter pale yellowish, genitalia fuscous. Wings hyaline, costa black, the third vein uniting with the costa at the basal half; halteres pale yellowish. Coxae, femora and tibiae pale, the three basal tarsal segments fuscous yellowish, the two distal segments reddish brown, shading to dark brown apically; claws long, slender, strongly curved; pulvilli shorter than the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment short, stout, dorsal plate long, broad, deeply and triangularly emarginate; ventral plate long, tapering, narrowly rounded. Harpes long, broad at base, the distal third produced, obtuse.

Female. Length .75 mm. Antennae dark brown; 22 segments, the fifth with a length about one-third greater than its diameter;

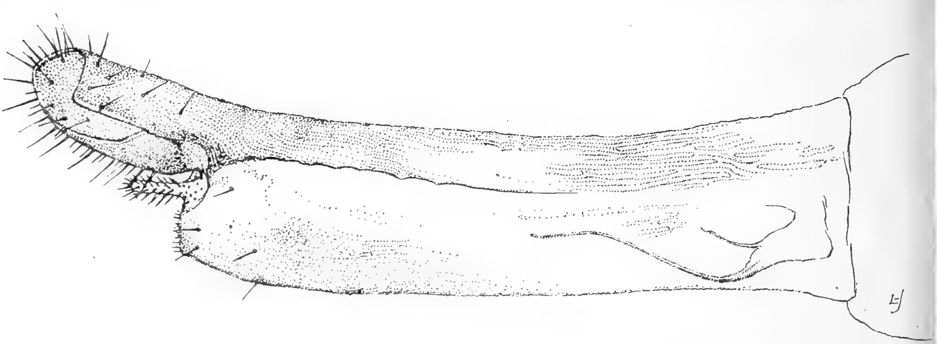

Fig. 51 Camptoneuromyia rubifoliae, ovipositor, enlarged (original)

terminal segment somewhat reduced, broadly rounded. Palpi; the first segment rather long, stout, the second probably narrowly oval, as long as the first, the third a little longer than the second, more slender, the fourth one-third longer than the third, slender.

Mesonotum dark brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum fuscous yellowish. Abdomen sparsely haired, dark brown, the ovipositor pale yellowish; halteres yellowish transparent. Coxae, femora and tibiae mostly light yellowish, the basal tarsal segments fuscous yellowish, becoming darker distally, the apical segments dark brown. Ovipositor about one-half the length of the body, the terminal lobes broad, long, narrowly rounded. Type Cecid. a1866.

Camptoneuromyia meridionalis Felt

1910 **Felt, E. P.** Ent. News, 21:269-70

This West Indian species may be separated from known American forms by the reddish brown abdomen and the 19 antennal segments, the fifth having a length about equal to its diameter. It was reared by William H. Patterson, then of the Agricultural School, St Vincent, W. I., from flower buds of Ipomoea infested with Schizomyia ipomoeae Felt. Type Cecid. 1379.

TROTTERIA Kieff.

Choristoneura Rubs.

1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:343 (Choristoneura)
1897 **Kieffer, J. J.** Syn. Cecid. de Eur. & Alg., p. 4 (Choristoneura)
1902 ——— Soc. Ent. Fr. Ann., 70:561 (Trotteria proposed)
1904 ——— Soc. Ent. Brux. Ann., 28:20
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 334-35
1911 ——— N. Y. Ent. Soc. Jour., 19:43
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 21

The genus Trotteria comprises a well-defined group, easily recognized by the abundant scale covering of the body, the peculiar venation, the relatively large eyes limited to the ventral two-thirds of the head, the greatly produced basal antennal segment and the long, setose spines on the posterior tibiae. Any one of these characters suffices to separate the genus. Type Lasioptera obtusa H. Lw.

The venation of the wings (pl. 6, fig. 9) is peculiar; costa to the apex of the wing, subcosta and the third vein are heavily scaled, the last being some distance from the nearly straight costa, rather strongly curved and uniting with the anterior margin near the distal third. The occiput is small while the ventral position of the eyes appears to be in some measure correlated with the greatly produced (fig. 52) first antennal segment. This latter has a length two and one-half to about four times its diameter. The flagellate antennal segments are sessile, cylindric and in most species have a length of only one-half or three-fourths that of the diameter. There is a rather thick subbasal whorl and a scattering subapical whorl of short setae and stout circumfili near the basal third and apically on these segments. The antennae may have from 16 to 22 segments. The femora are strongly swollen and the tibiae, particularly the posterior pair, are armed with long, setose spines which, in some forms extend to the base of the second tarsal segment. The male genitalia presents a very characteristic type, differing markedly in some respects from those of other Itonididae. The genus Choristoneura Rubs. is preoccupied by Choristoneura Mabille.

Practically nothing is known concerning the life history of these interesting forms. Rubsaamen believes that members of this genus may be parasitic in habit. The one American species reared was obtained from a jar containing galls of well-known Itonids, upon which it was probably parasitic, since no peculiar deformity could be recognized as its habitat.

Key to species

a Females

b 16 antennal segments; abdomen and tibiae dark brown, the fourth palpal segment with a length one-half greater than the third................ karnerensis Felt, C. 484

bb 20 antennal segments; abdomen dark brown; tibiae pale yellowish, the fourth palpal segment twice as long as the third..................... subfuscata Felt, C. 618

bbb 22 antennal segments

c Claws stout, legs thickly clothed with scales, the first antennal segment with a length four times its diameter; reared from Solidago.. solidaginis Felt, C. a1568y

cc Claws rather slender, legs rather thinly clothed with scales, the first antennal segment with a length thrice its diameter............... caudata Felt, C. 477

aa Males

b 18 antennal segments, the first with a length four times its diameter; abdomen thickly clothed with silvery scales, fourth palpal segment one-fourth longer than the third.........squamosa Felt, C. 522

bb 20 antennal segments

c Fifth antennal segment with a length more than three-fourths its diameter

d First antennal segment with a length two and one-half times its diameter......................caryae Felt, C. 334

cc Fifth antennal segment with a length scarcely three-fourths its diameter

d Abdomen silvery white; tibiae dark fuscous orange........... argenti Felt, C. 466

dd Abdomen silvery yellow; tibiae and tarsi black............... tarsata Felt, C. 667

ddd Abdomen pale brown; tibiae dark brown..................... metallica Felt, C. 335

Trotteria karnerensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 335

This female was taken at Karner, N. Y., July 5, 1906 on elder, S a m b u c u s c a n a d e n s i s .

Female. Length 1.66 mm. Antennae dark brown; 16 segments, the first subcylindric, with a length three times its diameter, the fifth with a length about one-half its diameter; terminal segment produced, apparently composed of two closely fused, strongly constricted near the middle, narrowly rounded. Palpi; the first segment subrectangular, with a length about twice its diameter, the second stouter, one-half longer, the third a little longer and more slender than the second, and the fourth about one-half longer than the third, more slender, strongly compressed. Mesonotum dark brown. Scutellum thickly clothed with pale silvery yellowish hairs. Abdomen dark brown, the segments margined posteriorly with dull silvery; ovipositor pale orange. Wings hyaline, costa dark brown, the third vein uniting with the costa near the distal fourth; halteres pale yellowish; pleurae and coxae rather thickly clothed with silvery white hairs; femora basally silvery yellow, apically banded with fuscous; posterior tibiae pale yellowish, fuscous distally, other tibiae and tarsi nearly uniform dark brown; claws long, slender, evenly curved, the pulvilli shorter than the claws. Ovipositor about as long as the abdomen, terminal lobe slender, with a length nearly five times its diameter, narrowly rounded. Type Cecid. 484.

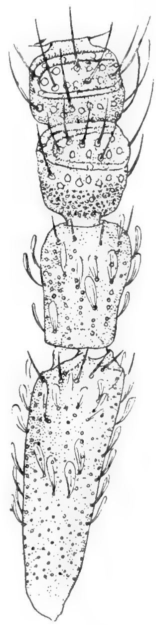

Fig. 52 T r o t t e r i a s u b f u s c a t a , basal four antennal segments, greatly enlarged (original)

Trotteria subfuscata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 335

This species was taken at Albany, N. Y., July 17, 1906 on Solidago.

Female. Length 2 mm. Antennae dark brown; 20 segments, the first with a length fully three times its diameter, the fifth with a length about three-fourths its diameter; terminal segment twice the length of the preceding, the distal fourth obtusely subconic. Palpi; first segment subquadrate, second twice the length of the first, a little stouter, the third a little longer, more slender than the preceding, the fourth about twice the length of the third, more slender. Mesonotum dark brown. Scutellum fuscous yellowish. Abdomen shining dark brown, ovipositor pale orange. Wings hyaline, costa dark brown, the third vein uniting with costa at the distal third. Halteres pale yellowish. Coxae, femora and tibiae mostly pale yellowish, tarsi dark brown; claws rather stout, slightly curved. Ovipositor probably about three-fourths the length

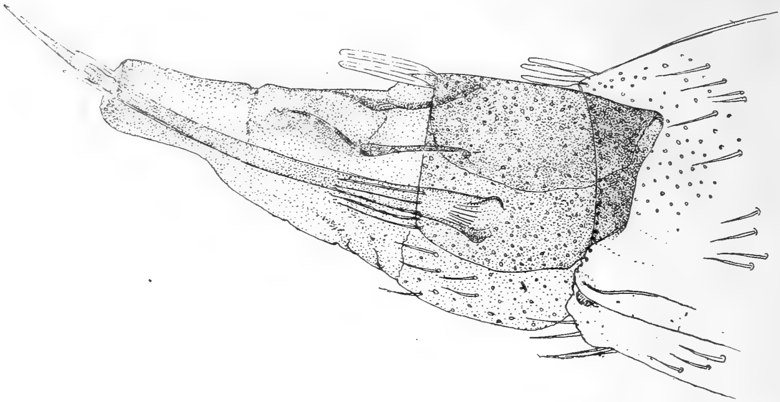

Fig. 53 Trotteria subfuscata, ovipositor, greatly enlarged (original)

of the body, lobes broad at base, tapering, broadly rounded. Type Cecid. 618.

Trotteria solidaginis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 335

This female was reared July 2, 1907 from a lot of infested Solidago material taken at West Nyack, N. Y., and supposed to contain only galls of Dasyneura adhesa Felt and the adherent type of gall made by Asphondylia monacha O. S. This species was also reared in association with Asphondylia thalictri Felt and is probably zoophagous.

Female. Length 1.66 mm. Antennae presumably dark brown, consisting of 22 segments, the first with a length fully four times its diameter, the fifth with a length about one-half its diameter; terminal segments produced, narrowly rounded. Palpi; first segment subrectangular, the second a little longer and stouter, the third a little longer than the second, more slender and the fourth about one-half longer and more slender than the third. Colorational and scale characters very similar to allied forms. Wings hyaline, costa dark brown, the third vein uniting with costa at the distal third. Legs very thickly clothed with stout scales; claws long, stout, evenly curved, the pulvilli shorter than the claws. Ovipositor about as long as the abdomen, the terminal lobes slender, tapering to an acute, bladelike apex. Type Cecid. a1568y.

Trotteria caudata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 335

This species was taken at Karner, N. Y., July 5, 1906 on bush honeysuckle, Diervilla trifida.

Female. Length 1.66 mm. Antennae dark brown; 19 and probably 22 segments, the first with a length about three times its diameter, the fifth with a length about half its diameter; terminal segment apparently free. Palpi; the first segment short, stout, irregularly subquadrate, the second stouter and more than twice the length of the first, the third a little longer and more slender than the second and the fourth one-half longer and more slender than the third. Mesonotum reddish brown. Scutellum dark brown with numerous dark brown apical setae or scales. Abdomen dark brown, rather thickly clothed with dull silvery scales, especially basally on each segment; pleurae thickly clothed with silvery white scales; ovipositor pale orange. Wings hyaline, costa dark brown, the third vein uniting w th costa at the distal fourth; halteres whitish transparent. Coxae, the basal portion of femora and the hind tarsi silvery white, the other parts of the legs a dark brown, lighter ventrally; claws long, rather slender, evenly curved, the pulvilli nearly as long as the claws. Ovipositor about as long as the abdomen, the terminal portion slender, tapering to a narrow, bladelike apex. Type Cecid. 477.

Trotteria squamosa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 335

This male was taken at Albany, N. Y., July 26, 1906 on New Jersey tea, L e d u m l a t i f o l i u m .

Male. Length 2 mm. Antennae dark brown; 18 segments, the first with a length nearly four times its diameter, the fifth with a length a little greater than its diameter; terminal segment produced, evidently composed of two closely fused, contracted at the distal third, tapering, narrowly rounded. Palpi; the first segment rather long, irregularly subquadrate, the second a little longer and stouter than the first, the third longer and more slender than the second, the fourth about one-fourth longer and more slender than the third. Mesonotum thickly clothed with bronzy, silvery scales. Scutellum ornamented with light brown scales, the dorsum of the abdomen thickly clothed with silvery scales, except the terminal segment which is dark brown. Genitalia reddish ventrally. The abdomen is clothed with thick tufts of silvery white scales. Wings subhyaline, costa dark brown, the third vein uniting with costa at the distal third; halteres silvery whitish. Coxae silvery, fuscous distally; femora and tibiae mostly light fuscous, lighter ventrally; tarsi darker; claws long, slender, evenly curved, the pulvilli shorter than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, swollen near the basal third; dorsal plate long, deeply and triangularly incised; ventral plate long, deeply and roundly incised. Harpes long, slender, irregular, obtuse. Type Cecid. 522.

Trotteria caryae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 110 (separate, p. 14) (Choristoneura)

1908 ———— N. Y. State Mus. Bul. 124, p. 335

This species was taken at Albany, N. Y., June 20, 1906 on hickory.

Male. Length 2 mm. Antennae dark brown, probably 20 segments, the first with a length about two and one-half times its diameter, the fifth with a length about three-fourths its diameter, cylindric. Palpi; the first segment short, rather slender, second and third subequal, stouter, the fourth one-half longer than the third. Head dark brown with two silvery spots at the base of the antennae, eyes black. Mesonotum covered with bronzy scales. Scute lum and postscutellum with long scales. Pleurae with very large, silvery scales. Abdomen clothed with pale brown scales, those on the last two segments with a bluish tinge. Wings hyaline, costa dark brown, the third vein joining costa at the apical third. Legs thickly scaled, pale yellowish at the base, the tibiae and tarsi dark brown; claws heavy. Genitalia; basal clasp segment stout; terminal clasp segment stout; dorsal plate broad, deeply incised; ventral plate narrow, deeply incised. Harpes stout, nearly straight. Type Cecid. 334.

Trotteria argenti Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 335

This midge was taken at Albany, N. Y., July 3, 1906 on New Jersey tea, L e d u m l a t i f o l i u m .

Male. Length 3 mm. Antennae dark brown; 20 segments, the first with a length fully three times its diameter, the fifth with a length scarcely three-fourths its diameter; terminal segment prolonged, more than twice the length of the preceding, obtusely rounded. Palpi; the first segment short, subquadrate, the second a little

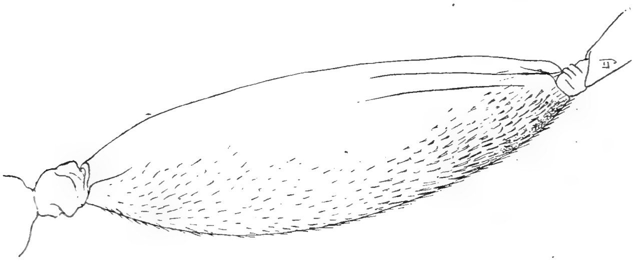

Fig. 54 T r o t t e r i a a r g e n t i , posterior femur, enlarged (original)

longer, stouter, rounding distally, the third longer and more slender than the second, the fourth one-half longer than the third, more slender. Mesonotum dark brown, thickly clothed with golden yellow scales, becoming more abundant posteriorly and giving the posterior half of the mesonotum a distinct, yellowish appearance, pleurae thickly clothed with silvery white scales. Scutellum thickly covered with pale yellowish scales. Abdomen thickly covered dorsally with silvery scales, except the naked, dark brown terminal segment; ventral surface uniform dark brown. Wings (pl. 6, fig. 9) subhyaline, costa dark brown, the third vein uniting with the costa at the distal fifth; halteres light fuscous basally, whitish transparent apically, club greatly enlarged. Coxae fuscous, femora mostly a pale fuscous orange, narrowly annulate with fuscous distally, tibiae dark fuscous orange, narrowly marked with fuscous distally, tarsi nearly uniform dark brown; claws stout, evenly curved. Genitalia; basal clasp segment stout; terminal clasp segment stout, slightly swollen basally; dorsal plate broad, deeply and triangularly emarginate; ventral plate narrow, deeply and narrowly incised. Harpes long, slender, subacute. Type Cecid. 466.

Trotteria tarsata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 335

The male was taken at Albany, N. Y., July 24, 1906 on scrub oak, Quercus ilicifolia or Q. prinoides.

Male. Length 2 mm. Antennae dark brown; 20 segments, the first with a length fully three times its diameter, the fifth with a length about half its diameter; terminal segment prolonged, about twice the length of the preceding, the distal fourth obconic. Palpi; first segment subquadrate, the second a little longer, narrowly oval, the third longer, more slender than the second, the fourth longer than the third, more slender. Mesonotum dark brown, thickly clothed with silvery, yellowish scales. Scutellum thickly clothed with similar scales. Abdomen nearly uniformly and thickly clothed with silvery, yellowish scales; terminal segments fuscous. Wings (pl. 6, fig. 10) hyaline, costa dark brown, the third vein uniting with costa at the distal fourth. Halteres yellowish transparent. Coxae and femora pale yellowish, tibiae and tarsi mostly black, the distal tarsal segment with silvery reflections. Claws rather stout, evenly curved. Genitalia (pl. 8, fig. 4); basal clasp segment long, stout; terminal clasp segment stout; dorsal plate broad, deeply and narrowly incised; ventral plate narrow, deeply and narrowly incised. Harpes long, swollen at the base, slender, the apex minutely dentate. Type Cecid. 667.

Trotteria metallica Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 106 (Lasioptera caryae)

1908 ———— N. Y. State Mus. Bul. 124, p. 335

This species was taken on hickory, Carya species, at Albany, N. Y., June 19, 1906.

Male. Length 2 mm. Antennae brown; 20 segments, the first with a length four times its diameter, the fifth with a length three-fourths its diameter; terminal segment with a length more than twice its diameter; subacute apically. Palpi; the first segment short, subquadrate, second one-fourth longer, nearly oval, the third slightly longer, more slender, the fourth one-half longer than the third. Head dark brown with two silvery spots at the base of the antennae. Mesonotum covered with bronzy scales. Scutellum and postscutellum with long scales. Pleurae with very large, silvery scales. Abdomen clothed with pale brown scales, those of the last two segments with a bluish tinge. Wings hyaline, costa dark brown, the third vein uniting with costa at the distal third. Halteres yellowish. Legs thickly clothed with scales, yellowish at the base, the tibiae and tarsi dark brown; claws medium. Genitalia, basal clasp segment stout, tapering; terminal clasp segment stout, dorsal plate broad, deeply incised; ventral plate narrow, deeply emarginate. Harpes stout. Type Cecid. 335.

EXPLANATION OF PLATES

PLATE I

Codling moth, Carpocapsa pomonella Linn.
Three apples showing typical side injury (author's illustration).

Plate I

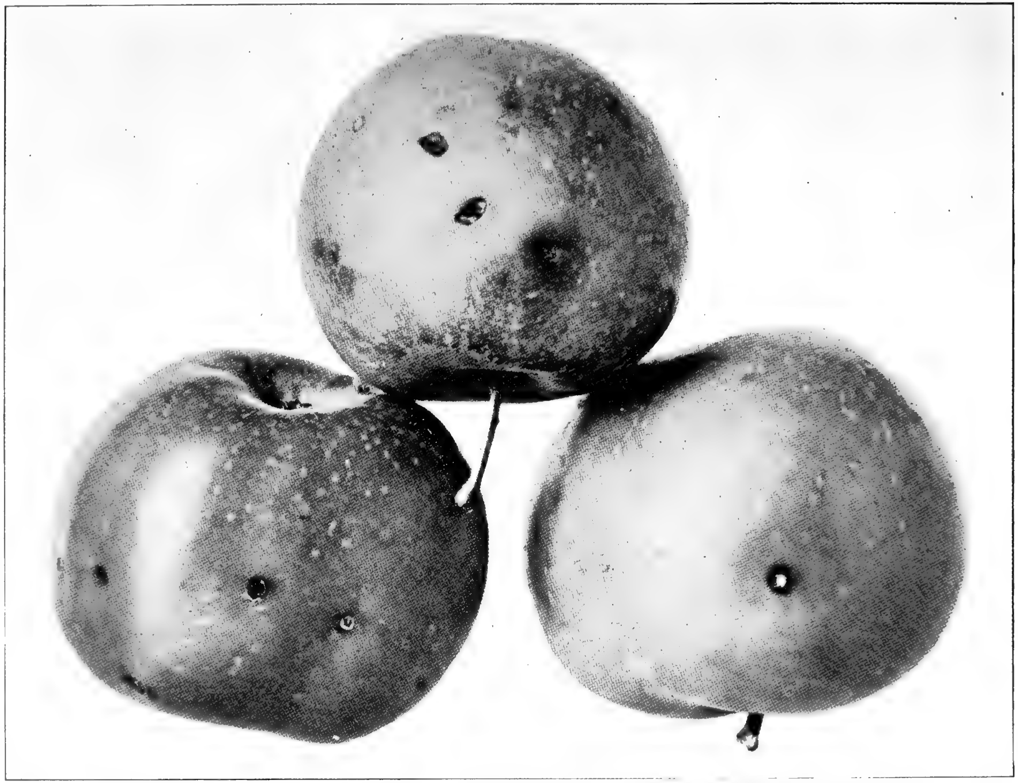

PLATE 2

Codling moth, C a r p o c a p s a p o m o n e l l a Linn.

Typical side wormy apples showing the work of nearly full-grown larvae (author's illustration).

Plate 2

PLATE 3

1 Grape tomato gall, Lasioptera vitis O. S.
2 Grape petiole gall, Neolasioptera vitinea Felt

Plate 3

1

2

PLATE 4

1 Gall of *Lasioptera galeopsidis* Felt, on *Galeopsis tetrahit*

2 Gall of *Asteromyia vesiculosa* Felt, on aster

Plate 4

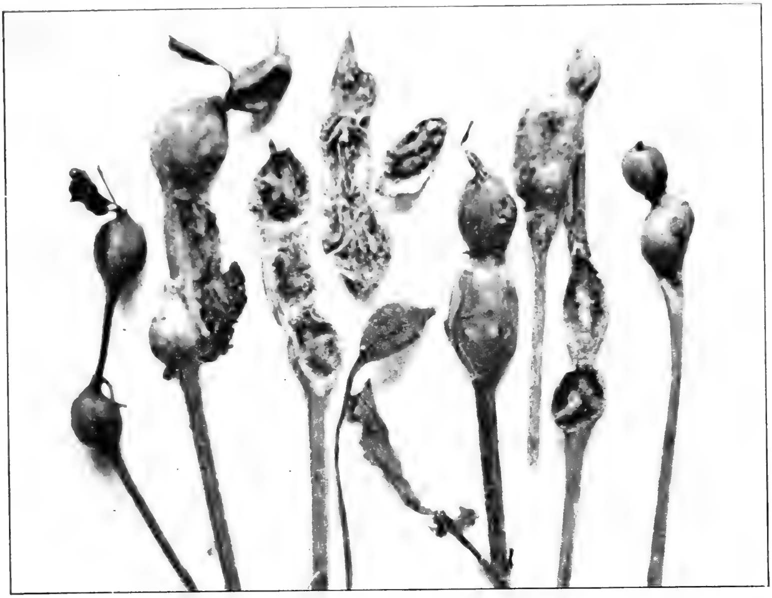

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PLATE 5

1 Wing of *Lasioptera serotina* Felt, female, x 20

2 Wing of *Lasioptera solidaginis* O. S., female, x 20

3 Wing of *Lasioptera abhamata* Felt, female, x 20

4 Wing of *Lasioptera cinerea* Felt, male, x 20

5 Wing of *Neolasioptera hibisci* Felt, female, x 20

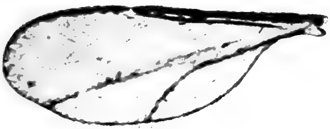
6 Wing of *Neolasioptera liriodendri* Felt, male, x 20

7 Wing of *Neolasioptera tiliaginea* Felt, male, x 20

8 Wing of *Neolasioptera vitinea* Felt, female, x 20

9 Wing of *Asteromyia asterifoliae* Beutm., female, x 20

Plate 5



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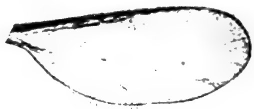

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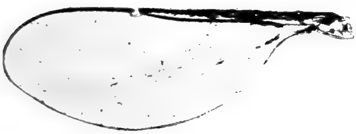

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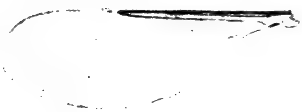

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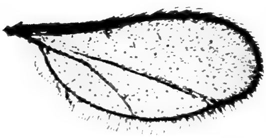

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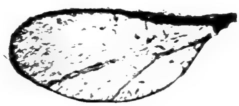

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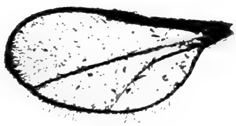

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PLATE 6

1 Wing of Asteromyia agrostis O. S., male, x 20

2 Wing of Asteromyia paniculata Felt, female, x 20

3 Wing of A. paniculata Felt, male, x 20

4 Wing of Camptoneuromyia hamamelidis Felt, male, x 20

5 Wing of Camptoneuromyia virginica Felt, male, x 20

6 Wing of Camptoneuromyia adhesa Felt, female, x 20

7 Wing of Camptoneuromyia brevicauda Felt, female, x 20

8 Wing of Clinorhyncha millifolii Wachtl., female x 20

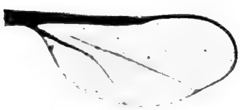
9 Wing of Trotteria argenti Felt, male, x 20

10 Wing of Trotteria tarsata Felt, male, x 20

Plate 6

1

2



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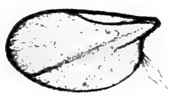

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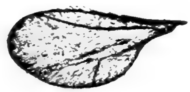

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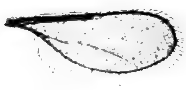

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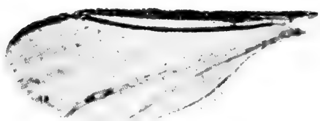

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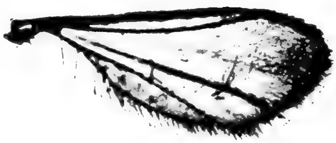

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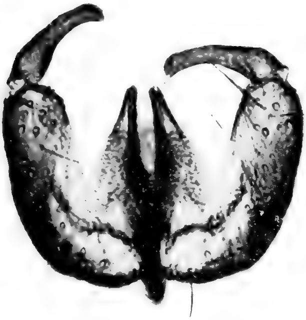
PLATE 7

1 Male genitalia of Lasioptera cinerea Felt, x 260
2 Male genitalia of Lasioptera consobrina Felt, x 260
3 Male genitalia of Neolasioptera liriodendri Felt, x 260
4 Male genitalia of Neolasioptera tripunctata Felt, x 260

Plate 7



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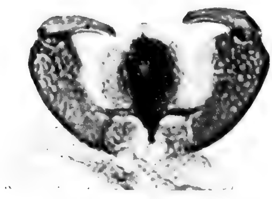

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PLATE 8

1 Male genitalia of Asteromyia agrostis O. S., x 260
2 Male genitalia of Asteromyia rubra Felt, x 260
3 Male genitalia of Asteromyia laeviana Felt, x 260
4 Male genitalia of Trotteria tarsata Felt, x 260

Plate 8

1

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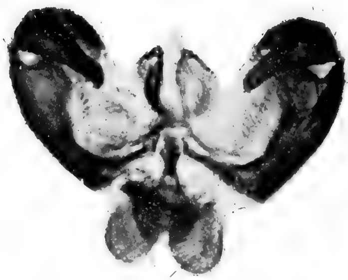

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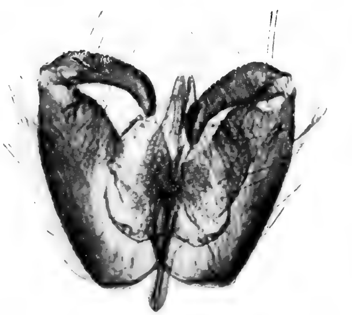

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INDEX

New York State Museum Bulletin

Entered as second-class matter November 27, 1915, at the Post Office at Albany, New York, under the act of August 24, 1912

Published monthly by The University of the State of New York

No. 199 ALBANY, N. Y. JULY 1, 1917

The University of the State of New York
New York State Museum

JOHN M. CLARKE, DIRECTOR

THE ADIRONDACK GRAPHITE DEPOSITS

BY HAROLD L. ALLING

ALBANY
THE UNIVERSITY OF THE STATE OF NEW YORK
1918

M110r-Je18-1500

The University of the State of New York
New York State Museum April 29, 1918

Dr Thomas E. Finegan
Acting President of the University

DEAR SIR: I transmit to you herewith for immediate publication as a bulletin of the State Museum a report on the Adirondack Graphite Deposits. The matter contained in this report is of exigent importance as it relates to the intensive development of a war mineral of the first moment. I therefore urge that its publication be expedited.

Yours sincerely
JOHN M. CLARKE
Director

THE UNIVERSITY OF THE STATE OF NEW YORK
OFFICE OF THE PRESIDENT
Approved for publication this 14th day of June 1918

Thos. E. Finegan
Acting President of the University

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THE ADIRONDACK GRAPHITE DEPOSITS

By Harold L. Alling

INTRODUCTION

The world's chief supply of high-grade graphite comes from the island of Ceylon where it has been mined for nearly a century in a most primitive way but at low cost. In 1916 a little more than 70 per cent of the crude crystalline graphite used in this country came from Ceylon. Graphite is also mined extensively in Bohemia, Bavaria and Mexico, the last-named country being noted for the amorphous grade applicable to pencil manufacture. Madagascar has lately come into prominence as a source of the crystalline article and promises to vie with Ceylon in the quantity of exports, which already amounts to over one-half the total credited to that island.

The graphite-mining industry in the United States has been a slow development; only recently has it shown signs of a growth which may at last win for it a place of importance in the world's trade. The industry was established here as far back as the middle of the last century, for it has been carried on in the Adirondack region for more than sixty years. Yet the total output of crystalline graphite in 1916, according to the records of the United States Geological Survey, was only a little over 5000 tons, or less than 15 per cent of the indicated supply available for consumption. Of the total, New York State contributed about one-fourth, ranking second to Alabama in size of output, with Pennsylvania, California and Montana contributing smaller amounts. An incentive to the expansion of the domestic industry has been given recently by the curtailment of supplies from abroad and a consequent rise in prices paid for the native product. A continuance of these conditions may be anticipated for some time at least so that there is opportunity for a very substantial increase in the development of our resources, in which the local industry should participate as fully as possible.

The present bulletin embodies the results of a survey of the Adirondack graphite districts, made in the summer of 1917. It aims to give a comprehensive estimate of the resources of the region so far brought to notice and to provide such information about the local geological conditions and other features which affect the outcome of mining and concentration of the graphite as may be useful in forwarding the future progress of the industry. In view of the current conditions, the publication of a report upon the Adirondack deposits which have so long occupied a prominent place in the industry of our country, may be held to be timely.

The writer would like to acknowledge his indebtedness to the many who have shown interest in the work or have assisted him in other ways. To Prof. George H. Chadwick he stands under especial obligations. The topographic maps of the graphite districts are in a large measure his contribution and he has also given freely of advice and suggestion in the study of the complex problems of geology — a service that can scarcely be expressed or valued by this formal acknowledgment.

EARLY MINING DEVELOPMENTS

The first attempt to extract graphite or "black lead," as it is popularly called, from the Adirondack rocks in any commercial way was on Lead hill (Chilson hill of some authors) near Ticonderoga, Essex county, N. Y. Graphite had been known to exist in this locality for a long time. Emmons mentions it in 1842,[1] and Beck gives a brief account of the occurrence.[2] In the fifties the deposits were being exploited by a company that eventually became the American Graphite Company. The Joseph Dixon Crucible Company, now of Jersey City, N. J., the first enterprise to import and manufacture graphite products in this country, took over the American Graphite Company in the eighties and has since been engaged in mining at one or another of its properties on Lead hill, at the Lakeside locality, at Hague, and at Graphite in Warren county.

About the year 1902 the Adirondack deposits began to attract general attention, and in the following years many prospects were opened, companies organized and mills for treating the ores were

[1] Emmons, E., Nat. Hist. N. Y. Geology of the Second District, p. 420.
[2] Beck, Nat. Hist. N. Y. Mineralogy, pt 3, p. 96–97, 1842.

built. Among the enterprises that entered the field at this time was a company which attempted to mine the Towne property. This company, after a year, abandoned work and moved to a site near Overshot pond, operating as the Columbia Graphite Company. There it found more ore but soon worked out all the available supply. Then it moved again, having dismantled its mill, and took over the holdings of the Ticonderoga Graphite Company at Rock pond. Much activity prevailed here for a time, but the property was soon leased to Pettinos Brothers of Bethlehem, Pa., who worked it for only a short time as the ore was cut off by a fault.

Another attempt at mining was made at the Buck Mountain pond locality, which also was not permanently successful. The property was worked for a time by the Consolidated Graphite Company and at another time by the Amalgamated Graphite Company. A huge mill was prematurely constructed and exists today as a dismal ruin.

Many companies that had started operations during the boom period failed to weather the financial stress of 1907 and have not attempted operations since. Fortunes have been lost in vain attempts to win the shining flake from the rocks of the Adirondacks. The history of the industry has been characterized rather by the number of failures that have been recorded than by the few examples of success.

One of the conspicuously successful enterprises has been the American Graphite Company. This company began operations on Lead hill, sending the graphite for treatment to its finishing mill at Ticonderoga. The pockety character of the graphite in the locality led the company to seek a more regular source of supply and it secured control of deposits of graphitic quartz schist in the town of Hague, Warren county, and began experimentation in the mining and treatment of this type of material. At Graphite, 5 miles west of Lake George, the company has developed the most important mine in the State. It has worked the graphitic quartz schist in Warren county ever since and has mined an immense amount of it. It would appear that the company was the first to abandon the northern area with its pockety contact form of graphite for the bedded or blanket type found in the southeastern Adirondacks. The large flake of the spectacular limestone and contact types still attracts attention. When, however, the mining of this kind of ore was found to be unprofitable, in general, the interest shifted southward, and several very promising mines have been opened and are operating on graphitic schist.

THE USES OF GRAPHITE

Contrary to the popular conception, the manufacture of lead pencils requires but a comparatively small amount of graphite, only about 5 per cent of the total being such material. This form of graphite is the amorphous variety. Other uses to which this form of material is put include electrodes for electric furnaces, dry batteries, electrotyping, paints, inks and numerous other purposes. A considerable amount of natural amorphous graphite is now supplanted by artificial material manufactured from coal by the heat of the electric furnace.

But we are more especially concerned with the crystalline or flake variety of graphite which nature alone seems able to produce. It is important to make a distinction between the two classes.

A great share of the flake graphite is manufactured into crucibles used in the production of crucible steels, brass and similar alloys. It has generally been held that Ceylon graphite alone was suitable, but the present shortage has resulted in the employment of domestic materials, at least in part mixed with foreign graphite and found to answer the purpose fairly well. The crucible manufacturers are today experiencing difficulty in maintaining their former quality as well as in meeting the market demands in quantity. This state of affairs is accounted for by the different characters possessed by the Ceylon and domestic materials and especially by the failure to secure a perfect substitute for the German clay used as binder. In 1916 the average crucible, it was said, was capable of withstanding only about half as many heats as the prewar articles. While this condition has been greatly improved, still the present crucibles do not equal the former in quality.

Stoppers used in closing poring holes in the huge steel ladles that receive the charges from furnaces, retorts and certain chemical wares are composed of graphite.

Second to refractory articles in consuming a large share of the supply is stove polish. The small-sized flakes (the intermediate grades) of the graphite mills are employed for that purpose. Graphite is being used more and more for lubrication, either in a dry condition as in textile mills where oil would soil the cloth, or added to lubricating oils and greases. In the latter form it is being extensively used in automobile lubrication.

The fine dust is used in metal paints and, when mixed with talc etc., is used as a facing to foundry molds.

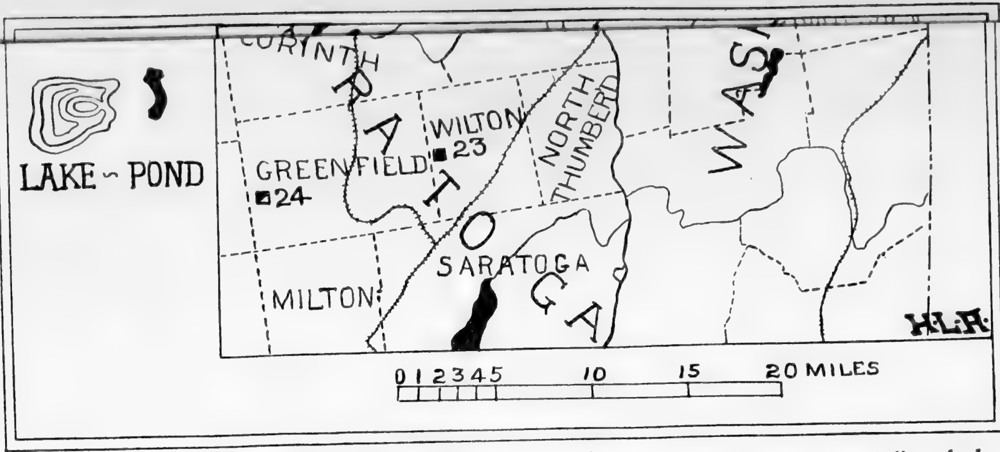
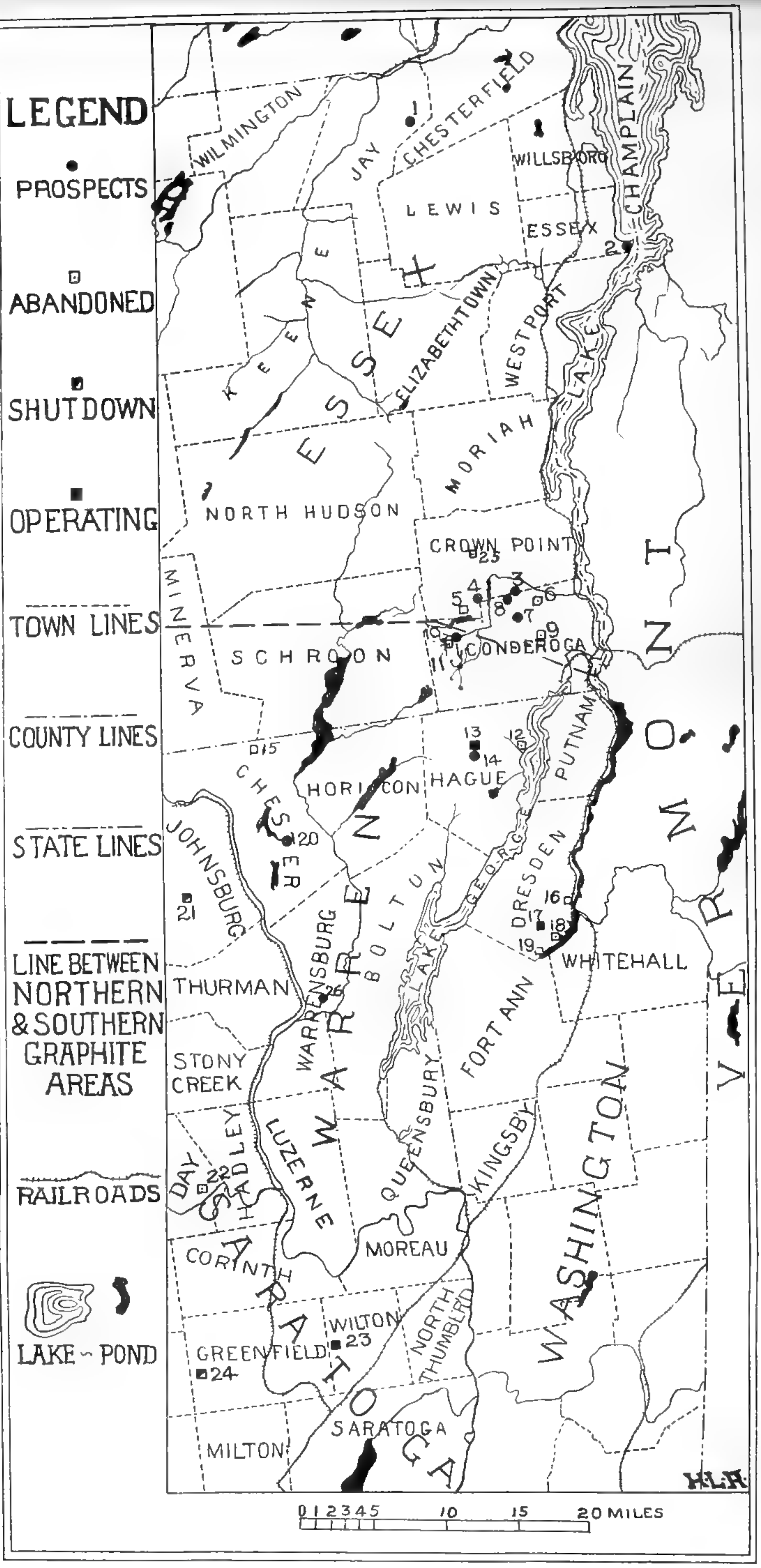


Fig. 1 Key map, showing the location of the graphite deposits in the eastern Adirondacks. Based upon the New York State Geological map of 1901.

1 Gulf prospect
2 Split Rock prospect
3 Towne property
4 Penfield Pond prospect
5 Crown Point Graphite Co.
6 Buck Mountain pond
7 Mason prospect
8 Betsy Cook prospect
9 Lead hill
10 Bly property
11 Rock pond
12 Lakeside mine
13 Dixon's American Graphite Co.
14 Faxon property
15 International Graphite Co.
16 Silver Leaf Graphite Co.
17 Hooper Bros.
18 Adirondack Mining & Milling Co.
19 Champlain Graphite Co.
20 Pottersville prospect
21 Rowland Graphite Co.
22 Sacandaga Graphite Co.
23 Graphite Products Corporation
24 Flake Graphite Co.
25 Columbia Graphite Co.
26 Mammoth Cave prospect



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22 Sacandaga Graphite Co.
23 Graphite Products Corporation
24 Flake Graphite Co.
25 Columbia Graphite Co.
26 Mammoth Cave prospect

DESCRIPTION OF THE GRAPHITE PROPERTIES

Although the chief purpose of this bulletin is to describe the commercially important deposits of graphite in Essex, Warren, Washington and Saratoga counties, an account of the unsuccessful mines is included, for many of them reveal features that furnish valuable aid in understanding the physical and geological conditions of graphite.

It has been found convenient to divide the eastern Adirondack graphite district into two areas — the northern, where the majority of the limestone and contact type of deposits occur, and the southern, which is characterized by the bedded or blanket form of ore body. (See the accompanying key map, figure 1).

The following prospects and mines occur in the northern area, listed from north to south.

The Gulf prospect, located in the township of Jay, Essex county, 4 miles south of Ausable Forks, is still undeveloped. No. 1 on the key map.

Split Rock prospect, now abandoned, is located in the township of Essex, Essex county, 8 miles northeast of Westport, just south of the Split Rock lighthouse. No. 2 on the map.

The Columbia Graphite Company's abandoned mine is situated in the township of Crown Point, Essex county, 2¾ miles north-northwest of Ironville. No. 25 on the map.

The Towne property lies in the township of Ticonderoga, Essex county, just south of the boundary between Crown Point and Ticonderoga and on the boundary between the Ticonderoga and Paradox Lake quadrangles. No. 3 on the map.

