New York State Education Department

NEW YORK STATE MUSEUM

66th ANNUAL REPORT

1912

In 3 volumes

VOLUME 2

APPENDIXES 2-5

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1914

State of New York

No. 43

IN ASSEMBLY

March 16, 1914

66th ANNUAL REPORT

OF THE

NEW YORK STATE MUSEUM

VOLUME 2

March 18, 1913

To the Legislature of the State of New York

We have the honor to submit herewith, pursuant to law, as the 66th Annual Report of the New York State Museum, the report of the Director, including the reports of the State Geologist and State Paleontologist, and the reports of the State Entomologist and the State Botanist, with appendixes.

St Clair McKelway
Vice Chancellor of the University

Andrew S. Draper
Commissioner of Education

Appendix 2

Economic geology

Museum Bulletin 166

166 Mining and Quarry Industry of New York 1912

University of the State of New York Bulletin

Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 24, 1912

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No. 549 ALBANY, N. Y. AUGUST 15, 1913

New York State Museum

JOHN M. CLARKE, Director

Museum Bulletin 166

THE MINING AND QUARRY INDUSTRY

OF

NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1912

BY

D. H. NEWLAND

University of the State of New York

Department of Science, July 9, 1913

Hon. Pliny T. Sexton

Vice Chancellor of the University

SIR: I beg to communicate herewith for publication as a bulletin of the State Museum, our annual report on the Mining and Quarry Industry of New York, which has been prepared by D. H. Newland, Assistant State Geologist.

Very respectfully

JOHN M. CLARKE

Director

THE UNIVERSITY OF THE
STATE OF NEW YORK

Approved for publication this 12th day of August 1913

Pliny T. Sexton

Vice Chancellor of the University

University of the State of New York Bulletin

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John M. Clarke, Director

Museum Bulletin 166

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1912

BY

D. H. NEWLAND

INTRODUCTION

The mineral resources of the State were very actively exploited in 1912 and the volume of business reported by many branches of the industry was of record proportions. In the face of the strong demand that prevailed throughout the year, prices for most products showed no marked advance; in fact they were but little above the average of the previous season, a period characterized by reaction and more or less pronounced depression. Under more favorable market conditions the yield, undoubtedly, would have reached a new figure; as it was the total fell short of the maximum by only a small amount.

A summary of the reports rendered by the mining and quarry enterprises throughout the State shows the actual value of the production to have been $36,552,784. This represented a gain of nearly 17 per cent, as compared with the amount reported for 1911, $31,730,747. The increase was more than enough to restore the loss incurred by the decline of the latter year and placed 1912 almost on a par with the record year of 1907 when the total reached $37,142,006.

The materials on which these production figures are based number over thirty and represent in most cases the first products of the mines and quarries. They do not of course cover the whole field of enterprise in this department of activity, since there are many large industries based on their further elaboration or manufacture, as well as others of equal importance engaged in the treatment of products secured from sources outside the State. Among such industries may be mentioned the manufacture of aluminum, calcium carbide, carborundum, pig iron and steel, soda products, coke, and many others that together greatly exceed in value of their outturn those branches under present consideration.

Among the metallic minerals found in the State, iron ore is the most valuable from an industrial standpoint. The gross output of this ore last year was 1,277,677 long tons. After allowance for concentration, which is practised by the Adirondack mines, there remained a total of 1,057,702 long tons of shipping ore which had a value of $3,349,095, as compared with 952,364 long tons valued at $3,184,057 for the year 1911. There was a good advance among the mines in the Clinton belt, though the magnetite ores as usual constituted the greater part of the production. New developments have been in progress which may lead to a material advance in the industry in the near future.

The clay-working industries contributed the largest items of the totals, with an aggregate value of $11,947,497 in 1912, and $9,751,659 in the preceding year. The large gain in production during the year was due largely to a better demand for structural materials, including common and pressed building brick, terra cotta, hollow fireproofing, etc., of which the total value amounted to $8,301,839, as compared with $6,473,857 in the preceding year. The number of brick for building purposes made in 1912 was 1,205,704 thousands, against 1,078,019 thousands in 1911, about three-fourths in each year being manufactured in the Hudson River district. The pottery trade also showed an improvement and the returns indicated a total value for the production of $2,876,762 which was a new record. About 200 firms were engaged in the various clay-working branches.