The Betsey Cook property is located in the township of Ticonderoga, 2 miles southeast of Ironville. Abandoned. No. 8 on the map.

A little prospect here called the Penfield pond property lies near the southern boundary of the township of Crown Point, near Penfield pond, and is not developed. No. 4 on the map.

The Buck Mountain Pond mine, now abandoned, is located in the township of Ticonderoga, between Buck mountain and Keeney mountain, as is shown on the Ticonderoga quadrangle. No. 6 on the map.

The Crown Point Graphite Company's mine and mill is likewise situated in the township of Ticonderoga 2½ miles southwest of Ironville. The property is today abandoned. No. 5 on the map.

The Mason property (not developed) is located in the township of Ticonderoga three-eighths of a mile east of Echo lake (Worcester pond on the map). No. 7 on the map.

Lead Hill, located 3 miles northwest of Ticonderoga, in the township of the same name. This property is abandoned.

Contact type in the township of Wilmington, exact location not known, but probably somewhere on the shoulders of Wilmington mountain 2½ miles west-northwest of Wilmington village.

The two following occurrences have been reported to but not visited by the writer. These are not indicated upon the key map.

Limestone type in the township of Newcomb, not far from village of Newcomb.

Contact or vein (?) type in the township of Minerva, just north of the town of Minerva (Schroon Lake sheet).

The next three prospects, although of the contact type, occur in the southern area:

A contact-limestone prospect, here referred to as the "Pottersville" prospect. This is located in the township of Chester, Warren county, 2½ miles south of Pottersville. Not developed. No. 20 on the map.

A prospect in a natural cave, locally called Mammoth cave, located in the township of Warrensburg, Warren county, one-half of a mile north of Warrensburg. No. 26 on the map.

On Pardo point, on Lake George, is a vein deposit of graphite.

Mines in the southern area, all of the bedded or blanket type, although a few show in a minor way other types as well:

The Bly property, located in the township of Ticonderoga on the northern slopes of Bear Pond mountain, is still undeveloped. No. 10 on the map.

Rock Pond property. This abandoned mine is to the southeast of the Bly property on the shore of Rock pond. No. 11 on the map.

Dixon's American Graphite Company is situated at Graphite, 5 miles west of Lake George in the township of Hague, Warren county. No. 13 on the map.

The Faxon property adjoins the American Company's land on the west and southwest. This property is still undeveloped. It has recently been sold. It is understood that the property will be worked by the American Graphite Co. No. 14 on the map.

The Lakeside mine of the American Graphite Company is located at the town of Hague on the lake shore. Abandoned. No. 12 on the map.

International Graphite Company's abandoned mine is situated in the township of Chester, Warren county, 3½ miles west-northwest of Pottersville. No. 15 on the map.

The Rowland Graphite mine, now inactive, is located in the town of Johnsburg, Warren county, about a mile south-southwest of the village of Johnsburg. No. 21 on the map.

The Adirondack Mining and Milling Company's abandoned mine and mill is on the west shore of South bay of Lake Champlain; township of Dresden, Washington county. No. 18 on the map.

Hooper Brothers' recently developed property lies in the township of Dresden, Washington county, about 4 miles due west of Whitehall. No. 17 on the map.

The Silver Leaf Graphite Company's workings are situated on the west side of South bay several miles north of the Adirondack Company's property. The mine has been abandoned. No. 16 on the map.

The Champlain Graphite Company. This property, likewise in the South Bay districts, is near the southern end of South Bay and has not been operated for ten years. No. 19 on the map.

The Sacandaga Graphite Company's property is located in the township of Day, Saratoga county, 1¼ miles due west of Conklingville. The mine is today abandoned. No. 22 on the map.

Graphite Products Corporation (formerly the Saratoga Graphite Company). This property now in operation is situated 1 mile southwest of King's Station, 4 miles north of Saratoga Springs in the township of Wilton, Saratoga county. No. 3 on the map.

The Flake Graphite Company (formerly the Empire Graphite Company). This mining district is located in the township of Greenfield, Saratoga county, 2¼ miles west of Porter Corners. No. 24 on the map. Probably will be in operation in 1918.

Several prospects reported to but not visited by the writer are as follows:

A limestone-contact deposit on the Welch farm, 3 miles southwest of Mineville.

A deposit 3 miles east of Hulett's Landing, Lake George.

Chamberlain & Company, 3 miles southwest of Canton, St Lawrence county.

M. W. Spalding, 4 miles southwest of Canton.

C. T. Holbrook, 1½ miles southwest of Pyrites, St Lawrence county.

Macomb Graphite Company — Popes Mills Graphite Company, 1½ miles southwest of Pope's Mills, St Lawrence county.

A deposit on the Indian River, 3 miles from Rossie, St Lawrence county.

Of the complete list, twenty-four of these properties were personally visited during the field season of 1917. The salient features of each will be discussed in the following pages.

THE GRAPHITE DEPOSITS OF THE NORTHERN AREA

While an attempt is made to avoid technical terms, certain concepts are necessary for a comprehensive grasp of the conditions found in the northern area.

Two general groups of rocks are involved: the first, a great series of sedimentary rocks originally bedded limestones, sandstones and shales that have been altered by earth forces to crystalline limestones, schists and gneisses. The second group comprises igneous rocks, among which granite is especially prominent. Igneous rocks are later in age and have invaded the sedimentary series from below. Where the hot fluid mass, saturated with various gases, came in contact with the sediments, especially if they were limestones, and the proper conditions obtained, graphite was developed by complex chemical and physical reactions within the zone of contact. The deposits of the northern area have, in large part, been formed by the process thus briefly outlined. The general subject of origin of the graphite deposits is treated fully on page 141.

The Buck Mountain Pond Property

Located in the township of Ticonderoga, Essex county, within the limits of the Ticonderoga topographic map of the United States Geological Survey, between Buck mountain and Keeney mountain,[1] near the shore of Buck Mountain pond.

The history of the various companies which have attempted to develop this deposit is extremely complicated but apparently the company which operated at one time was known as the Consolidated Graphite Company and at another the Amalgamated Graphite Company.[2]

The extent of the property is said to be a tract of 84 acres[3] on the

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[1] The local name of the latter is different from that given on the map.

[2] The Amalgamated Company included the Rowland Graphite Company near Johnsburg.

[3] Information supplied by Mr Charles T. Rowland of the Rowland Graphite Company.

south side of Buck mountain about 7 miles by road northwest of Ticonderoga, and a like distance southwest of Crown Point at about 1100 feet elevation.

The mine openings lie directly west of the pond where the main bed of the graphite-bearing rock outcrops on the northern slope of a small knoll a hundred feet high, several hundred feet from the pond. These openings occur directly behind the mill and extend west along the outcrop for 230 feet. Then after passing an interval of 720 feet to the west a second cut extends about 200 feet. In neither case has the excavation extended beyond 40 feet in depth. The bed of graphitic material can be followed along the strike for 1000 feet or more.

The eastern pits. The ore consists of two distinct rocks: a soft crumbly limestone carrying fairly large flake graphite, and the footwall, a dense green rock[1] produced by the action of the neighboring granite upon the limestone. The rocks here strike north 40° west (magnetic)[2] and dip from 25° to 30° southwest into the hill.

In the main drift-opening a crush zone occurs indicating a minor fault that cuts off the soft limestone bringing in a hard, unweathered variety. The ore contains considerable mica (phlogopite).

The western pits. Here the dip is considerably greater, being from 50° to 60°. Professor Crosby suggested the possibility of a fault being located somewhere in the concealed portion of the interval. The writer offers below another interpretation.

The summit prospects pits. On the hillside above the western cut are several prospect openings displaying the contact type of ore. This, although of spectacular appearance, is not of commercial importance.

The mill equipment. The mill is situated near the pond, where a plentiful supply of water for the boilers etc., was secured by pumping. The mill was amply large but is now in a ruined condition. The equipment consisted of crushers, rolls, buddles, tube dryers and blotters which are today of no value.

Geology and structure. The ore is chiefly limestone which has been invaded by a coarse variety of granite, known to geologists as pegmatite. This is of later age than the limestone and when in hot fluid condition profoundly affected the limestone, producing the green contact rock mentioned above. Graphite has been developed in this rock by chemical changes taking place during the

[1] Professor Crosby, in a report upon this property, interpreted this rock as quartzite.

[2] All compass readings are given uncorrected for the convenience of the miners. The correction in 1917 was about 13° west of north.

injection and solidification of the granite-pegmatite. The granite, the parent of the pegmatites, lies to the north, forming Buck mountain.

Lying on top of the limestone is a black and white rock of sedimentary origin, belonging to the same series as the limestone. This is the " para-amphibolite," a hornblende schist.

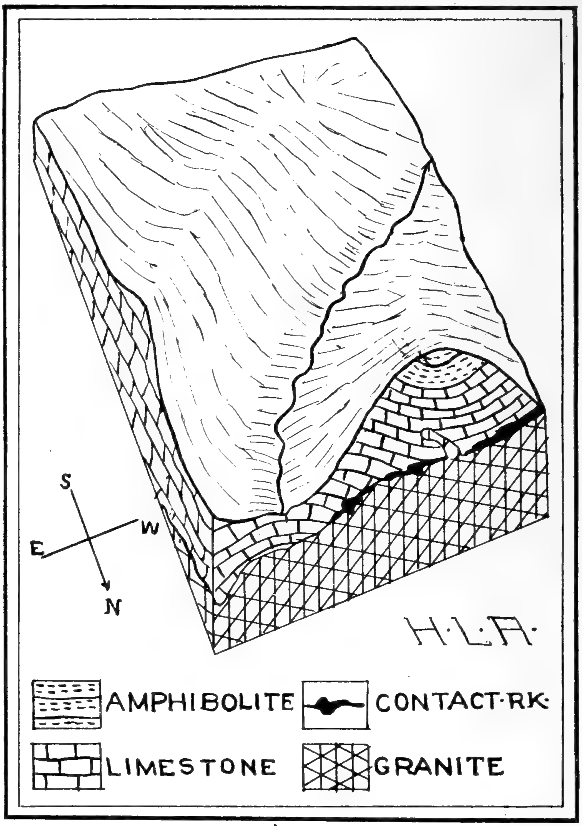

Fig. 2. Block diagram of the region at Buck Mountain pond, showing that the knoll is an anticline while the valley through which the outlet of the pond flows is a syncline. The old sedimentary series have been invaded from below by a granite. There is really more pegmatite than is actually shown. The end of the block toward the reader is an east and west section. H. L. Alling, 1917.

The knoll is composed of the sediments in the form of a trough, a syncline, while the valley to the east through which the outlet of the pond flows (at one point through a natural bridge) exhibits the opposite or arched structure — an anticline. Both the syncline and the anticline are pitching southward, as can be seen from figure 2. The mine openings to the west are on the western side of the syncline and thus the dip is greater than is the case in the eastern group of pits; hence the reason to question the presence of the fault suggested by Professor Crosby.

Future of the property. Although specimens can be gathered that show a good display of graphite, the deposit, like most of them in the northern area, is of the limestone and contact type which experience has shown to be rarely of sufficient regularity to have commercial importance.

The writer is indebted to Mr D. G. McGrew and Mr Charles Rowland for information about the Buck mountain locality.

The Penfield Pond Prospect

Located near the southern boundary of the township of Crown Point, one-half of a mile west of Penfield pond, very close to the 80° angle in the boundaries between Crown Point and Ticonderoga.

It is a small limestone deposit of rather striking characteristics but of no commercial importance. Specimens of white, grading to pink and red, limestone carrying large flakes of graphite (one-fourth of an inch in diameter) may be obtained. The Crown Point Graphite Company first opened a deposit near Penfield pond, but whether or not this is the locality is not known.

The Crown Point Graphite Company

Location. This recently abandoned property is situated in the township of Ticonderoga 2½ miles southwest of Ironville, one-fourth of a mile south of the road which runs west past Eagle lake (Lake Chilson on the map), and 7½ miles southwest of Crown Point Center and 10 miles from Ticonderoga. It lies within the Paradox Lake quadrangle. The mine, located on the northern slope of a low ridge overlooking a swamp, was opened about 1907 and has lain idle since 1910.

Workings. The workings consist of four inclined shafts nearly in line (three abandoned and one recently worked). The dip of the rocks and hence of the shafts is 55°–60° southward. The main shaft is reported to be 72 feet deep "from which the miners have drifted eastward along the ore bed, removing a considerable amount of ore by stopping and finally reaching the surface again about 150 feet east-northeast of the shaft."[1]

[1] Bastin, E. S., Mineral Resources. U. S. G. S., 1908, 2:729.

There are several surface pits and a trench to the west of the mine.

The mill stands on the steep hillside facing north, so that gravity methods of ore handling could be employed. The top floor carries the hoisting engine as well as the ore bin, into which the ore was directly raised from the shaft. On the floor below are two rows of crushers which feed into burrstone grinders, and the boilers for the single tube-dryer. On the lowest floor are the main boilers, driving engines, mine pumps and packing room. The difficulty in securing abundant water forced the company to resort to the dry method of concentration. The details of this method are not available as the writer was informed that the process was a secret one. The mill concentrates were hauled to Crown Point Center and there refined in a finishing mill. The fuel used was coal hauled from Crown Point station. The following grades were prepared:

Mill concentrates: no. 1, no. 2, no. 3.

Finishing mill products: flake — no. 1, no. 2, no. 3; dust — no. 1, no. 2.

A sample of concentrate was secured and the following measurements were made upon the size of the graphite flakes. These were secured by means of a microscope especially arranged for the work.

The average diameter is based on ten measurements. It is not known what grade this sample represents.

Average diameter	.91 x .65 mm
Maximum diameter	1.43 "
Minimum diameter	.39 "

The mill is said to have had a capacity of 30 to 50 tons a day.[1]

Geology. The geology is very similar to that at the Columbia Graphite property (see below). A representative section beginning on the north side of the road and running south would be as follows:

1 Pink granite, cut by frequent stringers and dikes of pegmatite and occasionally holding inclusions of the sedimentary rocks.

2 The swamp, referred to above, probably is a limestone valley, with beds of uncertain thickness, not necessarily underlying the full width of the depression. A small patch of limestone was found near the base of the hill.

[1] Bastin, E. S., Mineral Resources. U. S. G. S., 1914, 2:208.

3 Limestone succeeded by a biotitic schist.
4 Amphibolite.
5 The limestone ore, varying greatly in thickness, as limestone is easily molded and stretched by dynamic disturbances.
6 A thick mass of pegmatite.
7 More granite which continues to the shore of Eagle lake. The granite has absorbed considerable amounts of the sedimentary rocks and is cut by frequent pegmatites.

All the rocks dip at an average angle of 55° to the south.

The ore. The ore is nearly pure limestone, in places charged with dark minerals (augite), the workable portion being from 3 to 7 feet in width. It can be traced along the strike (north 65° to 70° east) for a distance of a thousand feet. There is a second bed 375 feet south of the main bed that can not be followed for so great a distance.

Most of the graphite flake " ranges from 0.9 to 3.0 millimeters in length and from 0.15 to 0.3 millimeter in thickness. . . . A composite sample of the ore selected . . . so as to represent approximately the run of the mine was analyzed in the laboratory of the United States Geological Survey and showed 2.97 per cent of graphitic carbon." [1]

In places the pegmatite comes in direct contact with the limestone without affecting it in any appreciable way, and again there is a development of large feldspar crystals set in a groundmass of finer grains. A " porphyry " of this type is shown near a dam not far from the main shaft.

" The even distribution of the graphite through the crystalline limestone renders it probable that the carbon formed an original constituent of the limestone. Its conversion to the graphite state, the recrystallization of the limestone, and the development in it of the mineral pyroxene are the result of metamorphism, possibly in part dynamic but due to some extent to the contact effects of the neighboring masses of granite." [2]

The term " metamorphism," especially that denoted as dynamic, refers to the changes taking place under the action of heat and pressure set up by stresses during mountain-making periods.

Future prospects. The future of the Crown Point graphite property is extremely doubtful. The limestone ore is uncertain in distribution, and the lack of mill water, the high dip, the necessity

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1908, 2:728.
[2] Loc. cit., p. 729.

for pumping and the long haulage are all against the successful operation of the deposit. The mill is in fairly good condition except that the machinery for final concentration has been removed.

The Betsy Cook Property

Located in the township of Ticonderoga 2 miles southeast of Ironville within the Paradox Lake quadrangle, at a fork in the road from Ironville to Echo lake (Worcester pond on the map).

The prospect holes consist of a long chain of shallow pits running northwesterly in a curved line. The southeast end is marked by a short drift, opened from a pit 8 feet wide, located behind an abandoned house, in a pyroxene-scapolite contact rock zone where a member of the sedimentary series has been affected by contact with a white granite. The sedimentary rocks here strike north 25° west, but the direction changes rapidly to north 60° west, eventually becoming north 80° west at the far end of the chain of pits. The bed is nearly on edge, dipping 83° north 46° east at the drift.

Geology. The graphite flakes, some of which are from one-fourth to three-eighths of an inch in diameter, occur in a dense green contact rock, usually badly weathered and stained brown due to the oxidation of the contained sulphides. The exact nature of the ore rock is complicated. It is chiefly composed of pyroxenes, hornblende, plagioclase feldspar, pyrite, biotite and titanite.

From a structural standpoint, we are probably dealing with an anticline that pitches very strongly northward cut to pieces by the granite which is usually bleached white on the line of contact.

The outlook for the property is certainly not bright. In the first place, the contact nature of the ore is against it; the presence of the biotite is another difficulty and the steep dip of the rocks is a third. It is fortunate for those interested that no mill was constructed.

The Towne Property

This abandoned property lies in the township of Ticonderoga, just south of the Crown Point-Ticonderoga boundary and on the border between the Ticonderoga and Paradox Lake quadrangles.

Pittsburgh capital became interested in the property and sunk a shaft in 1902, but gave up the enterprise the following year and moved to Overshot pond, operating under the name of the Columbia Graphite Company.

The workings consist of two openings about 6 rods apart. The eastern one is the shaft, about 108 feet deep, vertical and sunk across the dip of the rocks. The second pit is 12 to 15 feet square and 6 feet deep, from which starts a slope down the dip (10° south, 30° west magnetic).

Geology. The conditions are very similar to those in the Betsy Cook locality. The rocks involved are the biotite-hornblende schists and associated members of the "Grenville" sedimentary series. The granite (of "Algoman" age) has affected the schists, producing contact rocks. In the vicinity of the shaft the ore consists of the usual pyroxene rock carrying large flake graphite and the usual pyrite. Specimens at the drift show a very different type of contact rock, composed to a large degree of feldspar (andesine-labradorite), partly altered to clay substances (sericite).

The granite is frequently coarse textured and approaches a pegmatitic phase at contact with the schist.

The high biotitic nature of this contact deposit and the limited amount of graphite force us to abandon hope that this will be of any importance in the future.

The Columbia Graphite Company

Location. The Columbia Graphite Company's property is situated in the township of Crown Point 1 mile east of Round pond and the same distance southeast of Overshot pond, 2¾ miles north-northwest of Ironville within the limits of the Paradox Lake quadrangle.

The workings. The workings consist of a series of deep, open cuts, all on the same line of strike, in green serpentized (verde antique) limestone close to pegmatite, usually having a foot-wall of fine-grained, sandy quartzite. Several shafts, inclined 62° south 68° west (magnetic) are today filled with water. The ore was hoisted and teamed to the mill a short distance away. Apparently no extensive operations had been carried on underground.

The mill has been dismantled and all the valuable material removed. Enough remains, however, supplemented by local information, for one to know that the wet method of concentration was used, the ore having been reduced to proper size by crushers, a 16-stamp battery, and burrstone grinders. Water was secured by pumping from a brook one-half of a mile away. The concentrates were sent to the finishing mill at Crown Point Center for final treatment.

Size of the Graphite Flakes in the Concentrates

	No. 1	No. 2	No. 3
Average diameter......	.48 x .33 mm	.143 x .074 mm	.110 x .070 mm
Maximum diameter....	.90 mm	.310 mm	.150 mm
Minimum diameter.....	.20 mm	.015 mm	.030 mm

Geology. The geology in detail is most complicated, while the structure is comparatively simple. Starting to the north of the mine openings and proceeding southward, 15 feet of quartzite (approaching the vitreous type) is found dipping at a high angle under a sill-like mass of white granite of a similar thickness. A second bed of quartzite follows, heavily injected with granite, finally becoming sandy as it nears the limestone ore. The total thickness of the rocks here shown is about 70 feet. The ore is limestone carrying, besides the graphite, small amounts of dark green silicates that are today altered to serpentine, producing a verde antique marble. Farther south the white granite occurs in a huge mass that eventually becomes pink, deepening into red.

Such a succession of beds could hardly be repeated in another parallel section because the granite and the pegmatites penetrate and cut to pieces the sedimentary layers in a most complicated way. In one of the pits, where a coarsely crystalline pegmatite is shown, beautiful crystals of brown tourmaline can be secured, as well as pyroxene, scapolite and other pegmatite-contact minerals.

Usually the line of contact between the pegmatite and the limestone is marked by the development of the characteristic green contact rocks, rich in pyroxene crystals and graphite flakes, the latter frequently three-eighths of an inch in diameter. This rock constituted a portion of the ore formerly utilized.

Structure. At the pits the rocks dip about 60° south 68° west (magnetic), while farther west the strike changes to north 10° east and the dip decreases to 42° east. Here we are probably dealing with a syncline which seems to pitch eastward. Thus the mine pits are located on the northern edge of a trough of sedimentary rocks highly injected and cut to pieces by pegmatite dikes.

Economic future. The mine was worked during 1903 and 1904 but the company moved to Rock Pond in 1905. It is not a difficult matter to comprehend the cause of the failure of the company.

The nature of the deposit is against profitable mining. The ore is very pockety and too variable to furnish any large supply. Mr D. G. McGrew, formerly connected with the company, and Mr Samuel Buck gave assistance and furnished information concerning this property.

The Mason Property

Location. This property lies in the township of Ticonderoga, three-eighths of a mile east of Echo lake on the shortest road from Ironville to Ticonderoga by way of Echo lake and Street road, the exact location being south of the road on a farm owned by Mr. Mason. Although only prospect work has been done, samples of the unusually large flake, some of which measured 1½ inches in diameter, were sent to the American Graphite Company's mill at Ticonderoga but were found to be too large for treatment. The band of ore (the "vein" of the miners) strikes north 13° west (magnetic) and is said to be traceable for 20 to 30 rods, along which line nine openings have been made.

The size of the flake seems to grow smaller with depth from the surface. Mr Mason claims 12 per cent of graphite in the ore. Mica occurs on the southwest or hanging wall. The dip is very flat. The rocks shown here are limestone and pegmatite. One specimen of the latter carries black tourmaline. Like most of the deposits in limestone, the ore is localized in pockets and is exceedingly patchy, hence it is difficult, if not impossible, to estimate the quantity, but in all probability the supply is small.

The origin of the ore is clearly due to the action of the pegmatite upon the limestone, presenting the usual characteristics.

Lead Hill

Location. The property lies 3 miles northwest of Ticonderoga in the township of the same name and likewise within the Ticonderoga quadrangle, north of the "new" road to Eagle lake.

The extent of the property is considerable, comprising an area of several acres. There are numerous pits scattered over the southern and southeastern slopes of the hill, the important ones being shown on the accompanying map (figure 3).

History. As far as the writer has been able to ascertain, this property was the first to be exploited for graphite in the United States. It was well known that graphite occurred here in 1842, for Emmons says[1] that it "is well known at Ticonderoga where it forms

[1] Ebenezer Emmons, Nat. Hist. of N. Y., Geol. of the Second Dist. p. 420–21.

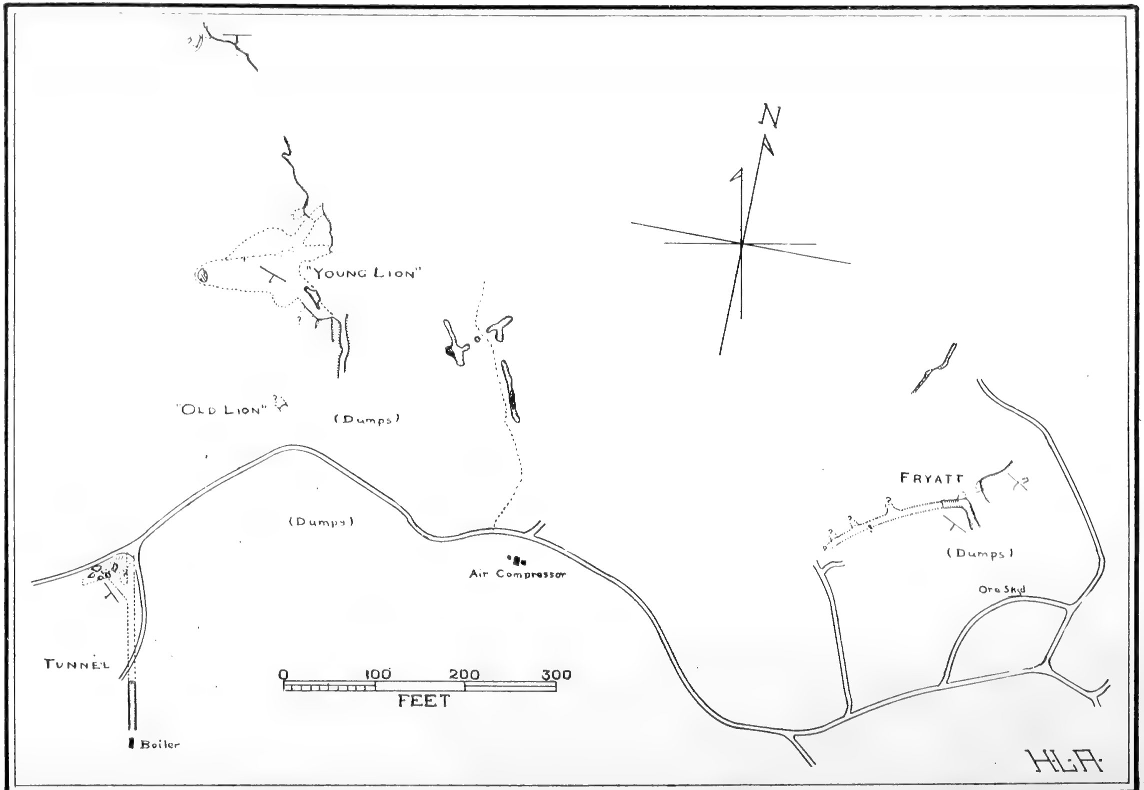

Fig. 3. Plane table map of the important workings on Lead Hill, near Ticonderoga, N. Y., showing the roads, open pits, underground workings and drifts. The workings in the southwest corner of the map are the so-called "Woodchuck" pits. Map by G. H. Chadwick and H. L. Alling, 1917.

a regular vein in gneiss." Beck[1] refers to it as occurring about 2½ miles from Ticonderoga at Upper Falls. " It is a vein of the purest foliated graphite several inches in width. The foliae often have a radiated arrangement, and are of considerable size. The gangue is calcareous spar, which often exhibits large and perfect cleavages. Granular graphite is also found associated with the above. This mine has not been much worked, but a considerable quantity of pure graphite is annually obtained from it, which is sold for a shilling a pound. It is thought that this is an extensive deposit."

It would appear that it was being worked by the American Graphite Company in the early fifties. The Joseph Dixon Crucible Company bought the American Graphite Company, and has exploited Lead hill, the Lakeside mine, and the great deposit at Graphite under that name.

In the early days, under the management of Mr William Hooper, the company was able to produce an exceedingly high-grade flake by using the ore-dressing machines that he developed. They made use of the wet method of concentration.

In the early days the interest taken in Lead hill was very great, but for reasons given below the American Graphite Company shifted its interest to the locality at Hague and that at Graphite. Since then the deposits on Lead hill have been worked only under small leases, among which was the Ticonderoga Graphite Company.

Today the locality is abandoned, although renewed attempts have been made to reopen some of the pits in recent years.

Workings. Of the various workings, six are sufficiently important to be treated separately. There are others that were reported to the writer, but the undergrowth and lumbering have rendered search very difficult. It is likely that some have escaped notice.

The " Woodchuck "[2] Workings. These are the first pits reached on approaching the property by the old wagon road. A group of three irregular shaft openings has been made along the line of contact between limestone and pegmatitic granite. Underground, various connecting passageways join them together. At a depth of some 40 feet they are tapped by a horizontal drift, which is a branch of the main one driven from the hillside to the south (see accompanying map, figure 4). The drifts were driven some twelve years ago, while the shaft openings were made much earlier. Dur-

[1] Beck, Nat. Hist. of N. Y., pt. 3, Mineralogy, 1842, p. 96–97.

[2] This is not the proper name, but conflicting opinions among the former workers necessitate the employment of this nickname.

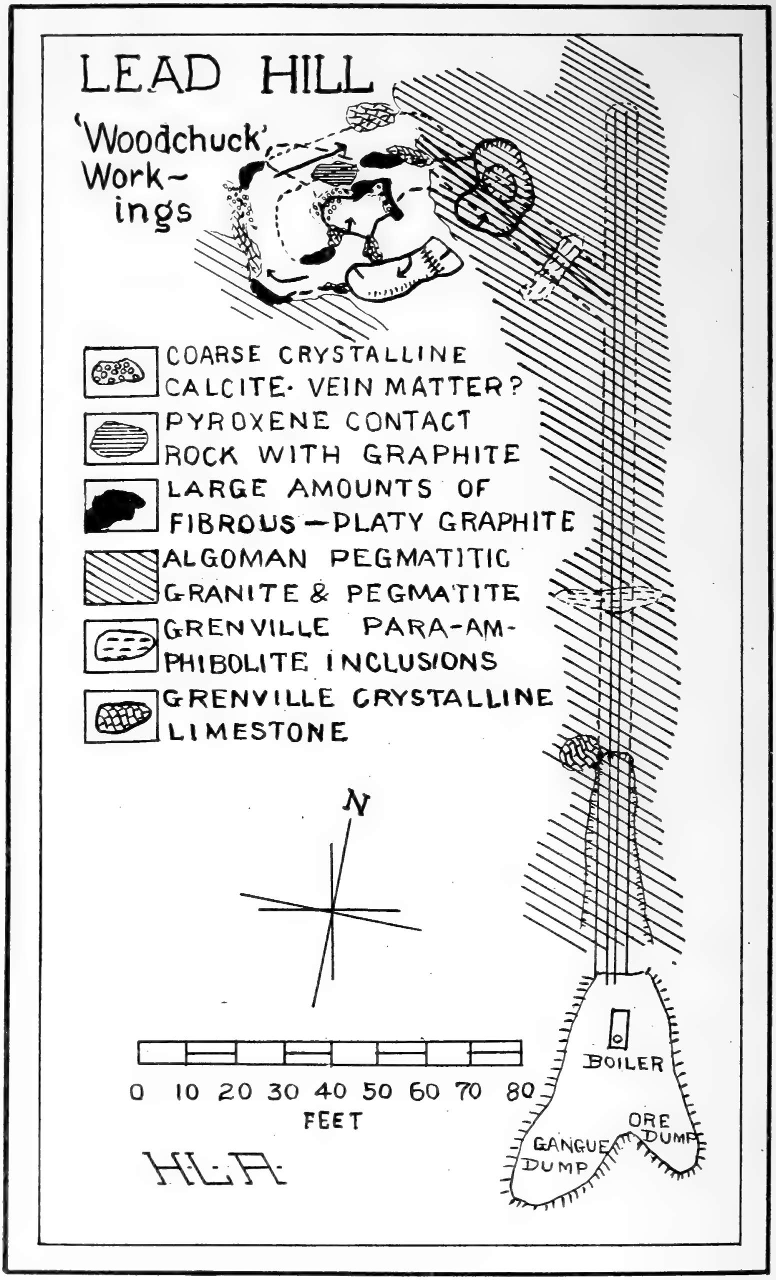

Fig. 4 Geologic reconnaissance map of the "Woodchuck" workings on Lead hill. G. H. Chadwick and H. L. Alling, 1917.

ing the last five years the main drift was extended farther with the hope of finding more ore, and at the same time for the purpose of tapping the bottom of a large slope pit (the Young Lion pit) farther up the hill to the north, but the attempt was eventually abandoned. The contact rock zone, which carries spectacular graphite, is likewise variable in thickness and in distribution. For the most part it is a white to green pyroxene rock with accessory scapolite. Frequently the pegmatite develops very coarse textures and shows feldspars 8 inches long; on the other hand, certain contact phases show large black-green crystals of pyroxene. Under a stringer or sheet of pegmatite is a mass of coarsely crystalline calcite, something like 3 feet in thickness. Between this and the capping igneous rock is a 3 inch layer of quartz, the under surface of which is coarsely crystalline showing the characteristic habit of the mineral. The edges of all the crystals are rounded, and very smooth as though corroded by solutions. This quartz, when examined under the microscope, appears to be vein matter. One of the hypotheses to account for the origin of this layer of calcite is that it represents a true fissure vein. The other theory is that the limestone has been recrystallized by the action of the pegmatite. In the Fryatt workings (described below) the contact is along sandy quartzite and there the prevailing rock is quartz, being possibly a recrystallized portion of the quartzite.

The drifts, especially the main one, run through barren pegmatitic granite which occasionally holds inclusions of sedimentary amphibolite, still maintaining the original relative positions with sharp outlines and without any graphitic development. Near the portal of the main drift lies a small mass of limestone overlain by a sheet of pegmatite, likewise without any graphite. At another point the pegmatite has penetrated the limestone, which still retains its crumpled and distorted foliation, by "lit-par-lit"[1] injection producing an injection gneiss. Still again the pegmatite becomes porphyritic with phenocrysts 2 inches long.

The Young Lion pit. This lies to the north of the "Woodchuck" pits a little to the east. It consists of a large underground chamber extending diagonally down the dip with an average slope of 22° and for 100 feet westward. It was once timbered but the pillars have long since rotted and large blocks have fallen from the roof, resulting in a lofty cave.

[1] French, "bed by bed." Applied to a structure composed of alternating bands composed of sedimentary and igneous rocks.

The same pegmatitic granite (largely an andesine rock) is shown here but the country rock is the sedimentary amphibolite, dipping 20° to 22° south 20° west (magnetic). The east wall is pegmatite and, as far as the section shown in the pit is concerned, can be regarded as a vertical plug which has sent dikes and stringers of its own material westward into the amphibolite, producing large flake graphite on contact. Much of the ore taken from the Young Lion pit is pure white pyroxene, in which flakes of graphite one-fourth of an inch in diameter are promiscuously distributed. The far end of the pit is filled with water. It is understood that the long drift at the "Woodchuck" workings was begun in an attempt to tap this to furnish drainage, but the enterprise was poorly planned inasmuch as they would have failed to make connections if the initial direction had been maintained. Along the line of contact with the main mass of pegmatite and the amphibolite the miners have removed a large amount of ore by stoping, reaching to the surface in several places.

The Old Lion tunnel. About half way between the "Woodchuck" and the "Young Lion" pits is a portal to a drift that is said to connect with the Young Lion pit.

The higher workings. Higher up and above the Young Lion pit are a series of workings, side wall pockets, trenches etc. They reveal examples of the same type of contact — the pegmatite upon the amphibolite.

The Fryatt workings. These are located a little to the east of the Young Lion pit, north of the old wood road, consisting of open pits verging on drift openings on two distinct levels. The upper series consist of two wall pockets, from one of which an inclined tunnel leads to the lower level to the west. The workings on the lower level comprise two wall pockets driven some 6 to 8 feet into the north wall. A drainage trench leads south. At the west end of the main pit a drift has been driven westward, rather near the surface, for in places this has fallen in.

The geology here presents a third species of contact deposit. Here the ore is the green augite-scapolite (the latter mineral is chiefly meionite[1]) rock. Closely associated with the contact rock is a quartzose material that may be either recrystallized quartzite or true vein matter. It is analogous to the crystallized calcite in the

[1] Bastin, E. S., Economic Geology, 5:147–48.

"Woodchuck" holes. At the pits themselves it is not possible to determine what the country rock is, but 55 feet east from the wall pockets on the upper level an exposure of the sandy quartzite schist occurs that shows the relations. The pegmatite overlies the quartzite and has developed the pyroxene-scapolite rock on contact. The line of demarcation between the three rocks is exceedingly irregular, although it is an easy matter to see that the pyroxene-scapolite rock increases in thickness on leaving the quartzite exposure to the west. The north wall consists of alternate layers and masses of quartzose and contact rocks. The lenses or blocks of green rock are often "lit-par-lit" injected with pegmatite. They are furthermore frequently fringed with foliated graphite. Near the contact with the pegmatite, the more dense pyroxene rock is comparatively barren of graphite.

The sixth set of workings. These are found higher up and to the north of the Fryatt workings. They consist of a narrow trench showing the pegmatite in contact with a quartz-feldspar rock which appears to be of sedimentary origin.

Other workings. South of the old road, supposedly to the east of the "Woodchuck" drift, there is said to be another group of workings known as the "Old Indian" which the writer was unable to find.

Summary of the pits. Four different members of the sedimentary series of rocks can be seen on the hill. Under certain conditions the pegmatitic granite has developed graphite on contact with every one of them: in the "Woodchuck" with limestone; in the Old Lion, the Young Lion and the higher pits with amphibolite; in the Fryatt with sandy quartzite; and in the sixth set with quartz-feldspar gneiss.

The ore. In every case the ore sought and mined was a variety of contact rock. It is often a most beautiful rock making very attractive museum specimens. The flake is frequently as large as a dime. An analysis of the Lead hill graphite, as given by Cirkel[1] is as follows:

Carbon	Hydrogen	Ash
99.87%	0.11%	0.02%

[1] Cirkel, Fritz, Can. Geol. Surv. Dep't of Mines, Mines Br. "Graphite," 1907. Analysis by Luzi, Berl. Ber. 1891, 24, 4085.

Concentrates. The following measurements have been made upon concentrates from ores of Lead hill:

	"Arthur vein"	Pit unknown
Average diameter	.38 mm x .50 mm	.38 mm x .57 mm
Maximum diameter	.80 mm	1.10 mm
Minimum diameter	.32 mm	.22 mm

Analyses of contact rock on Lead hill

MICROSCOPIC ANALYSIS

(Specimen 665 — Young Lion pit)

APPROXIMATE COMPOSITION		Graphite	6.0
		Augite	54.0
		Scapolite	35.3
		Titanite	1.5
		Tourmaline	1.4
		Pyrite	.7
		Quartz	.5
		Zoisite	.6
		Total	100.0
SIZE OF THE GRAPHITE FLAKES	LENGTH IN THIN SECTION	Ave.	1.84 mm
		Max.	2.80 mm
		Min.	1.50 mm
	THICKNESS IN THIN SECTION	Ave.	.095 mm
		Max.	.190 mm
		Min.	.030 mm

CHEMICAL ANALYSIS

(Specimen collected by Bastin)

SiO_2	47.91
Al_2O_3	6.32
Fe_2O_3	.33
FeO	3.11
MgO	11.86
CaO	22.88
Na_2O	.40
K_2O	.46
H_2O-	.96
H_2O+	.10
TiO_2	.44
CO_2	.95
P_2O_5	.25
S	.05
FeS_2	..
C	4.00
Total	100.10
Less O	.02
Total	100.08

The chemical analysis by George Steiger in the laboratories of the United States Geological Survey, U. S. G. S. Bul. 591, p. 40.

The quantitative microscopic analysis by the writer by the camera-lucida-polar planimeter method. These are approximate values by weight. See page 50 for a description of the methods employed in obtaining these results.

Its variable nature and its pockety distribution are factors leading to irregular supply, and precarious mining conditions. The supply is by no means exhausted but the writer feels confident that Lead hill can never regain the reputation that it held for so long in the early days of the graphite industry.

True fissure veins. Besides the contact type of graphite, the mineral occurs " in narrow veins from one to two inches wide, most of which are vertical and trend nearly north and south. They cut indiscriminately across the schists and pegmatitic granite, but in a number of cases apparently disappear when crystalline limestone is reached. In them graphite is usually the only mineral recognizable and forms aggregates of nearly parallel blades arranged about at right angles to the walls of the vein and closely resembling certain of the Ceylon occurrences. In most places the walls are sharp, and the pegmatitic granite shows no change of texture next to the vein. In a few places, however, the pegmatite becomes pyroxenic, finer grained, and somewhat graphitic next to the vein."[1]

" Kemp describes the graphite deposits . . . as true fissure veins cutting the laminae of the gneissic walls at nearly right angles. The wall rock is a garnetiferous gneiss with an east and west strike, and the vein runs at the big mine 12° west with a dip of 55° west. The vein filling is evidently orthoclase (or microcline) with quartz and biotite and pockets of calcite. The mineral is also associated with tourmaline, apatite and sphene [titanite]."[2]

The deposit on Lead hill has been popularly referred to as a " vein " or as a " dike." While it is true that very small veins do occur, the important graphite rocks are *contact rocks, and not veins.* The former do not extend in any definite direction such as is implied by the word " vein " or " dike." This matter is brought to the attention of the reader with the hope that the past nomenclature, which is clearly erroneous, may be corrected.

Split Rock Prospect

This is in Essex county, in the township of Essex, 8 miles northeast of Westport, within the Willsboro quadrangle, 30 to 40 rods south of the Split Rock Light House.

Workings. These consist of (1) a prospect pit verging upon a vertical shaft about 20 rods from the shore at an elevation of 60 feet above Lake Champlain, and (2) an opening for a drift on the lake shore, east of the pit. It is believed that an attempt was made to sink a shaft, which the pit represents, to join the horizontal drift.

Geology. The northern and eastern shore of the point shows members of the sedimentary or Grenville series of rocks which include schists and garnet gneisses, associated with crumpled

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1908, 2:730–31.
[2] Cirkel, Fritz, " Graphite," Can. Dep't of Mines, Mines Br. 1907, p. 56.

crystalline limestone dipping at a high angle into the lake. Several dikes of later age cut all the rocks in the vicinity. Near the lighthouse on the shore there are three dikes of great scientific interest.[1] The strike of the rocks varies greatly. The following measurements were obtained: N 19° E, N 30° E, N 35° E (magnetic), while the corresponding dips were 37° S, 69° E, 30° S, 60° E, and 45° S 55° E.

Away from the shore the Grenville rocks grade into syntectic rocks because of the assimilation and soaking due to the igneous activity of the intruding batholithic dark green gabbro (Algoman in age). This shell of syntectic rock[2] covers the gabbro so that the typical rock is not exposed until the shoulders of Split Rock mountain are reached.

We may regard the entire point as a section of Grenville strata which has been domed by an invading mass of gabbro. Numerous pegmatites (quartz-andesine rock) of the gabbro cut the overlying rocks.

The wall rock of the pit is a mixture of various contact rocks, including the usual green pyroxene rock with a high pyrite content. The latter carries microscopic traces of gelena (PbS) which is replacing the pyrite as beautiful intergrowths. The development of the graphite is limited to the immediate vicinity of the pit, which led the prospectors to think that they were dealing with a " vein." The occurrence of graphite on the lake shore also caused them to believe that they had found the continuance of the same ore body. The incorrect use of the term " vein " has been extremely unfortunate in practical mining, not only here but also in other sections of the graphite area.

After the miners had pushed their tunnel about 30 feet into the hill they encountered a diabase dike (augite-camptonite) 10 inches wide associated with a crush zone formed of brecciated fragments of itself indicating post diabase faulting. The dike strikes N 70° E with a dip of 45° N 20° W. Beyond the dike the rock is barren of

[1] Apparently a dike of diabase (microscopically an augite-camptonite) originally 6 to 7 feet wide, fractured and intruded by another dike of similar composition, but later in age. This was probably about 3 feet in width. Microscopically, it comes near to hornblende-camptonite. This latter dike is split and a third dike, 2 feet wide is intruded. This is the Bostonite. When Kemp and Marsters visited this locality in their study of the dikes of the Champlain region (U. S. G. S. Bul. 107) this " three story " dike was hidden by a boathouse, but this has subsequently been removed, exposing the dikes. It is hoped that this remarkable occurrence of three dikes cutting one another will be treated more fully elsewhere.

[2] Meaning a composite rock due to a mixing of two or more of distinct species.

graphite. The amount of displacement and the nature of the fault is unknown. Near the mouth of the drift-opening the rocks are highly folded and involved with the gabbro in a very complex manner.

In 1898 graphite veins were reported as occurring on Split Rock mountain.[1] It would seem as if these were not located at the spot where the above contact deposits occur. Kemp says that "at Split Rock . . . narrow veins or veinlets of graphite have been found crossing the gneisses, and filling fissures up to an inch in width. The graphite is in rather coarse leaves, and stands at an angle, somewhat less than a right angle, to the wall rock. Considerable vein quartz is mingled with it, and it is not so pure as one would infer at first sight. A large deposit of this sort would be the richest and most desirable of all, but veins have not yet been found crossing the gneisses in sufficient abundance to justify mining."[2]

It has been the opinion of graphite men and of the early geologists that graphite frequently occurs in veins. As has been said, some confusion resulted from the improper use of the term, which has been applied indiscriminately to graphite deposits of various origins. While it is true that fissure veins carrying graphite do occur, as is the case in the vicinity of Split Rock, they are insignificant and of no commercial value.

The Gulf Prospect

This property is in the township of Jay, Essex county, 4 miles south-southeast of Ausable Forks within the Ausable quadrangle or, more explicitly, to the east of the East branch of the Ausable river, a mile south of Ellis mountain, at the western entrance of a deep and narrow fault line valley known on the government map as the Gulf. Directly to the south runs a similar valley at right angles to the former, locally known as the South gulf.[3] The prospect is surrounded by hills on three sides, while to the west the ground slopes gently to the river.

Prospects. No definite information could be obtained in regard to the dates of prospecting, but from the appearance of the small diggings it is judged that it was done many years ago and has not been renewed. Several small diggings were made on both sides of the road running through the South gulf as indicated upon the

[1] The Mineral Industry for 1898, p. 383.
[2] Kemp, J. F., U. S. G. S. Bul. 225, 1903, p. 512–13.
[3] For the glacial geology of this region, especially the significant rôle played by these fault line valleys, see Bul. Geol. Soc. Am., 27:645–72, especially p. 658–60.

accompanying map. One of them is in the quartzite; the others are in amphibolitic limestone.

Geology. The range of rocks is rather complete. The sedimentary series is represented by two distinct strata of the quartzite and limestone, the latter of which in contact with igneous rocks has developed an amphibolite phase. The first rock found on approaching the property is a firm quartzite schist, usually graphitic, dipping 55° to 60° eastward, followed by an igneous rock that is very common in the center of the Adirondacks, known as anorthosite. Here it has been crushed and is somewhat " pulpy " in appearance. Then follows a pure limestone carrying a very small percentage of the usual silicates, but no graphite. Above occurs a quartz-feldspar (the feldspar is orthoclase) schist that likewise is graphite-free. Closely associated with the schist is a dense, hard, green quartzite. Cutting the sedimentary rocks are small dikes or bosses of a fine-grained variety of the augite-syenite. Especially in the vicinity of the diggings this rock has produced contact effects, including the development of large flake graphite. These flakes occur both in the limestone and in the quartzite.

The next rock is a fine-grained equigranular rock, nearly black in color and rich in garnets. This basic (femic) rock occurs as a dike 4 feet wide with a direction N 50° W (magnetic) near the western edge of the map. The writer has encountered several similar ones in the Adirondacks but has never seen them described. Under the microscope a specimen consists of augite, hornblende, basic labradorite and garnet. Mineralogically it might be classed as a gabbro but the texture is very different. This cuts all the above mentioned rocks in the vicinity. The last rock to be noted is diabase (augite-camptonite), two dikes of which were observed. All the dikes occur along the fault line of the gulf.

Ores. The graphitic rocks are clearly of two kinds: first, and most important, is the lower quartzite which carries medium to large-sized flakes, but no mica or clay substances. It splits readily but would be a hard rock to crush. The south road crosses several ledges of this quartzite, which dip at a high angle into the hills to the east. There appears to be a good supply of the mineral from what could be seen, although the glacial drift, which is exceedingly thick, obscures much of the surface.

The other type of ore has already been mentioned. It occurs as a contact effect where the small tongues of the augite-syenite cut the quartzite and limestone. The farmer who lives in the log cabin indicated on the map informed the writer that he has repeatedly plowed up chunks of graphite as big as his fist. It is a fine composite of very small flake and amorphous material.

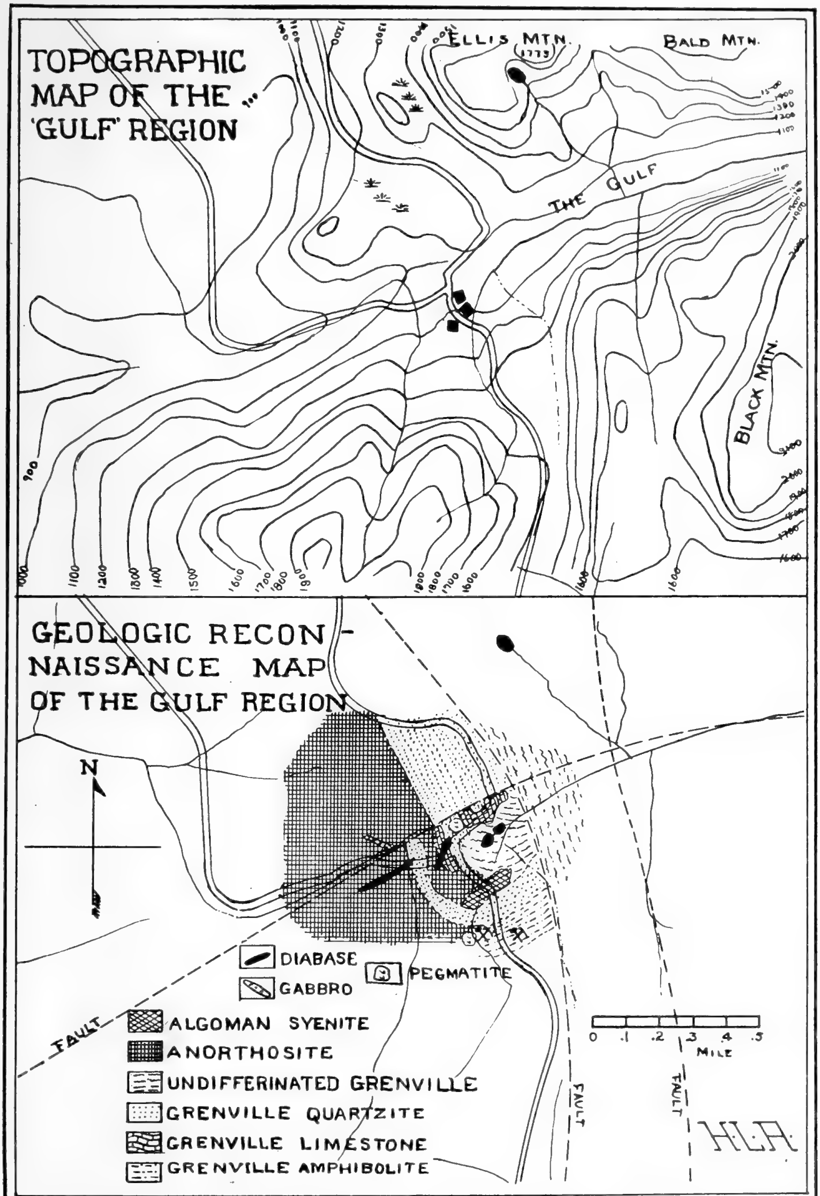

Fig. 5 Geologic and topographic reconnaissance map of the Gulf region, Ausable quadrangle. The topography taken from the Federal map; geology by H. L. Alling, 1915 and 1917.

Mining conditions. No active mining has been undertaken at the property, but the writer looked the situation over with such a prospect in mind. The north road is the one employed by the farmer and is passable even for a motor car. It is 3¾ miles by dirt road to the state road at Stickney Bridge, then 2 miles to Ausable Forks, the terminal of the Ausable branch of the Delaware and Hudson Railroad.

At the property there is not a sufficient supply of water for the wet process of concentration, nor is there water power. At Ausable Forks, however, there is probably sufficient water power for a finishing mill and in addition electric power is available.

Amount of ore. The quartzite ore is the only attractive material. It is impossible to say how much there is of it. The outcrop measures some 20 feet in width, while the extent along the strike is difficult to determine. It is possible that the Gulf and the South gulf faults delimit the amount of ore. The high angle of the dip is not favorable to mining. Considerable exploration will be necessary before anything more definite can be stated.

The Welch Prospect

This property is in the township of Moriah, Essex county, 3 miles southwest of Mineville, on the Welch farm, Newland[1] reports that " some prospect work has been done on a bed of graphitic limestone . . . which outcrops along the crest of a low hill and is accompanied by pyritous gneisses which are also more or less graphitic. In one pit a very rich band of limestone has been found, giving assays as high as 15 per cent graphite. The flakes are large and are built up of many laminae into comparatively thick plates. There is little mica in the rock, the accompanying minerals comprising pyroxene, serpentine, pyrite, tourmaline and quartz. The mining rights on the property are owned by the firm of Witherbee, Sherman & Company of Mineville."

It would appear from the above that this bed of limestone has been enriched by contact with some igneous rock, presumably pegmatite.

The Wilmington Prospect

This property is located in the township of Wilmington, Essex county, about 2½ miles west-northwest of the town of Wilmington. It is situated at an elevation of about 2800 feet on the shoulder

[1] Newland, D. H., N. Y. State Mus. Bul. 102, p. 76.

of Wilmington mountain in a moraine-filled valley between two rocky knobs of the mountain mass. It can be reached by following an old lumber road which leaves the road running from Wilmington to Franklin Falls. There are four prospect pits, two of which are the beginning of shafts in crystalline limestone and pyroxene-garnet contact rocks. The first one reached, after passing the group of recently constructed buildings, is in pale-blue, coarsely crystalline limestone which carries, besides the large graphite flake, the usual collection of silicates, garnet, diopside and occasionally a little pyrite. Cutting through this mass of limestone is a streak of garnet rock. The shaft which has been made here is perhaps 12 feet square and 20 feet deep. To the northeast in the bed of a small brook is a circular shaft sunk only to a shallow depth. This also is situated in limestone. Nearby in sharp contact with this is a black, crumbly rock composed of deep-green pyroxene and dark-red garnet. At the line of contact very large flakes of graphite have been developed and to some extent squeezed and rubbed into amorphous masses due to the slight movement that has taken place between the two contrasted masses.

Higher up the slope a shaft has been sunk in a limestone that is in part a conglomerate. This has been effected by the action of a basic pegmatite presumably of the anorthosite. The pyroxene crystals associated are often crystallographically well formed and present interesting corroded surfaces as though due to the action of vapors and solutions associated with the pegmatite. A few specimens collected of the more distinctly pegmatitic material contained hexagonal prismatic of pale-green apatite. The fourth pit is located in limestone.

The ore. The material was in a large measure the pale-blue limestone, but apparently the prospectors were interested to some extent in the contact rocks as well. Two years ago even during the winter active development work was in progress, but early in the spring of 1917 they gave up their attempts to develop the property. This prospect presents some very interesting features of considerable scientific interest, but the nature of the deposit being of the limestone-contact type rather indicates that its commercial value is slight. It would appear that the area occupied by graphitic rocks covers several acres and it might be that it might prove to be as extensive as Lead hill. It is either owned or controlled by J. E. Bliss of Tupper Lake.

Occurrences in Newcomb and Minerva

The economic collections of Columbia University contain specimens of contact graphite from these townships. Further information is not available.

The Pottersville Prospect

This property is in the township of Chester, Warren county, 2½ miles south of Pottersville, south of Loon Lake mountain, within the North Creek quadrangle.

This limestone-contact deposit has been noted by W. J. Miller,[1] who has mapped the area in which it lies, as Grenville gneiss. It is situated under the lee of a great fault line escarpment — the southern face of Loon Lake mountain.

In the field it was found that several beds of limestone, interbedded with amphibolite and with other members of the Grenville series, are cut by a dike of pegmatite which spreads over the present surface, but probably originally was a laccolith. The dip is 25° to 30° S 78° W (magnetic). No commercial importance can be attached to this locality.

The Mammoth Cave Prospect

This property is in the township of Warrensburg, Warren county, one-half of a mile north of Warrensburg, on the east side of the International highway.

This prospect consists of an opening that has been dubbed "Mammoth cave." The cave is a natural one due to the solution of the Grenville limestone, and has been somewhat enlarged by prospectors. It is 25 to 30 feet long, following the dip of the rocks (22° N 80° E). Overlying the limestone is a mass of typical syenite. Where this rock has come into contact with the limestone a thin layer carrying graphite flakes, which are often one-eighth of an inch in diameter, has resulted. The footwall is a contact rock composed of white pyroxene and scapolite and shows specks of a brilliant emerald-green mineral whose identification is not certain.

While this prospect exhibits some rather interesting features we can dismiss it from our minds as a commercial source of graphite.

SUMMARY OF THE NORTHERN AREA

A line can be drawn across the graphite area of the eastern Adirondacks north of which will be found almost all the limestone

[1] Miller, W. J., N. Y. State Mus. Bul. 170, p. 82.

and contact deposits, while most of the bedded or blanket areas all lie to the south. It may be that erosion, more severe in the southeastern portion of the region, has removed the contact zone rocks in the section and has carried the present surface down to the horizon of the graphite schists, while in the northern area can still be seen patches of the Grenville in which graphite has been developed by contact with igneous rocks under favorable temperature and pressure conditions.

The contact deposits of graphite are usually very striking to the layman and appear to be exceedingly rich and promising, but the writer is convinced that they are too uncertain, too pockety, and too limited in extent to pay for mining. The milling of graphite is still in the experimental stage. The bedded deposits, even though much more uniform in character, afford difficult milling problems but the treatment of contact ores is still more difficult because of their greater variability. Even granted a large deposit of this form of graphite, successful mining would be highly problematical. The early workers on Lead hill were fortunate in that they realized good prices for their product and had an unusually large deposit; and the operations were in charge of an inventive man.

The important deposits of the northern area do *not* occur in veins. It seems to be the universal opinion of graphite men in the Adirondacks that veins, carrying graphite (deposited from aqueous solutions) are common. On the contrary, they are extremely rare and are always too small to be of commercial importance. Graphite *does* occur, however, in the zone between an igneous rock and a sedimentary one. The rocks most commonly so grouped are pegmatite and limestone, which is the combination found at Buck Mountain pond, Columbia, Crown Point, the "Woodchuck" workings on Lead hill, Penfield pond, Mason, and in the Pottersville properties. Deposits have also been formed by pegmatites in contact with other members of the Grenville series; upon biotite-hornblende schists, as in the case of the Betsy Cook and Towne prospects; upon amphibolite, as in the Young Lyon pit on Lead hill; and upon quartzite, as is found in the pits of the Columbia Graphite Company and the Fryatt workings on Lead hill.

The syenite (a granite low in quartz) has developed graphite in contact with limestone as in the Gulf and Mammoth cave prospects. And finally, the gabbro developed graphite when in juxtaposition with a variety of sedimentary rocks, as at Split Rock. The writer concludes then that most of the igneous rocks exposed in the

Adirondacks, especially the latter series, which the writer regards as of Algoman age, were capable of producing graphite upon contact (metasomatic metamorphism) with nearly all kinds of metamorphosed sediments.

That graphite is not always developed at the line of contact between an igneous and a sedimentary rock is, of course, easily observed. The question as to why we find graphite at one place and not at another is not as yet answered to our satisfaction. Some discussion of this problem will be found when we come to the question of the origin of graphite.

THE GRAPHITE DEPOSITS OF THE SOUTHERN AREA

In describing the occurrences of graphite in the northern area, where the contact type is best shown, geological details have purposely been avoided, but are, however, indispensable in treating the major deposits in the southern area.

The blanket or bedded form of ore body should be regarded as a distinct stratum of the old sedimentary rocks known as the Grenville series. This series represents a succession of marine deposits consisting of limetones, sandstones, shales, conglomerates and their intermediaries that have subsequently been folded, faulted and acted upon by earth forces of such magnitude that their original characters, mineralogical make-up and structures have been greatly changed. The ancient limestones have been recrystallized to white marbles; the sandstones to quartzites and quartz schists, and the shales and conglomerates to various schists and gneisses. The rocks that composed this great series, one of the most ancient known in the world, occur throughout the Adirondacks, but are found more extensively on the flanks of the mountains, such as in the eastern foothills.

Usually the subdivision of the Grenville into distinct beds or strata has not been attempted in mapping a quadrangle. It is, however, of great practical importance to graphite interests to know the succession (stratigraphy) of the Grenville rocks at the various properties. As the beds exposed in a given locality may represent a portion near the top or bottom of the original series, a district some distance away may expose a different portion; the order of the beds may differ in the two cases. There may also have been horizontal differences due to local conditions of sedimentation or in the degree of subsequent alteration (metamorphism), producing a different kind of rock although representing the same stratum.

It is often possible when the succession of the beds is understood for a given area, to locate the graphite bed by reference to the hanging or the footwall, although the ore itself may not outcrop, as well as to locate important faults and folds. It was found that practically the same rocks, in the same order, occur on the Dixon, Faxon and the Lakeside properties as well as at the Hooper mine. How many different graphitic ore beds there are in the area investigated is not absolutely certain, but it seems highly probable that there are at least two distinct beds.

Since the deposition of the Grenville series and subsequent alteration (metamorphism) they have been penetrated and injected by a series of igneous rocks that welled up from below, cutting them and greatly altering them. The first of these is a white, fine-grained granite strongly squeezed into a gneiss. It is rarely pure, for it absorbed while in the molten condition quantities of the overlying rock. It is almost always highly involved in and with the Grenville quartzites, having frequently soaked through the latter along the original bedding planes, giving rise to "lit-par-lit" injection gneisses. This will be referred to as the Laurentian granite.[1]

Closely related to the granite in age, is a dark igneous rock here called a metagabbro. The significance of this rock and its relation to the Laurentian granite have heretofore been imperfectly known.[2] It is difficult to describe the metagabbro so that it can be recognized in the field, but suffice it to say that it varies from a fine-grained, dense, brown-black rock, similar to diabase or trap, to a salt-and-pepper combination, coarse grained and frequently gneissic. That some of it is later than the Laurentian granite has been demonstrated at the Hooper Brothers' and Flake Graphite Company's properties, although Cushing thinks that the greater part of it as shown generally throughout the Adirondacks is older.[3] It was found to cut the Laurentian granite but is cut by the later granites. Furthermore, the Laurentian granite and the metagabbro have been folded with the Grenville series, while the later granites have not.

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[1] See H. P. Cushing et al., N. Y. State Mus. Bul. 145, p. 46–47, 177–80, and Bul. 169, p. 21–26; also Am. Jour. Sci., 39:288–94.

[2] The writer belives that this investigation has demonstrated that the Adirondack amphibolite is in part (1) sedimentary, a distinct stratum of the Grenville series; (2) in part igneous, this metagabbro; and (3) altered, impure limestones. A careful study of all three types has shown that in the majority of cases it is possible to distinguish them. (See summary of southern area).

[3] H. P. Cushing. Personally communicated.

Its typical behavior is sill-like (laccolith), often acting like a member of the Grenville strata in a given case, but frequently it cuts diagonally across the bedding. At the Hooper mine it cuts out the ore at the west end of the property after it has acted as a capping rock for a long distance.

The rocks above mentioned were folded and faulted before the intrusion of the anorthosite, as well as of the syenite, quartz-syenite, syenite-granite and granite that are different phases of related deep-seated rock masses. These syenite-granite rocks and their dikes (pegmatites) are in the main responsible for the development of the contact type of graphite already treated. In the southern area they have another significance for the miner, and that is in the way they frequently cut the ore. Such considerations are important in estimating ore reserves.

These rocks are here assumed to be of Algoman age. This correlation is merely suggested in the same way that the term Laurentian has been used.

Following the Algoman granitic rocks in time of intrusion is the long recognized Adirondack gabbro — green-black in color, often showing long, slender needles of feldspar (labradorite) and likewise referred to the Algoman.

The list of rock units is completed by the trap or diabase dikes, coal-black bands from a few inches to many feet in width, that cut all the above-noted rocks.

Thus summing up the Adirondack rocks, placing the oldest rocks at the bottom, the geological column would be:

Keweenawan, in part	Diabase
Algoman	Gabbro Granite Syenite Anorthosite
Laurentian	Metagabbro Granite
Grenville series	Para-schists Para-gneisses Quartzites Para-amphibolites Limestones

The Dixon and Faxon Properties

The property of the American Graphite Company and the adjoining property, owned by William H. Faxon, comprise a single district and can for the most part be treated as a unit.

Location. The Dixon-Faxon properties are located in the township of Hague, Warren county, about 4½ miles west of Lake George on the southern border of the Paradox lake, and the northern edge of the Bolton quadrangles. The headquarters of the Dixon Company has become known as Graphite. The Faxon property is to the south and the southwest.

At the present time the Dixon Company is the most important producer of flake graphite in the Adirondacks, and possibly in the United States. Continuous mining has been pursued for over thirty years and it is largely due to this company that the production of graphite has been maintained.

The Faxon property has been extensively prospected by diamond drilling and promises to be a large producer when developed. It has been stated from time to time in the last ten years that Faxon was just on the point of commencing operations, and there is now every evidence that he will soon do so.

Geology. In order to grasp the conditions of mining, the character of the ore and the problems of supply, a knowledge of the rocks and their succession is necessary.

The ore is a quartz schist, somewhat feldspathic, containing about 5 to 7 per cent of graphite and small amounts of biotite and pyrite. It varies from a few feet to 20 feet in thickness as it pinches and swells, but the average would be about 15 feet. This stratum is so characteristic, not only here but in most of the other mines in the southern area, that it would be very desirable to give it a distinctive name. It has been impossible up to the present time to secure an ideal name. The term "Graphite schist" would, perhaps, conform to geological tradition, taking the name from the village of Graphite. As some confusion may result, in that all the bedded ores are graphitic schists, the term "Dixon schist," while open to criticism[1] is here used for convenience and should not become an established name in Adirondack geology.

It is highly probable that the Dixon schist occurs as two long lenses, which can be regarded as separate beds. It is the general opinion that as one bed thickens the other diminishes in thickness.

[1] As it is preoccupied, Dixon formation, Silurian of Tennesee; see Pete, William F., & Bassler, Ray S., U. S. Nat. Mus. Proc. 34:407–32.

These are usually separated by the same kind of rock that forms the footwall, which is garnetiferous gneiss. The American Graphite Company in its main mine is probably following the lower bed, there the thicker of the two. As the rock that forms the roof is the same as the footwall, it has been assumed that the rock that overlies the ore is garnetiferous gneiss. The writer would emphasize this fact, for some confusion has resulted from incorrect statements.[1]

The upper bed of the Dixon schist is usually capped by a limestone, although this is occasionally absent. The limestone is sometimes pure but more frequently siliceous. This formation the writer chooses to call the Faxon limestone, taking the name from Faxon pond. No definite statement can be made as to the thickness, as it has been molded and stretched like so much putty under the stresses to which the whole region has been subjected, but a maximum thickness of 20 feet can be given.

The Faxon limestone is capped by a quartzite,[2] usually vitreous, approaching a glassy phase in certain localities. This is referred to as the Swede Pond quartzite, taking its name from Swede pond. It is probably several hundred feet thick. This is overlain by another limestone bed of crumbly texture or "sandy" to which no distinctive name has been applied.

It is followed by a sillimanite schist which the writer calls the Catamount schist,[3] then by a para-amphibolite designated as the Beech Mountain amphibolite.

The footwall of the ore is extremely characteristic. It is a bluish green rock with purple garnets as large as peas. It has been found to be the footwall here, at the Hague mine, at the Hooper mine and many other localities. When examined under the microscope it is found to contain, besides quartz, feldspar and garnet, long slender needles of the mineral sillimanite. In the literature it is spoken of as a garnet-sillimanite (para-) gneiss.[4] The term "Hague" gneiss seems to be highly appropriate and will be used here. It is some 50 or 60 feet thick on the Faxon property but decreases in thickness toward the east.

Beneath is a rock that appears to be a granite but is not a simple

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[1] The Mineral Industry for 1890, p. 383. Kemp, J. F., & Newland, D. H., 51st Ann. Rep't, N. Y. State Mus., 2:539, fig. 4, section.

[2] Noted by Kemp & Newland, 51st Ann. Rep't, N. Y. State Mus., 2:539. See the Mineral Industry for 1898, p. 383.

[3] See description of the Bear Mountain pond region and the property of the International Graphite Company.

[4] 51st Ann. Rep't, N. Y. State Mus., 2:530. Microphotograph.

pure rock but a syntectic.[1] Careful studies indicate that the lower beds of the Hague gneiss have been "soaked" and saturated by igneous solutions of the Laurentian granite. In this syntectic rock the characteristic garnets of the former are absent but the sillimanite is still persistent. This syntectic rock is termed the Trumbull gneiss, from Trumbull mountain. The lower portions of the Trumbull are comparatively free from sedimentary admixture and approach the true Laurentian granite in character.

The summary of the stratigraphy for this district is as follows:

AGE	ROCK	NAME
Keweenawan	Diabase	.....
Algoman	Gabbro	.....
Laurentian	Granite	.....
Grenville	Para-amphibolite	Beech Mountain
	Graphite schist	Bear Pond schist
	Sillimanite schist	Catamount
	Limestone	.....
	Quartzite	Swede Pond
	Limestone	Faxon
	Graphite schist	Dixon
	Garnet-sillimanite para-gneiss	Hague
	Syntectic rock	Trumbull

American graphite mine. The great share of the mining is underground and more closely resembles coal mining than operations on a vein deposit. The extensive mining has resulted in very large chambers; the entrance drift driven into the hillside with a southwest direction, follows the strike of the Dixon schist for a distance of probably over one-half of a mile. At the far end of the opening, near the southwestern limits of the mine, the mine tracks are near the surface, but the miners have worked down the dip to the southeast one-fourth of a mile, reaching a depth of 200 to 250 feet. The roof needs little support and for that purpose is left an occasional pillar of ore. The floor of the mine is exceedingly uneven as the dip (average about 20 to 25 degrees) is not constant but varies considerably, due to irregularities of the Grenville rocks. Occasionally the Hague gneiss and the hanging wall come together, pinching out the ore. The deepest portion of the mine, now abandoned and filled with water, is known as the "big sink." The breast here is said to be barren of graphite and in character abrupt and nearly vertical. The ore here has been cut off by a fault (see below). The present mining is localized in the far south corner of the property close to the Faxon line.

[1] Suggested by Kemp, ibid. Used to indicate a rock composed of the admixture of two or more different rocks.

The main versus the "bastard" bed. Graphite men state that the schist mined in this locality occurs as two distinct beds. The one opened in the American mine is probably the lower one, which here is the thicker. The upper one is known as the "bastard vein."[1] Garnet-sillimanite rock (a portion of the Hague gneiss) separates them. It is the common belief that as the Faxon line is approached the main bed becomes thinner, while the "bastard" stratum increases in thickness and constitutes the ore on that property. Bastin suggests such a possibility and says:[2] "It is probable that the ore on the Faxon property . . . is the continuation of one or the other of the beds worked by the American Graphite Company . . . though their continuity has not been certainly traced."

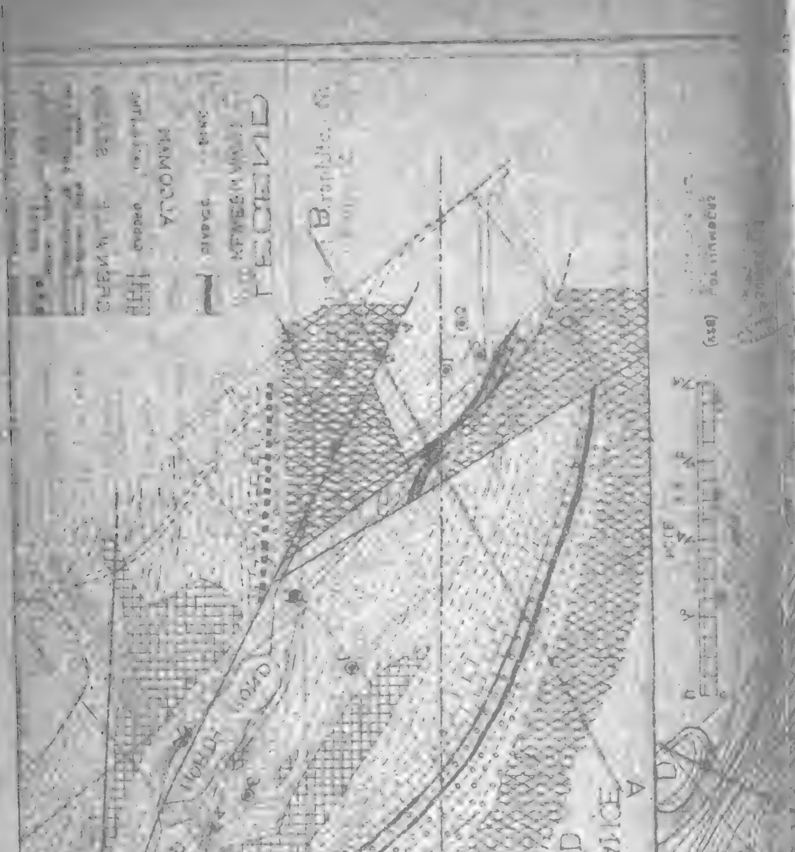
The writer was not afforded an opportunity to see this for himself, although it is very reasonable in view of the known stratigraphy to assume that the beds are continuous. Which of the two beds is the important Faxon ore is not proved, but from the diamond drill records it appears likely that it is the upper bed.

On the geologic map two beds are represented; when one is thin the other is thick.

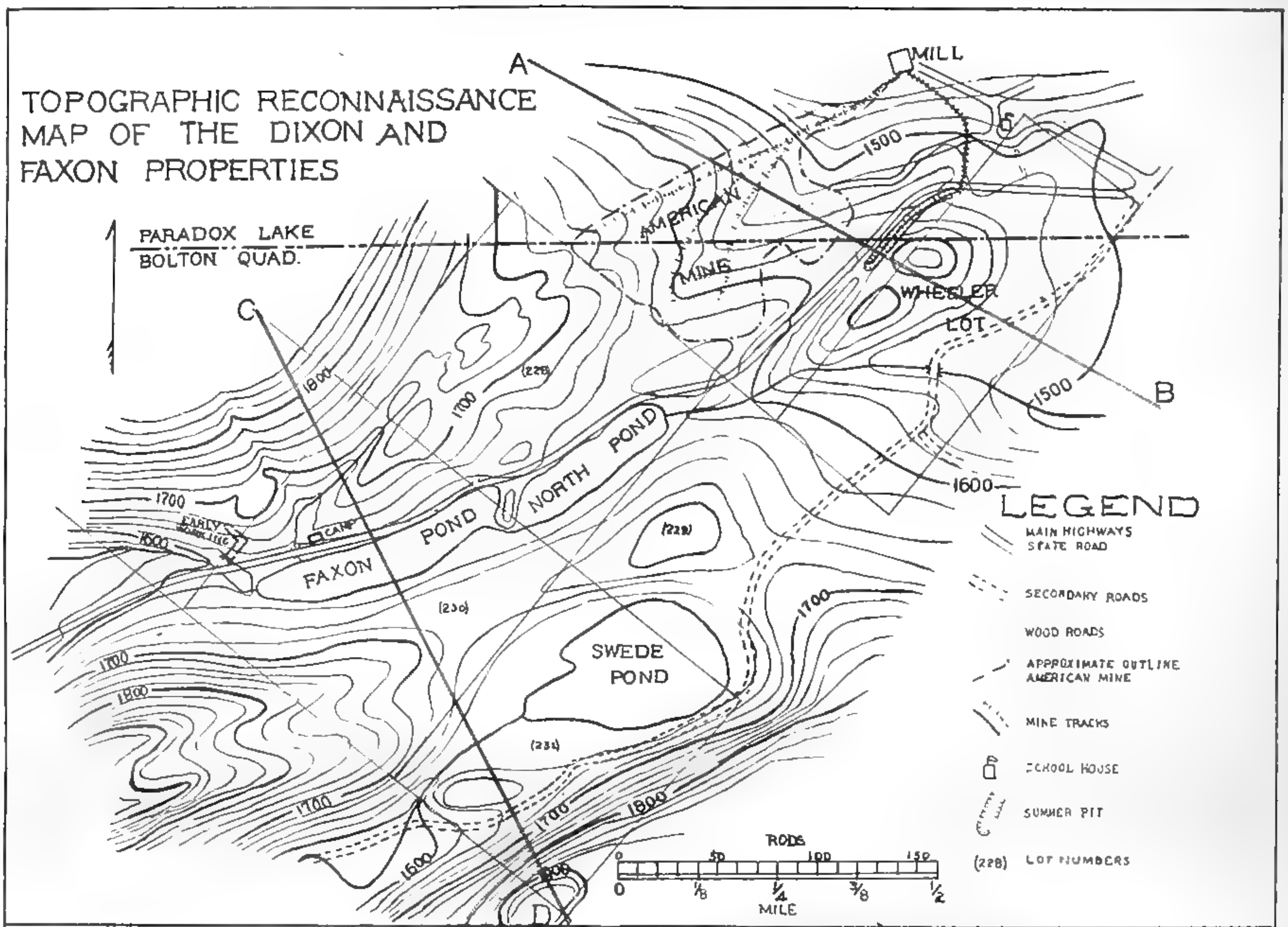
The summer pit. To the east of the outcrop of the main bed of the American Graphite Company is a northeast and southwest pit about 600 feet in length following a bed of the graphitic schist. The ore here strikes N 50° E and dips 20° to the southeast, and is parallel to the other outcrop. The pit is "shallow and operated during the summer season . . . The thickness of the bed at the mouth of the pit is from 6 to 10 feet. . . . This pit was opened about 1890. The ore is similar to"[3] that in the main mine.

The relation between the two outcrops has long been in dispute. Kemp and Newland[4] suggest that the two beds of the graphitic schist are separated by a fault causing a repetition of the beds. That such actually is the case was demonstrated by the rocks freshly exposed along the right of way of the new state road. There is a sudden change from the Swede Pond quartzite to the Faxon limestone. Exposures of the former show crushing by the slipping of the two blocks on each other. Specimens were secured that exhibit brecciated fragments recemented by the infiltration of silica. This

[1] The use of the term "vein" is likewise incorrect when applied to bedded deposits.
[2] Bastin, E. S., Mineral Resources, U. S. G. S. 1908, 2:725.
[3] Bastin, E. S., loc. cit. p. 724.
[4] N. Y. State Mus., 51st Ann. Rep't, 2, fig. 4, 1897, and the Mineral Industry for 1898, p. 383.



schist



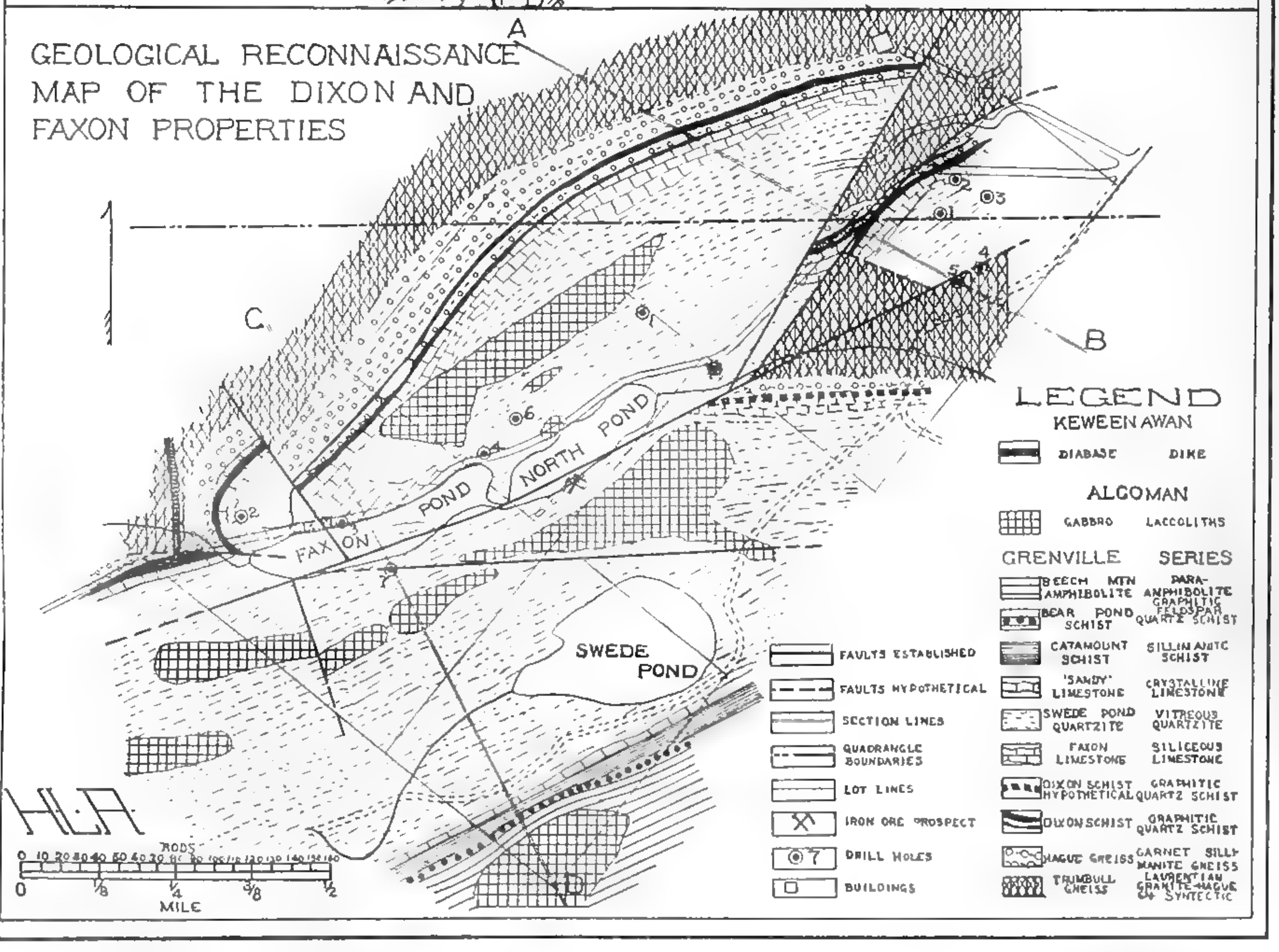


Fig. 6 Topographic and geologic reconnaissance map of the Dixon-Faxon graphite properties at Graphite, N. Y. Based on an old forestry map. Topography in part from the government maps by G. H. Chadwick. Geology by H. L. Alling, 1917.

fault is the main "cut-off." Again to the east is a similar fault but of less magnitude. The evidence for this fault is just as positive. To the east of both, the main and the bastard beds outcrop. The thickness of the two here is apparently the reverse of that exhibited in the main mine.

The summer pit was intermittently worked for a number of years during the summer (hence the name). It has lain idle for some time until recently. Considerable ore has been mined along the strike but not much along the dip as the miners are close to the line of the Wheeler lot, of which the mineral rights are owned by W. H. Faxon. The southern end of the Summer pit bed is probably cut off by a fault. This is not proved and hence it is indicated upon the map by a dashline. It is reported that the northern end dies or pinches out. The writer had no opportunity of investigating this.

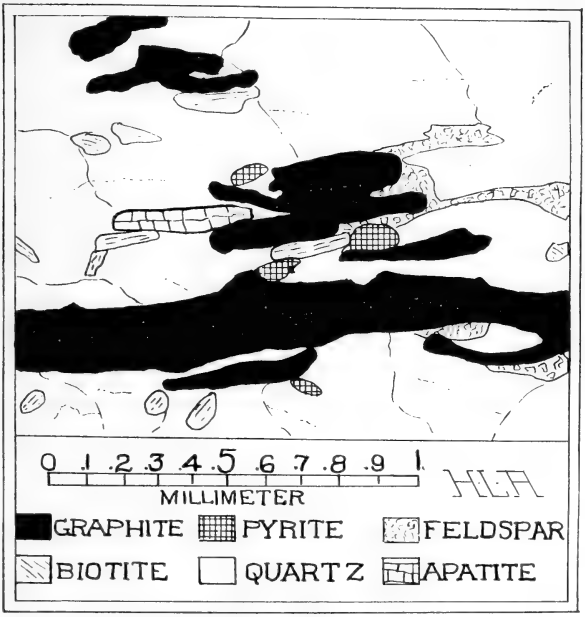


Fig. 7 Cammera-lucida drawing of microscopic thin section of very high-grade Dixon ore from the main mine. (Specimen 850). H. L. Alling, 1918.

To the south of the bridge over North pond outlet an exposure of the Trumbull gneiss was found. The particular specimen examined microscopically probably represents the transition from the Trumbull to the Hague gneiss — the footwall of the graphitic schist. Thus there is the possibility of a bed, probably dipping southward, continuing onto the lot owned by the American Graphite Company. The Algoman gabbro which outcrops so frequently on the southern edge of the area mapped has intruded the sediments as mushroom-shaped bodies (laccoliths), doming up the Swede Pond quartzite. Just where the feeding channel or channels (the "stem of the mushroom") of the mass of gabbro on the lot is of course not known, but it may be that they cut through the ore at some point underneath the surface.

The Dixon schist. This is a sedimentary rock composed of interlocking quartz grains with accessory microcline and oligoclase feldspars (usually altered to sericite), pyrite, graphite and bleached brown biotite; in part completely altered to chlorite. Occasionally a little apatite, titanite, zircon and garnet is found. The graphite is almost always associated with the biotite, usually interleaved with it, and frequently with the pyrite as well. The graphite, biotite and pyrite occur in bands parallel to the schistosity.

Chemical analysis of the American ore

	SAMPLE A	SAMPLE B		SAMPLE C
SiO_2	65.10			
Al_2O_3	9.15			
Fe_2O_3	4.68			
FeO	3.09			
MgO	2.21			
CaO	1.17			
Na_2O	.24			
K_2O	2.32			
H_2O —	.50			
H_2O +	2.33			
TiO	.96			
CO_2	None			
P_2O_5	.74			
S	3.26			
MnO	.03			
C	5.29	Graphite	6.25	5.36
Total	101.61			
Less O	1.63			
	99.98			

Sample A is a composite sample analyzed by George Streiger in the laboratory of the United States Geological Survey. Collected by E. S. Bastin.[1] Sample B is another collected by Bastin (Econ.

[1] Bastin gives this analysis in Econ. Geol., 5: p. 141. F. W. Clarke, U. S. G. S. Bul. 591, p. 40, gives the identical analysis for the Adirondack Graphite Company's (Washington co.) ore. As it seems highly improbable that the schists of the two localities should be exactly alike, it seems very likely that some error has occurred in ascribing the analysis to both companies. It seems probable that this analysis was made upon the American Graphite Company's schist.

Geol., 5:137). Sample C is a composite sample analyzed by W. H. Hall in the laboratories of the Massachusetts Institute of Technology.