The improved conditions in the building trades also brought about an increased output of quarry materials, inclusive of granite, limestone, marble, sandstone and trap, which were valued in the aggregate at $5,718,994. The total for 1911 was $5,560,355. Divided according to uses the output for 1912 consisted of building stone valued at $692,534, monumental stone $103,641, curbstone and flagstone $621,327, crushed stone $2,754,839, and miscellaneous $1,546,-653. More than one-half the value was returned by the limestone quarries which furnish the greater part of the crushed stone used for concrete and macadam. The marble and trap quarries were less active than usual, but there was a gain in both granite and sandstone.

In the cement trade, conditions showed a great improvement compared with their trend in recent years, which had been steadily reactionary. The demand for both portland and natural cement was brisk and prices advanced steadily with the progress of the season. The combined product of the two kinds amounted to 4,783,535 barrels, against 3,691,373 barrels in 1911. The gain was mostly recorded by the portland cement plants which contributed 4,495,842 barrels to the total, as compared with 3,416,400 barrels in the preceding year. Natural cement constituted an aggregate of 287,693 barrels, against 274,973 in 1911. Owing to the fact that the output of the mills was delivered largely under contracts, the value of the production averaged less than in 1911, though current prices were considerably higher.

Salt is a commodity that has been produced in the State for upwards of a century. It is obtained both by mining underground and by sinking wells into the salt, the brine from these being evaporated by solar or artificial heat, or used directly for chemical manufacture. The quantity of salt raised from the mines and wells in 1912 amounted to 10,502,214 barrels, and had a value at the place of production of $2,597,260, both totals exceeding those for any previous year. Livingston county, with the only active salt mines in the State, was the leading producer.

The mining of gypsum, the raw material from which plaster of paris and hard wall plasters are made, has become an important industry of late years, having had a very steady growth in the last decade. The material is mainly produced by underground operations, though in some localities it is quarried. The output for 1912 amounted to 506,274 short tons and in its marketable forms had a value of $1,186,845.

The combined value of petroleum and natural gas, the only representatives of the class of mineral fuels obtained in the State, amounted last year to $3,220,647. There was a material gain in the production of natural gas, the well flow having been 6,564,659 M. cubic feet against 5,127,571 M. cubic feet in 1911; but the oil industry was less active and returned an output of only 782,661 barrels, as compared with 955,314 barrels. The heavy decline in the crude oil market in 1910 was responsible in large measure for the decreased output last year, as it put a check upon new drilling that is necessary to maintain a balance with the depletion of old wells.

Among the minor industries in which New York has a prominent place by reason of its natural resources, are those of talc, garnet, graphite and pyrite. Talc is mainly obtained from a single district in St Lawrence county, which has a practical monopoly of the fibrous talc trade. The production last year amounted to 61,619 short tons valued at $511,437, or about the usual quantity. Garnet for abrasive use is produced in Essex and Warren counties, and the output last year was 4112 short tons with a value of $117,325. Graphite of the more valuable crystalline sort is found in the Adirondack region; the total product last year was reported as 2,628,000 pounds and represented a value of $142,665. Pyrite for acid manufacture is mined in St Lawrence county.

The remaining mineral materials represented in the list of products for last year included apatite, clay, diatomaceous earth, emery, feldspar, marl, millstones, metallic paint, mineral waters, slate pigment, quartz, slate, sand, sand-lime brick, and zinc ore. There were no additions to the list during the year, but on the other hand one industry — that connected with the production of carbon dioxid from natural sources — was discontinued as the result of the recent action taken for the conservation of the Saratoga mineral waters.

Mineral production of New York in 1911

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement	Barrels	3 416 400	$2 930 434
Natural-rock cement	Barrels	274 973	134 900
Building brick	Thousands	1 078 019	5 443 303
Pottery			2 196 054
Other clay products			2 083 405
Crude clay	Short tons	14 193	11 982
Emery	Short tons	769	8 810
Feldspar and quartz	Short tons	21 802	75 719
Garnet	Short tons	4 285	121 759
Graphite	Pounds	2 510 000	137 750
Gypsum	Short tons	446 794	1 092 598
Iron ore	Long tons	952 364	3 184 057
Millstones			13 177
Metallic paint	Short tons	7 237	68 870
Slate pigment	Short tons	1 646	12 864
Mineral waters	Gallons	8 923 628	756 147
Natural gas	1000 cubic feet	5 127 571	1 547 077
Petroleum	Barrels	955 314	1 251 461
Pyrite	Long tons	53 453	251 466
Salt	Barrels	10 082 656	2 191 485
Sand and gravel			1 727 367
Sand-lime brick	Thousands	15 178	92 064
Roofing slate	Squares	11 273	52 311
Slate manufactures			Nil
Granite			148 633
Limestone			3 174 161
Marble			278 041
Sandstone			1 060 106
Trap			899 414
Talc	Short tons	65 000	552 500
Other materials [1]			232 832
Total value			$31 730 747

[1] Includes apatite, carbon dioxid, diatomaceous earth, marl and zinc ore.