Quantitative microscopic analyses of the Dixon ores

		No. 751 "Bastard" bed near Summer pit state road	No. C 3-N Main mine	No. 850 Main mine	No. 851 Main mine	No. 852 Summer pit	No. 853 Summer pit
Quality		Poor	Average	Above normal	Above normal	Average	Average
Approximate composition by weight	Graphite	3.7	5.2	9.8	7.8	7.8	6.4
	Biotite	4.6	2.4	.3	3.8	4.4	.7
	Chlorite	.2	.7	2.0	.8	1.2	6.5
	Oligoclase-andesine	22.0	25.3	16.0	19.1	7.3	14.3
	Microcline	.4	1.4	.3	.3	.1	.9
	Orthoclase	.2	.5	.3	.1	.1	.2
	Quartz	62.6	60.8	64.4	64.5	74.5	67.0
	Pyrite	1.4	1.7	5.9	2.4	5.3	1.7
	Apatite	.6	.7	1.0	1.2	1.1	1.0
	Titanite	.3	.1	....	....	.1	....
	Zircon	....	.1	....	....	....	.1
	Tourmaline	....	....	....	....	....	.1
	Garnet	4.0	....	....	....	....	....
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Size of the graphite flakes — Length in thin section	Average	.32 mm	1.10 mm	1.79 mm	1.03 mm	.70 mm	.67 mm
	Maximum	.50 mm	3.50 mm	5.20 mm	2.50 mm	1.40 mm	1.42 mm
	Minimum	.20 mm	.34 mm	.30 mm	.40 mm	.32 mm	.35 mm
Size of the graphite flakes — Thickness in thin section	Average	.014 mm	.045 mm	.050 mm	.079 mm	.056 mm	.043 mm
	Maximum	.025 mm	.074 mm	.089 mm	.147 mm	.095 mm	.070 mm
	Minimum	.003 mm	.020 mm	.020 mm	.020 mm	.020 mm	.012 mm

The Dixon schist as shown at Graphite, both in the main mine and in the Summer pit, is practically free from micaceous minerals.[1]

The ore has been rubbed or squeezed to some extent, resulting in an easily disintegrated material. This is especially true in the case of certain specimens of the Summer pit ore which falls to pieces even by crumbling with the fingers. In one of the slides of the ore from the main mine (no. C3-N) some of the graphite flakes and pyrite grains were observed to be split apart, and in case of the pyrite, penetrated by a secondary fibrous aggregate, probably of sericitic mica. While the writer does not feel justified in going on record that the sericite is replacing the graphite and pyrite, it certainly appears to be the case. The pyrite has been broken up into

[1] Newland, D. H., N. Y. State Mus. Bul. 161, p. 32.

triangular shaped pieces by the slender, fibrous laths. The only similar occurrence that has been noted is the development of zeolitic minerals between the thin laminae of graphite flakes in certain contact zone rocks of the northern area.

Microscopic Analyses

In addition to the chemical analyses here quoted, a number of microscopic analyses of the graphite ores of the different graphite properties are included in this report. As this type of analyses and the method of making it is unusual, a word concerning it is introduced at this point.

The microscopic analyses were made by means of a petrographic microscope equipped with a camera lucida. By this arrangement the outlines of the mineral grains in a given field were traced upon coördinate paper and the areas occupied by the different species determined by either one of two methods. For the larger areas a polar planimeter was employed that measured the areas directly. For the smaller units the areas were secured by counting the individual squares of the cross-section paper. These two methods were used together as the paper was ruled in the same units as those recorded by the planimeter. The sum of the areas occupied by the grains of the different numerals was assumed to be proportional to their volumes. By multiplying the volumes by the average specific gravities of the minerals the proportion by weight was secured and then calculated to 100 per cent. Usually three different microscopic fields to each slide were analyzed and their results averaged. Care was taken to use an optical system (objectives and oculars) so that the largest practical field was obtained. The results of this method are only approximate and should be regarded as merely indicating the proper order of magnitude. In case of the graphite special pains were taken to secure as accurate a result as possible. For this mineral the probable error is likely about ± 1 per cent while for the more abundant minerals an error of ± 2 per cent to ± 3 per cent at least can be expected. It has not been possible up to the present to check these results against a chemical analysis, for a given hand specimen of this sedimentary schist is variable and any two specimens, even if taken from the same spot, will show slight differences in mineralogical make-up.

The measurements made upon the graphite flakes were secured in a similar manner, using the camera lucida. A scale, adapted for the particular optical system employed, was moved into position so that the images of the flake and the scale coincided. The maximum and minimum diameter of each of ten normal flakes was measured in this way and the results averaged. The thin sections of the graphitic schists were cut perpendicularly to the plane of the schistosity and thus the graphite flakes appeared as long laths. The length of these is a measure of the diameter of the flakes. The average length is the result of ten measurements. The width of these laths gives the thickness of the flakes. Other measurements have been made upon flakes brushed off from hand specimens and laid flat upon a microscopic slide. The concentrates were treated in this same manner. All these measurements are fairly accurate.

The mill. The ore from the mine is hauled directly into the mill. The concentration process is by the usual Adirondack wet method. The process is briefly described as "crushing, rolling," stamping by a battery of California stamps, " and buddling to a 70 per cent concentrate."[1] "The concentrates are said to average about 3 per cent by weight of the ore mined."[2] . . . "The average output of the mine is 160 to 180 tons a day."[3] . . . "The milling process is kept secret."

The American Graphite Company concentrates

GRADE	COARSE FLAKE	FINE PRODUCT
Average diameter	.37 mm x .62 mm	.015 mm x .021 mm
Maximum diameter	1.11 mm	.040 mm
Minimum diameter	.23 mm	.003 mm

The concentrates are hauled by motor trucks down the steep grade to Hague and there transferred to barges on Lake George which carry it to Ticonderoga for final treatment in the finishing mill there. The details of the refining process are not made public. It is reported that in 1908[4] there were four Munson under-runner burr mills and five Abbé pebble mills in use. Further details are not available.

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[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1913, 2: 217.
[2] Kemp & Newland, 51st Ann. Rep't, N. Y. State Mus. 2: 539.
[3] Bastin, E. S. ibid.
[4] W. R. Ingalls, The Mineral Industry for 1908, 17: 493.

The Faxon Property

The title to the adjoining property to the south and southwest is held in fee by William H. Faxon of Chestertown.[1] The land embraces about 1300 acres. In addition is included the mineral rights on lot 229, known as the Wheeler lot, which contains about 100 acres. The nature of the ground and location of the different lots can be learned by glancing at the accompanying topographic and geological map, which is based upon an enlargement of an old forestry map.

The early workings are located about a mile southwest of the mill of the American Graphite Company and consist of a short drift driven into the face of a cliff exposed in a natural ravine (just northeast of the diabase dike, which is shown on the map) N 75° E (magnetic) for 50 feet, then turning a right angle to N 15° W for 45 feet more. The ore and associated rocks here strike N 50° E and dip 20° to the southeast.[2] The roof of the drift is siliceous limestone, which has been at this point overthrust from the southeast, the line of faulting being nearly parallel to the bedding planes. This is of minor importance. This fault has been pointed out by Bastin, who says:[3] "There is evidence of shearing movement in the bed overlying the ore, lenses of quartz schist surrounded by crystalline limestone having been broken in several instances and the fragments dragged apart, though still preserving their angular outlines. There is also some crumpling in the more quartzose layers."

"Two distinct beds are found here separated by a band of garnetiferous gneiss (the Hague gneiss). In drill hole 2 . . . a similar relation holds, the upper bed measuring about 4 feet and the lower 18 feet with 26 feet of the garnetiferous gneiss between them. The two beds appear to merge" [or the upper bed is missing] "a little farther northeast, for in no. 3 hole . . . a single seam over 20 feet thick was encountered and this continues with local variations as to thickness to the northeast limits of the property, except in the places where the series is invaded by a gabbro intrusion"[4] [and displaced by faulting].

Mr Newland directed the writer's attention, in the field, to the unusual, perhaps unique behavior of the diabase dike that is indicated in the southwest corner of the map. Just north of the new state

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[1] The Faxon property has been sold to a Long Island party. It is understood that the property will be worked by the American Graphite Company.

[2] Bastin, E. S., Mineral Resources, U. S. G. S., 1908, 2:724.

[3] Loc. cit. p. 725.

[4] Newland, D. H., N. Y. State Mus. Bul. 142, p. 37–38, 1910.

road the dike is exposed with a width of 40 feet, penetrating the thicker member of the Dixon schist on the south side of the road; but instead of behaving in a normal way and reaching to the surface it has expended its energy in splitting this seam by forming a large mushroom mass (laccolith) about 270 feet in length. This unusual laccolithic mass is chiefly confined to the west side of the main body of the dike. The rock itself is normal Adirondack diabase, olivine free, exhibiting chilled margins and is being quarried for surfacing the road.

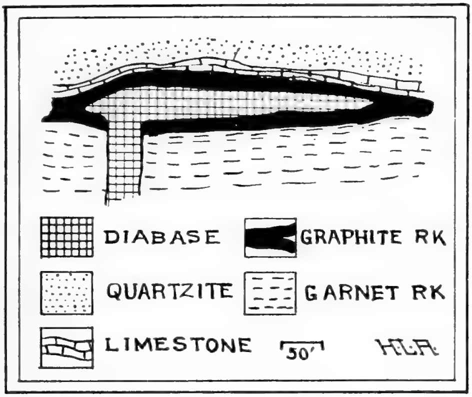

Fig. 8 The laccolithic diabase dike on the Faxon property, not far from the old workings. The new state road has cut through this mass of diabase, revealing the fact that the dike formed a laccolith which splits the Dixon schist. Looking south. H. L. Alling, 1917.

Just back of the camp and running northwest is a fault, recognized by Mr Newland, that offsets the ore, as can be seen from the geologic map. Across Faxon pond to the south another fault is indicated cutting across Swede Pond mountain. As these two faults are drawn it would appear that they are separate affairs, but it is quite possible that a little more care in the field would reveal the fact that it is the same fault. From a study of the drill records kindly furnished by Mr Faxon, although difficult of interpretation due to insufficient data, the writer suggests the possibility of a fault of small displacement running from hole 4 in the Wheeler lot southwest through the ponds between holes 3 and 7 (of the Faxon group). This is the North Pond fault. Another, trending east and west from hole 7 continued to the old road, where well-defined slickensides occur in the Algoman gabbro. Although these faults upstep the ore each time to the southeast, the ore apparently is dipping with more or less regularity and continues from lots 228 and 230 to lot 231.

Secondary to the interest taken in the possibilities on lots 228, 230 and 231, the Wheeler lot has received considerable attention. The Summer pit bed continues onto the Wheeler lot, as is shown by the drill records of holes 1 and 2, where 15½ and 5 feet of ore is found respectively. Hole 3 went down 232 feet without finding any graphite. It may be that hole 3 was beyond the eastern limit of the ore as the Summer pit bed thins or pinches out to the north, as previously suggested, or that the schist takes a pronounced roll and was not reached by the drillers. Holes 4 and 5 failed to strike any ore. Six feet north of hole 4 is a ledge of the Swede Pond quartzite,

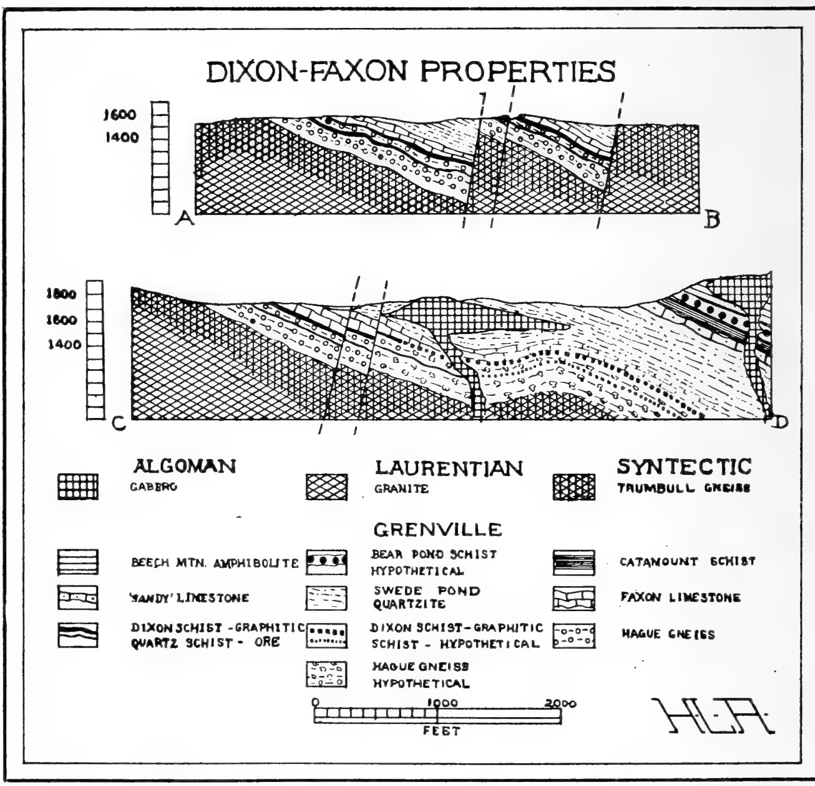

Fig. 9 Geologic reconnaissance cross-section of the Dixon-Faxon properties, showing the normal faulting and the laccoliths of the Algoman gabbro. Ratio of vertical to horizontal scales 1 : 1. Geology by H. L. Alling, 1917.

while the record gave 48 feet of hardpan and gravel and a succession of rocks which is quite different from the expected stratigraphy. The writer interprets this in the light that drillers encountered a crush zone — the North Pond fault. The tally sheet of hole 5 is valueless for the purpose of identifying the horizons, as it states 284 feet and 6 inches of " rock." It makes a big difference whether it is the Swede Pond quartzite (a rock above the ore) or the Trumbull gneiss (a rock beneath the ore). In the vertical section (A-B) it is thought that the latter condition is the more correct one in view of the occurrence of the Trumbull gneiss at the bridge over the outlet of North pond and hence no ore can be expected to the east of the North Pond fault in line with the section, but there is the possibility of some south of this, as has been suggested when describing the Dixon property.

The American Graphite Company has in the Summer pit the most feasible approach to the ore. It would be less expedient to tap the ore on the Wheeler lot by a shaft because that would entail hoisting and pumping.

There is no question but that the ore on the Wheeler lot is of high grade. Bastin[1] describes it as follows: " Under the microscope quartz in irregular interlocking grains is seen to be the most abundant mineral. Feldspar, in part plagioclase and in part microcline, also occurs, but has suffered considerable alteration. Brown biotite in small quantities, as are also small rounded prisms of apatite. Graphite occurs in plates averaging about 0.45 millimeters in length and about 0.075 millimeters in thickness."

The natural surroundings are favorable for mining and milling operations. Access to the Faxon bed may be had on the line of outcrop or by vertical shafts below the surface exposures. The depth to which these would have to be sunk would not exceed more than 300 feet until the less available reserves were sought.

Access to the deposit on the Wheeler lot can be had only through a shaft, as the outcrop is on the Dixon land. The new state road, now nearing completion, places this lot within easy reach.

An abundance of water can be had from the ponds, but if extensive excavations are made underground Faxon and North ponds will probably be drained. It is expected that mill water can be had from Swede pond by constructing a syphon over the low divide, piping it to the mill, where the wet process of concentration will probably be used.

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1908, 2:724–25.

The transportation facilities of the Faxon property are excellent. The new state road will make the haulage problem to and from Riparius (Riverside) station on the Adirondack branch of the Delaware and Hudson a matter of 22 miles of easy going for a motor truck.

Quantitative microscopic analyses of the Faxon ores

			No. 726 Old drift	No. 838 Outcrop, main bed east of reservoir near top	No. 854 South-west	No. 855 South-west	No. 856 Main bed outcrop	No. 857 Main bed outcrop
Quality			Good quality	Poor quality	Good quality	Good quality	Average quality	Average quality
Approximate composition by weight	Graphite		8.5	4.2	8.7	8.1	6.7	6.8
	Biotite		3.1	....	3.2	3.0	.9	2.3
	Chlorite		1.4	72.7	1.9	1.7	10.4	8.7
	Oligoclase-andesine		19.4	11.0	20.8	7.8	20.1	17.5
	Orthoclase		4.1	.6	.4	....	.7	....
	Quartz		58.5	7.0	57.9	74.4	57.9	57.0
	Pyrite		4.0	3.9	5.8	3.2	1.7	2.1
	Apatite		1.0	.4	1.3	1.8	1.6	1.3
	Titanite		....	.2	....	....	....	4.3
	Total		100.0	100.0	100.0	100.0	100.0	100.0
Size of the graphite flakes	Length in thin section	Average	.44 mm	.53 mm	1.20 mm	.75 mm	.66 mm	.69 mm
		Maximum	.80 mm	1.00 mm	2.70 mm	1.50 mm	1.10 mm	1.60 mm
		Minimum	.20 mm	.20 mm	.60 mm	.20 mm	.25 mm	.30 mm
	Thickness in thin section	Average	.033 mm	.025 mm	.050 mm	.050 mm	.051 mm	.054 mm
		Maximum	.080 mm	.042 mm	.090 mm	.120 mm	.095 mm	.095 mm
		Minimum	.020 mm	.010 mm	.010 mm	.020 mm	.025 mm	.023 mm

The Faxon properties include a power site on the Schroon river, where it is understood that a dam is already in place which is able to furnish from 500 to 1000 horsepower. This available power would ensure great economy over a steam plant.

Estimate of tonnage. It is a matter of some difficulty and uncertainty to arrive at an estimate of ore reserve. A much more detailed survey, including the making of an accurate topographic and geologic map, would be necessary before accurate determinations can be made. Calculations based upon the data at hand would indicate that there are some 5,000,000 tons of ore that are more or less available.

The Lakeside Mine of the American Graphite Company

Location. This mine is located near the shore of Lake George, just back of the Trout House at Hague, township of Hague, Warren county.

The American Graphite Company opened this mine many years ago. The property represents one of the first occurrences of graphite quartz schist in New York State and possibly in the country to have been exploited.

The workings consist of two parallel drifts driven for a considerable distance due magnetic north, nearly parallel to the strike, which is N 20° W. How far these extend is not known, as it was impossible at the time of the visit to explore them for more than several hundred feet on account of water. The two are about 50 to 60 feet apart and the easterly one is 15 feet higher than the other. They are nearly horizontal but gradually slope downward so that free drainage becomes impossible. How extensive the underground operations are is not known. The upper drift is entered also by a slope about 100 feet from the portal.

Geology. The stratigraphy is strikingly like that of the Dixon and Faxon properties, but with minor variations. The graphite bed is a single stratum of the Dixon schist 12 to 15 feet thick. The footwall is the Hague gneiss in its typical development,[1] which in turn lies upon the Trumbull gneiss, which rests upon and holds inclusions of a para-amphibolite. This hornblendic rock is better shown at the Hooper mine, where it is named the Dresden.

The hanging wall is different from that found at the Dixon and Faxon properties, as the Faxon limestone is absent. Specimens taken just above the two portals appear to be the Dixon schist minus graphite. Quartz is the dominant mineral with accessory feldspar, which is entirely altered to sericite and traces of pyrite, chlorite, apatite and titanite. A little higher up, however, this quartz schist becomes very feldspathic until a true feldspar-schist ("arkosite") is found. The feldspar is chiefly soda-microcline. An abnormal percentage of titanite ($CaTiSiO_5$) suggests that some igneous influence has been at work. Again it is possible that this feldspar schist is equivalent to the Faxon limestone or that the limestone possibly is not represented. In stratigraphic geology a change in character of equivalent beds is usually thought to be the result of different conditions obtaining at the time of deposition; for example,

[1] Kemp, J. F., U. S. G. S. Bul. 225, p. 513.

deep water versus near-shore conditions. But in dealing with recrystallized sediments the degree of metamorphism enters as a factor to render the problem more complex. The absence of the Faxon limestone seems to be confined to the eastern edge of the area. As we shall see, this bed is wanting in nearly all the mines in the South Bay district. Does this mean that the old shore of the Grenville sea was to the east, that is, as far as Faxon time is concerned?

This feldspar-schist grades into the typical Swede Pond quartzite. Higher beds than this formation are not shown in the vicinity of Hague. There is no question in the writer's mind that the Lakeside mine exhibits the same graphitic bed now being worked at Graphite.

The ore. The ore is very similar, if not identical, in character to the Dixon schist shown on the Dixon-Faxon properties. The specimens collected are exceedingly low in mica and unusually high in graphite which may run as high as 10 per cent.[1]

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[1] Ihne, F. W., The Mineral Industry, 1908, p. 432.

Analyses of the Lakeside ores

CHEMICAL ANALYSIS	No. 2569
SiO_2	76.37
Al_2O_3	6.75
Fe_2O_3 / FeO	1.66
MgO	.91
CaO	1.42
Na_2O	1.04
K_2O	1.32
H_2O-	.38
H_2O+	1.22
TiO_2	.59
CO_2	none
P_2O_5	.74
S	....
MnO	....
FeS_2	3.54
C	4.63
TOTAL	100.08

QUANTITATIVE MICROSCOPIC ANALYSES			Lower portal No. 758	Higher portal No. 761	Ore dump No. 765
APPROXIMATE COMPOSITION BY WEIGHT		Graphite	9.1	9.6	....
		Biotite	.2	.2	....
		Chlorite	.2	.2	....
		Feldspar	8.0	7.5	....
		Quartz	72.5	81.2	....
		Pyrite	9.1	1.0	....
		Apatite	.9	.3	....
		TOTAL	100.0	100.0	....
SIZE OF THE GRAPHITE FLAKES	DIAMETER IN HAND SPECIMEN	Average	.69 mm x .80 mm	.89 mm x 1.03 mm	.59 mm x .84 mm
		Maximum	1.15 mm	1.50 mm	1.09 mm
		Minimum	.54 mm	.42 mm	.40 mm
	LENGTH IN THIN SECTION	Average	.71 mm	.91 mm	....
		Maximum	1.20 mm	1.90 mm	....
		Minimum	.30 mm	.40 mm	....
	THICKNESS IN THIN SECTION	Average	.073 mm	.060 mm	....
		Maximum	.090 mm	.125 mm	....
		Minimum	.050 mm	.020 mm	....

The chemical analysis by Chase Palmer in the laboratories of the United States Geological Survey, U. S. G. S. Bul. 591, p. 40.
The quantitative microscopic analyses by camera-lucida-polar planimeter method. These are approximate values by weight.

The exact cause of the abandonment of the Lakeside mine is not known to the writer, but the suggestion has been made that when the drifts extended below the level of the portals so that the water had to be pumped, the company ceased work and confined its attention to the deposit at Graphite. From what the writer observed there appears to be plenty of ore still unmined and it is quite possible that interest may be renewed in this locality.

The mill, which has been partly demolished, used the dry method of concentration, employing Hooper air jigs.

The Bear Pond Mountain Region

The Bly and Rock Pond Properties

Location. This district is situated in the township of Ticonderoga within the Paradox Lake quadrangle. The Bly property is on the northern and southwestern slopes of Bear Pond mountain. The Rock Pond mine is located on the shore of Rock pond to the southeast of the other. As the two properties are close together and each shares in the same geological conditions, they have been mapped as a single unit and will be described together. The properties can be reached by a road leading west from Chilson, following a fairly good dirt road to a farmhouse just north of the junction of Putnam creek and Bear pond outlet. From there a wood road leads to Bear pond. On the shore of the pond are the camp buildings belonging to Mr John D. Bly of Crown Point, who is the owner of the graphite property.

The Bly pits. The road on the north side of the mountain follows the outcrop of the graphitic schist, which here stands on edge with nearly vertical dip. A number of prospect pits have been opened to test the extent of the graphitic strata. The most important is the Eutoka pit. Near the end of the north road is the Joan pit. Mr Bly has not traced the stratum any farther to the west. South of the Joan pit on the other side of the hill is the South Side pit. The stratum here exposed has been regarded by Bastin[1] as another and distinct bed, but careful examination in the field shows that the two exposures very probably exhibit the same bed that has been isoclinally folded. The Bly property is still undeveloped.

Rock pond. In 1901 Gray Brothers began to develop a deposit at Rock pond. A well-designed ten stamp mill was erected during the following year by the Ticonderoga Graphite Company, organized for the purpose of working it. In 1903 the Ticonderoga Company allowed the Columbia Graphite Company, which had abandoned its former location near Overshot pond, to experiment with the deposit. In the following year the Rock pond property was formally taken over and worked during 1904 and 1905 by the Columbia Graphite Company, backed by Pittsburgh capital. The next year the plant was leased to Pettinos Brothers of Bethlehem, Pa., who worked it for only a brief period as the ore was cut off by a fault, it is said.

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[1] Bastin, E. S., Economic Geology, 1910, 5:141.

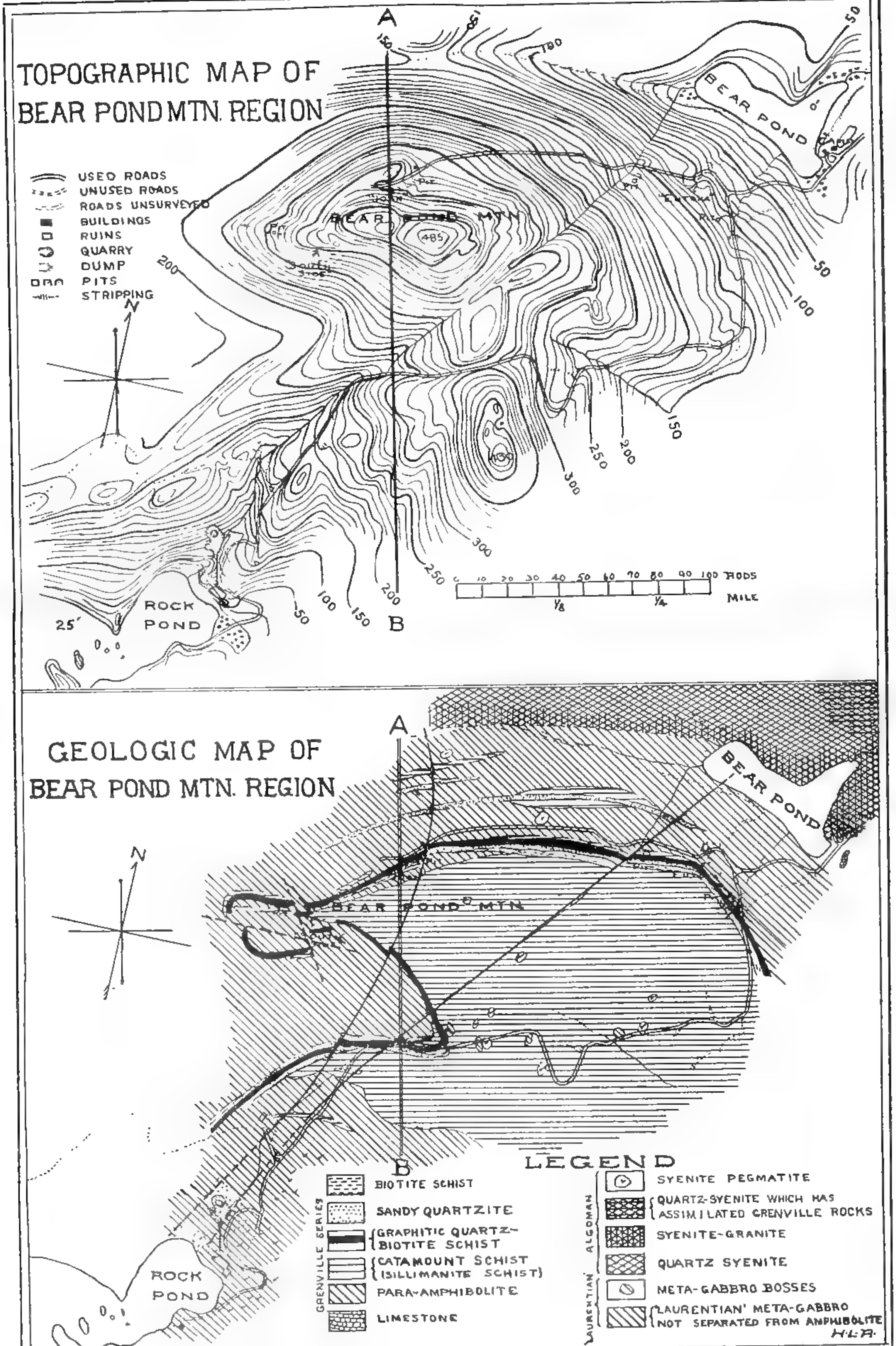

Fig. 10 Geologic and topographic map of the Bear Pond Mountain region. Datum plane, Bear pond. Plane table survey by G. H. Chadwick and H. L. Alling. Topography by G. H. Chadwick; geology by H. L. Alling, 1917.

Rock pond workings. These consist of an abandoned pit about 150 feet in diameter and 40 feet deep, filled with water, and a drainage tunnel. The rock is chiefly a feldspar schist (an "arkosite"[1]) carrying graphite and heavily impregnated with pyrite which carries traces of galena. The oxidation of the former mineral to various oxides, hydroxides and the sulphate of iron has deeply stained the walls of the pit with reds, yellows and browns, with splashes of white incrustations of copperas.

Geology and structure. The geology in essence is not very complicated but with the isoclinal folding and subsequent compression followed by igneous injection, the structure is very involved.

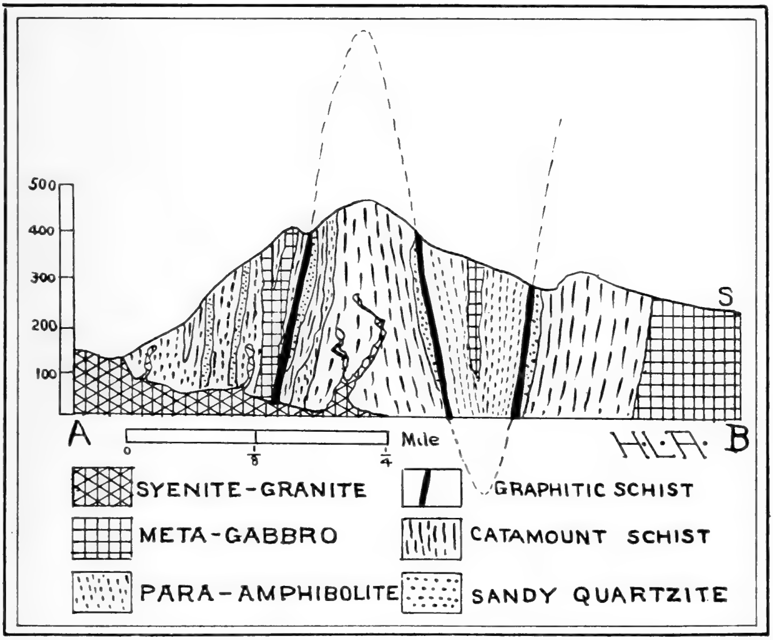

Fig. 11 Vertical section of the Bear Pond Mountain region, showing the isoclinal folding of the Bear Pond schist and associated rocks. H. L. Alling, 1917.

Bear Pond mountain is probable an anticline (see section, figure 11), while the south side of the hill is a syncline, both strongly pitching westward. These folds have been truncated by erosion, so the line

[1] The term arkose is the "special name for a sandstone rich in feldspar fragments, as distinguished from the more common, richly quartzose varieties." (Kemp, J. F., "Handbook of Rocks," 1911, p. 187). The term "arkosite" is proposed to signify an arkose that has been metamorphosed into a rock analogous to quartzite.

of outcrop of the graphitic schist (called for our purpose the Bear Pond schist) follows a Z-shaped pattern on the map.

Grenville stratigraphy. The folding and compression make it difficult to be sure of the succession of the different beds. The lowest member exposed, however, is limestone, which is found in one place near the camp. It may be equivalent to the "sandy" limestone shown on the southern edge of the Dixon and Faxon map. The next formation is the sillimanite schist called the Catamount schist from Catamount mountain near the International Graphite Company's property west of Pottersville in Warren county. In the hand specimen the long prismatic needles of the mineral sillimanite are shown.

The next rock is the Bear Pond schist — the graphitic member. It is uncertain how thick this formation is, but it is about 30 feet. Frequently this grades into a biotitic schist. Above the ore, stratigraphically, is the amphibolite, very possibly the Beach Mountain rock of the Faxon property. In mapping the Bear pond region it was often impossible in the field to distinguish this from the metagabbro and so the two rocks have been mapped together. With the microscope one can frequently distinguish them. Interbedded in the amphibolite are numerous lenses, lentils and drawn-out masses of sandy quartzite and sillimanite schist. It is doubtful if these can be ascribed to any definite place in the stratigraphic table.

Several igneous rocks are shown here. The first one to be noted is the metagabbro. Petrographic examination reveals that it was an augite monzonite; now it is a hornblende-feldspar (ortho-) schist. It was injected into the sedimentary strata before the isoclinal folding took place. Many small knobs puncture the Catamount schist, frequently exhibiting contact effects on the margins. This rock is much in evidence in the vicinity of Rock pond, where it has injected the "arkosite" in "lit-par-lit" fashion.

After the folding and lateral compression the area has been invaded by the Algoman syenite and granite. Very often this rock has absorbed, through assimilation, various members of the Grenville series, forming syntectic rocks. Numerous pegmatite bosses cut all rocks shown on the map. On the eastern slope of the mountain the Catamount schist is cut to pieces by them in such a manner as to indicate that the main body of the syenite granite is not far below the present surface.

Bear Pond Mountain column

AGE	ROCK	NAME
Algoman	Pegmatite	....
	Granite	....
	Syenite-granite	....
	Quartz-syenite	....
Laurentian (?)	Metagabbro	....
Grenville	Para-amphibolite, in which are interbedded lenses of sandy quartzite and sillimanite schist	Beech Mountain
	Graphite feldspar-quartz schist	Bear Pond schist
	Sillimanite schist	Catamount schist
	Limestone	....

Faults. There are two main faults that cut across the area, each resulting in a physiographic depression. As the strata are nearly vertical, the amount of vertical displacement is not known but the lateral displacement of the Bear Pond schist and associated beds is 20 to 40 feet. The faults trend in such a direction as strongly to suggest that they nearly converge at the Rock Pond pit. At the western end of the Joan loop the graphitic bed has been greatly dissected and broken apart, probably by cross-faulting and perhaps by injections of the metagabbro. In the vicinity of Rock pond the faults are of frequent occurrence and very puzzling to trace in detail.

The Bly property.[1] The Bear Pond schist is a bedded deposit which probably has no connection with the Dixon schist. Its place in the general geological column is tentatively suggested as between the Catamount schist and the Beech Mountain amphibolite.

The Eutoka pit. This is a narrow trench dug along the strike of the bed and reached by a short adit. The rock is usually soft, due to surface weathering. This Bly has experimented with and has produced some good concentrates.

Bly concentrates

	No. 638d	No. 638b	No. 638c
	EUTOKA PIT	EUTOKA PIT	EUTOKA PIT
Average diameter	.64 mm x 1.12 mm	.46 mm x .77 mm	.052 mm x .067 mm
Maximum diameter	1.40 mm	1.30 mm	.130 mm
Minimum diameter	.32 mm	.20 mm	.020 mm
Estimated per cent			
Graphite	Nearly 100	80.0[2]	12.0
Biotite	....	12.0	28.0
Quartz and feldspar	....	8.0	60.0

[1] This property is sometimes referred to as the "Jumbo Mine."
[2] A chemical analysis by H. F. Gardner gives 77.04 per cent of graphite carbon.

The rock has been severely squeezed to an amorphous (really microcrystalline) condition. The percentages of mica and clay substances furnish a serious problem in the matter of separation. The pits farther west, designated as no. 1, no. 2 and the Joan pits, show nearly the same characters, but the rock is not much weathered, while the South Side pit shows some variation. This difference leads Bastin[1] to think that the north and south beds were different

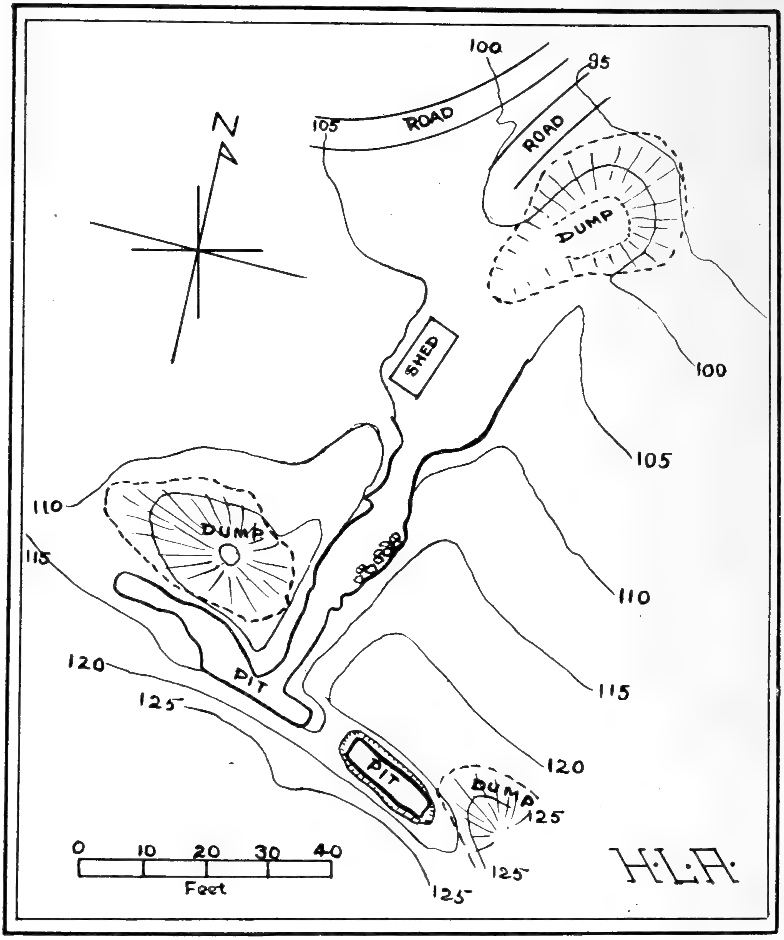

Fig. 12 Plane table map of the "Eutoka" pit on the Bly property. G. H. Chadwick and H. L. Alling, 1917.

and distinct. But it must be remembered that although today they are near together they were separated by one-fourth of a mile at

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1908, 2:726.

least before being folded, so that lateral differences in deposition may well account for this.

The Bear Pond schist. The northern arm of the Z-shaped outcrop of the graphitic schist is a feldspar-quartz-biotite graphitic schist. The feldspar dominates over the quartz while the mica, usually phlogopite and biotite, altered in part to chlorite, exceeds the amount of the graphite present. In the table showing the results of quantitative microscopic analysis, the percentages by weight of the constituent minerals are only approximate, but it is believed that they are of the proper order of magnitude. The minerals present in very small amounts and secondary alteration (katamorphic) products are purposely omitted. To a very large extent the feldspar is plagioclase almost entirely changed to secondary products, chiefly sericite. Likewise the phlogopite and biotite are weathered partly to chlorite and serpentine. Not all the quartz was an original constituent of the arkosic sands of which the Bear Pond schist is the metamorphic equivalent, for there has been an introduction of silica. The graphite is entirely distinct from this and its period of development must antedate this activity.

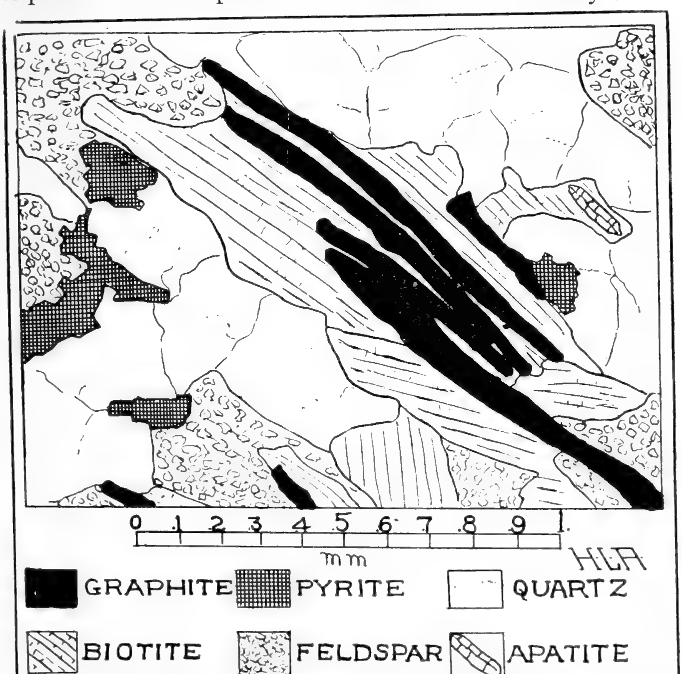

Fig. 13 Camera-lucida drawing of microscopic thin section of Bear Pond schist from the "No. 2" pit, showing the interleaving of the chloritic biotite and the graphite flakes and the introduced pyrite. X 100. H. L. Alling, 1918. (Specimen No. 847).

The graphite occurs as elongated, oval to irregular shaped flakes, nearly all of which are parallel to the schistosity of the rock, frequently interleaved and surrounded by mica and pyrite. The latter mineral has clearly been introduced at two different periods. The flakes very often bridge across the grains of quartz or feldspar. In the crushing of such ores the attrition of the flake is likely to occur. The cross-sections of the flakes, as seen in the microscopic slides

Quantitative microscopic analyses of the Bly ores

			Eutoka pit	1 pit	2 pit	Joan pit	"South Side" pit
			No. 639 845	No. 846	No. 847	No. 640 848	No. 641 849
APPROXIMATE COMPOSITION		Graphite	6.5	6.5	5.5	6.0	6.5
		Mica	10.0	10.8	11.5	11.0	10.8
		Feldspar	40.0	64.2	57.0	59.5	27.5
		Quartz	33.5	10.8	14.5	18.5	53.0
		Pyrite	10.0	7.7	11.5	5.0	2.2
		TOTAL	100.0	100.0	100.0	100.0	100.0
		Species of feldspar	Andesine oligoclase	Andesine microcline	Plagioclase	Plagioclase	Orthoclase
SIZE OF THE GRAPHITE FLAKES	DIAMETER IN HAND SPECIMEN	Average	1.23 mm x 1.44 mm	1.20 mm x 1.37 mm	.73 mm x 1.25 mm	.85 mm x 1.35 mm	.94 mm x 1.41 mm
		Maximum	1.50 mm	1.84 mm	1.50 mm	2.00 mm	1.80 mm
		Minimum	.90 mm	.80 mm	.65 mm	.65 mm	.75 mm
	THICKNESS IN THIN SECTION	Average	.029 mm	.022 mm	.028 mm	.024 mm	.025 mm
		Maximum	.060 mm	.036 mm	.066 mm	.041 mm	.043 mm
		Minimum	.018 mm	.012 mm	.006 mm	.019 mm	.012 mm

prepared from specimens, reveal the fact that dynamic disturbances have frayed them into forms resembling horsetails. Analyses of four samples from various pits are reported by Bastin as running 6.4, 6.6, 6.2 and 8.8 per cent of graphitic carbon. "An analysis of a composite sample selected in 1904 to represent as nearly as might be the general run of the property showed about 5 per cent of graphitic carbon."[1] The ore from the "South Side" pit differs from the others in that the quartz is more abundant than the feld-

[1] Bastin, E. S., Resources, 1908, 2:728.

spar and the latter is orthoclase rather than plagioclase. Still the mica exceeds the amount of graphite present.

The graphite is not limited entirely to the Bear Pond schist, for frequently the Catamount schist exposed in contact with it contains small amounts. It is the opinion of the writer that igneous activity, in which the metagabbro and the Algoman granite-pegmatites have had a share, the latter being the more important factor, has redistributed the graphite, causing some of it to lodge in the adjacent rocks. This is particularly true of the South Side pit and the central bar of the Z-shaped outcrop.

Bastin regards the bed on the north side of the hill as having a thickness of 40 feet.[1] The writer thinks that this is a little excessive, for the graphitic Catamount schist that lies next to the Bear Pond schist is too low in graphite to be considered as a source of supply. It is thought that possibly the 40 feet includes some of the sillimanite schist.

Considerable space has been given to the description of the Bly ores, for the quantity is very great, probably equalling the tonnage of the Hooper property.

Possibilities of exploitation. There are several serious considerations to be taken into account in regard to the exploitation of the Bear Pond mountain property. In the first place, there is the high mica content, proportionately larger than that of the graphite. The usual methods of concentration do not make a clean separation of the two. "Most of the graphite plates are bordered on both sides by biotite and lie between the biotite laminae as between leaves of a book. Thus biotite crystals 0.15 to 0.45 millimeter thick may inclose graphite flakes of about one-tenth of this thickness."[2] It would appear to be exceedingly difficult to treat commercially this type of ore successfully by buddling. It has been pointed out that the habit of the plates to bridge different grains interferes with the chance of securing large flakes in the concentrates.

In the second place, the vertical dip would render mining operations rather difficult. Probably the most economical method would be by open cuts along the strike, starting in at the Eutoka pit, rejecting the soft, weathered material, with its high clay content, and working up the slope which would enable a gravity tramway to be employed. Offsets at the crossings of the fault lines should be looked for.

In the third place, the transportation problems are rather serious. The roads from the Eutoka pit to the farmhouse at the junction of

[1] Bastin, E. S., loc. cit. p. 726.
[2] Bastin, E. S., Economic Geology, 5:142.

Putnam creek and Bear pond outlet are rough and would require considerable improvement before being available. The property is a long distance from any railroad, the nearest station being at Ticonderoga, 9 miles away.

For success in operation it is essential that the property should be worked on a large scale and the milling and refining problems be solved by careful experimentation. The graphite product, also, might well be converted into merchantable forms at the plant.

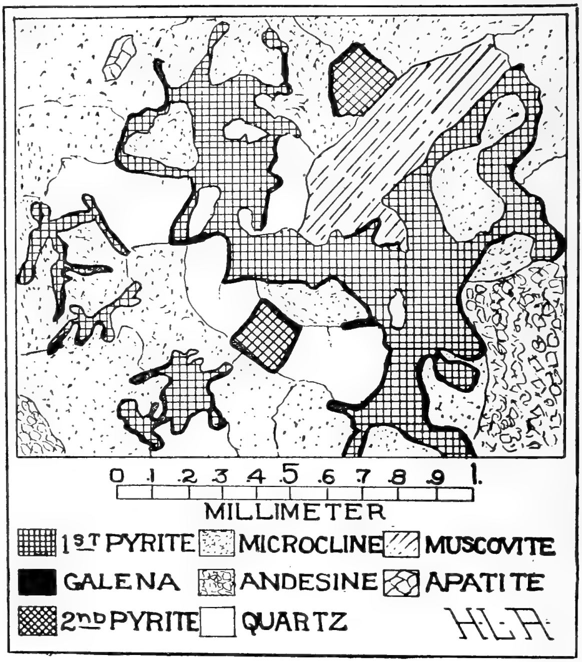

Fig. 14 Camera-lucida drawing of microscopic thin section of Rock Pond "arkosite" from head of pit, showing the two generations of pyrite and introduced galena coating the pyrite. X 100. Specimen 681. H. L. Alling, 1918.

"The plans for developing the property include erection of a mill at the mine for rough concentrating and the erection of a finishing mill at Crown Point village. Both of these mills can be run by water power, and electric power can be generated for the cheap operating of the mine machinery."[1]

The Rock pond property. All that remains of this enterprise today is a big hole in the ground from which a trickle of brick-red

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1908, 2:728.

water is flowing, giving off a strong order of copperas (iron sulphate), and the dismal ruin of a huge mill with several acres of tailings.

The geological relations exhibited here are puzzling and among the most difficult the writer has ever seen. The rock mined was a very dense, hard, fine-grained feldspathic schist (arkosite) dipping at an angle of 78° with small size flake, perhaps running from 2 to 3 per cent, and considerable amounts of pyrite and perhaps pyrrhotite. If the conditions shown on the map are correct, then

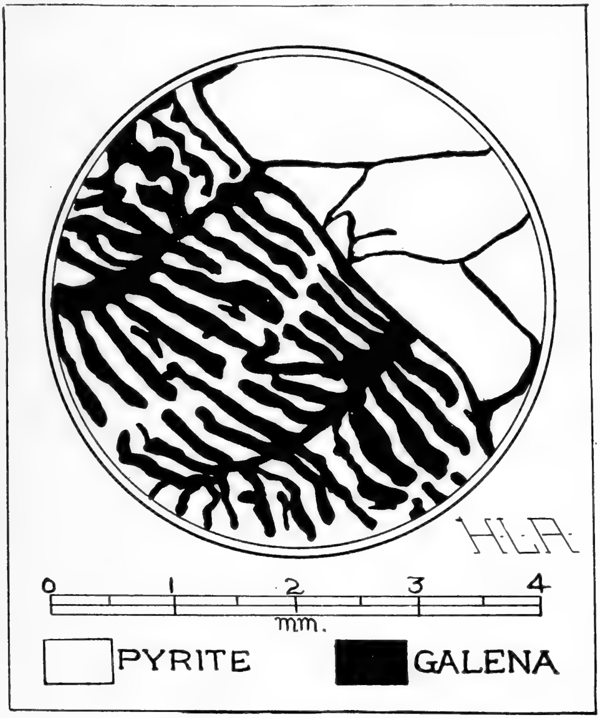

Fig. 15 Camera-lucida drawing of polished specimen of vein pyrite from Rock Pond pit, showing the microscopic intergrowths of pyrite and galena, the latter replacing the former. X 20. Specimen 650 P. H. L. Alling, 1918.

the miners were operating in a block of ore faulted on all sides. Where this rock should be placed in the geological column is a problem that can not be attempted at this time.

The graphite must be regarded as of organic origin but its relation to the pyrite, for such exists, is rather obscure. Examination shows that the pyrite is of two generations. The first introduction of the pyrite preceded the faulting, while the perfect cubes of the mineral represent the later or postfaulting period. Polished sections of massive pyrite from a vein reveal microscopic intergrowths of galena and pyrite; the former probably replacing the latter. The percentage of the pyrite in the average rock is exceedingly high. The findings of micro-analyses are as follows: Ore from pit, 17 per cent; at head of pit, 7 per cent; rock from drainage tunnel near shore of Rock pond, 40 per cent, by weight. In addition to the pyrite disseminated through the "arkosite" there are true fissure veins, some of which are 4 to 5 inches wide. In fact, the average run of the graphite ore contains more pyrite than graphite, yet it was the latter mineral that alone was saved, the sulphide being allowed to go into the waste. If more ore should be found it would seem as if it would pay to save the pyrite for sulphuric acid manufacture.

Quantitative microscopic analyses of the Rock Pond "arkosite"

			No. 650 Drainage tunnel	No. 665 South side of pit	No. 681 Head of pit	No. 683 West corner of pit	No. 684 10 feet south of 683
APPROXIMATE COMPOSITION BY WEIGHT		Graphite	2.0	2.7	1.4	.4	....
		Biotite	trace	trace	trace	1.4	....
		Chlorite	5.0	7.4	4.6	9.0	....
		Orthoclase	40.9	trace	trace	trace	....
		Microcline	.7	62.2	68.4	70.0	....
		Andesine	trace	2.9	trace	trace	....
		Quartz	10.3	2.7	16.0	9.5	....
		Pyrite	40.0	17.5	7.6	3.0	....
		Muscovite	.6	.3	little	trace	....
		Sericite	trace	trace	trace	5.0	....
		Carbonates	trace	.3	little	1.5	....
		Apatite	.3	.1	trace	trace	....
		Titanite	none	none	none	.2	....
		Augite	none	.2	1.8	none	....
		Sillimanite	.2	none	none	none	....
		Galena	.3	.3	.2	little	....
		TOTAL	100.0	100.0	100.0	100.0	....
SIZE OF THE GRAPHITE FLAKES	DIAMETER IN HAND SPECIMEN	Average	....	.57 mm x .99 mm	.31 mm x .50 mm	....	.66 mm x .88 mm
		Maximum	....	2.55 mm	1.02 mm	....	2.30 mm
		Minimum	....	.30 mm	.20 mm	....	.30 mm
	LENGTH IN THIN SECTION	Average	.45 mm	.66 mm	.56 mm	.23 mm	....
		Maximum	.60 mm	.89 mm	.91 mm	.42 mm	....
		Minimum	.30 mm	.34 mm	.35 mm	.18 mm	....
	THICKNESS IN THIN SECTION	Average	.077 mm	.061 mm	.031 mm	.042 mm	....
		Maximum	.150 mm	.082 mm	.061 mm	.051 mm	....
		Minimum	.049 mm	.034 mm	.023 mm	.020 mm	....

Milling practice. The mill had a daily capacity of 3000 pounds of graphite. The ore was loaded into side-dumping cars which were hauled up an inclined track into the mill. There the ore was crushed, passed under a battery of ten California stamps, treated with water and fed to the buddles, following the usual Adirondack practice. The concentrates were hauled to Ticonderoga for shipment.

The mill has been torn down, and all the valuable material has been removed. It is difficult to express an opinion about the value of this property, but until the faults are carefully investigated and understood it would not be possible to state whether or not the ore is entirely exhausted.

Hooper Brothers' Property

Location. This recently developed property is located in the township of Dresden, Washington county, on the west side of South bay of Lake Champlain about 4 miles due west of Whitehall. Active mining operations commenced in April 1916. The establishment includes a mill, office, boarding house, blacksmith shop, etc.

Geology. In many ways the conditions that obtain here are very similar to those found on the Dixon and Faxon properties. It is quite clear that the graphite-bearing rock is the same stratum being worked at the town of Graphite.

On approaching the mill, passing the extensive tailing pond, which has been created by damming a swamp, one finds the Potsdam sandstone, a rock of Upper Cambrian age,[2] in sharp contact upon the yellow quartzite of the Grenville series. The mill is situated directly upon this quartzite schist which splits easily into slabs. However, this is not a pure rock but a syntectic of two. The Laurentian granite has soaked it, "lit-par-lit" injected it, so it would not be readily recognized as the equivalent of the Swede Pond quartzite. It is only rarely that an exposure can be found that reveals the original quartzite free from granitic material.

The syntectic Swede Pond gneiss directly overlies the ore, the Faxon limestone being absent. The graphite rock is the typical Dixon schist; a quartz-feldspar-schist with 5 to 6 per cent of graphite, exposed along the north road[1] and is found to outcrop for a long distance along the strike at the base of a steep cliff (cuesta front).

Beneath the ore is the rock that has been referred to as the Hague gneiss, but the garnet is not so well developed and the sillimanite

[1] Constructed in colonial days by General Burgoyne as a military road.
[2] Possibly of "Ozarkian" age.

is less abundant than is the case at Graphite and Hague. There is no question but that it represents the same stratigraphic unit. Beneath the Hague is the para-amphibolite, already mentioned, the dresden amphibolite. In composition, character and in habit it is similar to the Beech Mountain amphibolite, but this occupies a totally different and distinct horizon.

Two igneous rocks, both later than the Grenville rocks and which have an important bearing upon the extent of the ore, are shown. The first one to be noted is the black, gabbroic rock that acts as a cap to the long ridge running east and west. This is the so-called Laurentian metagabbro (formerly an augite monzonite) that occurs as a big sill or thin laccolith covering and replacing in part the syntectic Swede Pond gneiss. It formerly spread over a much more extensive area than is shown today, for erosion has removed large quantities, only small patches remaining. Even in the vicinity of the mill small " skins " of the metagabbro adhere to the Swede Pond gneiss. It was chilled rapidly on contact with the country rock, and specimens studied microscopically show a very fine-grained rock with diabasic texture but comparatively free from ferromagnesian minerals. To the west this cap of the metagabbro keeps cutting out more and more of the Swede Pond gneiss until it actually cuts the ore itself. This marks the westward extent of the available ore, the eastern end of the outcrop being obscured by a swamp. No one can tell where the feeding channels of the metagabbro are, nor whether they will be encountered in extensive underground operations.

One of the nice problems of Adirondack geology is the origin of the amphibolite. As has been pointed out before (in the introduction to the graphite deposits of the southern area) an " amphibolite " may be of one of three origins. The metagabbro of the Hooper property is truly igneous. The criteria used in distinguishing it from the other types are given in the summary. It remains to discuss its age relations. It lies on top of and has " lit-par-lit " injected the syntectic Swede Pond gneiss. This gneiss was previously saturated and injected by the Laurentian granite. Thus one is forced to conclude, contrary to Cushing's experience[1] that it is later in age than the Laurentian granite. Furthermore, it was found to have been folded with Grenville rocks before the intrusion of the later granite which is referred to the Algoman. It would be stretching the matter beyond the known data to conclude that all

[1] Personally communicated.

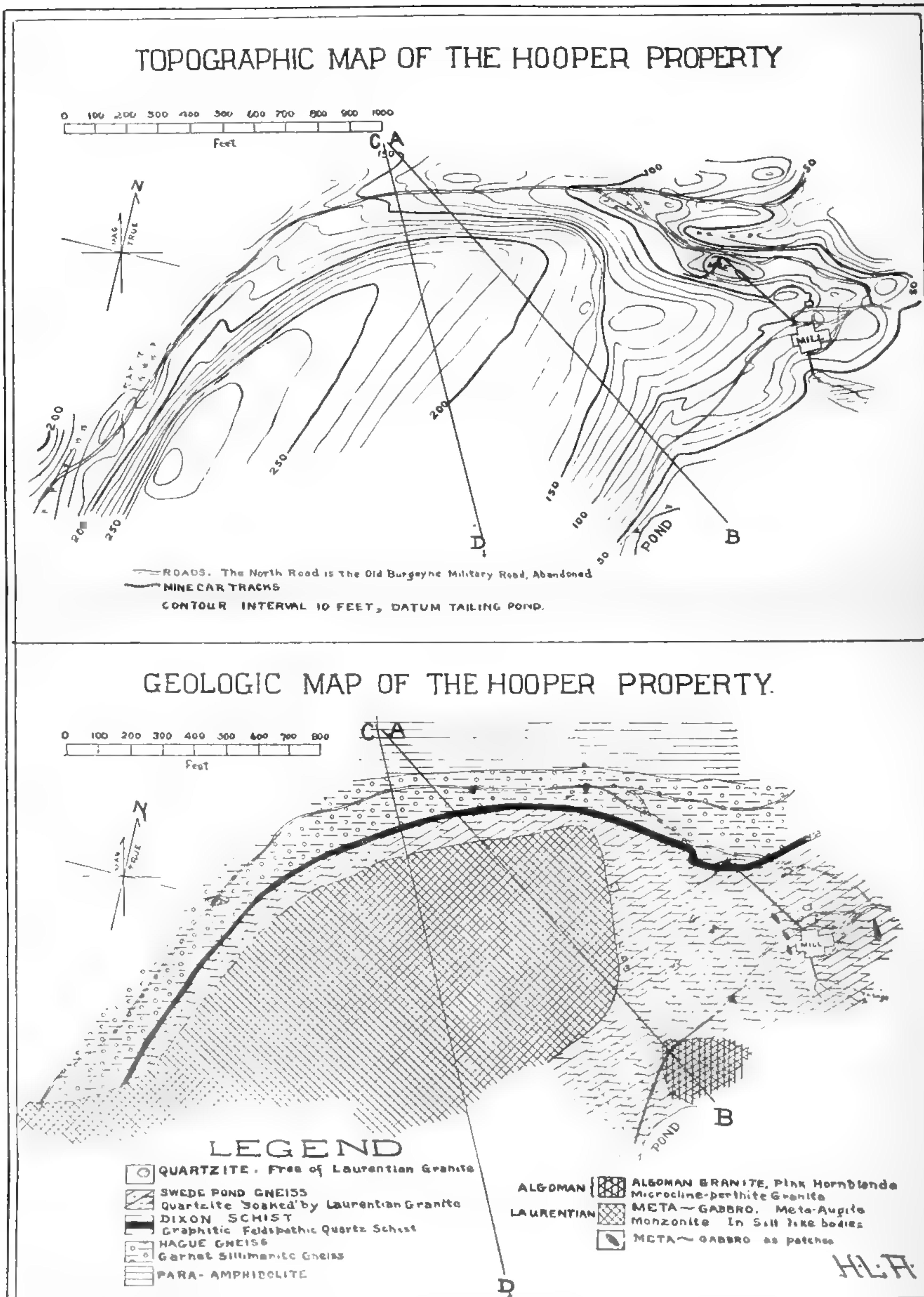

Fig. 16 Topographic and geologic map of the Hooper property, four miles west of Whitehall, N. Y. The contour interval 10 feet. Datum: Surface of tailing pond. Map based upon plane table survey by G. H. Chadwick and H. L. Alling. Topography by G. H. Chadwick; geology by H. L. Alling, 1917.

igneous amphibolites (orthoamphibolites) are of the same age. Cushing believes that some are certainly older than the Laurentian granite. That may be the case with the metagabbro on Bear Pond mountain.

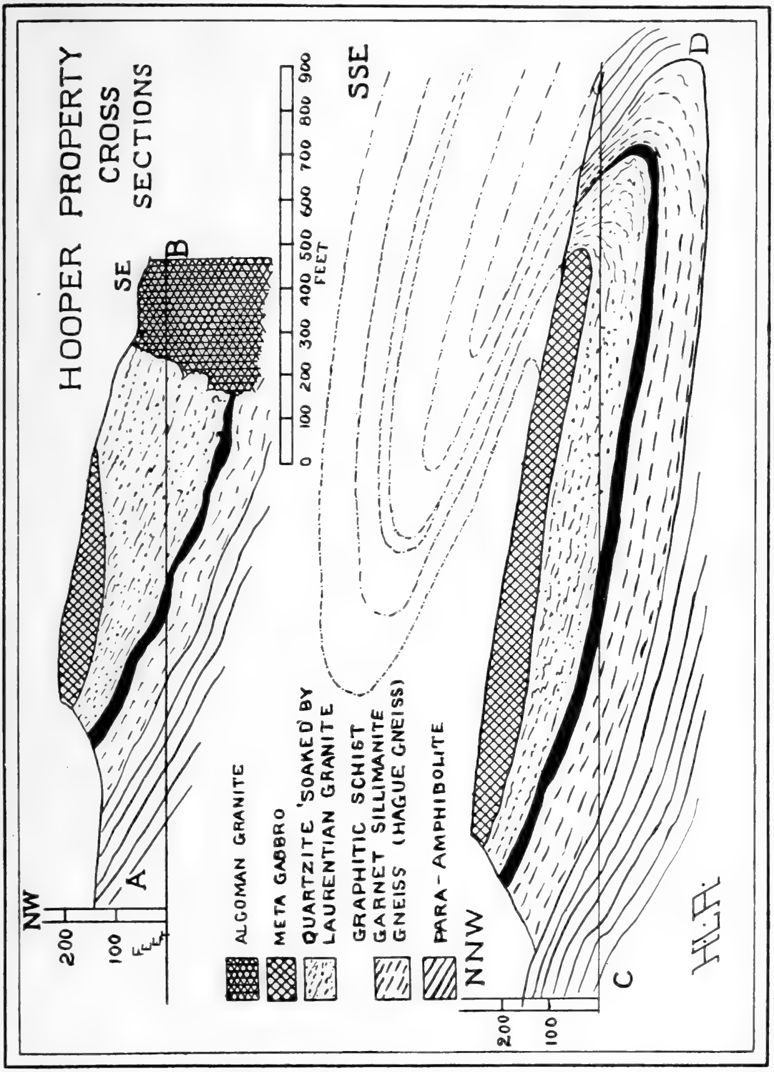

Fig. 17 Cross-sections across the Hooper property. Elevation datum surface of tailing pond. Section A-B shows the metagabbro sill as a cap and the Algoman granite cutting off the ore in depth. Section C-D shows the isoclinal folding of the rocks and the pinching out of the ore to the south-southeast. Ratio of vertical to horizontal scales 1:1. H. L. Alling, 1917.

The other igneous rock is the pink Algoman granite. A single knob is exposed on the south road. This has injected the syntectic Swede Pond gneiss in "lit-par-lit" fashion. Consequently the resulting rock is a double injected syntectic — the Grenville quartzite saturated and injected by the Laurentian white granite and then subsequently injected by the Algoman granite. The presence of this later rock here indicates to the practical miner that it very likely cuts off the ore in depth as is shown by the vertical section. See figure 17.

Structure. The beds, including the graphitic layer, are dipping at an angle of 25° to the southeast. Considerable variation from this figure is to be expected as the dip is rarely constant for any great distance. This is well shown in the main pit. Near the eastern end a dip of 26° S 35° E was measured, while directly north of the office on the north road 32° S 18° E was noted. The twice injected gneiss on the south road was found to have the following dip: 10° S 20° E. Other observations show that the beds are probably flattening as they continue to the southeast.

Along the south road beyond the limits of the map, the quartzite, very free from the Laurentian granite, essentially the typical Swede Pond quartzite, was found succeeded by the Hague gneiss and the Dresden amphibolite in the reverse order, due to isoclinal folding; the rocks have been folded back upon themselves. The rocks all show crinkling and stretching. A careful search for the ore that normally lies between the Swede Pond and the Hague gneiss, revealed only a narrow black band with the graphite flakes stretched, rubbed and polished. The unresistant Dixon schist on close folding is stretched and pulled out into a narrow band which often breaks under such excessive strains.

In spite of this pinching of the ore and the cutting out by the Algoman granite, there is an immense amount of ore, perhaps a million and a half tons, within the property.

The ore. The graphite schist is the familiar Dixon schist very similar to the rock being mined at Graphite by the American Graphite Company. Perhaps the schist here has not been so squeezed and is harder and firmer than some of the best ore, say, from the Summer pit.

It is a quartz-feldspar combination with dominant quartz, 65 to 80 per cent, feldspar 15 to 30 per cent, and accessory graphite, biotite, chlorite and pyrite. The micro-analyses, tabulated below, although only approximate, show the relations fairly well. The ore from the main pit, which is located near the eastern limit of the outcrop, does not exhibit the best ore on the property, as is revealed by the series of test pits farther westward. The rock now mined carries a small flake which is highly involved with chloritic material. The latter is probably derived from the alteration of micaceous minerals. Pit no. 2 shows a rock with larger flake and an almost total absence of biotite and chlorite.

Quantitative microscopic analyses of the Hooper ores

			No. 758a Pit 1	No. 721 Pit 2	No. 722 Pit 3	No. 772 Pit 4	No. C4-N
Approximate composition by weight		Graphite	7.7	4.9	5.7	5.0	8.7
		Biotite	4.7	.7	4.9	1.8	1.4
		Chlorite	6.6	1.9	....	4.8	4.5
		Andesine	13.6	28.1	2.3	23.9	8.0
		Quartz	64.6	60.1	82.2	58.8	75.0
		Pyrite	1.2	2.2	4.9	5.7	.3
		Apatite	.9	1.0	....	....	1.6
		Titanite	.7	1.1	....	....	....
		TOTAL	100.0	100.0	100.0	100.0	100.0
Size of the graphite flakes	Diameter in hand specimen	Average	.51 mm x .71 mm	.68 mm x 1.18 mm	.78 mm x 1.19 mm	.51 mm x .91 mm	....
		Maximum	1.36 mm	1.35 mm	2.05 mm	1.43 mm	....
		Minimum	.20 mm	.40 mm	.40 mm	.35 mm	....
	Length in thin section	Average	.44 mm	.78 mm	.68 mm	.74 mm	.90 mm
		Maximum	.85 mm	1.10 mm	1.20 mm	1.10 mm	2.50 mm
		Minimum	.20 mm	.35 mm	.30 mm	.30 mm	.20 mm
	Thickness in thin section	Average	.036 mm	.037 mm	.038 mm	.046 mm	.053 mm
		Maximum	.050 mm	.080 mm	.059 mm	.060 mm	.150 mm
		Minimum	.021 mm	.020 mm	.015 mm	.030 mm	.020 mm

Microscopic measurements on Hooper concentrates

GRADE	Plus no. 8[1] Silk	Minus no. 8 Silk
Average diameter	.33 x .65 mm	.17 x .23 mm
Maximum diameter	1.05 mm	.29 mm
Minimum diameter	.21 mm	.08 mm

[1] Chemical analyses by H. F. Gardner give 89.00 and 86.32 per cent graphitic carbon for these two grades respectively.

The last pit exposes the poorest grade found. It is possible that the samples secured do not represent the average run, as they may have been taken from near the top of the stratum. The texture indicates, however, that the metagabbro, which is not far away, has affected it.

Inclusions in the ore. In the main pit two or three lens-shaped masses of a tough green rock lie in and split the ore. These are known to the miners as "nuts," a very good descriptive term because of their resemblance to almonds in shape. These rock masses are often 10 feet long and 4 or 5 feet thick. Microscopic study of specimens taken from one of them shows that they are probably due to contact effects of an igneous rock upon the ore. It is very likely that they will be encountered as further development is undertaken.

Mining operations. Today the mining is confined to an open cut near the eastern limit of the outcrop. The ore is loosened by blasting, the large blocks being broken up by sledge hammers and loaded into self-dumping cars. These are run upon a turn-table and placed upon the main inclined mill track. The cars are then hauled directly into the mill by a cable system. Near the western end of the main pit a curving drift is being driven which will eventually follow the strike to the west.

Milling practice. The ore is passed through crushers, hence to two banks of California stamps. From there the pulverized rock is fed to a series of conventional buddles. The concentrates from these are then treated upon Wilfley jig tables; the final grading is accomplished upon revolving silk reels, using no. 8 silk. The concentrates are then dried and ready for shipment. The size of the concentrates, samples of which were furnished by Hooper Brothers, was measured and is tabulated above. Constant improvements and modifications in the mill and its equipment are under way and likewise plans are being made to increase the tonnage capacity of the mine and mill.

Economic summary. It is very apparent that the prospects of this property are unusually bright. There is every indication that a large supply of flake graphite may be expected from this mine.

The Champlain Graphite Company

Location. This property is situated in the township of Dresden, Washington county, on the shore of South bay across Lake Champlain from Whitehall. The property was first opened in 1904. The company was organized in 1907, but the mine was operated only a short time and is today abandoned.

Mine. The mine consists of an open pit in the face of the abrupt cliff. It is about 100 feet long and 25 feet wide and deep, partly filled with water. This cut exposes a crush zone in the graphite schist which is partly in fault contact with the metagabbro, evidently a portion of the same mass exposed on the Hooper property. This is today a hornblende diorite.

The ore. The ore is a quartz-feldspar schist, very likely the Dixon schist, but a little lower in quartz than is the usual run. The feldspar is almost entirely weathered to secondary sericite but enough remains to demonstrate that it is largely andesine. The graphite flake is rather small and much involved with considerable chlorite and a little pyrite and biotite, reminding us of the Bly ores. The graphite flake varies "from .015 millimeter to .025 millimeter in thickness and up to 1.3 millimeters in length; the average length does not exceed 0.75 millimeter."[1] There is a lack of parallelism of the flaky minerals, due to the shearing movements associated with the faulting. The graphite is said to constitute from 4 to 7 per cent of the rock.

Quantitative microscopic analysis of the Champlain ore

No. 720
South side of pit

APPROXIMATE COMPOSITION BY WEIGHT	Graphite	5.3	SIZE OF THE GRAPHITE FLAKES	Average diameter	.60 mm x 1.00 mm
	Biotite	9.2			
	Chlorite	3.7			
	Andesine	38.2		Maximum diameter	1.39 mm
	Quartz	38.0		Minimum diameter	.28 mm
	Pyrite	4.3		Average length	.76 mm
	Apatite	1.3		Maximum length	1.42 mm
	TOTAL	100.0		Minimum length	.34 mm
				Average thickness	.043 mm
				Maximum thickness	.075 mm
				Minimum thickness	.025 mm

The pyrite is of two generations, the early introduced type has irregular outlines becoming distinctly fuzzy at times. The later form is in perfectly bounded cubes. Both the graphite schist and the metagabbro are seamed with veins often 2 inches wide, consisting of coarsely crystalline calcite, feldspar, quartz and some garnet. The general strike of the beds is N 10° E.

The mill. A well-constructed mill which was built in 1905 stands close to the water's edge, 300 feet from the quarry with which it is connected by a short tramway. "The equipment includes a jaw crusher, 12-inch rolls, broken-screw agitators, three buddles, drying floor, bolting machines, tube mill, etc."[2]

Economic future. The predicament in which the Champlain Graphite Company found itself is a striking example of the disastrous results that follow the attempt to open a mine before con-

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1909, 2:823.
[2] Bastin, E. S., loc. cit. p. 823.

ditions are known. The geological situation is decidedly unfavorable for such an enterprise on account of the crushing of the rocks along the fault line; and the liability that the metagabbro cuts off the ore is always present. Mr Newland, who visited the property when operations were in progress, states that above the mine a considerable distance up the slope another exposure of the graphite schist occurs which is very likely an extension of the same bed, and which offers more promising conditions for a successful mine. Is the rock in the pit a downfaulted block? Thus there may be more ore in sight but it is very clear that the present mine is a failure.

The following two mining properties were not visited by the writer. The descriptions are based upon the published accounts, especially Bastin's.

The Adirondack (Graphite) Mining and Milling Company

Location. " The mill and the mine of the Adirondack . . . Company are about a mile northeast of the Champlain Graphite Company's plant, near the wagon road which skirts the South Bay shore."[1] The property was opened in 1904 but has remained idle since 1907. " The hillside quarry is about 100 by 100 feet and 30 feet in maximum depth, and all of the rock exposed is more or less graphitic." The ore is the characteristic quartz-feldspar schist, readily cleavable, " which is more uniform in character than that at the Champlain mine," probably due to the absence of faulting. " The strike is quite regular and averages N 80° W. The dip is about 30° south. A thickness of 25 feet . . . is exposed."[2] " The graphite forms very fine, thin scales coating the cleavage planes. It is accompanied by brown mica, garnet, quartz and pyrite."[3]

" A thin section of the typical ore when examined under the microscope shows quartz as the most abundant mineral with sharply bounded . . . [sericite] aggregates, which . . . represent altered feldspar grains and abundant brown biotite. Associated with the last and for the most part interleaved with it occurs the graphite, which according to an analysis made in the laboratory of the United States Geological Survey, constitutes 5.29 per cent of the rock. The sample analyzed was a composite one collected by the writer [Bastin] from various parts of the quarry and probably approaches closely the average run of the mine. Some chlorite and zoisite occur, and certain bands parallel to the schistosity are very

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[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1909, 2: 823.
[2] Bastin, E. S., ibid.
[3] Newland, D. H., N. Y. State Mus. Bul. 102, p. 76.

rich in pyrite. The rock owes its foliated structure to subparallel arrangement of the graphite and the biotite flakes. The graphite flakes in the thin section studied vary from 0.02 millimeter to 0.015 millimeter wide and range up to 0.9 millimeter in length. The average length is not over 0.5 millimeter.

"The mill of this company was situated at the quarry, but at the time of the writer's [Bastin] visit had not been running for many years. The equipment includes a jaw crusher, crushing rolls, a stamp mill with two batteries of five stamps each, an inclined screw washer, Wilfley table, two buddles, and a flotation separator of special design."[1]

Chemical analysis of the Adirondack Company's ore

SiO_2	65.10
Al_2O_3	9.15
Fe_2O_3	4.68
FeO	3.09
MgO	2.21
CaO	1.71
Na_2O	.24
K_2O	2.32
H_2O —	.50
H_2O +	2.33
TiO_2	.96
CO_2	None
P_2O_5	.74
S	3.26
MnO	.03
FeS_2	....
C.....Graphite	5.29
Total	101.61
Less O	1.63
Total	99.98

Analysis by George Steiger, U. S. G. S., Bul. 591, p. 40.[2]

The Silver Leaf Graphite Company

"A prospect opened by the Silver Leaf Graphite Company" in 1904 "is situated in the woods about a mile west of the Champlain Company's mine. It consists of one pit 15 feet wide and 40 feet long and 5 to 6 feet deep. The ore is similar to that at the Champlain mine. The graphite schist strikes 40° west and dips 25°

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1909, 2: 823.

[2] F. W. Clarke gives this analysis in U. S. G. S. Bul. 591, p. 40. Bastin, Econ. Geol., 5: 141, gives the identical analysis for the American Graphite Company's ore. As it seems highly improbable that the schists of the two localities should be exactly alike, it seems very likely that some error has occurred in ascribing the analysis to both companies. As Bastin uses the value 5.29 per cent in accounts of both of these properties he is possibly unaware of the matter.

east."[1] Bastin reports that quartzite layers are present at this locality; it is quite possible that the Swede Pond quartzite is exposed above the ore.

"The company has no mill." The property is today abandoned.

The International Graphite Company

Location. This abandoned property is situated in the township of Chester, in Warren county, 3½ miles west-northwest of Pottersville on the southern edge of the Schroon Lake sheet, just to the east of the junction of Trout and Alder brooks. It lies in a depression which represents a limestone valley.

The mine was opened prior to 1900. In 1901 the plant was enlarged, although at that time the continuous presence of pay ore had not been demonstrated.[2]

Workings. The workings consist of an inclined shaft sunk to 150 feet from which a drift has been driven; a vertical shaft, depth unknown; and two small prospect pits.

Geology. W. J. Miller[3] has mapped the area on the quadrangle immediately to the south of the mine as Grenville limestone and interbedded gneisses. The limestone is well shown at Natural Bridge.[4] This area can be traced into the Schroon Lake sheet to include the International Company's property. The knowledge of the stratigraphy is not so complete as would be desirable, but the essential features apparently are as follows:

The ore bed is a quartz-feldspar schist 18 to 25 feet thick dipping 25° N 50° W (magnetic). This grades into the overlying layers which contain more and more mica until a mica schist is the dominant type. Above is an amphibolite, which very likely represents an altered impure limestone formation, as will be pointed out later. Succeeding the amphibolite is a thick bed of limestone, with interbedded layers of granular, siliceous rock. This is overlain by another amphibolite. This group of rocks, above the ore, taken *en masse,* very probably is equivalent to the Faxon limestone that we have noted before. But on the International property this is a thick formation, the upper beds possibly representing a replacement of part of the Swede Pond quartzite by limestone. Succeeding this group is a quartz gneiss often with garnets and shreds of mica. It is seamed and cut by igneous injections to the extent that

[1] Bastin, E. S. Mineral Resources, U. S. G. S. 1909, 2:823.
[2] The Mineral Industry for 1901, p. 369.
[3] Miller, W. J., New York State Mus. Bul. 170.
[4] Loc. cit., plate 1, facing p. 10.

it rarely presents a pure type of rock. The writer's interpretation is that it is in part sedimentary and in part igneous; the Laurentian granite has injected it, soaked it, and has assimilated sufficient quantities to form a syntectic rock. It is suggested that this represents the Swede Pond horizon. The presence of the Laurentian, the Algoman granite, or the siliceous and argillaceous character of the Faxon limestone may be factors in the production of the contact type of amphibolite which forms the base and top of the Faxon formation. In the field north of the mine the syntectic Swede Pond gneiss is cut by a diabase dike, 2½ feet wide running N 60° E.

If the above relations hold, the following is especially important, not only scientifically but as bearing on the problem of the graphite resources of the State. Resting upon this syntectic rock, and forming the slopes of Catamount mountain is a sillimanite schist, which furnishes the type example of the Catamount schist (see the Bear Pond mountain region). It is believed that the full thickness of the Catamount is shown here. Certain phases are somewhat graphitic and the inference is strong that we are not far from the horizon of the Bear Pond schist, the ore-bed of the Bly property. That such is the case, however, is by no means demonstrated, but the suggestion is worth considering. If such is the case, then, there are two distinct graphitic beds. From what has been learned it is safe to say that the lower (stratigraphically), or Dixon schist, is the better of the two. Provided that the stratigraphy as here developed is actually the true state of affairs, then prospecting for more graphite takes on a new significance.

The ore. A specimen taken from the ore bin, representing the typical rock mined, was found under the microscope to be a quartz-feldspar schist, abnormally high in graphite and pyrite, the latter running 25 per cent by weight of the rock. Biotite and phlogopite, which are present in greater amounts than is usually the case, are interleaved with the graphite like leaves in a book. In addition to these differences from the normal Dixon schist the presence of diopside (a member of the pyroxene family) and tourmaline must be noted. Material from the rock dump reveals many evidences that igneous action of the pegmatitic variety has taken place in this vicinity. Contact rocks of all sorts are plentiful, although actual access to them *in situ* is impossible. The peculiar nature of the ore strongly suggests that redistribution and concentration of the graphite flake has taken place, resulting in a rich zone within the schist. As we shall see later, the Rowland and the Sacandaga ores are very similar. The flake is comparatively large and interleaved with the pyrite and mica.

The percentage of biotite is sufficiently high to give serious difficulty to the miller, which was the case, the writer was informed. Certain specimens taken from the dump show a decided approach toward hydrothermal action, almost veiny in habit.

Quantitative microscopic analyses of the International ores

			No. 741 Ore bin typical	No. 742 Ore dump very rich	No. 739 Second prospect hole east of shaft	No. 745 Concentrate
Approximate composition by weight		Graphite	7.1	...	4.5	...
		Biotite	5.7	...	trace	...
		Chlorite	trace	...	trace	...
		Andesine-labradorite	20.6	...	50.0	...
		Quartz	38.8	...	2.0	...
		Pyrite	22.1	...	2.3	...
		Apatite	1.1	...	.2	...
		Diopside	3.4	...	22.0	...
		Tourmaline	2.2	...	none	...
		Hornblende	none	...	19.0	...
		Total	100.0	...	100.0	...
Size of the graphite flakes	Diameter in hand specimen	Average	1.04 mm x 1.61 mm	1.68 mm x 2.50 mm	...	.53 mm x .77 mm
		Maximum	2.40 mm	5.20 mm	...	1.50 mm
		Minimum	.50 mm	.85 mm	...	.30 mm
	Length in thin section	Average	1.03 mm	...	.43 mm	...
		Maximum	1.70 mm	...	.90 mm	...
		Minimum	.40 mm	...	.20 mm	...
	Thickness in thin section	Average	.042 mm	...	.033 mm	...
		Maximum	.080 mm	...	.055 mm	...
		Minimum	.025 mm	...	.018 mm	...

The igneous activity has brought about a rich ore, specimens of which can be found that are far richer than the usual Dixon or Bear Pond schists, but the improvement in the amount of graphite is obtained at the expense of uniformity. This element in graphite milling is an important factor and is frequently overlooked. It is not difficult for the writer to appreciate this cause in the failure of the company.

Faults. In the bed of Alder brook, at the bridge just before reaching the mill, the pink Algoman granite is splendidly shown in its typical development. Consulting the geological map of the North Creek quadrangle we find that Miller has indicated a fault extending from a point a mile northeast of Holcombville northeast to the edge of the sheet. He says:[1] it extends "along the western base of the Henderson mountain mass. Its position is plainly marked by the topography, and though the scarp is not as steep as usual, it is nevertheless very prominent and straight and cuts across the foliation of the rocks at a high angle. . . . As judged by the height of the scarp at the south end and also at the base of Henderson mountain, the displacement is fully 700 feet. . . . No tilting of this fault block is noticeable. This fault certainly continues for some 3 miles northward into the Schroon Lake quadrangle along the western bases of Green and Pine Hills." The writer's observations are in perfect accord with this interpretation. This fault, which brings in the granite, delimits the graphite ore on the west. Several prospect pits to the east of the mine show graphite, but the rock actually exposed is the micaceous schist — the upper transition beds of the ore. How far the graphitic schist can be traced eastward along the strike is not known, but it is quite reasonable to expect that it can be done for some distance.

Mining and milling methods. The main inclined shaft is completely housed and leads directly from the floor of the hoisting shed downward for 150 feet with a steep angle, at which level a little drifting has been done. From the hoisting house the ore was trammed in small cars through a covered passageway to the ore bin and drying house. Crushing, stamping, buddling and screening were the essential features of the process.

Economic conditions at this property are not very favorable for production. Mining operations are down to creek level, forcing the employment of pumps every inch of the way. The ore, although exceedingly rich in spots is very variable, due to the igneous (magmatic) agencies of the Algoman granite. The latter rock exists near the surface beneath the ore which probably limits the schist as to depth. The high biotite-phlogopite content and toughness are factors also to be considered.

The Rowland Graphite Company

Situation. The property is in the township of Johnsburg, Warren county, about a mile south-southwest of the village of Johnsburg and 6 miles by an excellent state road southwest of Riverside station

[1] Loc. cit., p. 56.

on the Adirondack division of the Delaware and Hudson Railroad within the North Creek quadrangle. The exact location is shown by the crossed hammers on the geological map of the North Creek sheet.[1] The mine is situated on the southern slope of a low hill.

The Rowland property, in fee and lease, covers over 200 acres in the valley of Mill creek.[2]

Beck,[3] in 1842, wrote: " In Warren county, graphite will probably be found in considerable abundance. There is a locality of it on the farm of Mr Noble, at Johnsburg. Several hundred weight of good graphite has been obtained from this mine. The mineral occurs in irregular shaped masses weighing from one to twenty pounds, in a vein of quartz."

Active development of the property took place prior to 1899. In 1900 operations began and working continued as late as June 1910, but today the mine is idle. There seems to be no prospect of reopening the mine.

Workings. " The principal opening consists of an open cut running westerly [N 72° E, magnetic] . . . about 100 feet long and 30 feet deep at the west end, where a shaft in the deep west end of the cut penetrates the bed of graphite schist to a depth of 22 feet below the present bottom of the cut, and a short drift running southward from the shaft on the richest part of the bed."[4]

Geology. The immediate area has been mapped by W. J. Miller as composed of Grenville crystalline limestone interbedded with horneblende and horneblende-garnet gneisses, which strike N 70° E and dip 20 to 35° to the south.

The ore bed is in all probability the Dixon schist, some 28 feet in thickness, the upper portion of which is decidedly micaceous and lean in graphite while the center is exceedingly rich due to igneous redistribution and reorganization, as will be shown later. Associated with the ore is a limestone (the Faxon), in part interbedded with it and in part beneath, specimens of which may be obtained from the material removed from the entrance of the trench. Above the ore is a quartzite, just what the reader may expect, the Swede Pond formation; on top of this is a horneblende-biotite rock that occurs as an isolated patch in the field to the southwest of the mill.

Beneath the ore is another quartzite, about 50 feet thick, which the writer regards as equivalent to the Hague gneiss. This is void

[1] Miller, W. J., N. Y. State Mus. Bul. 170.
[2] Information kindly furnished by Mr Charles T. Rowland.
[3] Beck, Nat. Hist. of N. Y. State, pt. 3 Mineralogy, 1842, p. 421.
[4] Crosby, W. O., Special report on the property.

of garnets and the particular slide examined failed to show any sillimanite. Whenever the Laurentian granite is found its habit invariably is to saturate, to soak into, and inject a quartzose formation and leave the more calcareous and ferruginous beds unaffected. The Hague gneiss, except for the minerals that furnish the customary earmarks, is essentially a feldspathic quartzite. Garnet and sillimanite are regarded by most petrographers as indicating or strongly suggesting metamorphic action. The writer would therefore maintain that these two minerals are not reliable or consistent characteristics of this formation but may be due to the Laurentian granite which is absent at the Rowland property. This Hague quartzite is decidedly purer than its equivalent at Hague.

At the Hooper property we saw that a para-amphibolite stratigraphically lies beneath the Hague gneiss. This was tentatively named the Dresden. Its presence on the Rowland property at this horizon fits in with the general scheme of things. This amphibolite is about 65 feet thick, which is exposed on the western slopes on the knob to the northwest of the mine. Below the para-amphibolite is a limestone formation which we have not before encountered. This I propose to call the Johnsburg limestone, of which only the top portion was seen, so the total thickness is unknown.

The Algoman granite is exposed at the village of Johnsburg, but lies at no great depth under the sedimentary rocks, up through which it has sent numerous pegmatites and profoundly affected the Dixon schist.