Mineral production of New York in 1912

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement	Barrels	4 495 842	$3 488 931
Natural-rock cement	Barrels	287 693	142 165
Building brick	Thousands	1 205 704	6 889 940
Pottery	....	....	2 876 762
Other clay products	....	....	2 180 795
Crude clay	Short tons	8 583	18 980
Emery	Short tons	589	6 479
Feldspar and quartz	Short tons	28 584	115 419
Garnet	Short tons	4 112	117 325
Graphite	Pounds	2 628 000	142 665
Gypsum	Short tons	506 274	1 186 845
Iron ore	Long tons	1 057 702	3 349 095
Millstones	....	....	15 358
Metallic paint	Short tons	8 012	72 176
Slate pigment	Short tons	1 750	12 800
Mineral waters	Gallons	9 682 447	760 847
Natural gas	1000 cubic feet	6 564 659	1 882 297
Petroleum	Barrels	782 661	1 338 350
Pyrite	Long tons	58 137	286 577
Salt	Barrels	10 502 214	2 597 260
Sand and gravel	....	....	2 549 729
Sand-lime brick	Thousands	21 231	133 736
Roofing slate	Squares	9 738	83 222
Slate manufactures	....	....	Nil
Granite	....	....	202 096
Limestone	....	....	3 510 445
Marble	....	....	241 847
Sandstone	....	....	1 280 743
Trap	....	....	483 863
Talc	Short tons	61 619	511 437
Other materials [1]	....	....	74 600
Total value	....	....	$36 552 784

[1] Includes apatite, diatomaceous earth, marl and zinc ore.

CEMENT

The cement business last year was of large volume, but in the early months was conducted on a small margin of profit to the manufacturer. Prices showed, however, an upward trend with the progress of the season, the first really sustained improvement in the market that had taken place for some time. This lent an encouraging aspect to the year's record as compared with that of 1910 or 1911, and appeared to indicate that the critical period which tested the financial and technical equipment of the plants as never before had been passed.

The opening of the year found the companies carrying heavy stocks and prices on the same low level they reached in the latter part of the preceding season. Demand was exceptionally heavy and served to absorb most of the surplus in the next few months, so that by spring the mills were able to make a slight advance in quotations. There was no check to activity and in midsummer an additional increase was made, followed by others from time to time until by December, New York prices reached a level fully 50 per cent higher than that at the beginning of the year. The actual price movement was from about 60 cents a barrel in January to 95 cents a barrel in December, the quotations being for cement in bulk at the mill. Inasmuch as much of the selling by the manufacturers is on contract, they were, of course, not able to realize the full benefits of the advance and the average basis on which the year's sales were made may be placed at around 78 cents.

The natural cement trade in which New York State is still represented, though to a much smaller extent than formerly, followed practically the same course as indicated for the portland branch. The demand was active and at increasing prices with the season's advance. Owing to the adverse conditions experienced by manufacturers in the few preceding years, more serious in their case than in that of the portland cement companies, their plants were not in shape to allow them to take much advantage of the conditions; consequently, the outturn was not materially different from the figure reported for 1911.

In volume of production, the year was notable, the total having been exceeded but once or twice in the history of the industry. The actual quantity of portland and natural cements manufactured was 4,783,535 barrels as compared with 3,691,373 barrels in 1911 and 3,657,015 barrels in 1910. The only other years that made a comparable showing were in the period from 1895 to 1900 when the natural cement business was at the height of prosperity and contributed an output about equal to that reported last year by the portland mills.

As shown in the accompanying tables, the production of portland cement in 1912 reached the figure of 4,495,842 barrels, against 3,416,400 barrels in 1911. Its value was $3,488,931, as compared with $2,930,434 in the preceding year. The average value of the product, however, was only 77.6 cents a barrel, against 85.8 cents for 1911. There were seven mills in operation during the year, the same number as reported active in 1911.

The output of natural cement amounted to 287,693 barrels, valued at $142,165, the larger part of which was contributed by a single plant in the Rosendale district of Ulster county. The total for 1911 was 274,973 barrels with a value of $134,900. The average value was approximately 50 cents a barrel in both years. Aside from Ulster county, the only other county which was represented in the industry was Onondaga with three small plants.

Production of cement in New York

YEAR	PORTLAND CEMENT		NATURAL CEMENT	
	Barrels	Value	Barrels	Value
1892	124 000	$279 000	3 780 687	$3 074 781
1893	137 096	287 725	3 597 758	2 805 387
1894	117 275	205 231	3 446 330	1 974 463
1895	159 320	278 810	3 939 727	2 285 094
1896	260 787	443 175	4 181 918	2 423 891
1897	394 398	690 179	4 259 186	2 123 771
1898	554 358	970 126	4 157 917	2 065 658
1899	472 386	708 579	4 689 167	2 813 500
1900	465 832	582 290	3 409 085	2 045 451
1901	617 228	617 228	2 234 131	1 117 066
1902	1 156 807	1 521 553	3 577 340	2 135 036
1903	1 602 946	2 031 310	2 417 137	1 510 529
1904	1 377 302	1 245 778	1 881 630	1 207 883
1905	2 117 822	2 046 864	2 257 698	1 590 689
1906	2 423 374	2 766 488	1 691 565	1 184 211
1907	2 108 450	2 214 090	1 137 279	757 730
1908	1 988 874	1 813 622	623 588	441 136
1909	2 061 019	1 761 297	549 364	361 605
1910	3 364 255	2 939 818	292 760	147 202
1911	3 416 400	2 930 434	274 973	134 900
1912	4 495 842	3 488 931	287 693	142 165

With continued favorable conditions in the market, a further increase in the State's cement industry may be expected. The annual total should soon exceed 5,000,000 barrels, and it is certain that the local portland industry is destined to become a very prominent factor in that trade.

For the current year, the increment of an additional plant will appear in the total, as the Millen Portland Cement Co. began operations on April 1st. This company built a new mill at Jamesville, Onondaga county, a few years ago, but did not start production until this spring. The mill has a capacity of 700 barrels a day. The materials used are limestone from the large quarries of the Solvay Process Co., nearby, and local clays.

CLAY

The clay deposits in the State are not noteworthy for their variety of character or industrial adaptability, and in fact are mainly restricted to the common sorts useful for ordinary building brick and materials of that class. They are widely distributed, however, so that practically every center of population is or may be supplied with clay structural materials from nearby yards. This branch of the industry is consequently of the greatest importance, the continued rapid expanse of population in the larger cities furnishing a market that is scarcely rivaled by that of any other state.

The clays that are utilized in brick manufacture are, with few exceptions, modified glacial deposits. Residual clays are practically absent. They have been transported from the Adirondacks and other regions of accumulation, or produced by the abrading action of the ice upon shales, and deposited in the streams and lakes that existed along the margin of the ice sheet. The most extensive beds occur in the Hudson and Champlain valleys which in late Glacial time were occupied by lakes which reached high above the present water levels. In the Hudson valley they are interstratified with sands and gravels, and build terraces on either side which lie at different elevations up to 300 feet or more. The workable clays often attain a thickness of 50 feet and in some places they exceed 100 feet. The clays have a bluish color, but are weathered to brown or yellow for some distance from the surface. They contain relatively high percentages of iron, lime and other fluxing ingredients and consequently fuse at a relatively low temperature. The color of the burned clay is generally red.

Glacial clays, more or less modified by water sorting, are also abundant in the interior and western parts, specially in the larger stream valleys. Syracuse, Rochester and Buffalo have rather extensive brick manufacturing industries which supply the local markets. Clay suitable for stoneware is found near Syracuse.

In addition to common brick, which is the principal article produced from these clays, the list of manufactures includes drain tile, hollow blocks, fireproofing and earthenware.

On Long Island and Staten Island are found local deposits of Cretaceous clays, similar to those of New Jersey. They have been utilized to some extent for stoneware and brick by Long Island manufacturers, but the principal developments have been at Kreischerville and Green Ridge, Staten Island. At Kreischerville, excellent grades of fire brick and fancy pressed brick are made from these clays.

Besides the surficial clays, the shale beds which are found in the Paleozoic strata, especially of the Devonic system, afford much material that is adapted for building and paving brick, terra cotta, tile etc. They are utilized mainly in the southern and western sections. Among the localities where they are worked are Angola and Jewettville, Erie county; Jamestown, Chautauqua county; Alfred Center, Allegany county; and Corning, Steuben county. At Catskill, on the Hudson, building and paving brick are made from Hamilton shale that is dug at Cairo.

The manufacture of porcelain and chinawares has become an important branch of the industry, having shown a quite remarkable growth during the last decade. Its importance, however, is ascribable to the local facilities for assembling the raw materials and marketing the finished products. The kaolin and ball clays for the purpose are brought in from the southern states, and some of the kaolin is imported from England. The quartz and feldspar mostly come from New England, though of these materials New York possesses considerable resources which would seem to be capable of supplying some of the local requirements.