Structure. The knowledge of the succession of the beds was applied to the problem of the structure. The mill is situated in a low depression between two low hills, the one to the north being of some prominence. The latter is composed almost entirely of the Hague quartzite dipping south. Although the summit of the hill is higher than the mine, it represents a horizon stratigraphically beneath the ore; hence the Dixon schist has been eroded and no ore to the north of the shaft in the immediate vicinity can be expected. This hill is an anticline, while the low dome to the south of the hill is a syncline in a north and south section which in reality is a structural basin, with its major diameter probably lying in an east and west direction. The actual extent to the east is not definitely known. The accompanying reconnaissance map perhaps brings out this idea better than a description. The semicircular swing of the graphitic schist is entirely inferred from the occurrence and behavior of the Swede Pond and the Hague quartzites, as well

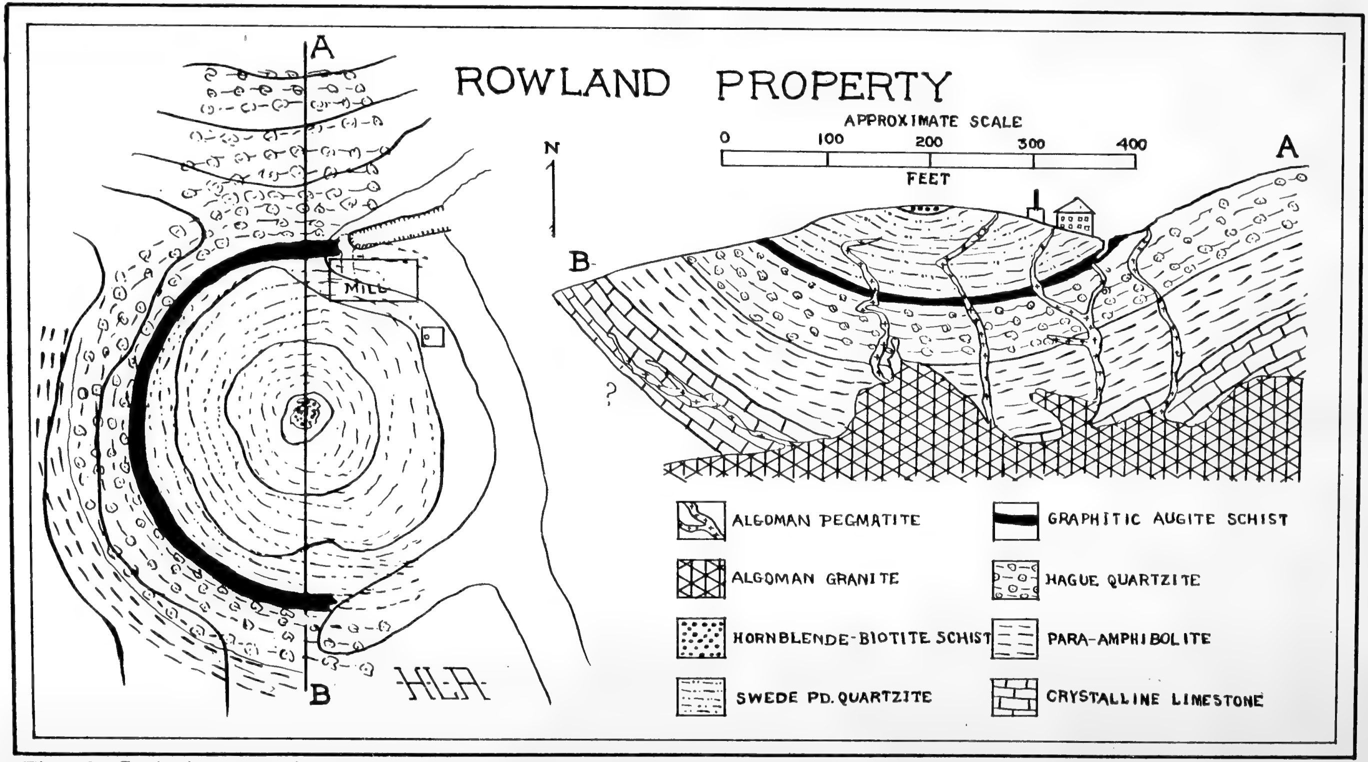

Fig. 18 Geologic reconnaissance map and north-south section of the Rowland property. The Grenville rocks, including the ore, have been folding in a structural basin. The Faxon limestone, which normally lies upon and in the graphitic schist is omitted, as its position and thickness are not perfectly known. G. H. Chadwick and H. L. Alling, 1917.

as the Dresden amphibolite. Although the map is based upon measurements secured by pacing, it is quite clear that the diameter of the basin is not over 300 to 500 feet. If this is so, then the amount of ore present on this property is decidedly limited.

Amount of ore. The mine is located upon the rim of the structural basin. Professor Crosby, in a report upon the property, remarks that the dip seems to flatten as the drifting to the south continues. This is exactly what would be expected from such a structure. Toward the center of the basin the dip should approach zero.

All the rocks in the neighborhood are shot through by pegmatites in such a manner as to indicate that the Algoman granite is not far distant. It is a possibility that it has cut off the ore bed near the center of the basin. Some exploratory work in the way of trenching along the line represented upon the map would be advisable. Several well-placed diamond drill holes would settle many of the questions raised.

Let us calculate the probable amount of the ore, assuming that the above inferences are facts.

Appropriate diameter of basin, 400 feet.
Area of basin, 125,600 square feet.
Thickness of pay ore, 10 feet.
Volume of pay ore, 1,256,000 cubic feet.
Weight of one cubic foot, 168 pounds.
Weight of pay ore, 210,000,000 pounds.
Amount of available graphite, 5 per cent.
Weight of graphite in ore, 10,500,000 pounds or 5250 tons.

This, of course, assumes that not much ore exists to the east. It is not certain how far it continues. In walking east from the mine toward the fork in the road ("1355" in altitude), in the first brook crossed, the Johnsburg limestone was found beneath the Dresden amphibolite. Furthermore, W. J. Miller has placed a little cross (×) upon the geologic map where the secondary road crosses this same stream. This indicates limestone. The writer does not know whether it is the Johnsburg or the Faxon, but it is more probable that it is the former. The ore certainly does not reach this far. This perhaps illustrates the practical side of applied geology.

The ore. The bedded ore of the Rowland property reminds us of that found at the International Company's mine. It has been affected by the Algoman granite. Below is the tabulated result of microscopic analyses, percentage by weight. It is at once apparent that there is a very great range in the ore. The bed sufficiently graphitic to be regarded as ore is something like 25 feet thick, of which one-third appears to be a good workable ore. Crosby had representative samples collected at intervals of 1 foot from two parallel sections 10 feet apart, through the richest part of the bed. He classifies the bed as follows:

"1 Eight feet of micaceous quartzite with more or less graphite, chiefly in streaks and affording some graphitic ore.

"2 Twelve feet of graphite schist, probably all of workable grade and much of it carrying 10 per cent or more of graphite.

"3 Ten feet of quartzite and brown mica schist with some disseminated graphite and streaks of graphitic schist.

"A general or composite grab sample of fifty pieces from the pile of ore from the drift . . . was analyzed by Dr W. T. Hall of the Massachusetts Institute of Technology with the following result: 8.09 per cent of graphitic carbon. This is certainly a very favorable showing . . . and it is equally certain that a considerable part of the Johnsburg bed runs over 10 per cent of graphite and some of it over 20 per cent."[1]

[1] Quoted from Professor Crosby's report.

Quantitative microscopic analyses of the Rowland ores

			No. 734 Ore bin typical	No. 731 Base of outcrop in the trench	No. 732 Five feet higher than 731	CONCENTRATES	
						No. 736a [1]	No. 736b [2]
APPROXIMATE COMPOSITION BY WEIGHT		Graphite	9.4	6.5	2.1	....	....
		Biotite	trace	1.0	20.3	....	....
		Chlorite	1.5	trace	trace	....	....
		Andesine-labradorite	none	25.5	36.7	....	....
		Quartz	none	46.0	none	....	....
		Apatite	trace	trace	trace	....	....
		Diopside	84.7	14.5	3.7	....	....
		Titanite	trace	2.0	3.3	....	....
		Orthoclase	none	trace	10.5	....	....
		Tourmaline	none	none	2.2	....	....
		Zircon	none	none	.1	....	....
		Pyrite	1.5	4.5	21.1	....	....
		TOTAL	100.0	100.0	100.0	....	....
SIZE OF THE GRAPHITE FLAKES	DIAMETER IN HAND SPECIMEN	Average	1.22x.89 mm	1.00x.54 mm	.67x.52 mm	1.05x.61 mm	.70x.46 mm
		Maximum	2.40 mm	1.90 mm	2.25 mm	2.10 mm	1.20 mm
		Minimum	.40 mm	.27 mm	.31 mm	.30 mm	.27 mm
	LENGTH IN THIN SECTION	Average	1.03 mm	.68 mm	.51 mm	....	....
		Maximum	1.70 mm	1.10 mm	.90 mm	....	....
		Minimum	.60 mm	.40 mm	.25 mm	....	....
	THICKNESS IN THIN SECTION	Average	.067 mm	.050 mm	.034 mm	....	....
		Maximum	.130 mm	.100 mm	.080 mm	....	....
		Minimum	.025 mm	.010 mm	.018 mm	....	....

[1] Chemical analysis by H. F. Gardner gives 85.04 per cent graphitic carbon.
[2] Chemical analysis by H. F. Gardner gives 54 per cent graphitic carbon.

Such a rich ore is not the usual experience in the bedded deposits of the Adirondacks. Whenever a rich type is encountered, such as at the International, the Rowland and, as we shall see, at the abandoned Sacandaga mine, igneous agencies have left their mark. Pegmatitic action has moved some of the original carbon in the schist from one layer to another. White pyroxenes, usually diopside, have been developed partly from original primary constituents and partly from introduced magmatic matters. Here at the Johnsburg locality the ore from the center of the bed is exceedingly abundant in diopside (84.7 per cent by weight for specimen 734). This makes a rock very difficult to crush without severe attrition of the flake. Thus there are disadvantages in a rich ore. Furthermore, it makes a variable bed that at once presents special concentration problems.

Vein type of graphite. Quite distinct from the bedded deposit is the occurrence of several true fissure veins of quartz carrying foliated graphite. They without doubt represent the last dying phases of the igneous activity of the Algoman granite. These veins are chiefly of hydrothermal deposited quartz that cut through the schists and quartzites in a most irregular way. Bordering the edges of these veins of pure milky quartz, the fibrous graphite is arranged in rosettes and spherulitic forms as a fringe, often an inch in width. One of them cuts diagonally across the trench so that it is exposed on both sides. A detailed drawing of this par-

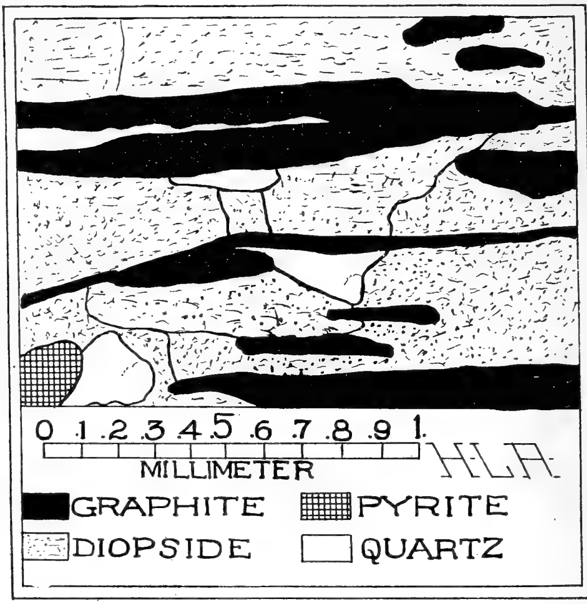

Fig. 19 Camera-lucida drawing of microscopic thin section of the "high-grade" Rowland ore, showing the graphite flakes embedded in diopside. H. L. Alling, 1918.

ticular one is here given. It has been stated that two more veins were found in the shaft and drift. "The mine superintendent stated that in 1899 one piece of nearly pure graphite weighing 543 pounds was taken out."[1]

Exceedingly attractive specimens may be collected from the dump; they are so striking that it is not surprising that they have

[1] Miller, W. J., N. Y. State Mus. Bul. 170, p. 82. A chemical analysis by H. F. Gardner gives 82.72 per cent graphite carbon for the vein type of graphite.

aroused serious interest. While individual masses of this fibrous graphite seem to compare very favorably with certain grades of Ceylon graphite, its limited and erratic habit prohibit any serious consideration as a source of graphite.

Here we have a very instructive display of graphite in three associations. In the first place, the sedimentary schist with its 5 to 6 per cent of graphite; second, the highly concentrated center due to a mild form of contact metamorphism; and third, true fissure fillings of quartz with fringes of graphite. The writer wishes that

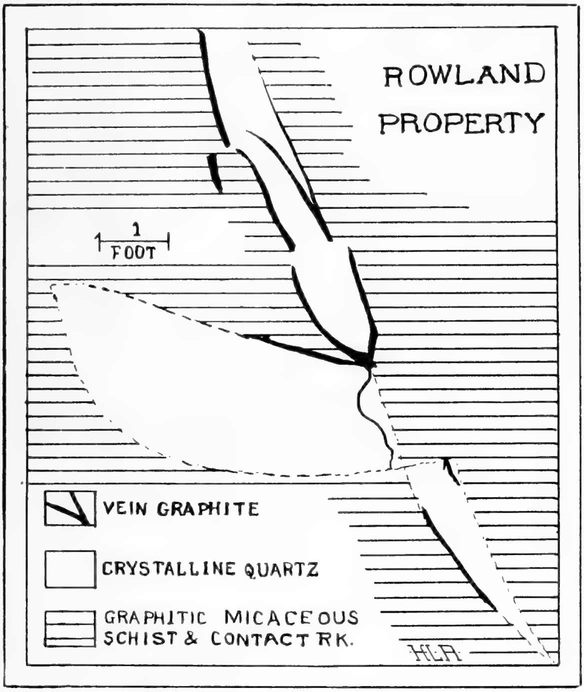

Fig. 20 Detailed drawing of a true fissure vein carrying graphite on the Rowland property. This is situated on the south side of the trench 40 feet from the portal of the shaft. G. H. Chadwick and H. L. Alling, 1917.

graphite men could see this type with its peculiar and characteristic habit and make the easy distinction between the different occurrences. One of the purposes of this bulletin is to suggest a rational way of sizing up a graphite property. If the mode of origin is appreciated, much worry is dispensed with. The distinction between the different types is usually not difficult; here, at the Rowland mine, it is possible to see the behavior of bedded ores and veins and comprehend the relative values.

The first mill was constructed on piles on the bank of Mill creek; the selection of this site was unfortunate for the first spring flood carried it downstream. The present mill stands upon the rim of the basin forcing the company to hoist the ore 50 to 60 feet by a cranelike arrangement into the ore bin. Pumping is necessary to keep the shaft and drift dry. It is possible that such an expensive method could have been avoided by placing the mill farther to the east and driving a horizontal drift following the strike.

It was observed that the mill was not arranged so that a complete gravity system could be employed. For example; the top of the crusher hopper was not flush with the floor of the ore bin. This necessitated the rehandling and lifting of the ore.

Water in the vicinity is plentiful, especially to the west in Mill creek where a small dam was built and water pumped over the brow of the hill to the mill, evidently for the boilers. Yet the dry method of concentration was attempted. A Newaygo separator, manufactured by the Newaygo Portland Cement Company, was employed. This proved unsatisfactory, but recently experiments with an electrostatic process were made with excellent results, it is stated.

The transportation facilities are very favorable. A comparatively new state road runs from Riverside, the nearest railroad station to Weaverton (Weverton on the map), from which there is a fairly good dirt road to Johnsburg. It is understood that the construction of a road 1¼ miles in length would make transportation a simple matter for motor trucks.

Summary. It has been shown that the amount of ore is probably limited, variable and difficult to crush. Hence, unless a careful survey points to the contrary, we can conclude that the future of this property is rather uncertain.

The Sacandaga Graphite Company

Situation. This property is in the township of Day, Saratoga county, 1¼ miles due west of Conklingville in the Sacandaga valley, within the Luzerne topographic sheet. The property may be reached by an 8 mile drive from Hadley, on the Delaware and Hudson Railroad, following the north road west of Conklingville to the fork (with a bench mark of 748 feet) and turning north along the east bank of a small stream, three-eighths of a mile. The mill stands to the west of the road. The mine is located about 1700 feet to the east at an elevation of 1000 feet.

The property was opened in 1906 by the Glen Falls Graphite Company. In 1911 the Sacandaga Graphite Company took over the mine and mill. The mill was constructed in 1906.[1] Today the property is abandoned.

Openings. There are three irregular-shaped open pits dug into the southwest slope of a prominent knoll. The southernmost one is a wedge-shaped pit excavated between the converging footwall which forms a V in vertical section. The middle pit is verging upon a drift. The third opening is a long trench, now partly filled with water dug along one of the walls of the V.

Geology and structure. The rocks found in the Sacandaga mine are dipping about 30° N 20° E into the hill slope. They are crushed, sheared and affected by igneous agencies to such an extent that the unravelling of the geological structure is apparently a difficult matter. When the stratigraphy of the beds is worked out in detail, however, it is evident that we are dealing with a syncline, tightly squeezed, and strongly pitching to the northwest.

The graphite schist is very probably the familiar Dixon schist. Its normal thickness has been greatly reduced so that 10 feet was the maximum thickness observed, the average being about 5 feet. At one spot the top layers grade into a narrow band of quartzite, comparatively free from graphite, but this is immediately succeeded by a bed of mica schist. Stratigraphically on top is the familiar limestone, referred to as the Faxon. This is never present in its full thickness and is often wanting in a given section; it has been squeezed and pulled apart during the intense folding. Overlying the limestone is a quartzite, heavily injected by the Laurentian granite which has developed a high percentage of feldspar (now entirely altered to sericite) and biotite. This is without doubt the Swede Pond quartzite soaked by the old granite. The type example of this is the syntectic gneiss shown on the Hooper property. The rock here does not exhibit its full thickness as the upper portion has been cut off and replaced by the Laurentian granite. The latter rock is exposed at two places near the pits; to the southwest of the middle pit and the trench, where it has been crushed to a pulp resembling the anorthosite of the east central Adirondacks. Above the Laurentian is a black rock, very hard to break, containing flakes of muscovite mica. It was classified in the field as a metagabbro. An examination of a slide cut from a hand specimen, however, casts serious doubt upon such an interpretation. This is composed almost

[1] Newland, D. H., N. Y. State Mus. Bul. 112, p. 27.

entirely of augite and scapolite with brilliant green spinel and brown tourmaline. It is a contact rock. It seems to cut irregularly across the bedding of the sedimentary rocks. It seems likely that the Algoman granite was in part, at least, responsible for its development.

The series of rocks that underlies the ore is unusually complete. Directly beneath is the Hague gneiss, which forms the walls of the wedge-shaped pit. It is not quite like the typical rock as exposed at Hague, for instead of sillimanite, the rock contains biotite. Below is the para-amphibolite (the Dresden), followed by the limestone that occurs at the Rowland property. This is the Johnsburg limestone of the writer. It has suffered shearing and stretching in a manner similar to that experienced by the Faxon. It is found only here and there. Up to this point in the description of the graphite properties, beds lower down in the geologic column have not been encountered, but the Sacandaga mine furnishes a new bed. This is another quartzite that will be termed the Sacandaga quartzite. The thickness of this formation is unknown.

The structure of the beds has already been outlined; a syncline whose axis lies in a northwest-southeast direction, pitching to the northwest, has been truncated by erosion so that the present surface of the hill slope cuts diagonally across the beds, which outcrop in the form of a V with the apex to the southeast. In vertical section this gives a V inclined 30° into the hill slope. The accompanying block diagram is an attempt to present this a little more concretely. The southern pit is located at the very apex of the fold. When the pit was abandoned, the miners had worked out all the ore, inasmuch as they encountered the Hague gneiss on three sides.

The other two pits are located upon the northeast limb of the fold. The miners confined their operations to the single outcrop. They have not followed down the dip of this limb far enough to reach the bottom of the fold, but it is evident that at the pits the amount of ore is exceedingly limited. It is possible that more ore could be found farther along the strike to the northwest.

Sedimentary type of ore. The ore that has received serious attention is very probably the Dixon schist, but the Sacandaga exposure shows a decided variation from the usual type. It is a feldspar schist, very low in quartz but high in graphite, the latter running about 10 per cent in the central zone of the bed. The feldspar is chiefly microcline-microperthite, comparatively fresh, while the subordinate introduced (3) oligoclase-andesine is almost completely altered to sericite. There are two micaceous minerals present; one is brown biotite (perhaps the variety known as haughtonite), while the other is a pale yellow-green mica approaching chloritic or chloritoid forms. (The latter may be ottrelite in part.) Pyrite is present but a little lower in amount than is usually the case. The richness of the ore and its high potash (microcline) content point to igneous activity similar to that displayed at the

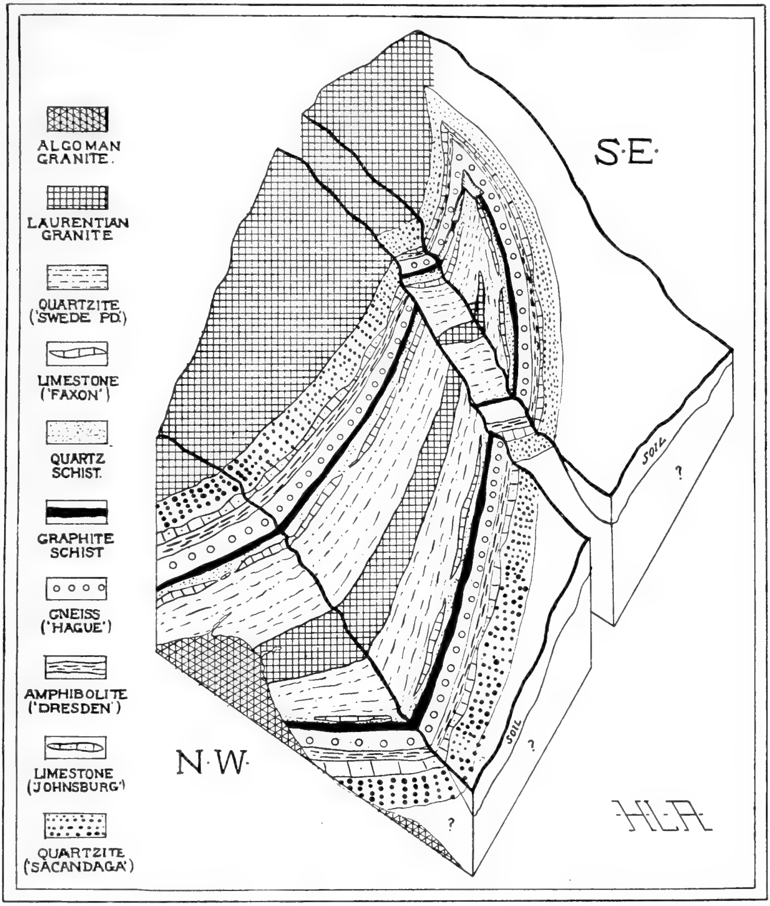

Fig. 21 Generalized block diagram of the Sacandaga Graphite Company's property, showing the inclined pitching syncline, invaded by both the Laurentian and the Algoman granites. The three pits are indicated near the apex of the fold. Length of the block is about one-fourth of a mile. Structure by G. H. Chadwick. Geology by H. L. **Alling, 1917.**

International and Rowland mines. The graphite appears to have been reorganized and redistributed, developing a very rich zone. The graphite flakes are not confined to the schist, as the adjacent rocks contain scattering amounts.

Microscopic analyses and size of the flakes

	Middle Pit Central Zone	Length of flake	
	No. 829		
		Average	.72 mm
		Maximum	1.40 mm
Graphite	10.5	Minimum	.32 mm
Biotite	5.5		
Chlorite	5.5	Thickness of flake	
Microcline-microperthite	67.5		
Oliogoclase-andesine	5.0		
Quartz	2.0	Average	.042 mm
Pyrite	2.0	Maximum	.098 mm
Apatite	2.0	Minimum	.020 mm
TOTAL	100.0		

Contact type of ore. The igneous, or pneumato-igneous, action attributed to the Algoman granite is further shown by the development of the contact type of graphite. It was found in small amounts in the trench and in the middle pit. The rock that carries the large flake is the usual pyroxene material — the type gangue of the graphite of the northern area.

Whether or not the richness of the graphite now found in the sedimentary schist is in any way due to the infiltration of any of the contact type is an unsettled question, but the suggestion is worthy of consideration.

Summing up all the facts and relationships observed, it is very clear that folding, redistribution and igneous agencies have all had a share in the development of the mineral. It is quite certain that the sedimentary type of ore is limited, that it varies in composition and character from place to place, and is too high in biotite, as well as too difficult to crush, to arouse any commercial interest. In regard to the contact type of ore, the conclusions reached from the study of the deposits of the northern area apply here and incline us to abandon any hope that this mine will ever be productive.

The mill. The company's mill is located 1700 feet to the southwest of the mine connected by a wagon road down which the ore was teamed. A small dam has been built across the stream so that the mill was operated in part by water power. The dryers were supplied with steam from a boiler using cord wood and sawmill refuse for fuel. "Only test runs have been made with the graphite from the mine, but the power was partially utilized for very fine grinding of Ceylon graphite for electrotyping purposes." The equipment included a "Sturdevant crusher, Sturdevant rolls, hexagonal revolving screens, wet screens, a dryer of special pattern, burrstone mill, and equipment for bolting and grading."[1]

[1] Bastin, E. S., Mineral Resources, U. S. G. S., 1904, 2:212.

In 1912 the following grades were made.

GRADE	PER CENT OF GRAPHITE	PRICE PER POUND
Pulverized flake	92	15 cents
No. 1 flake	90	9 cents
Stove-polish grade	80	6 cents
Foundry facings	60	3½ cents

The Flake Graphite Company

(Formerly the Empire Graphite Company)

This mining district is in the township of Greenfield, Saratoga county, 2¼ miles west of Porter Corners, just west of the Hoffmans fault. The location is indicated by crossed hammers on the geological map of the Saratoga quadrangle.[1]

Workings. The principal working is an open cut extending east and west along the northern slope of a spur of the main ridge. " The outcrop of the beds strike nearly east and west and is marked by a slight depression in the easterly sloping ridge. [The graphitic schist] is traceable for 1500 feet or more from the present mine openings, which are on the eastern end of the outcrop."[2] From this open cut three inclined slopes have been driven following the dip of the graphitic bed into the hill. The main slope has an initial dip of 32° due magnetic south, which increases until a dip of 48° is found at a distance of 207 feet from the portal. At this depth cross cuts lead to the bottom of two parallel back stopes. At the distance of 30 feet from the present bottom another back stope has been driven from the east wall of the slope. About 50 feet from the portal one of the parallel slopes curves and joins it. Several drifts farther east that were driven by the Empire Company will be abandoned by the Flake concern.

The present inclined drift has a defective hanging wall for 50 feet or so that allows a large amount of seepage, causing a wet mine. The first few feet present a solid roof but this gives way to porous and fractured rock with some loose gravel. This necessitates timbering and the employment of tin gutters. It was found that a stream formerly had its course on the hill slope above the drift.

[1] Cushing, H. P., & Ruedemann, R., N. Y. State Mus. Bul. 169.
[2] Newland, D. H., N. Y. State Mus. Bul. 161, p. 34.

The stream cut into the rocks overlying the ore and effectively weakened the hanging wall. The channel is now filled with glacial material. It would have been better to have driven a horizontal drift at a lower level until the ore bed was reached and then have followed down the dip. The present methods necessitate pumping and hoisting.

In 1912 a nearly horizontal drift, then designated as "No. 2," followed the strike of the schist farther to the east than the inclines above mentioned. It was planned to block out the ore between this and the surface, but as the turn from the direction of dip to that of the strike was made too near the portal, there was little ore to be had.

Still farther east, in loose ground, a drift was attempted. This was to furnish drainage for the "No. 2" drift but was poorly planned and probably will be abandoned.

On the south side of the knoll there are three abandoned prospect holes.

Geology and structure. The area in which the mine is located has been mapped by Cushing, who suggests that the block in which the graphite-schist is found on the property, represents a portion of the same block in which similar beds occur that are now being worked by the Graphite Products Corporation, 8 miles to the east.

The Grenville rocks are dipping from 30° to 50° southward, varying from a few degrees west of south to S 70° W. Cushing is of the opinion that there are two beds of the schist that "are capable of utilization, because of the high graphite and low mica content. The upper bed, from 10 to 14 feet thick, has been the one chiefly worked up to date. The lower bed is much thinner (4 to 5 feet). They are separated by a 4-foot thickness of quartzite and thin limestone. Underneath is a much more solid bed of mica gneiss."[1]

The writer would question whether this parting is sufficiently well defined to separate the ore into two distinct seams. The parting consists of limestone and green quartzite layers that pinch and swell, disappear and come in again in a most irregular way. Some of the siliceous stringers are interpreted as metapegmatites of the Laurentian granite. The present miners are operating the total thickness of the rock.

The graphite rock is at present correlated with the Dixon and the limestone, which is usually siliceous, as the Faxon. The footwall was not observed at any near-by locality but the "mica gneiss" of

[1] Cushing, H. P., N. Y. State Mus. Bul. 169, p. 149.

Cushing is, in all probability, the Hague gneiss, somewhat more biotitic than is customary. Above the Faxon is the expected Swede Pond quartzite which "is more or less involved with the white, garnet-bearing granite which we regard as Laurentian."[1] This is the familiar syntectic Swede Pond gneiss. On climbing the hill this syntectic rock was observed to be penetrated by pegmatitic dikes suggesting the near presence of the Algoman granite. Thus, when the higher slopes and the summit were reached, it was not surprising to find a splendid display of the granite. This was dark grey-green in color suggesting the augite-syenite of the central Adirondacks. The microscope, however, shows the quartz content to be about 30 per cent, placing the rock among the granites. The ferromagnesian minerals are all altered to serpentine and chlorite, but probably were originally amphiboles.

The significant fact for us is that this is the Algoman and not the Laurentian granite. The latter rock was injected into the Grenville before that series was folded, and thus it frequently behaves like a stratigraphic unit, not interfering with the continuance of the ore in depth. On the other hand, the Algoman came in after the intense folding and its habit is to cut through the sedimentary layers, which include the ore. Thus the writer strongly suspects that the ore does not continue "all the way to China." How much farther down the dip the workings can continue before encountering the main body of the granite is, of course, not known, but a diamond drill would settle the matter.

On the summit of the knoll several small patches of the black metagabbro were observed that remind us of the Hooper property. On the farther side of the same hill a large mass of it was found cut by the Algoman but cutting the Laurentian injected Swede Pond gneiss, thus establishing their relative age relations. That all the metagabbro of the Adirondacks is of the same age is certainly not proved. Doctor Cushing says that "there is certainly much (ortho-)amphibolite in the region which is older than the Laurentian and is the oldest eruptive present, so far as I know,"[2] There seems to be no escape from the fact that this metagabbro, on the property, is younger than the Laurentian granite but older than the Algoman granite.

Passing over the metagabbro, an outcrop of the Swede Pond gneiss was again found. At one spot a minor fault was suspected by the brecciated condition of the rock. This gneiss is succeeded

[1] Ibid.
[2] Communicated by letter, November 1917.

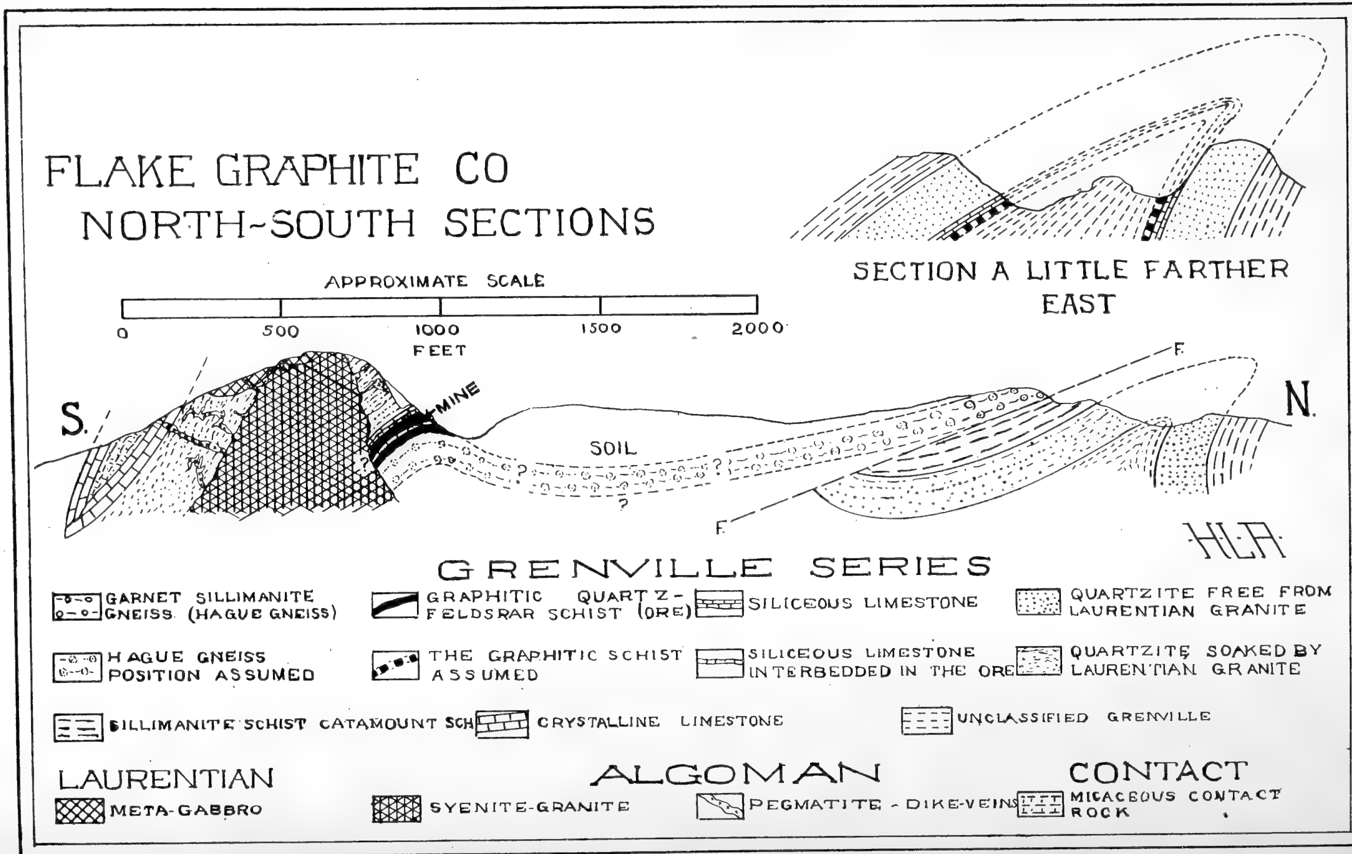

Fig. 22 Geologic reconaissance cross-section of the Flake Graphite Company's property. Based upon a traverse by G. H. Chadwick and H. L. Alling, 1917.

by a bed of limestone which is correlated with the crumbly limestone which we met with on the Faxon property. Continuing southward, ignoring the numerous pegmatites, a biotitic rock was found that has been unsatisfactorily interpreted. Some of it is clearly a contact rock consisting of titanaugite and biotite, while other specimens are quartz-augite rocks with chondrodite (?); still others look like the Hague gneiss, but its presence here would be difficult to explain unless there has been a repetition of the beds by faulting or that this limestone is the Faxon rather than the crumbly member. The limestone is again found near the base of the hill, probably repeated by isoclinal folding.

In this limestone occur two prospect pits of bygone days. One of them was of the nature of a drift driven into the hillside in a crush zone, along which pegmatitic solutions have given rise to a limited amount of the contact type of graphite. At a later geologic period a narrow disabase dike 34 inches wide, N 60° E, has followed the same line of weakness.

The second pit is located a little distance farther up the slope and a little to the west. Here a trench was made in serpentized limestone that is today verde antique marble. This is in contact with a mass of the perplexing "biotitic rock." One of the pegmatites above mentioned has cut the limestone and developed a good display of the spectacular contact type of graphite. The third pit is a square shaft sunk some 10 to 12 feet in barren pegmatite.

Outcrops are lacking immediately north of the mine; the nearest exposures occur perhaps three-eighths of a mile distant on the farm owned by Nathan Towne. The typical Hague gneiss dipping 20° S 0° E was found cut by numerable pegmatite dikes, which in one place have developed graphite by contact action. Beyond a gap of 20 feet is an exposure of the typical Catamount schist, so similar to the rock from the Bear Pond mountain region that hand specimens of the two are indistinguishable. The Catamount here dips 51° S 2° E. In the glacially filled depression between the two rocks Mr Towne dug up for us a few pieces of graphitic schist. It would seem to us that that ore was a transported boulder, not in place.

Continuing northward the thick Swede Pond quartzite was encountered. The writer followed the road, passed over a gap and found the quartzite again forming a precipitous cliff. The Swede Pond here was a beautiful semitransparent to translucent pinkish buff rock, dipping 50° magnetic south. Beyond, the Catamount reappears. The interpretation that the writer would put upon these relationships is that the Catamount schist and the Swede Pond quartzite are anticlinally folded, while the Hague gneiss has been overthrust upon the Catamount; the little valley, in which the stray ore was buried, representing the fault line depression. Retracing his steps to the gap between the exposures of the Swede Pond and swinging to the east along the base of the cliff, the writer found a rusty micaceous schist filling the core of the anticline. Identification of this rock is rendered impossible, due to the fact that it is badly weathered, sheared and fractured.

The tentative vertical section (see figure 22) which is based in large measure upon Professor Chadwick's suggestions, indicates that the rocks are folded, faulted and penetrated by igneous rocks in a complicated manner. The stratigraphy as here disclosed is apparently identical with that shown on the Dixon and Faxon properties. The structure, however, is far different, rendering the mining conditions less favorable.

The ore. The graphitic schist is in many respects similar to the Dixon, Faxon, Hague and Hooper ores. There is, however, considerable variation, which is shown in the microscopic analyses here tabulated, especially in the amount and in the size of the graphite flakes. The first two columns give analyses of specimens taken from the ore dump. The fine flake rock probably came from the top of the bed while the big flake sample represents the central portion.

Quantitative microscopic analyses of the Flake Graphite Company's ores

			No. 798 Ore dump fine flake	No. 799 Ore dump big flake	No. 799a Back stope "best ore"
Approximate composition by weight		Graphite	4.5	7.0	10.0
		Biotite	trace	3.0	7.0
		Chlorite	trace	3.0	trace
		Andesine	31.8	1.0	10.0
		Quartz	47.5	75.0	70.0
		Augite	5.5	....	....
		Pyrite	6.0	9.0	7.3
		Apatite	2.2	2.0	.2
		Titanite	2.5	....	....
		Total	100.0	100.0	100.0
Size of the graphite flake	Diameter in hand specimen	Average	.50x.68 mm	.76x1.10 mm	.66x.90 mm
		Maximum	.92 mm	2.40 mm	1.96 mm
		Minimum	.30 mm	.50 mm	.42 mm
	Thickness in thin section	Average	.039 mm	.064 mm	.053 mm
		Maximum	.059 mm	.149 mm	.080 mm
		Minimum	.027 mm	.031 mm	.039 mm

Concentrates

	GRADE	No. 2 Fk	No. 2 Fk	No. 3 Fk	No. 4 Fk	Dust D3X
DIAMETER	Average	.42x.58 mm	.43x.66 mm	.27x.48 mm	.14x.23 mm	.09x.15 mm
	Maximum	.91 mm	.90 mm	.70 mm	.59 mm	.20 mm
	Minimum	.20 mm	.28 mm	.20 mm	.09 mm	.04 mm
		Some quartz very little biotite	Some quartz very little biotite	Some quartz some biotite	Lots of biotite and quartz	Biotite, quartz, feldspar in large amounts
	Chemical analysis[1]	90.80	86.88	87.54	54.40	46.80

[1] Chemical analyses by H. F. Gardner.

It is a quartz-schist having a considerable range in the amount of the micaceous minerals, the small-sized flake sample showing the lowest content. The injection of the pegmatites has mussed up the flakes, twisting and fraying them into fantastic forms. In the proximity of pegmatites the ore is usually more abundant in graphite and in pyrite. The distorted and split character of the flake present special milling problems. It might be well to ignore this form of schist in mining, selecting rock free from pegmatitic material. The ore from the back stope is regarded by Mr R. L. Dowling as the best ore. True, it probably does carry a high percentage of graphite, but the mica is present in detrimental amount.

Mining practice. The ore is hauled up the steep slope in small mine cars by a cable system to the surface, onto a mill car loading platform. From there the ore is transferred by a shute to automatic dumping cars and pulled into the rear of the mill. An air compressor of Ingersoll-Rand manufacture, located in a shed near the portal of the slope, supplies air for the drills. In the same building is located a very neat Delco generator driven by a gasoline-kerosene engine which keeps a storage battery charged. The latter supplies the electricity for lighting the mine and the mill.

It is the opinion of the writer that the original mining layout was unfortunate. The present system necessitates pumping and a double car system. It is suggested that the old opening, which was known as "No. 2," be extended farther down the dip and along the strike to the west and overhand stoping be employed in working up the dip, allowing the loosened ore to gravitate to the mine cars below. This drift might be extended to the bottom of the present slopes, furnishing two exits. Such a method of procedure is probably necessary to secure an amount of ore commensurate with the mill capacity.

The mill. The mill structure is the best constructed of those visited by the writer. It is built of reinforced concrete and utilizes the natural hill slope in gravity systems. The milling practice is described in detail under the head of "Concentration" to which the reader is referred.

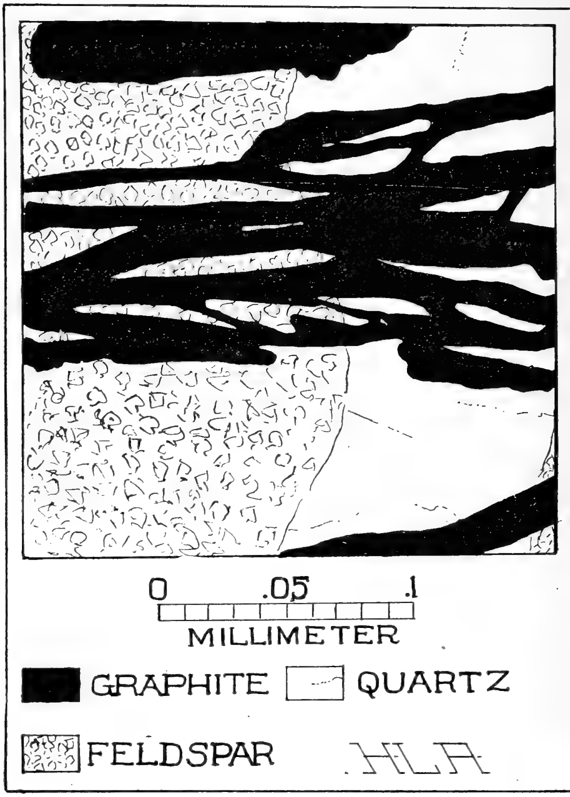

Fig. 23 Camera-lucida drawing of microscopic thin section of ore from the Flake Graphite Company's mine, showing a graphite flake split into thin plates by the injection of pegmatite. Specimen No. 798. Magnification X 430. H. L. Alling, 1918.

Future of the property. At the present time the Flake Graphite Company is taking over the property of the Empire Company and making changes in the mill equipment and organizing for active operations in the near future, probably in the spring of 1918.

In all probability there is a great supply of ore. The graphitic schist has been followed along the strike for 1500 feet and the incline has followed the 10-foot ore bed down to 200 feet or more. We can assume: 1500 x 200 x 10 = 3,000,000 cubic feet of ore rock. A cubic foot weighs about 168 pounds, hence there is 500,000,000 pounds or 2,500,000 tons of ore. No diamond drilling has been done on the property. There is the possibility of the granite cutting the ore.

The Graphite Products Corporation

Location. This mine, now in active operation, is located 1 mile southwest of King's Station, 4 miles north of Saratoga Springs, in the township of Wilton, Saratoga county, the exact location being indicated by crossed hammers on the geological map of the Saratoga quadrangle.[1] It lies about one-half of a mile west of the Saratoga-Mt McGregor fault in the southeast corner of a block of the Grenville quartzitic area mapped by Cushing.

The property was first opened about 1910 by the Saratoga Graphite Company,[2] which worked it in a small way for two years. After the lapse of some time the present company assumed control and began the work of enlarging the mine and plant, and is now operating it.

The mine is reached by following the state highway leading to Glen Falls for a distance of 3 miles, keeping north on a good dirt road for 1¼ miles. A sharp left-hand turn up the hill leads to the mill.

Workings. There are two distinct outcrops now being worked. The original pit as left by the Saratoga Graphite Company, is 75 by 30 feet and has been abandoned. To the west a new opening has been made that extends 375 feet along the strike; the latter varies from N 50° W to N 75° W. From this pit on the south side a number of inclines have been driven on a slope from 38° to 42° S 15° W, these meeting two parallel horizontal drifts which follow the strike. In them mill car tracks were laid. This working is locally known as the mine.