PRODUCTION OF CLAY MATERIALS

The accompanying tables give the production of clay materials during the last two or three years, the statistics being arranged according to items of manufacture and also, so far as practicable, according to counties in which the operations were carried on. They are based on reports submitted by the individual plants.

There was some improvement in the conditions affecting the clay-working industry last year as compared with those prevailing in 1910 and 1911, most noticeable in the increased output of building brick, which represents in value about one-half the entire production. The gain may be considered as indicative of a more normal state of business, after the pronounced depression that characterized the previous season, but did not suffice to bring the total up to a new record. It was mostly contributed by the brick manufacturers in the Hudson valley, who sell in the New York market. The average prices in that important center were considerably above those reported for 1910 and 1911.

Among the other branches of the clay-working industry, those of pottery and terra cotta also showed good increases, the production of pottery being much the largest ever reputed. The remaining products, inclusive of paving brick, fire brick, drain tile, sewer pipe and fireproofing were manufactured on a reduced scale.

The actual value of the production of clay materials of all kinds in 1912 was $11,947,497 as compared with a value of $9,751,659 in 1911 and $11,518,982 in 1910. The gain for the year was $2,195,838 or about 23 per cent. The largest value recorded for any year was in 1906 when it amounted to about $14,000,000.

Production of clay materials

MATERIAL	1910	1911	1912
Common brick	$6 563 212	$5 310 511	$6 646 436
Front brick	119 859	132 792	243 504
Vitrified paving brick	333 511	307 529	174 048
Fire brick and stove lining	464 693	413 500	380 005
Drain tile	254 679	202 292	122 571
Sewer pipe	137 731	138 258	77 644
Terra cotta	1 062 017	718 700	1 139 291
Fireproofing	256 820	229 627	230 833
Building tile	65 190	82 217	42 575
Miscellaneous	134 752	20 179	13 828
Pottery	2 136 518	2 196 054	2 876 762
Total	$11 518 982	$9 751 659	$11 947 497

The product of common building brick had a value of $6,646,436 as compared with $5,310,511 in 1911, representing an increase of $1,335,925. Front brick also showed an increase, with a total value of $243,504, against $132,792. Vitrified paving brick accounted for a value of $174,048, as against $307,529, the large decrease being due to a suspension of operations by one of the larger manufacturers. Fire brick and stove lining were valued at $380,005, as compared with $413,500 in the preceding year. The output of drain tile fell off very considerably, with a total of $122,571, against $202,292 in 1911. Similarly, that of sewer pipe amounted to only $77,644, against $138,258 in 1911. The production of terra cotta was valued at $1,139,291, as compared with $718,700; of fireproofing at $230,833, against $229,627; and of building tile, inclusive of roofing and floor tile, at $42,575, against $82,217. The miscellaneous clay manufactures, including such items as flue lining, fire tile and shapes, conduit pipes and acid-proof brick, amounted to $13,828, against $20,179 in 1911. The potteries of the State reported an output valued at $2,876,762, against $2,196,054 in the preceding year.

Of the 38 counties in the State that had representation in the clay-working industry last year, Onondaga stood at the head in the value of its product which reached a total of $1,368,345. In 1911 it also held the same place with a value of $912,892. The greater part of the product consisted of pottery which is an important industry in Syracuse and vicinity. Ulster county ranked second in the list and contributed a total of $1,296,779, all reported by the brick yards in the Hudson River section. Rockland county displaced Erie county which held third place in the previous years by reporting a value of $994,967, also represented by common building brick. Erie county with a diversified industry that includes most of the common clay manufactures besides pottery ranked fourth with products valued at $810,516. The other counties that reported a value exceeding $500,000 were Dutchess ($665,082) Orange ($615,155) Kings ($574,805) and Schenectady ($539,928).

Production of clay materials by counties

COUNTY	1910	1911	1912
Albany	$641 227	$470 503	$457 694
Allegany	*a*	9 000	*a*
Cattaraugus	63 887	90 153	135 480
Cayuga	20 675	15 724	3 740
Chautauqua	129 331	166 322	113 315
Chemung	*a*	76 169	79 510
Columbia	454 550	284 475	381 888
Dutchess	649 862	648 151	665 082
Erie	841 726	755 602	810 516
Greene	266 452	139 578	202 306
Jefferson	7 997	*a*	3 630
Kings	569 720	602 756	574 805
Livingston	*a*	70 295	125 642
Monroe	264 421	325 849	246 264
Montgomery	*a*	*a*	14 400
Nassau	111 650	105 740	119 708
New York	*a*	*a*	56 884
Niagara	22 882	25 426	22 357
Oneida	126 907	95 605	85 975
Onondaga	833 892	912 892	1 368 345
Ontario	269 549	255 298	341 617
Orange	761 500	565 152	615 155
Queens	551 375	402 398	613 605
Rensselaer	348 172	173 564	169 179
Richmond	633 010	470 591	723 875
Rockland	1 080 117	747 040	994 967
Saratoga	388 428	393 490	516 632
Schenectady	505 966	486 327	539 928
Steuben	219 615	149 649	181 663
Suffolk	101 560	73 750	92 150
Ulster	1 121 460	829 035	1 296 779
Warren	*a*	*a*	17 875
Washington	3 685	10 350	19 620
Westchester	371 328	297 997	344 798
Other counties *b*	158 038	102 778	12 113
Total	$11 518 982	$9 751 659	$11 947 497

a Included under other counties.
b In 1910, aside from counties marked (*a*), are included Genesee, St Lawrence, Tioga, Tompkins and Wayne counties. In 1911, aside from counties marked (*a*), are included Clinton, Genesee, St Lawrence, Tompkins and Wayne counties. In 1912, aside from counties marked (*a*), are included Clinton, St Lawrence, Tompkins and Wayne counties.

MANUFACTURE OF BUILDING BRICK

The manufacture of building brick is the most important branch of the clay-working industry, with regard both to the number of plants represented and the value of the product. Altogether there were 152 yards that reported as active last year, distributed among 31 counties. The total number of common brick made was

1,187,973,000. This represented an increase over the number manufactured in the preceding year, which totaled 1,066,982,000. The gain came from the counties along the Hudson river, from Rensselaer county southward, and was due to the improvement in the building trades in New York and other large cities in the vicinity. The New England trade also showed a better demand, as instanced by the increase in the production of the plants which shipped mainly to that market, notably those of Saratoga county.

The value of the common brick made last year was $6,646,436, or an average of $5.59 a thousand, as compared with $5,310,511, an average of $4.98 a thousand in 1911. The rise in prices indicated by this comparison was very substantial and the season on the whole may be considered as quite prosperous in this branch of the industry. Since 1910 the selling value at the yards has increased nearly 20 per cent.

In addition to the common building brick, there were manufactured last year 17,731,000 front or fancy brick with a value of $243,504. The output for 1911 numbered 11,037,000 valued at $132,792. The aggregate production of brick for building purposes was thus 1,205,704,000 valued at $6,889,940.

A feature of the record that appears on comparison of the statistics for several years past is the marked falling off in the number of plants and the tendency toward the restriction of the active industry to those localities or districts which possess natural advantages for manufacturing or marketing the product. As the annual output has been maintained at a fairly even rate, aside from fluctuations due to market influences, this indicates that the average outturn has enlarged very considerably, no doubt with resulting economies. In 1906, for instance, there were 231 yards in operation, distributed among 37 counties.

Production of common building brick

COUNTY	1911		1912	
	Number	Value	Number	Value
Albany	59 517 000	$319 503	69 100 000	$381 694
Cattaraugus	1 088 000	8 109	570 000	4 510
Cayuga	1 813 000	11 724	....	....
Chautauqua	4 140 000	28 406	3 040 000	20 483
Chemung	....	....	12 300 000	79 510
Columbia	57 695 000	284 475	69 434 000	381 888
Dutchess	133 229 000	648 151	122 085 000	665 082
Erie	35 975 000	222 673	43 184 000	277 696
Greene	28 779 000	139 578	36 573 000	199 360
Livingston	425 000	2 550	....	....
Monroe	21 100 000	116 600	22 632 000	147 107
Montgomery	....	....	3 200 000	14 400
Nassau	15 790 000	98 445	15 399 000	105 048
Niagara	3 178 000	25 426	3 114 000	22 357
Oneida	14 434 000	93 105	12 525 000	79 575
Onondaga	22 000 000	132 750	16 985 000	119 134
Ontario	....	....	2 500 000	16 250
Orange	121 800 000	565 152	113 363 000	615 155
Rensselaer	13 352 000	67 760	13 800 000	76 452
Richmond	23 456 000	106 823	33 297 000	175 358
Rockland	162 400 000	747 040	184 595 000	994 967
Saratoga	81 575 000	392 427	103 210 000	516 632
Steuben	....	....	1 988 000	13 922
Suffolk	11 500 000	68 750	15 200 000	92 150
Ulster	178 287 000	829 035	231 550 000	1 296 779
Warren	....	....	3 575 000	17 875
Westchester	52 654 000	263 498	52 844 000	318 422
Other counties *a*	22 795 000	138 531	1 910 000	14 630
Total	1 066 982 000	$5 310 511	1 187 973 000	$6 646 436

a Includes in 1911 Chemung, Clinton, Montgomery, Ontario, St Lawrence, Tompkins, Warren and Washington counties. Includes in 1912 Cayuga, Clinton, Jefferson, Livingston, St Lawrence Tompkins and Washington counties.