To the north, across a swamp, at a distance of 400 feet, is the quarry, where open cut methods are employed. At the present time this pit is the main source of graphite. It is 200 by 80 feet, and 30 feet deep, extending east and west. Farther west a number of

[1] N. Y. State Mus. Bul. 169.
[2] Newland, D. H., N. Y. State Mus. Bul. 161, p. 34 and Bul. 190, p. 30.

prospect holes show that the schist can be traced a long distance along the strike.

Geology and structure. The same stratum of quartz schist, which carries the graphite, occurs in the two outcrops in the mine and in the quarry, repeated by faulting. The stratigraphy prevailing at both localities is in accord with such a suggestion. Starting " in the bottom of the ravine by the old mill . . . a serpentinous limestone forms the bed of the brook for some distance."[1] The next rock to the north is a para-amphibolite (see left end of section, figure 24), dipping 30° south. If this rock is the Beech Mountain amphibolite it would be reasonable to expect that the sillimanite schist (Catamount schist) should succeed it in passing northward, or stratigraphically downward. This proved not to be the case; the amphibolite grading into the quartzite, which is vitreous but as the crest of the knoll, under which the horizontal drifts are located, is reached it was found to be crumbly and injected and saturated by the old Laurentian granite, producing a syntectic rock which in a few cases is an augen-gneiss. This probably is the Swede Pond gneiss. The northern slope of the knoll is composed of siliceous limestone — the Faxon. Between the limestone and the quartzite is a lenticular mass of the metagabbro. Beneath the limestone is the graphitic schist shot through by " pegmatitic material which forms knots (" nuts ") and stringers . . . probably due to injection from a granite magma."[2] Here 10 to 15 feet of the ore bed is exposed. The tunnels which have been driven along the course of the beds at points below the outcrop tap the fresher portions of the bed. The floor of the inclines exhibits slickensided surfaces suggesting that a fault, parallel to the bedding, occurs here.

The writer was unable to observe the footwall rock, which would normally be the Hague gneiss or its equivalent. A swamp beyond compels the writer to put a gap in the cross section. Almost anything may have happened in this interval, in view of the faulting that characterizes this locality. Pegmatite, quartzite and metagabbro are the rocks next encountered. That the last is not a para-amphibolite but an igneous rock has already been suggested by Newland.[3] Beyond is another depression, furnishing but a single outcrop in the nature of a reddish garnetiferous quartz-feldspar para-gneiss that is difficult of classification unless it be the Hague gneiss. If this be the case, then between the metagabbro and the

[1] Newland, D. H., N. Y. State Mus. Bul. 190, p. 31.
[2] Ibid.
[3] Ibid., p. 30.

Quantitative microscopic analyses of the Graphite Products Corporation's ores

			No. 783 West end of the mine	No. 787A The quarry ore injected with pegmatite	No. 786 The quarry ore free from pegmatite
APPROXIMATE COMPOSITION BY WEIGHT		Graphite	7.7	7.9	....
		Biotite	1.9	.6	....
		Chlorite	trace	2.8	....
		Feldspar	9.2	30.3	....
		Quartz	73.2	55.2	....
		Serpentine	5.8	trace	....
		Pyrite	1.2	3.2	....
		Apatite	1.0	trace	....
		TOTAL	100.0	100.0	....
		Species of feldspar	Andesine	Microcline and andesine	....
SIZE OF THE GRAPHITE FLAKES	DIAMETER IN HAND SPECIMEN	Average	.70x.42 mm	1.43x.70 mm	.68x.41 mm
		Maximum	1.30 mm	4.25 mm	.80 mm
		Minimum	.20 mm	.45 mm	.30 mm
	LENGTH IN THIN SECTION	Average	.75 mm	.77 mm	....
		Maximum	1.30 mm	2.00 mm	....
		Minimum	.30 mm	.30 mm	....
	THICKNESS IN THIN SECTION	Average	.065 mm	.071 mm	....
		Maximum	.120 mm	.150 mm	....
		Minimum	.030 mm	.031 mm	....

Graphite Products Corporation concentrates

Specimen no.	789a	789A	789B
Grade	Mill concentrate	Finishing mill no. 1	Finishing mill no. 2
Average diameter	.205 mm x .437 mm	.372 mm x .677 mm	.268 mm x .451 mm
Maximum diameter	.600 mm	.924 mm	.831 mm
Minimum diameter	.133 mm	.194 mm	.233 mm

Hague there is the possibility of another bed of the graphitic schist. Climbing out of the depression upon the low ridge a view of the quarry can be had. The rocks here are faulted and penetrated by pegmatite. A better idea of the conditions that prevail here can be secured from the cross section of the quarry than from a description. It was not possible to name with certainty the rock forming the floor of the quarry. A reasonable suggestion is that it is the Hague gneiss. The north end of the section ends in a limestone, in

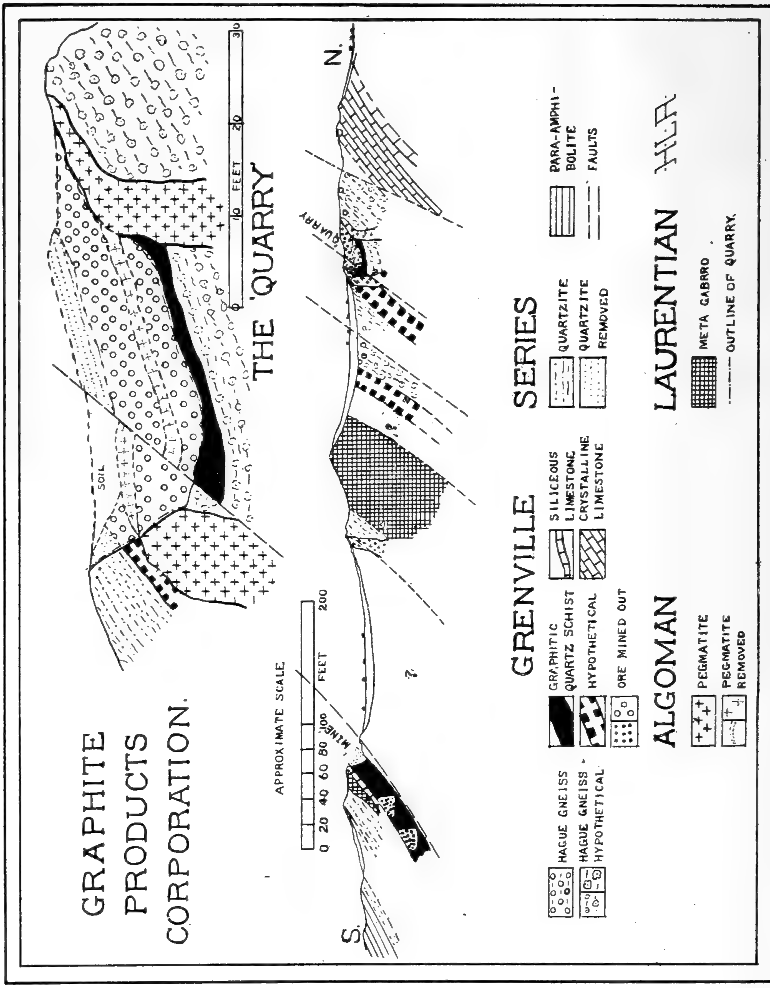

Fig. 24 Geologic cross-section of the Graphite Products Corporation's property. Based upon a plane table traverse by G. H. Chadwick and H. L. Alling, 1917.

which several prospect pits have been dug. Four fault lines have been drawn in the section; the one in the quarry being the only one that could be demonstrated, the others are inferred.

Diabase dikes. It will be noticed from the geological map of the Saratoga sheet[1] that to the west of the mine there are three

[1] N. Y. State Mus. Bul. 169.

extraordinarily long diabase dikes running from the north-northeast to the south-southwest. Five hundred feet west of the concentration mill is another one that evidently was not observed when the mapping of the quadrangle was in progress. The width of this dike is 36 feet. This has an important bearing upon the mining conditions, both in the mine and in the quarry. At the time of our visit the west end of the drifts was about 90 feet away and headed for it. A test pit on the strike to the west of the dike shows that there is very little or no displacement associated with the dike. Thus it would seem that the drifts will eventually cut through the diabase and the miners will find that the ore continues on the farther side. Likewise the further extension of the quarry will be hampered by the same dike. A much smaller one located just across the road from the finishing mill is parallel to the other but is only 10 inches wide.

The ore. This is the normal schist, similar to the American, Hague, Flake and Hooper ores, but the pegmatite stringers have caused some variation in the composition, including the graphite content. For the exact composition, see the tabulated microscopic analyses. "The outcrop is badly weathered and softened through oxidation of the contained pyrite, which is rather plentiful in the unweathered rock."[1] The material from the bottom of the inclines along the drifts is apparently better, where about 20 feet of rock is shown. The expense of operating the mine by the underground methods has led the company to exploit the quarry much more extensively at the present time than the mine. The schist now being worked "contains less mica than the more easterly ledges and with the coarser size of the flake affords better material for mill treatment."[2]

Mining practice. The quarry is a recent venture and the methods in use are in an experimental stage. The ore is hauled up an inclined track by a donkey engine and dumped into wagons. The teams follow the road to the east end of the mine and the ore is dumped down a chute into the mine cars on the upper drift level, which carry it directly into the concentration mill. It is the plan, if the quarry holds out, to provide a better and more permanent system.

The mine is being worked only in a small way at the present time.

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[1] Newland, D. H., N. Y. State Mus. Bul. 190, p. 31.
[2] Ibid.

The drifts are being driven westward and some overhead stoping is being done as well as working down the dip.

Milling practice. The Graphite Products Corporation, which took an active interest in the property in 1915, has constructed a new concentration mill, the old one of the Saratoga Company being fitted out as a finishing mill, a little distance away. The usual Adirondack practice is in force: crushing, stamping, buddling, screening and drying. The finishing mill uses Hooper pneumatic jigs which prepare the flake for the market.

The mill water is secured from the small stream that flows past the mill. The brook valley has been dammed and receives the tailings. The water is filtered through sand banks and used over again. In the late fall the floodgates in the dam are opened and the spring freshets carry the accumulated tailings down stream, emptying the reservoir.

Summary. Cushing says that " much the same assemblage of rocks " [is shown on both the Flake and Graphite Products properties] " and the general similarity of the rock association strongly suggests that we are dealing with the same rock horizon."[1] With this opinion the writer is in full accord. Isoclinal folding, accompanied by some overthrust faulting, characterizes the Flake property, while this locality exhibits repeated faulting. This is very fortunate for the Graphite Products Corporation in that it has exposed two beds, and possibly a third.

Amount of ore. It would seem as if there was a large store of graphite rock on this property, but the complicated structure of the quarry, especially, demands careful work as the operations are continued.

The " Hulett's Landing " Prospect

" A very low-grade deposit of graphitic quartzite was discovered by Prof. J. F. Kemp on the east shore of Lake George about 3 miles back of Hulett's Landing. A peculiar feature of this deposit is the fact that the hanging wall is a very large eruptive dike. As in the Hague mine the 'vein' seems to have been a line of weakness. The flake of this deposit is very small and of too low grade to be of any value."[2]

Dr W. McKim Marriott reports[3] that in 1916 he collected specimens from an outcrop that occurs near Long pond, which he states

[1] Cushing, H. P., N. Y. State Mus. Bul. 169, p. 148–49.
[2] The Mineral Industry for 1902, p. 347.
[3] Letters of September 9 and 12, 1917.

is apparently of considerable extent. He was kind enough to send the writer several samples that bear out Professor Kemp's opinion that they are of too low a grade to demand any attention.

It would appear that the deposit is of the usual graphitic schist, outcropping along the ridge between Lake George and Lake Champlain. The eruptive dike may well be the metagabbro. The reader is cautioned to interpret the word "vein" as it is used above to mean a bedded deposit.

The Macomb Graphite Company — Popes Mills Graphite Company

The mine is in the township of Macomb, St Lawrence county, south of Black lake, 1½ miles southeast of Popes Mills, within the Hammond quadrangle.

Workings. "The cut shows a finely laminated graphite quartz-schist complexly foliated and corrugated. It may represent the highly metamorphosed deposits of organic material near the shores of the [pre-] Cambrian sea. The contact line of the indurated Cambrian sandstone is irregularly disposed as the northern boundary of this locality. The laminated deposit is crumpled, friable, quartzose and contains a small proportion of iron [pyrite]. The property has been worked to a limited extent by a small company under the name of the Macomb Graphite Company. A section about 75 feet long and nearly 15 feet deep into the face of one of the folds has been made. The structure is uniform and rich in graphite. The company mined about 100 tons of rock for experimental purposes. The deposit seems to grow richer and the percentage of the iron [pyrite] to decrease with depth. Although the milling was done with rather crude equipment the yield was from 15 to 20 per cent of graphite.

"Several tons of excellent concentrates were produced, averaging more than 90 per cent of carbon. The product was distributed to various manufacturers to determine its practical value for lubrication, foundry work, metallic paint and other uses.

"The reports were highly satisfactory. For lack of capital the company has temporarily ceased operations after having worked out the major problem of extraction."[1]

Cirkel[2] says: "Some development work was done last year (1906) on a prospect near Popes Mills, town of Macomb. The graphite occurs as fine scales in schist and the deposit is said to be extensive.

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[1] Mills, Frank S., Eng. & Min. Jour., Feb. 22, 1908, 85:397.
[2] Cirkel, Fritz, "Graphite," Can. Dep't. of Mines, Mines Br. 1907, p. 57.

About 500 tones of rock have been taken out and a mill has recently been completed." The property has laid idle for several years.

It would appear that this deposit is of the very fine crystalline form that usually is referred to as amorphous. Apparently the metamorphism of the Grenville rocks has been less severe in the northwestern Adirondacks than in the southeastern areas. Thus the carbon has not been so completely recrystallized to graphite. The material from the Macomb locality is well suited for certain forms of lubrication, foundry work, etc., but is not crystalline enough to be used in the manufacture of crucibles. It is understood that the Macomb Graphite Company has, within recent years, relinguished its holdings on the mine to the Popes Mills Graphite Company, although it still operates the mill.

Size of concentrate

Average diameter	.145 mm x .202 mm
Maximum diameter	.42 mm
Minimum diameter	.09 mm

The Rossie Prospect

Beck[1] says that graphite "is thought to exist in workable quantities in the town of Rossie and elsewhere in St Lawrence county."

"In St Lawrence county some attention has been given to a deposit occurring on the Indian river about 3 miles [probably south] from Rossie village. The graphite forms the principal constituent of a schist, through the body of which it is distributed richly in very small scaly particles. It is a crystalline graphite, but too fine in size to be easily separated. Trial shipments of the crude material were reported to have given satisfactory results when used for foundry purposes."[2]

The Smith Graphite Property

This property was visited and mapped in detail during the summer of 1918 after completing the report on the Adirondack graphite deposits. This deposit is situated in the township of Chesterfield about 4 miles directly south of Clintonville and one-half of a mile south-southeast of the southern end of Trout pound within the limits of the Ausable sheet.

Topography and physiography. The graphite schist occurs in a narrow valley extending northwest and southeast as a side valley

[1] Beck, Nat. Hist. N. Y. State, pt 3, Mineralogy, 1842, p. 421.
[2] Newland, D. H., N. Y. State Mus. Bul. 120, p. 30.

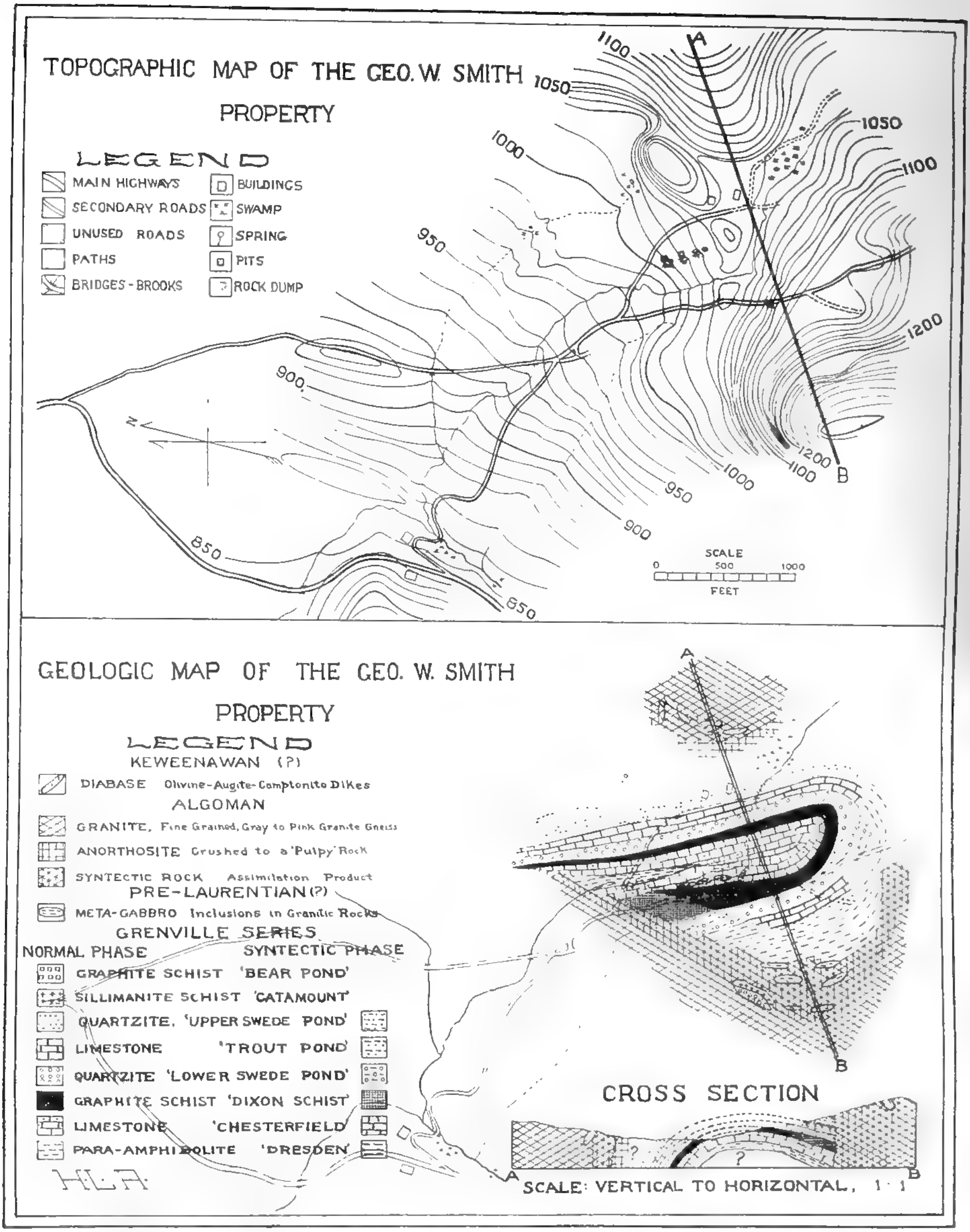

Fig. 25 Topographic and geologic map of the George W. Smith property. Based upon a stadia-plane table survey. Topography and geology by H. L. Alling, 1918.

to the long north and south depression that is traceable from Trout pond to Elizabethtown. The origin of this side valley is directly due to the easily eroded Grenville strata which here are composed in large measure of limestone. The valley walls and inclosing hills are of igneous rocks that are much more resistant to destructive forces.

The continental ice sheet widened the north and south valley as well as scraped off the decomposed rock decay which had formed during the interglacial periods. During the retreat of the glacier, heavy glacial streams flowed through the main valley alongside of the ice tongue which occupied the valley bottom. Extensive boulder trains and deltas were deposited, which can be traced for a long distance southward. The ice tongue deposited crescent-shaped moraines north of Lewis and one in the side valley in which the graphite schist is exposed. This moraine is convex up stream showing that it is the work of the continental ice rather than that of a local glacier. Although it is somewhat dissected yet it has forced the present brook to seek a course to one side of the valley forcing it out of its normal course. Morainal ridges and glacial silts obscure much in this side valley and greatly interfere with detail mapping.

The pits. Graphite was discovered years ago by marble men seeking a supply of serpentinized limestone (verd antique). In their original search they were disappointed. The property is now owned by George W. Smith of Keeseville, N. Y. A large number of pits and small diggings have been made to determine the extent and quality of the graphite rock. Two of them are situated on the east side of the valley where the schist is exposed, dipping from 55 to 40° to the east. From north to south these pits will be called No. 1 and No. 2 respectively. Seven hundred feet to the southwest of these pits are a number of diggings and pits situated near a wood road. The rocks exposed here are nearly horizontal. To the east of the road they dip to the northeast at a low angle, while to the west of the road the strata dip in the opposite direction.

Geology and structure. It is evident from the behavior of the graphite schist and associated Grenville rocks that they have been folded into a anticline, which is slightly tilted to the west and pitches to the north (see figure 25). The present surface of the region has so truncated the graphite schist that the line of outcrop forms a U-shaped pattern on the map. While the stratigraphy of the Grenville series in this locality is in many respects similar to that exposed on the active graphite properties in the southern region, there are some interesting variations.

Above the ore is a bed of quartzite about 50 feet thick that is evidently equivalent to the horizon called the Swede Pond quartzite. On top of this quartzite is a bed of crystalline limestone which is commonly siliceous and contains various green silicates that have been changed to serpentine. It is about 50 feet thick and is surmounted by another layer of quartzite. The question arises whether this lime formation is equivalent to the so-called "sandy" limestone which is shown on the southern edge of the Dixon-Faxon properties. If this is the case then it is a little difficult to explain the second stratum of quartzite. Thus it is proposed that this limestone be called the Trout Pond limestone and the two quartzite formations be called the lower and upper Swede Pond. It is of course possible that the Trout Pond limestone is replacing the Swede Pond quartzite in somewhat the same way that the Faxon limestone was found to do on the International Graphite Company's property. On the southern slope of the prominent ridge that limits the valley on the west a quartzite-carrying graphite was encountered. It is possible that this is the Bear Pond schist which constitutes the ore on the Bly property, or this graphite may have been introduced into the Swede Pond by the action of adjacent igneous rocks. From a study of a thin section cut from this material, the writer concludes that the former interpretation is probably the correct one. The so-called sandy limestone is either absent or so highly silicified that it could not be recognized as such. At the Flake Graphite Company's mine (Greenfield, Saratoga county) a parting composed of limestone and green quartzite separated the ore into two distinct layers. On the Smith property a thin stratum of limestone occurs near or on top of the graphitic member.

Beneath the ore is another limestone that seems to be a new one in Grenville stratigraphy. While it is conceivable that this may be a phase of the Faxon it is deemed best to introduce a new term, the Chesterfield limestone. This is some 50 feet thick. There is some uncertainty in regard to the rock that lies beneath the Chesterfield, as exposures are very rare. In the core of the anticline loose boulders of a para-amphibolite were encountered in sufficient numbers to justify the conclusion that they came from a bed situated beneath the limestone. No evidence could be secured that the garnet-sillimanite gneiss of the southern area, named the Hague gneiss, was present.

The ore. The graphite rock appears to be the Dixon schist. In general it is a quartz schist with feldspar, graphite, pyrite, apatite, zircon and biotite. The ore from pits no. 1 and no. 2 is greatly superior to any found elsewhere on the property. Here it is essentially a quartz schist with 14 to 18 per cent graphite and a surprisingly small mica content. On the west side of the valley the ore that is exposed near the wood road is of poor quality with a low graphite and a high mica content. There is considerable improvement, however, in depth, but no ore has as yet been encountered

Quantitative microscopic analyses of the Smith ores

		Second pit 900	Path summit of anticline 902	Path 5 feet below surface 902a	Path 3 feet 8 inches below surface 919	Hill 12 feet below surface 920	Hill 3 feet below surface 921
Approximate composition by weight	Graphite	14.6	3.0	6.9	7.8	14.0	6.1
	Biotite	...	14.0	8.5	13.0	...	4.5
	Chlorite	.3	...	...	...	...	...
	Feldspar	1.2	40.0	40.0	31.3	...	21.5
	Quartz	82.3	14.6	26.0	26.9	...	37.6
	Pyrite	.2	6.0	15.3	20.0	11.5	29.5
	Apatite	.1	.4	.4	.3	...	.7
	Garnet	...	12.0	...	...	...	...
	Diopside	...	...	.3	...	23.0	...
	Serpentine	...	...	...	...	50.2	...
	Kaolin	.8	...	...	...	...	...
	Sillimanite	...	10.0	...	.3	...	...
	Zircon	.5	...	...	...	...	...
	Hematite	...	...	...	...	1.3	...
	Zincblende	...	...	...	...	...	.2
	Total	100.0	100.0	100.0	100.0	100.0	100.0
Graphite Chemical analysis		18.92	2.94	...	7.34	12.6	8.5
Size of the graphite flakes: Length in thin section	Average	1.31 mm	.52 mm	.45 mm	.59 mm	.77 mm	.54 mm
	Maximum	2.20	.90	.70	1.00	1.25	.80
	Minimum	.44	.26	.30	.33	.32	.31
Size of the graphite flakes: Thickness in thin section	Average	.038 mm	.048 mm	.050 mm	.034 mm	.075 mm	.039 mm
	Maximum	.060	.065	.100	.068	.200	.071
	Minimum	.010	.017	.012	.010	.040	.015

on the west limb of the anticline that equals the ore from the first two pits. Furthermore, the ore on this side of the valley has been affected by the action of the igneous rocks which have penetrated the ore in some places as pegmatite dikes which have developed, in some local cases, traces of graphite by contact action. Specimens from the bottom of a pit dug at the side of the wood road revealed the presence of pyroxene (diopside) which has been developed by contact metamorphic action, reminding us of the Rowland-International ores. In all the surface exposures the quality is low, but improvement may in general be looked for in depth. It is possible that the surface layers exposed on the west limb of the anticline are the lower beds of the Swede Pond quartzite into which the graphite has been carried by igneous activity. The ore on the west limb is much more available than the material on the east limb, in that quarry methods could be employed, because the graphite schist lies in a horizontal position, but the inferior character forces us to place our emphasis upon the cast limb in spite of its greater dip.

The graphite schist in pits nos. 1 and 2 is separted into several seams by layers of yellow quartzite. In no. 1 pit the following order was found in descending order: 2 feet of graphite schist, 9 inches of quartzite, 1 foot 6 inches of graphite, 1 foot 6 inches of quartzite, 4 feet 10 inches of graphite schist, making a total of 8 feet 4 inches of graphite schist. In no. 2 pit the beds occur as follows: 4 feet 6 inches of graphite schist, 2 feet of quartzite, 9 inches of graphite, 2 feet of quartzite, 9 inches of graphite, making a total of 6 feet of graphite ore. This alternation of graphite and quartzite is unfortunate in that it will complicate the mining practice, involving as it will the rejection of some of the blasted rock.

Microscopic examination of the yellow quartzite, that separates the graphite seam into several layers, seems to indicate that this is in part igneous material. It is quite possible that the igneous activity has removed the graphite from the barren zones and concentrated it in the other portions of the bed. If this should be true it might interfere with the uniformity and character of the rock in depth. This suggestion is furthermore strengthened by the finding of large flake graphite which has the appearance of being of the contact type. This occurs near the bottom of the Dixon schist in contact with the Chesterfield limestone.

About 1000 feet north of no. 1 pit a ridge of the lower Swede Pond quartzite dips at an angle approaching 90°. It is inferred from this outcrop that the graphite rock is situated thus to the west of this exposure, but as this account is being written the presence of the ore at this spot has not been proved. If, however, this should be established it would be safe to assume that the ore can be traced for about 2000 feet along the eastern limb of the anticline. Assuming 6 feet for the thickness of the graphite ore and that the bed should be followed for 300 feet down the dip, the available tonnage of the schist is calculated to be 300,000 tons.

There are no indications that the total depth to which the work can extend is limited to 300 feet, but as the dip undoubtedly will increase in depth, which is especially true of the ore farther north along the strike, the mining difficulties will increase. It is quite possible that preliminary work could be conducted by quarrying the ore along the strike from a point near no. 1 pit southward.

The number of igneous rocks present on this property is not absolutely known, but according to the present knowledge the Algoman granite and the anorthosite are present. The latter rock occurs as small bosses which have been severely squeezed so that the rock resembles the crushed or "pulpy" phases of the rock as shown throughout the Adirondacks.

Farther away from the sedimentary rocks the amount of Grenville admixture becomes less until a fine-grained granite makes up the bulk of the rock exposed. This is in all probability the Algoman granite. In this granite a large number of inclusions of amphibolite occur in a manner quite similar to the inclusions found in the so-called Laurentian granite of St Lawrence county. The microscope points very clearly to the fact that these inclusions are igneous and it is quite possible that they represent the ancient metagabbro which Cushing believes to be the oldest eruptive in the Adirondacks. If this is so, then they must be older than the Laurentian granite; and in view of the fact that the term Laurentian is primarily applied to the older granite, the term pre-Laurentian is used in the legend on the map of this property.

Syntectic rocks. The valley is delimited on both east and west by ridges composed of igneous rocks which present a number of perplexing problems that up to the present time have been only partially solved. The relation between the Grenville rocks which occupy the valley and the igneous rocks is apparently an eruptive one rather than that they exist together by virtue of a fault. The east valley wall is composed of a syntectic rock resulting from the assimilation of Grenville rocks by an igneous magma.

On the west, the transition from the sediments to the granite can be traced much more satisfactorily. It is possible to recognize the different forms for several hundred feet even though they have been saturated by the solutions of the igneous rock. These blend gradually into rusty assimilation products which give away in time to the normal granite.

The last igneous rock that is recorded in the region is the diabase (olivine-augite-camptonite), two dikes of which were found. One is near the pit on the west limb of the anticline cutting the Chesterfield limestone. It is 4 feet 10 inches wide and runs from north 65° to north 80° west. The other dike is situated on the west hill slope and is 1 foot 9 inches in thickness and extends across the foliation of the granite north 76° east.

Water supply. It is quite possible that there is a sufficient amount of water available on the property. The outlet of Trout pond alone may be sufficient although more water could be secured from this brook after it had been enforced by the stream that crosses the anticline, as shown on the map. If, however, this supply proved to be too scanty it is quite possible that water could be secured for boiler and mill use from Trout pond.

Transportation. The secondary roads from the pits to the main highway are in fair condition. The renewing of the culverts and bridges and a little grading would make the property very accessible. It is 4 miles by highway to Clintonville through which the Ausable Forks branch of the D. & H. railroad runs. This road although quite passable for a motor car is rather hilly and it might be that some improvement would be necessary in order that heavy laden trucks could use it.

Summary. This property exhibits in some places ore that is of unusually high quality. Some care must be taken to establish the exact limits of the ore on the west and on the east sides of the valley. At the present time the position of the contact between the ore and the igneous rocks is only approximately known. However, it is certainly worth while to conduct exploratory work on this deposit.

SUMMARY OF THE SOUTHERN AREA

It is the bedded deposits of the graphitic schists of the southern area that are the commercial deposits of the Adirondacks. We have seen that there are four distinct types of ores.

1 The normal quartz-schist with 5 to 7 per cent of graphite which is the valuable rock at the American Graphite Company, the Faxon property, the Lakeside mine, Hooper Brothers' mine, the Champlain Graphite Company, the Adirondack Mining and Milling Company, the Silver Leaf Graphite Company, the Flake Graphite Company, and the Graphite Products Corporation. The rock worked at all these localities is very probably the same stratigraphic unit, referred to as the Dixon schist. It exists as two beds or lenses at the Dixon, Faxon and probably at the Flake mines, but in the other properties it is represented by a single bed. In general, the formation varies in thickness from a maximum of 30 feet to a minimum of 3 feet. The upper portions of the Dixon schist are usually micaceous, which seems to be true of the bottom layers as well. As a general habit an increase in the feldspar percentage is accompanied by a rise in the biotite-chlorite content, although there are a few exceptions to this rule.

2 The second type is the feldspar-quartz schist with 6 per cent of graphite and 10 per cent of micaceous minerals. This is exemplified by the Bly ore. It is the writer's opinion that this schist represents a distinct and different horizon from the Dixon schist. It would seem as if it did not have such a great areal extent. This is the Bear Pond schist.

3 The third type is a phase of the Dixon schist affected by a mild form of contact metamorphism, which has developed pyroxenes and tourmaline and redistributed the graphite resulting in an abnormally high graphite content in certain layers. This is the International-Rowland-Sacandaga type.

4 The last group has only one known representative; the Rock Pond ore, which is a meta-arkose ("arkosite"), being composed almost entirely of potash feldspar. Its stratigraphic position is unknown.

There is a practical basis for such a classification. Milling practice rules out, for the present, the last three classes. It may be that with the development of milling processes, already suggested, some of these can be successfully worked in the future. The slightly contact metamorphosed beds present a very variable rock that is difficult to crush without undue attrition of the valuable mineral. The chief objection to the Bly ores is the high mica content. The commercial possibilities were touched upon while discussing the Bear Pond Mountain region.

Average of the quantitative microscopic analyses of graphitic schists of the southern area

The properties from which specimens have been micro-analysed are capitalized.

	Normal Dixon schist	Slightly contact metamorphosed Dixon schist	Bear Pond schist	Rock Pond " arkosite "
Graphite	6.9	7.6	6.2	1.6
Biotite	3.3	3.4	9.4	.3
Muscovite	.....	.....	.....	.1
Chlorite	6.1	1.4	1.4	6.7
Sericite	little	little	little	little
Andesine	15.7	16.9	39.5	.7
Orthoclase	.7	.....	9.5	10.3
Microcline	.4	13.5	.6	52.3
Quartz	61.6	24.6	26.1	9.6
Pyrite	3.5	7.9	7.3	17.1
Apatite	1.0	1.0	1.0	.1
Garnet	.1	.....	.....	.....
Diopside	.2	22.8	.....	.5
Titanite	.3	.4	.....	.05
Serpentine	.2	.....	trace	.....
Tourmaline	none	.5%	.....	.....
Carbonates	trace	trace	trace	.4
Sillimanite	none	none	.....	.05
Galena	none	none	.....	.2
TOTAL	100.0	100.0	100.0	100.0
Represented by	DIXON FAXON HAGUE HOOPER CHAMPLAIN Adirondack Silver Leaf FLAKE GRAPHITE PRODUCTS	INTERNATIONAL ROWLAND SACANDAGA	BLY	ROCK POND

Classification of the graphite ores

Dixon schist	Bear Pond schist	Rock Pond arkosite	Slight contact metamorphosed	Contact	Veins
Dixon Faxon Hague Hooper Champlain Adirondack Silver Leaf Flake Graphite Products					
	Bly				
		Rock Pond			
International			International	International	
			Rowland		Rowland
Sacandaga			Sacandaga	Sacandaga	

Grenville Stratigraphy

It is the hope of Adirondack geologists that the Grenville series can be "put in order." Up to the present time the succession and the thickness of the beds are unknown, and likewise we are unacquainted with the base and the top of the series. W. J. Miller[1] has made a beginning following I. H. Ogilvie,[2] but their units are far too large for our use. Most of the geologists are interested in the purely scientific side of the problem, but the writer's task demands that he take a practical as well as a scientific view. Hence he started the field work with the hope that something could be done with the stratigraphy as an aid to the problems of the graphite deposits of the Adirondacks. He feels that he has, in part at least, arrived at something definite.

Composite geological column showing the Grenville stratigraphy of the southern graphite area

Rock	Name	Estimated thickness in feet	Type locality
Top unknown			
Para-amphibolite	Beech Mountain	150	Beech mountain southeast of Graphite
Feldspar-quartz graphite schist	Bear Pond schist	30	Bear pond, Ticonderoga
Sillimanite schist	Catamount	70	Catamount mountain, International property
Limestone	....	20	Faxon property
Quartzite	Swede Pond	400	Swede pond, Faxon property
Limestone	Faxon	20	Faxon pond, Faxon property
Quartz-graphitic schist	Dixon schist	30	Dixon mine
Garnet-sillimanite gneiss	Hague gneiss	60	Lakeside mine at Hague
Para-amphibolite	Dresden	120	Township of Dresden, Hooper property
Limestone	Johnsburg	30	Johnsburg Rowland property
Quartzite	Sacandaga	70	Sacandaga river, Sacandaga mine
Bottom unknown			
	Total	1000	

As the number of beds recognized increased, it became necessary that some name be attached to each one. The names here proposed have already caused some criticism, and rightly so. Geological usage demands that a name should indicate the geographical locality where the formation is typically shown, and furthermore the name should not be preoccupied. Such an ideal has not been realized. This is

[1] N. Y. State Mus. Bul. 170, p. 10.
[2] N. Y. State Mus. Bul. 96, p. 479.

accounted for by the scarcity of geographical names in the sparsely settled Adirondacks and that the writer was forced to devote his energies to the graphite properties and did not have the time to go exploring over the country in search of typical outcrops. The names are purely tentative, and nothing more. It is the writer's hope, however, that as continued progress is made in untangling the Grenville series more suitable names and better correlations can be proposed.

The practical application of the stratigraphy has already been pointed out. There was hardly a mine that did not have problems that, in a manner at least, were solved by using the knowledge of the succession of the beds. A striking example is the conclusion reached in regard to the amount of ore on the Rowland property. The value is not limited to the question of the amount of ore, but can be used in locating and determining the amount of displacement of faults. In this connection see the Dixon and Faxon properties.

THE IGNEOUS ROCKS

The Algoman. The anorthosite, syenite, granite and gabbro (arranged in order of their age), which compose the younger group of igneous rocks, the writer regards as Algoman in age. They have been so thoroughly discussed in the various bulletins of the New York State Museum as to call for no further discussion. The writer would take more kindly toward the view that the syenite-granite masses represent several different centers of intrusion contemporaneous in age rather than that they represent differentiated portions of a single body.

The name Algoman, perhaps, needs a word in the way of explanation. Correlation of igneous rocks is, at the best, difficult, but the Precambrian rocks of Canada have been studied in sufficient detail to furnish data for numerous correlation tables, twenty of which have been examined. There is a striking similarity in nearly all; there are only two periods of igneous activity prior to the Keweenawan. The other granite of the Adirondacks, Cushing regards as Laurentian. Hence, if we follow Miller and Knight,[1] we are compelled to employ the term Algoman. It furnishes a much desired " handle."

The metagabbro. This igneous rock found on a number of the graphite properties has not received the attention in Adirondack geology it deserves. The cause of this is not difficult to find. It has been pointed out that the amphibolites are often difficult to interpret as they have been derived in a number of ways: (1) Grenville para-amphibolites, (2) metamorphosed basic (femic) igneous rocks such as gabbros, diorites, and diabases, (3) contact metamorphosed impure limestones.[2] Excluding the last as unimportant in the present discussion, the choice rests between para-amphibolites and ortho-amphibolites. Cushing, and especially Martin,[3] lean strongly toward the igneous interpretation. While it is true that some of the amphibolites are igneous, it is not necessarily the case in all.[4] Granting that some are sedimentary and some are igneous, a distinction between the two is difficult and frequently impossible, for they are often confoundingly alike.

Specimens were collected from rock masses where field relations pointed to a definite origin. Microscopic examination revealed

[1] Miller, W. G., & Knight, C. W., Jour. Geol., 23:588.
[2] Cushing, H. P., N. Y. State Mus. Bul. 191, p. 15.
[3] Martin, J. C., N. Y. State Mus. Bul. 185, p. 57.
[4] Löwinson-Lessing, F., " Uber die chemische Natur der feldspath Amphibole." Ann. de l'Inst. Polytech. Pierre le Grand. St Petersbourg, 15:559–76, 1911.

striking similarities and a few differences. The similarities need not be touched upon. It is the latter that are important.

The interpretation of para-schists and para-gneisses should be guided by mental reference to the original unmetamorphosed rock. What kind of a sediment did we have in the beginning? Cushing suggests a calcareous shale.[1] Now as the first point in our examination it is difficult to conceive of a shale without any free quartz. If any original quartz is present in an amphibolite, it gives it a sedimentary look, for basic (femic) rocks are usually lacking in this mineral. But, on the other hand, the absence of quartz does not furnish a reliable criterion for igneous origin, for recrystallization may have brought about the formation of various silicates, using up the quartz present.

The pyroxene-amphibole (the "pyribole" of Johannsen[2]) content was next examined. It is held by many geochemists that pyroxene is a high temperature mineral, while amphibole is a lower temperature form,[3] the change from pyroxene to amphibole being a paramorphic (or "autometamorphic") one. Whatever the nature

Chemical analysis of para-amphibolite (hornblende schist) from Lead hill, Ticonderoga

SiO_2	48.26
Al_2O_3	13.32
Fe_2O_3	1.41
FeO	11.55
MgO	6.66
CaO	10.55
Na_2O	3.36
K_2O	0.80
H_2O —	.06
H_2O +	.96
TiO_2	1.99
CO_2	.38
P_2O_5	.20
S	.20
MnO	.14
FeS_2	....
C	None
	99.84
Less O	.10
	99.74

Collected by E. S. Bastin, analyzed by George Steiger in the laboratories of the United States Geological Survey, U. S. G. S. Bul. 591, p. 40.

[1] N. Y. State Mus. Bul. 169, p. 19, and Bul. 191, p. 15.
[2] Johannsen, Albert, Jour. Geol. 1911, 19:319.
[3] Elsden, J. V., "Principles of Chemical Geology," 1910, p. 114.
Becke, F., Tschermak, Min. u. Petro. Mitth. 16:327–36.
Clarke, F. W., U. S. G. S. Bul. 616, p. 386.
Lacroix, Mineralogie de la France, 1893–95, 1:668–69.

of the change may be, the process furnishes some aid in the problem. If a large amount of pyroxene (say augite) is found in an amphibolite, it suggests an igneous origin. Martin,[1] for example, points out that the dynamic disturbances of the northwestern Adirondacks (Canton sheet) were sufficient to all but completely transform the pyroxene to amphibole. Thus the absence of augite does not prove a sedimentary origin but may suggest it. On the other hand, the presence of pyroxene points toward igneous origin. In neither case is this criterion conclusive.

Hunting for additional criteria, the writer investigated the feldspars in turn. Now Vogt,[2] Becke,[3] Marc,[4] and Harker[5] attempt to present the physical chemistry of the system; albite-orthoclase-anorthite by a thermo-equilibrum diagram. The plagioclase series is an isomorphous one[6] (solid solutions), while the orthoclase-albite pair is an eutectiferous one.[7] The third pair, orthoclase-anorthite is very likely similar to the latter. Thus plotting the three component system upon a triangular base, an eutectic line is to be drawn, connecting the two eutectic points. If the feldspar composition in the magma was on the potash side of this eutectic line, the resulting crystals would approach the orthoclase type of feldspar, while if it were on the other side plagioclase would result. But if the position of the molten feldspar was on or near the eutectic line, the solid minerals would be divided, on freezing, into orthoclase and plagioclase, usually in about equal amounts. In examining the slides of the amphibolites, it was found that the undoubted sedimentary types carried a motley collection of all sorts of feldspars with no definite proportion among them, while the igneous varieties carried an evenly split orthoclase-andesine content, for example. A rock with both potash and soda-lime feldspars is termed a monzonite. While it is not certain that the ferromagnesian minerals were original pyroxenes, it seems likely, and hence the writer suggests that the ortho-amphibolites he has encountered are in large measure meta-augite-monzonites, although the name metagabbro is employed as a more general term.

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[1] Martin, J. C., N. Y. State Mus. Bul. 185, p. 57.
[2] Vogt, J. H. L., Silikatschemelzlosungen, 1914, 2:120–21.
[3] Becke, F., Tschermak, Min. u. Petro. Mitth. (2), 1906, 25:361, 383–85.
[4] Marc, Robert, Vorlesungen über die Chemische Gleichewichtslehre, und ihre Anwendung auf die Probleme der Mineralogie, Petrographie und Geologie, fig. 68 and pages 69, 111–12.
[5] Harker, Alfred, "The Natural History of Igneous Rocks," 1909, p. 250.
[6] Day, Arthur L., & Allen, E. T., Carnegie Inst. Pub. 31.
[7] Warren, C. H., Proc. Am. Acad. Art and Sci., v. 51, no. 3, p. 127–54.