Output of common brick in the Hudson River region in 1911

COUNTY	NUMBER OF PLANTS	OUTPUT	VALUE	AVERAGE PRICE PER M
Albany	10	59 517 000	$319 503	$5 37
Columbia	6	57 695 000	284 475	4 93
Dutchess	15	133 229 000	648 151	4 85
Greene	5	28 779 000	139 578	4 85
Orange	6	121 800 000	565 152	4 64
Rensselaer	4	13 352 000	67 760	5 08
Rockland	24	162 400 000	747 040	4 60
Ulster	20	178 287 000	829 035	4 65
Westchester	6	52 654 000	256 449	4 87
Total	96	807 713 000	$3 857 143	$4 78

Output of common brick in the Hudson River region in 1912

COUNTY	NUMBER OF PLANTS	OUTPUT	VALUE	AVERAGE PRICE PER M
Albany	12	69 100 000	$414 600	$6 00
Columbia	5	69 434 000	381 888	5 50
Dutchess	17	122 085 000	665 082	5 45
Greene	6	36 573 000	199 360	5 45
Orange	8	113 363 000	615 155	5 43
Rensselaer	4	13 800 000	82 800	6 00
Rockland	23	191 595 000	1 063 352	5 55
Ulster	21	231 550 000	1 296 779	5 60
Westchester	6	52 844 000	318 422	6 03
Total	102	900 344 000	$5 037 438	$5 60

Hudson River region. Brick manufacture is carried on in the tidewater section of the Hudson river under a uniformity of conditions and on a scale that is unique in this country, if not in the world. The region embraces the nine counties along both sides of the river from Rensselaer and Albany to Manhattan island, to which may be added the proximate portion of New Jersey embraced in Bergen county. The same kind of clay is used throughout with similar methods of treatment, and the product is practically all of one grade which is classed in the market as "Hudson common hard."

In the nine counties within New York State are included about 125 yards with a capacity of one and one-quarter billion brick in the six or seven months that constitute the average season. So large an output is seldom warranted by the market requirements, however, and the average outturn may be placed at about one billion. The maximum number reported in any recent year was 1,230,000,000 in 1906.

The principal market for the product, of course, is New York and its environs, though some are shipped to the New England towns. Practically the whole output goes by water, on barges which hold upward of 200,000 each and which are made up into a fleet towed by one or more tug boats. In the lower stretch of the river, the shipments from the yards continue throughout the year, whereas the more remote ones have to concentrate their shipments during the months of open water. Formerly the product was handled by several commission agents operating independently and in competition, but in 1911, a general selling agency was established under the title of the Greater New York Brick Company, which now disposes of the output of all but a few yards. The total costs of shipment, storage in New York and commission for sales may be placed at about $1.25 a thousand.

The season of 1912 may be considered a fairly prosperous one with respect to the number of brick marketed and prices, comparing favorably in the latter particular with the preceding year or two. The output was larger than in 1911, but fell considerably below that of 1910 when under the effects of a period of overextended activity, the production far exceeded the market requirements. The surplus of that year amounted to fully 350,000,000 which were carried over into 1911, and which justified a policy of curtailment on the part of manufacturers so as to maintain a closer balance with the market. By thus restricting the outturn, manufacturers were able to maintain prices during 1911 and even to receive somewhat higher returns than the average for the previous year. The opening of the 1912 brickmaking season ranged from the middle to the latter part of May and was delayed about two weeks beyond the average date on account of wet weather. There were about 100,000,000 old brick on hand at that time. Prices started at around $6.50 a thousand, New York basis, or say $5.25 at the yard. They gradually advanced with the progress of the season and reached $7.25 in December. The open weather in the early winter enabled manufacturers to continue shipments much longer than usual, so that the stock in New York was unusually heavy at the first of the year.

The total number of brick in stock at the yards and in New York on January 1, 1913, is placed according to authoritative information at 312,004,000. The stock on May 1st was 141,204,000. These figures, of course, refer to the stocks which are held for sale in the New York market. A few plants in the more northerly counties sell a part or the whole of their output locally, as those in the vicinity of Albany and Troy, or ship by rail to the interior of the State or to New England.