The critical points in the above discussion can be summed up as follows: the criteria for the sedimentary origin of the amphibolites, the presence of original quartz and motley collection of feldspars; for igneous origin, high pyroxene content and evenly "split" feldspars.

These criteria have been used in classifying the amphibolites whose origin was not forthcoming from the field relations. How successfully it has been done can not be tested at the present time, but the hope is entertained that some progress has been made in this difficult problem. The probable age relations of this rock have already been touched upon.

The Laurentian granite. The existence of a granite much older than the Algoman series of eruptives in the Adirondack region seems to the writer to have been sufficiently proved to need but little comment. Its universal habit is to be intricately involved with the Grenville series. This led the early geologists to regard it as a Grenville sediment.[1] Even today this view is entertained by a few.[2] "The recognition of pegmatitic phases of the rock threw the first doubt upon its sedimentary character," while "the chemical analysis finally settled the question."[3] The writer wishes to add this additional bit of evidence which supports the contention that the rock is of igneous origin. At the Dixon-Faxon and Hague localities it was found that the lower beds of the Hague gneiss were soaked and "smothered" by this rock, while the Hooper and Rowland districts show that the Hague gneiss rests directly upon the Dresden amphibolite, the granite being wanting. Its behavior in affecting one stratigraphic unit here, and a different one there and its entire absence in a third locality, is very suggestive of the igneous nature of the rock. As to its age, the reader is referred to the Hooper and Flake occurrences and to Cushing's reasons for regarding it as Laurentian.[4]

SYNTECTIC ROCKS

The lack of uniformity of the rocks, even those usually regarded as wholly igneous, has led the writer to believe that many of the rocks are of "composite character as a result of injection or assimilation, giving on one hand a sediment more or less 'soaked'

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1 Cushing, H. P., N. Y. State Mus. Bul. 77, p. 17–19; Kemp & Hill, N. Y. State Geol. 19th Ann. Rep't, p. r 32–r 35.
2 Miller, W. J., N. Y. State Mus. Bul. 182, p. 11.
3 Cushing, H. P., N. Y. State Mus. Bul. 169, p. 21.
4 Cushing, H. P., "Age of the Igneous Rocks of the Adirondack Region," Am. Jour. Sci., 1915, 39:288–94, especially p. 292–93.

with igneous material, and on the other hand an igneous rock which has melted into itself or assimilated sedimentary material. Between these two types every gradation exists, thus introducing additional complication and uncertainty."[1] This condition is strikingly the case north of the Bear Pond Mountain region (see northeast corner of the map of that region) in the area between Eagle lake (Chilson lake on the map) and Bear pond. It seems a mistake to map such an area as though of simple composition and origin.

The soaking effects of the Laurentian granite have been pointed out before. Two syntectic rocks have been recognized: the smothered Hague gneiss termed the Trumbull gneiss, and the Swede Pond quartzite when similarly affected. The peculiar habit of the granite in soaking the salic rocks in preference to the subsalic beds has repeatedly been observed.

Grenville Structure

From the first reconnaissance of the Adirondacks the Grenville strata have been regarded as intensely folded, metamorphosed and foliated. Recently W. J. Miller has raised some doubt as to the validity of such a conclusion.[2] As the blanket types of ore are members of the Grenville series, it is of great practical importance to know the actual conditions. Overwhelming evidence of strata repeated in reversed order, of synclines and anticlines tightly squeezed, supports the contention that the Grenville has been complexly isoclinally folded, Bear Pond Mountain, the Hooper, Sacandaga, and the Flake properties being specific cases.

Faults come in and play a major rôle, as in the Dixon-Faxon and Graphite Products Corporation districts. The faults are not all of the same age but apparently range from the middle Precambrian to Postordovician in age. Reasons for this conclusion can not be given here.

THE CONCENTRATION OF FLAKE GRAPHITE

Probably the greatest problem confronting the graphite operators of the Adirondacks is the separation of the flake graphite from its associated gangue minerals. The process of separation is usually subdivided into (1) the "concentration," and (2) the "refining" operations. The former is performed in the mills most commonly

[1] Smyth, C. H., Jr., N. Y. State Mus. Bul. 158, p. 143.
[2] Miller, W. J., "Origin of Foliation in the Pre-Cambrian Rocks of Northern New York," Jour. Geol. XXIV, no. 6, p. 587–619.

situated near the mines, while the refining is rarely practised by the mine operators, the majority of them sending their concentrates to other concerns for treatment.

Ore separation in general is based on marked physical or chemical characteristics of the ore and the gangue: (1) differences in specific gravities, (2) differences in electrical conductivity, (3) selective behavior of a mixture of water and oil upon the surface tension, or (4) upon the magnetic properties of the ore and the gangue minerals. Up to the present time graphite separation is accomplished by specific gravity methods.

" The whole problem of the concentration of graphite is in great contrast to that of metallic ores, in that in the former case we seek to save the light minerals and reject the heavy, while in the latter case the reverse is true."[1]

The specific gravity method of concentrating graphite is subdivided into the wet and dry processes. Both methods require that the ore, as it comes from the mine, first be reduced to a pulverized condition. This is effected by various types of crushers, rolls and stamps. A great variety of rock breakers are in use. There are jaw crushers, which are intermittent in action; and the rotary and gyratory types that are continuous in operation. Further crushing is done by rolls which are constructed of manganese steel. The space between the rolls varies from practically nothing to three-fourths of an inch. They are fed with lumps about 1¼ to 1½ inches in size. Frequently, however, California stamps are used instead of, or in combination with, rolls.

From this point on, the wet and dry methods differ. In the wet process, which is the one most commonly employed in the Adirondacks, the crushed rock is mixed with water and fed to a series of buddles. These consist of circular tanks 3½ to 4 feet in depth and 16 to 18 feet in diameter, with a slightly convex bottom, so that the floor of the tanks slopes in all directions from the center to the circumference. A vertical shaft, situated in the center of the buddle, carries a tub, perhaps 3 feet in diameter, with a perforated bottom. The mixture of crushed ore and water is fed into this tub by a stationary sluiceway or launder. Thus the ore is made to enter the buddle at the center and is carried toward the sides by the water which is allowed to escape through specially arranged openings, either controlled by manually operated valves or wooden stoppers fitting round holes. The movement and even distribution

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[1] Kemp, J. F., U. S. G. S. Bul. 226, p. 513.

of the layers of slime is further assured by the action of paddles or brushes that are attached to (usually) two horizontal arms secured to the shaft. The revolving brushes lightly rub the surface of the material in the tank and gradually slide up the shaft as the buddle is filled up. The graphite flakes, by virtue of the low specific gravity and flaky, scaly nature, are mainly floated to the sides while the heavier and more massive minerals are dropped near the center of the tank. It usually consumes several hours to fill a single buddle so a series of them are employed; while one is being filled another is being emptied.

After the tank is filled, the material is allowed to dry partially and is then shoveled up. The outer portion nearest the wall of the tank is composed of rather clean concentrates. The inner portion, consisting of sand tailings, is rejected, while the middle portion consisting of both graphite and gangue materials, is passed to another buddle for further concentration. Usually two or three buddles comprise the first set and a like number make up the second. Buddles are the favorite form of concentrators in the Adirondack mills; the amount of labor involved in their use, however, has led a few operators to seek a cheaper method.

The buddle concentrates must be further treated. The more common process is by the use of revolving screen reels. "The reels are hexagonal and are covered with screens of various sized mesh. The reels are slightly inclined; the ore is fed into one end and the concentrates thrown out at the opposite end as the reel rotates. Jets of water directed against the outer part of the reel aid in the separation of the graphite and impurities. The latter because of their small size pass through the screens and are thrown away."[1]

The common practice in most mills is to regrind the seconds, to crush the quartz and feldspar grains and send it through the screen again. The graphite is then dried. A number of different types of dryers are in use. Both direct and steam methods are employed.

The most common one is the rotary tube form, although a number of specially designed dryers were seen. Final sizing on screens divides the concentrates usually into four grades. These are then ready for the finishing mill.

In some mills, Wilfley jig tables are used, operating upon the buddle concentrates before the reels performed their function.

[1] Miller, B. L., Topo. and Geol. Sur. of Pa. Rep't 6, p. 87–88.

The mill concentrates average:

First grade	70 to 80 per cent carbon
Second grade	60 to 70 per cent carbon
Third grade	25 to 30 per cent carbon
Fourth grade	8 to 12 per cent carbon

They are bagged (a bag weighing about 110 pounds) and shipped to the refining mill.

A concrete example of milling practice. It was not possible for the writer to secure data for a complete account of the milling practice in the Adirondacks. The wet process of the Empire Graphite Company, now the Flake Graphite Company, has, however, been clearly set forth by F. C. Nicholas.[1] The writer can do no better than to abstract the article.

The mill, which is arranged on the gravity principle, has a capacity of 200 tons in 24 hours.

The material from the mine is delivered to a rock breaker and reduced to 1½ to 3 inches in size. The broken rock then drops to the rolls, which are 20 feet long by 2½ feet in diameter, which reduce it to a fine sand. This is fed to a second pair of rolls more closely set. The fine powder is then ready for the buddles. The buddles are constructed of reenforced concrete and lined with matched boards, 18 feet in diameter and 4 feet high. The concentrates from the first operation are sent to a second set of buddles. A set of wet screens is next in order, where the graphite flake is divided into two sizes. A rotary steam dryer then removes the moisture. The final process makes use of silk cloth screens that classify the flakes into four sizes.

Since this was written, two banks of five stamps each, manufactured by the Allis-Chalmers Mfg. Co., and another set of buddles have been installed. It is believed that the stamps have replaced the rolls. Final treatment is accomplished in Hooper air jigs, manufactured by the Ticonderoga Machine Company. A classifier is being constructed and will serve to recover some of the graphite in the buddle tailings. A change in the type of the crusher is also being made.

Such changes in the equipment for the concentration of an ore as are found here are evidence of the experimental state of graphite milling.

[1] Min. World, Jan. 4, 1918, p. 18

The equipment of the Hooper mill at the time of visit is very similar to that of the Flake Graphite Company. Crushing, stamping, buddling, screening and drying are the essential steps in the process. Further improvement is being made, the details of which are not made public.

The dry process. Only three mills, so far as the writer knows, have operated with the dry method: the Lakeside mine at Hague, the Crown Point Graphite Company, and the Rowland plant. These have been abandoned and little direct information is available. In the Rowland mill a Newaygo separator, manufactured by the Newaygo Portland Cement Company, was experimented with, but apparently without success.

The finishing of graphite. In the early days of the industry, the mines in the vicinity of Crown Point sent their concentrates to a finishing mill located at Crown Point Center. Power was secured from Putnam creek. As it has long been closed, details of the processes used there are unavailable.

The American Graphite Company maintains its refining mill at Ticonderoga; the Flake Graphite Company and the Graphite Products Corporation finish their products on their own properties.

The machine that is most generally used in the final treatment of the graphite concentrates is the Hooper pneumatic concentrator, a brief account of which is here given.[1]

In essence it consists of an inclined frame over which is stretched a broadcloth screen, up through which a continuous series of air pulsations are delivered by a device located below. Two sets of strips are arranged over the cloth screen, the lower group of which is inclined toward one side, while the upper set is inclined in the opposite direction. ". . . and when (concentrates) composed of particles of different gravities are fed upon the (screen) the pulsations through the broadcloth . . . cause the heavier mineral particles to be thrown (settle) to the bottom . . . and are thus guided . . . toward the tailing side of the (concentrator),"[2] while the clean graphite is guided by the upper set of strips to the opposite, or concentrating side, thus bringing about a separation of the gangue and the ore.

[1] For a full description, see Richards, "Ore Dressing," p. 820, and Canadian Min. Jour., 30:271–72, 1909.

[2] Ibid.

CONCENTRATION PROBLEMS

Mechanical ore separation is an ancient art and a modern science. In the western section of the United States ore dressing is on a far firmer basis than in the case of a comparatively small industry like that of graphite. The separation of graphite from the gangue is exceedingly difficult, calling for long experience and mechanical ingenuity, which is rarely available in the graphite areas of the Adirondacks. Numerous failures can be attributed to this cause. During the past 15 years the technology has experienced some remarkable improvements which have revolutionized the practice of ore dressing in general. Graphite separation has suffered from neglect and lays far behind. Still the old process of buddling continues to be the chief method, while flotation and electrostatic separation have been developed without making any impression in the graphite industry of this region.

Table of specific gravities

MINERAL	SPECIFIC GRAVITY
Apatite	3.19 to 3.23
Biotite	2.70 to 3.10
Chlorite	2.65 to 2.96
Feldspar	2.47 to 2.67
Garnet	3.15 to 4.30
Graphite	2.09 to 2.23
Muscovite	2.76 to 3.00
Phlogopite	2.78 to 2.85
Pyrite	4.95 to 5.10
Pyroxene	3.20 to 3.60
Quartz	2.65 to 2.66
Serpentine	2.50 to 2.65
Titanite	3.40 to 3.56

These newer processes render it possible to separate a wide range of minerals of close specific gravity, that can not be separated by jigging or slime washing. Even minerals having the slight difference in specific gravity of 0.35 can be treated. The electrostatic method has many admirers and promises to be used more and more. Several large deposits of graphite seen by the writer were regarded of little commercial value because of the large amounts of micaceous minerals present. The separation of biotite and graphite is exceedingly difficult, if not impossible, by the usual processes. If, however, the electrostatic or flotation processes can be adapted to graphite milling, then there are great sources of graphite still untouched that would become available.

Two ores of even identical composition can not always be treated by the same method. On account of the different physical character in which graphite occurs, amorphous and flake graphite must be treated differently. Difficulties arise if the character of the ore changes as mining operations proceed, and this is regarded as one of the principal sources of trouble. The selection of a method of milling seems to have been made often without any regard to what the general run of the mine was likely to be. Test holes should be made to determine the character of the ore before mill equipment is bought. In fact, the construction of a mill should proceed only when *all* the conditions of the deposit, the character of the ore as well as the extent of the ore body, are fully known.

"It is quite certain that there is no single process that is a universal panacea for all the difficult problems of ore treatment. For certain ores one process is best adapted; for other ores another process. For still other ores the best results may be achieved by a combination of two or three, or even more of the special processes."[1]

The presence of micaceous minerals, biotite, phlogopite, chlorite etc. offers the greatest problem. Although they are higher in specific gravity than graphite, the flaky nature of the former prevents separation by gravity methods as they are floated off in company with the graphite. The particles of mica "are of approximate similar size, and being frequently of the black variety (biotite), they may be readily overlooked in the hand specimen or in the graphite concentrate. The easiest method of detecting the mica and of estimating its relative proportion to the graphite, is to examine the material under the microscope when the former can be readily distinguished by its translucency."[2]

It is quite possible that a more complete separation of the mica can be effected through the electrostatic method. This can be briefly described as follows: It is based upon the fact that graphite is capable of receiving and retaining an electric charge, while micaceous minerals, as well as most of the other gangue materials, refuse to do so. The machine consists of horizontal parallel rods of brass set one above another like the rungs of a ladder, which are charged with a high potential. Down past these flows the dry, pulverized rock; the gangue materials, not affected, fall vertically and drop into a receiver, while the graphite is repelled laterally away from the bars and drops into troughs arranged in front. The process is repeated until a complete separation is

[1] Ingalls, W. R., Eng. and Min. Jour., 1905, p. 643.
[2] Newland, D. H., N. Y. State Mus. Bul. 179, p. 34.

made. The middlings are sometimes reground to rub off the quartz and feldspar grains still attached to the flakes, and then passed through the machine again.

Mr Charles T. Rowland, president of the Rowland Graphite Company, had a representative of the Huff Electrostatic Separator Company make a thorough investigation covering the milling of the Rowland ore in 1916. He says: " The sample used in making this test was blasted out of the bed, as it was desired to get . . . an average sample of the output of the mine. This report shows that the ore can be milled economically with a good recovery, and that the flake produced is of very high grade and compares very favorably with the best flake now being produced in this country."[1]

Cirkel says that " Experiments have . . . shown that . . . (flake) graphite may possibly be separated from the gangue electrostatically, and it is not unlikely that such a process may be worked before long. The writer [Cirkel] submitted a parcel of 100 pounds for preliminary test to the Huff Electrostatic Separator Company of Boston, Mass., and the tailings from this test were without question quite clean. The middlings consisted of graphite with attached gangue particles, and need regrinding before they can be again submitted to the electrostatic treatment. The concentrates appear to be free from rock, but there was some attached gangue. The writer [Cirkel] believes that if this product was submitted to the polishing treatment it is likely that a clean article may be the result."[2]

The size of the graphite flake is another factor that must be taken into consideration. A rock carrying a coarse flake is more desirable, other things being equal, since the value of the concentrates and the economy and perfection of the separation is in direct proportion to the size. One of the many factors involved is the easy crushing of the rock. Among other things that affect the ease of crushing is the mineralogical make-up of the ore. The presence of pyroxene (diopside), such as was seen in the Rowland ore, offers serious objections to its utilization. The crushing machines must be designed and adjusted so as to cause the least amount of attrition to the flake. Moreover, there is the actual condition in which the flake is found. It was repeatedly observed that where folding, squeezing and igneous activity have taken place, the flake has been frayed out into fantastic forms, resulting in the splitting of the

[1] Rowland, Charles T., letter of Oct. 16, 1917.
[2] Cirkel, Fritz, Trans. Can. Min. Ind. 1912, 15:267

flake into thin, bent plates which under rolls or burr-stones would be reduced in size. This would lead the writer to suggest that ore near pegmatites be carefully examined before being sent to the mill, as any fraying of graphite should cause its rejection.

It is quite possible that a preliminary roasting of the ore prior to crushing will have a very beneficial effect, both upon the quantitative results of separation and upon the quality of the graphite that is recovered. The object of such a treatment would be the disintegration of the ore by chemical and physical changes in modifying the pyrite and the quartz, so that the amount of severe crushing would be lessened and therefore the attrition of the flake be reduced to a minimum.

The lack of uniformity in the ore is a factor frequently overlooked. The concentration processes are very sensitive to any change in the character of the ore. "To a certain extent the problems encountered by each operator are unique, as slight differences in the mineralogical composition of the ore may compel operators in near-by mines to instal decidedly different types of machinery. In some instances, even in the same mine, the ore may vary sufficiently as the work is extended to make it necessary to alter the concentration process. The fact that those companies that have a rather uniform kind of ore in their mines are also frequently making changes in the methods of concentration, is further evidence of unsolved problems."[1]

Most of the bedded deposits carry pyrite; the normal schists about 4 per cent, the Bly ores 7 per cent, and the Rowland-International-Sacandaga class 11 per cent by weight, while the Rock Pond ore is exceedingly rich in this sulphide, which runs from 15 to 40 per cent of the rock. As the rock is crushed for the graphite content, it would seem that perhaps this could be saved without adding materially to the milling cost. Pyrite might be a profitable by-product.

The amount of graphite is perhaps the first matter that interests the average graphite man. While this is of vital importance, it is not the only factor. The writer has not taken the time to make chemical analyses of the different ores collected, the microscope enabling him to obtain a far better opinion of values. The example of the "rich" Rowland ore, illustrates this point. In St Lawrence county, where metamorphism has not been so severe, the crystallization of the carbon content of the old sediments to graphite has not proceeded so completely, and the percentage of "amorphous"

[1] Miller, B. L., Topo. and Geol. Surv. of Pa. Rep't 6, p. 82.

(really micro-crystalline) graphite is much higher.[1] Certain deposits of this kind will assay 20 per cent of carbon, but the value of such an ore is relatively low. In fact, successful graphite milling is one of the few industries that has a very close relation to the geology of the ore. Lack of knowledge of the geologic conditions then has been a considerable factor in the many failures.

" There is far more secrecy among graphite producers in regard to the milling methods employed than in almost any other kind of ore separation and (some) companies . . . refuse to admit visitors to their mills. The extremely small probability of one company profiting by the experience of another and thereby injuring its market through increased competition would seem to indicate the uselessness of secrecy employed by many graphite companies. On the contrary, there is little doubt but that the increased prosperity of one company would have a beneficial effect on all the others in the district, at least until the production increased far beyond its present proportions, and the problems of concentration might be more speedily solved under the plan of cooperation and mutual assistance."[2]

[1] Newland, D. H., N. Y. State Mus. Bul. 120, p. 30.
[2] Miller, B. L., Topo. and Geol. Surv. of Pa. Rep't 6, p. 82.

COMMERCIAL STATUS

Bastin says that "Today there are more abandoned mines and mills in the United States than the number in operation . . . In the number of times some of these properties have changed hands in the course of a few years, there is a record of misrepresentation and disappointment that can hardly be equaled in any other branch of mining, and many properties have been notoriously associated with stock manipulators of doubtful character."

Newland reports that "The amount of capital expended in the erection of new milling plants and mine equipment during the past five years aggregates several hundred thousand dollars, and in many cases there has been little or no return for the outlay."[1]

Of the thirty-seven graphite properties here listed, only three are in full operation, two of which are recently organized companies.

The causes of these failures are many and varied. Some of them have already been pointed out. The mining and milling of graphite is a highly technical matter; it is not an easy and quick road to wealth. It demands a knowledge of the nature of the ore, its tenor, the geological condition of the surrounding area, the precise location of faults, folds, pinches, and swells, how the ore will crush, the size and quality of the flake, of the best, the average run and the poorest ore, how much mica is present etc. It is necessary to know the possible resources and secure a mill equipment to correspond. There are a great many factors that must be considered before actual operations are undertaken.

The writer has been greatly impressed by the lack of diamond drilling in most of the graphite districts. Only two properties have used this valuable method of securing data, and even then full benefit from the cores has not been obtained. The drill records are usually made by laymen in geology, and only the portions that are composed of ore are saved. Some records, furnished to the writer, were fairly intelligible and proved of value in detail mapping, while others were so ambiguous as to be more confusing than helpful. When a core is recovered, every inch of it should be saved! In one case a geologist who had the stratigraphy of the district in mind could have furnished the owners a fairly complete description of the conditions that would be found underground. All this information has been lost with the loss of the cores. Sometimes where diamond drilling has been done it has been so planned that little or no returns

[1] Newland, D. H., N. Y. State Mus. Bul. 120, p. 30.

could have been expected. One company sank a drill in a mass of the Algoman gabbro in search of ore, when a geologist could have saved them time and money. The writer has no personal axe to grind, but he wishes to call attention to the fact that consulting mining geologists are available, whose services would cost less and save the expensive mistakes of present methods.

Besides the more technical problems, there are the financial questions. The writer believes that Bartley's recent article[1] has a great deal of truth in it that is of value to us and hence he has abstracted certain portions of Bartley's paper. Bartley believes that graphite companies who simply mine and mill the ore, selling the concentrates or finished products to graphite manufacturers are usually operating on a narrow margin of profit. This usual practice has been one of the causes of the unstable conditions and the fluctuations in the industry generally prevailing in this country. Bartley thus comes to the conclusion that the methods which have proved detrimental must be done away with and that "the successful American graphite miner must be to a certain degree a manufacturer." To illustrate this point he assumes that the finished product of the average plant is as follows:

1 Flake, 90–95 per cent carbon
2 Flake, 68–72 per cent carbon
3 Flake, 24–28 per cent carbon
4 Flake, 8–12 per cent carbon

"The first has a ready demand, and the price is based on the price asked in the Ceylon market for similar grade. The price (before the war) was about 9–10 cents a pound. (It is used in crucible manufacturing, for lubricants, and for special electrical requirements.) There is less demand for the second grade and the price, naturally lower, running (in normal times) around 4–4½ cents. It is principally sold to manufacturers of graphite oils, graphite greases, stove polish, etc. The two lower grades are of little, if any, value to the miner, who often is glad to dispose of them at any price.

"Here to my mind is the secret in mining American graphite successfully. It costs just as much to mine and refine the lower grades as for the higher. The next thing to consider is the average yield of graphite the mine will deliver, how this yield when finished will divide up into the four grades, etc.

[1] Bartley, Jonathan, "Can Profits Be Made in American Graphite?" Iron Age, July 8, 1915, p. 86–87.

(The experiences of Kemp, Bartley, Bastin and the writer suggest that the average percentage of graphite in the average ore is about 4 to 5. This means that from every net ton of mined rock only 80 to 100 pounds of concentrates will be produced).

"I believe that the following statements can be depended on as a fair average (before the war):

Every 100 pounds of concentrate will yield:

	Market price
35 per cent of first grade at 10 cents	$3.50
20 per cent of second grade at 5 cents	1.00
15 per cent of third grade at 2 cents	.30
30 per cent of fourth grade at 1 cent	.30
	$5.10 or 5 cents a pound

(One net ton is thus worth $100.) "To produce the same in concentrates at a cost of 4 cents a pound means $80; the cost of refining can be placed at $4 a ton, making a total cost of $84, thus giving a net profit of $16 a ton. *No man can run a graphite mine on this margin of profit.*

[Then he must manufacture graphite products as well as produce.) "Why sell [the first grade] for 10 cents a pound when [it is possible to] get from 14 to 16 cents for it [as a manufactured product] with very little added cost? A very large percentage of this is sold for lubricating purposes, put up in tin cans . . . With a steam-jacketed kettle and a couple of mixers you are equipped to convert the second grade into graphite oils and greases [securing 15 to 25 cents a pound instead of 5 cents]. With paint grinding mills and mixers you are fixed to make use of the third grade, and realize at least 5 cents a pound. By adding soapstone" etc., to the fourth grade you can get 3 cents a pound for it as foundry facings, instead of 1 cent. It is a difficult matter even to estimate the cost of the machines needed in manufacturing such products. Bartley's opinion is that it would be in the neighborhood of $6000 "to handle the output of a 75-ton mine." It seems to the writer that that is an exceedingly low figure, and that the probable cost would be much higher.

The writer has gathered the impression that one of the causes of the comparatively low price obtainable for concentrates is due to the fact that the producers of graphite articles "play one mine against another" and thereby keep the market price at such a low point that the margin of profit is dangerously small. During the period of the war the price of the highest grade has risen, while the market value of the lowest grade has fallen. The present prices will not continue after the war.

The present prices average[1]: No. 1 flake, 88 per cent of graphitic carbon, 12½ to 15 cents a pound; No. 2 flake, 82 per cent carbon, 9 to 12 cents; dust, 40 per cent carbon, ¾ cents.

THE PROSPECT FOR FUTURE PRODUCTION

Ore reserves are always mere guesses based upon probabilities. Nevertheless the writer offers the following estimates.

The American Graphite Company has undeveloped lands, but it is not possible at the present time to estimate the tonnage of its reserves. In the matter of probable reserves the following properties can be regarded as commercially important: the Faxon property, Hooper Brothers', the Flake Graphite Company and the Graphite Products Corporation, which have a collective reserve estimated to be in the neighborhood of 10,000,000 to 13,000,000 tons of graphite schist, half of which is readily available. This is not counting the Bly property, which is probably out of the running, for the present at least, until a concentration process can be devised to handle the mica.

In conclusion, the successful graphite miner will be one who has an extensive deposit of the bedded schist of uniform grade, measurably free from mica, without geological complexities, who operates in a large way and manufactures a good share of his own products.

ARTIFICIAL GRAPHITE

Graphite made in the electric furnace or as a by-product of the blast furnace has been regarded in lay circles as forecasting the doom of the mining of graphite. This is true to only a very small extent, and does not affect the Adirondack deposits of *flake* graphite. The electric furnace product is manufactured from coal and is amorphous. Its use is chiefly confined to the manufacture of dry batteries and electrodes. The carbon that accumulates in the washing tanks of illuminating gas companies is likewise put to similar uses. This amorphous carbon is not usable in the manufacture of crucibles and certain graphitic greases.

The flake graphite in slags is highly charged with oxides of iron, which reduce its refractibility to such an extent as to render it

[1] Newland, D. H., Eng. and Min. Jour., Jan. 19, 1918, p. 151.

useless. Furthermore the flakes are usually thinner than the natural flake. Nature has produced a form of graphite that man, as yet, has not equaled.

THE ORIGIN OF GRAPHITE

The discussion of the origin of graphite is of commercial and of scientific interest. The important rôle that origin plays in " sizing up " a graphite property has been pointed out in the preceding pages, and it does not need to be repeated here.

The origin of the mineral has been a favorite topic for many pens, and almost as many theories have been advanced as there are writers on the subject. The causes of these antagonistic views are varied. In essence it has been the conflict between the organic and the inorganic theories. Some would claim that all deposits have had an organic origin, while, on the other hand, the other extreme is maintained.

The writer is in full accord with Kemp, Bastin, B. L. Miller and Winchell, that graphite has been formed by *both* processes, acting entirely independently and sometimes in conjunction.

The attempt to arrive at the origin of the graphite in the Adirondacks is made difficult by the early views that still persist. Such statements that: " The Dixon . . . Company has in its mine near Graphite a fissure vein of small thickness but of great length and depth, cutting through gneiss,"[1] or what Cirkel reports as Kemp's description of Lead hill " as true fissure veins,"[2] and that the ore at the Flake Graphite Company is a metamorphosed dike,[3] obscures rather than clarifies our problem.

The organic type of graphite. Bastin[4] presents an imposing array of arguments to support the contention that the " Dixon " schist as shown at the mining village of Graphite is of sedimentary origin. He summarized them as follows: "(1) in the highly quartzose, nonfeldspathic character of most of the graphitic rock; (2) in the evenly and highly garnetiferous character of much of the wall rock [the Hague gneiss]; (3) in the persistence of the graphitic schists and associated garnetiferous gneisses with fairly uniform trend, width and character for considerable distances; (4) in the presence locally of interbedded masses of crystalline

[1] Ingalls, W. R., The Mineral Industry, 1908, 17:493.
[2] Cirkel, Fritz, " Graphite," Can. Dep't of Mines, Mines Br. 1907, p. 56.
[3] Nicholas, F. C., Min. World, Jan. 4, 1908, p. 18.
[4] Bastin, E. S., " Origin of Certain Adirondack Graphite Deposits," (Econ. Geol. 5:134).

limestones [the Faxon limestone]; (5) in the fairly even dissemination of the graphite through the workable schist." He further supports these arguments by a chemical study of the schist.[1] All of this evidence can be summed up in a few words: The Dixon schist is a stratigraphic unit in a sedimentary series. Having settled to his satisfaction that the schist is sedimentary, Bastin concludes, and the writer feels quite correctly, that this graphite is organic in origin.

But the graphite, as such, was not present in the original clastic sediments when they were deposited in the Grenville sea. Graphite in unmetamorphosed sediments is known[2] but such occurrences are rare and without much question the graphite has been derived from preexisting metamorphic rocks which have suffered disintegration. We can dismiss this factor as unimportant in the formation of the Dixon schist.

Walcott[3] has suggested that the Dixon is a metamorphosed coal seam. There are several serious objections to such an interpretation. (1) The metamorphism of a coal bed usually gives a true amorphous or microcrystalline form of carbon; (2) from our present knowledge of coal it would seem improbable that a sufficiently developed form of life had appeared in Grenville time to have furnished coal.

Kemp's view is that the original rock was a bituminous shale. If we use the term shale loosely, chiefly as signifying a structure, then there is no difficulty in accepting this view, but if an argillaceous sediment is implied then this can be criticized on the ground that the Dixon schist is not a metashale but a metasandstone. Bastin maintains that " it seems most probable that the deposits represent carbonaceous sandstones, locally clayey, interbedded with only slightly carbonaceous impure sandstones and with small amounts of limestone, all of which have been completely recrystallized with the development of a schistose structure and the conversion of the original carbonaceous material into graphite through the usual processes of dynamic metamorphism."[4] There is some objection to Bastin's term " carbonaceous." True carbonaceous matter in black muds seems to have been derived from ligneous material. Plants

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[1] See Bastin, E. S., " Chemical Composition as a Criterion in Identifying Metamorphosed Sediments." Jour. Geol., 17:445.

[2] In Cambrian sandstone, as reported by E. T. Wherry, Econ. Geol., 7:764, and in Triassic Sandstone of Massachusetts, Emerson, Mon. XXIX, U. S. G. S., p. 365.

[3] Walcott, C. W., Bul. Geol. Soc. Am., 10:227; U. S. G. S. Bul. 86, p. 398.

[4] Bastin, E. S., Econ. Geol., 5:134, et sec.

containing lignum, that is, vascular plants, apparently do not appear until the Lower Devonian and hence algae[1] are called upon to supply the carbon. On the decay of such plants an odoriferous thick oil (" sapropelic " matter) results that can be regarded as akin to bitumin; hence the writer prefers the term " bituminous sandstone." The habitat of these algae seems to have been shallow water near the shore. This view is strengthened by the gradual disappearance of the Faxon limestone to the east and its replacement by metaarkoses and metagraywackes, indicating that the shore of the Grenville sea at Dixon-Faxon time was to the east.

All the specimens of the graphite schists (all types) studied revealed considerable amounts of pyrite. A large proportion of this has been introduced; two distinct periods are clearly recognizable, especially in case of the Rock Pond ores where an excessive amount permits easy observation. A small amount, however, appears to have been an original constituent in the argillaceous sandstones, or that the iron content was in the form of chloritic minerals. During metamorphism " much of the iron is reduced to the ferrous condition . . . and it may . . . combine with sulphur, which is often present under these conditions, to form pyrite. The presence of 'carbonaceous matter' favors this reduction, as shown by the common association of . . . sulphides with graphitic shales."[2] Smyth[3] points out the close genetic relations of pyrite and graphite. That graphite, as such, or as organic carbon, having the property of precipitating the pyrite has been pointed out by Von Cotta[4] and Jenny.[5] Smyth[6] says: " Thus, for the graphite, a history somewhat similar to that of the pyrite is indicated, but with the difference that most of the former is thought to be carbon that was original in the sediments, which has undergone some concentration and may have received minor additions from magmatic sources, [see later] while, in the case of the pyrite, the relative importance of these sources is reversed." Thus the evidence furnished by the pyrite would add support to the contention that the carbon was present in the sediments as an original constituent.

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[1] White, David, Econ. Geol., 3:298; Osborn, H. F., " The Origin and the Evolution of Life," 1917, p. 50, fig. 5.
[2] Leith, C. K., & Mead, W. J. " Metamorphic Geology," 1915, p. 104–5.
[3] Smyth, C. H., jr, " Origin of Certain Adirondack Pyrite Deposits," 65th Ann. Rep't, N. Y. State Mus. 1911, 1: 174 et sec.
[4] Von Cotta, " Treatise on Ore Deposits," Eng. Trans. p. 46–47.
[5] Jenny, W. P., " The Chemistry of Ore Deposition," Trans. Am. Inst Min. Eng., 1903, 33:455–57.
[6] Ibid. (see p. 182) footnote.

The change of organic carbon to crystalline graphite has been affected by the heat and pressure accompanying mountain-making stresses, or static metamorphism, causing the volatilization of hydrogen and nitrogen, and the dehydration of the residue, followed be the recrystallization of amorphous carbon to graphite.[1]

The sedimentary limestone type. When discussing the northern area with its characteristic type of graphite, emphasis was purposely laid upon the contact type. While the majority of the prospects and mines are situated at contact zones, some of the limestone appears to be graphitic without any necessary connection with igneous rocks. The limestone, for example, throughout the Paradox Lake quadrangle was frequently observed to be slightly graphitic. The most plausible origin for the graphite in this rock is that it is organic. It may be that the history of the carbon here has been very similar, if not identical with the formation of the Dixon schist. It is a striking thing that as we pass into the interior of the Adirondack highland the limestones become barren of graphite. Whether this is due to the action of igneous rocks culminating in the great anorthosite body or due to the fact that we are moving away from the old Grenville shore into areas where deep-water conditions prevailed, is, of course, unknown.

THE INORGANIC TYPE OF GRAPHITE

The contact form. Graphite occurs at contact zones between an igneous rock and a sedimentary one, usually in contact rocks rich in pyroxenes, and in the margins of the eruptive rock. The statement that graphite occurs in pegmatites is probably true *per se,* but it seems to the writer to be somewhat misleading; for it is confined to the margin along the line of contact. Apparently the country rock was a necessary reagent in the formation of the graphite. Several specimens collected on Lead hill were first taken to be limestone with graphite. The trial with a knife blade proved that the white material was too hard for calcite, hence it was called pegmatite material. A thin section showed it was white pyroxene; hence it was a contact rock, not a pegmatite.

There are two views in regard to the origin of the contact form of graphite: (1) that the carbon, in some form, was an original constituent of igneous magmas, or (2) that the igneous rock in its

[1] See Hatch, F. H. & Rastall, R. H., " Petrology of the Sedimentary Rocks," London, 1913, p. 293.

ascension through graphitic sediments picked it up and deposited it on cooling at the margins of its mass.

Winchell[1] states that "graphite is practically insoluble in silicates at ordinary temperatures of magmas; it is upon this fact that its value as a refractory material partly depends. How, then, can the occurrence of graphite as a constituent of igneous rocks . . . be explained?" The temperature of liquefaction and vaporization of graphite is in the neighborhood of 3000° Centigrade at normal pressures. The effect of increased pressure in raising the melting point is so small that we may neglect this factor.[2] "Therefore the suggestion sometimes made that sublimation from carbon vapor [is responsible] seems highly improbable."[3] It seems equally clear that carbon could not be in silicate solutions as a solid in an undissolved form or in true solution.

Volatile hydrocarbons are then offered as a source of graphite.[4] That such gases do occur as constituents of igneous rocks, has long been recognized.[5] Winchell has ably discussed the probabilities and points out that "it seems improbable that they are the source of graphite deposits, for several reasons. First, in the presence of water they will apparently be wholly transformed into carbon monoxide and hydrogen at 700° to 800° C. Second, in the absence of water the decomposition of hydrocarbons occurs (only) at high temperatures . . . ; any graphite that resulted from such a process should be formed in the hottest part of the intrusive magma rather than in the much cooler (margins) . . . where the graphite is actually found; and . . . no reaction is known for the decomposition of hydrocarbons below 500° C."

In a similar way Winchell disposes of the theory that the rôle played by carbides is responsible for the formation of graphite.

The most plausible theory is that the ultimate source is either carbon dioxide or carbon monoxide. Examination of the pegmatites from a great many of the contact deposits of the northern area shows microscopic gas bubbles of the oxides of carbon in great abundance. Lincoln,[6] Chamberlain[7] and Salisbury[8] point out that

[1] Winchell, A. N., "A theory for the Origin of Graphite," Econ. Geol. 1911, 6:222.

[2] Harker, Alfred, "The Natural History of Igneous Rocks," 1909, p. 163.

[3] Winchell, ibid.

[4] See references given by Winchell.

[5] Lincoln, F. C., Econ. Geol. 1907, 2:257; Chamberlain, R. T., "Gases in Rocks," Carnegie Inst. Pub. 106.

[6] Lincoln, F. C., Econ. Geol., 2:258.

[7] Chamberlain, T. C. & Salisbury, R. D., "Geology," 1:618, 619.

[8] Chamberlain, T. C., Carnegie Inst. Pub. 106.

the oxides of carbon certainly exist in magmas as they are important constituents of volcanic emanations. The experiments of Boudouard[1] with the system $CO - CO_2$ in equilibrium, show that on cooling from 1000° to 500° C. at normal pressures CO breaks up in CO_2 and " lamp black."

$$2\ CO - CO_2 + C$$

This form of carbon may be converted into graphite by the application of pressures and heat, as is illustrated by its presence in gray cast iron.

Bastin[2] sought to arrive at the temperature at which graphite of the contact type was formed. He examined a suite of specimens from Lead hill, and found that the " quartz was penetrated in a most irregular manner by flakes of graphite oriented in all directions and inclosed numerous crystals of augite. There can be no doubt that the three minerals crystallized contemporaneously." The quartz was examined in the light of the modifications that quartz experiences when subject to thermal changes;[3] and was found to be in the alpha condition. This indicates beyond reasonable doubt that the quartz, graphite and augite crystallized below the inversion temperature of quartz, which is 575° C. This temperature is in accord with the experiments of Boudouard and the conclusions reached by Winchell.

Weinschenk[4] believes that any kind of igneous rock can, if the physical conditions obtain, produce graphite upon contact with any kind of calcareous sediment. The examination of all the contact deposits of the Adirondack strongly supports this view. The Fryatt workings on Lead hill, however, where the sediment is a good clean quartzite seem to question the necessity of limiting such action to calcareous rocks.

The vein type of graphite. The true fissure veins of Split rock, Lead hill and the Rowland property, as well as elsewhere, indicate that the graphite-forming period continued after the solidification of the pegmatitic-granite, syenite, gabbro or whatever particular series of igneous rock that carried the oxides of carbon. But the graphite is no less magmatic when it occurs in veins than the quartz with which it is associated. The quartz is a hydrothermal product.

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[1] Ann. Chim. Phys., 1910, 29:5

[2] Bastin, E. S., Econ. Geol., 5:134.

[3] Wright, F. E. & Larson, " Quartz as a Geologic Thermometer," Amer. Jour. Sci., 1909, 28:423-77.
See Fenner, C. N., Amer. Jour. Sci. iv, 36:331-81.

[4] Weinschenk, E.," Memoire sur l'historie du Graphite" Compt. Rend. VIII Congr. Geol. Internat. 1900, p. 447. Zur Kenntniss der Graphitlagerstätten.

Reasoning based upon the work of H. Dixon[1] indicates that the following reactions are reversible:

$$CO_2 + 2H_2 \rightarrow 2H_2O + C$$
$$2CO + 2H_2 \rightarrow 2H_2O + 2C$$

But the intermediate steps appear to be:

Above 900° C.	$2CO_2 + 2H_2 \rightarrow 2CO + 2H_2O$
Below 900° C. / Above 500° C.	$2CO + 2H_2O \rightarrow 2CO_2 + 2H_2$
Below 500° C.	$CO_2 + 2H_2 \rightarrow 2H_2O + C$

This goes to show that the oxides of carbon (gases) in the presence of gaseous water react to form graphite. Much of this water is probably magmatic, while some of it may be derived from the sediments. Available analyses of such rocks give from 1 to 2 per cent of water. This may partly explain the occurrence of graphite at the margins of pegmatites; the heat of the intrusive releasing it from the sediments and acting as one of the reagents. In a similar manner the CO_2 from limestones ($CaCO_3$) may have been liberated and thus there is furnished another reagent for the process.

Applying the theories outlined above it is reasonable to expect that "any magma which contains sufficient water, upon coming in contact with bituminous (sediments) may be expected to convert all that portion of the carbon which is heated above . . . 600° C. to the oxide state. The resulting gases are soluble in water and silicate melts. When this solution cools below 600° C. graphite may be expected to crystallize out . . ."[2] If this explanation of the origin of graphite is correct, then certain contact deposits may have a complex origin; the carbon being derived from organic remains in sediments was picked up by the intrusive (as oxides) and redeposited. Such a process may possibly be the one responsible for the contact and vein types on Lead hill. This is suggested upon the basis that in the Barrett Construction Company's abandoned spar quarry, on the eastern slopes of Lead hill, there is shown the Hague gneiss enveloped by the same pegmatitic-granite mass that forms Lead hill. If the stratigraphy of the Grenville, as here developed,

[1] Dixon, H., Jour. Chem. Soc., 1886, 49: 94.
[2] Winchell, loc. cit.

can be relied upon, it is safe to infer that a bed of the Dixon schist should have underlaid the hill before the injection of the igneous rock. Thus the pegmatite may have derived the graphite from the Dixon and deposited the graphite upon contact with the higher lying beds such as the amphibolite in the Young Lion pit, which may be the Beech Mountain rock, etc.

The slightly contact metamorphosed type. The enriched ores of the International, Rowland and Sacandaga properties probably were developed by a mild form of this absorption and redeposition action of the thermal waters upon the graphite of the original Dixon schist, causing a concentration-enrichment effect.

Summary. Thus it is concluded that the graphite in the Adirondacks has been formed by several distinct and rather complex processes. The organic origin is proposed to explain the Dixon, Bear Pond schists, and the Rock Pond "arkosite." The inorganic theory is regarded as the most plausible to explain the contact and vein deposits, while a combination of the two is held to account for the International-Rowland-Sacandaga type and perhaps some others.

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