The total number of brick made in the nine counties along the river last year was 900,344,000. In all, there were 102 yards active. The output at the average selling prices of the year was valued at $5,037,438, or $5.60 a thousand. The total number for 1911 was 807,713,000 valued at $3,857,143 or $4.78 a thousand. The gain in price during the past two years is well shown by comparison with the figures for 1910 when the output was larger than last year's by 200,000,000 but actually fell a little short of the given total value.

Of the several counties, Ulster leads in quantity and value of its product, with a total last year of 231,550,000 valued at $1,296,779. Rockland holds second place, contributing 191,595,000 valued at $1,063,352. Dutchess and Orange counties come next in order with nearly the same output.

OTHER CLAY MATERIALS

The manufacture of vitrified paving brick was carried on by four companies in Cattaraugus, Chautauqua, Erie and Steuben counties, the same number as in 1911. The number of paving brick made was 11,031,000 valued at $174,048, against 18,996,000 valued at $307,529 in the preceding year. The reduced output was caused largely by a shut-down of the plant at Catskill for most of the year, the plant having been taken over by a new company known as the Tidewater Brick Co. The average price of paving brick was $15.78 a thousand, against $16.19 a thousand in 1911.

Fire brick and stove lining were made in Erie, Kings, Rensselaer, Richmond, Washington and Westchester counties and their combined value was $380,005 against $413,500 in 1911. The number of fire brick made was 9,011,000 valued at $327,412. The stove lining was valued at $52,593. There were nine companies in operation, the same number as in the preceding year. Most of the clay employed in the manufacture of the materials comes from outside the State, though the product of Richmond county is made from local clays.

The output of drain tile was contributed by nine counties, of which Albany had the largest product. The value of the year's manufacture amounted to $122,571 against $202,292 in 1911. Reports were received from 16 active plants, or the same number as reported in the previous year. The value of the sewer pipe produced was $77,644 as compared with $138,258, all from Monroe county.

Fireproofing, including terra cotta lumber, hollow brick and various other kinds of hollow clay ware used for fireproofing, was made last year by six companies with plants situated among the counties of Erie, Kings, Monroe, New York, Oneida and Rensselaer. The total value of the output was $230,833, as compared with $229,627 in 1911 when 7 companies were active. Local clays are employed for these articles.

Building tile, including roofing tile, vitrified floor tile, and terra cotta tile, was reported from Allegany, Kings and Monroe counties by 3 firms. The output had a value of $42,575, against $82,217 in 1911.

Architectural or ornamental terra cotta showed a large increase last year, reaching a value of $1,139,291, as compared with $718,700 in 1911, the largest that has ever been reported. Its manufacture is carried on by 3 companies in Queens, Richmond and Steuben counties.

The miscellaneous clay materials accounted for a value of $13,828, against $20,179 in the preceding year.

POTTERY

The manufacture of pottery has become one of the larger branches of the clay-working industry, showing a steady gain of output during the last several years until it now ranks second only to brickmaking in importance. The materials used are mostly brought from outside sources as there are no deposits of white-burning clays suitable for china or porcelain within the State. Feldspar, quartz and stoneware clays, as well as an excellent grade of slip clay, exist in large deposits, but except for slip clay, the local resources are not utilized to any extent for pottery. The recent growth of the home market seems to afford opportunity for development of some of those resources, especially those of feldspar and quartz.

The products of New York potteries include porcelain and china tableware which are made chiefly by the Onondaga Pottery Co.

and the Iroquois China Co., of Syracuse, the Buffalo Pottery Co., of Buffalo, and the Union Porcelain Works, of Brooklyn. Porcelain electric supplies are manufactured by the Empire China Works, Brooklyn, Locke Insulator Co., with plants at Lima and Victor, Pass & Seymour, Syracuse, General Electric Co., and Weber Electric Co., Schenectady. Chemical and sanitary ware are made by the Chas. Graham Chemical Pottery, Brooklyn. The other products include stoneware, red earthenware, cream-colored ware, clay tobacco pipes, etc.

The total value of the pottery produced last year was $2,876,762, as compared with $2,196,054 in 1911. The electric and sanitary wares accounted for $1,727,553, of which the greater part was represented by the value of the electric supplies. The value of certain metal fixtures is included, however, with that of the electric supplies. China or porcelain tablewares accounted for the next highest total, $1,038,428. The stoneware was valued at $46,024 and red earthenware at $29,697. All other products represented a value of $35,060.

Value of production of pottery

WARE	1910	1911	1912
Stoneware	$41 925	$39 095	$46 024
Red earthenware	25 713	32 495	29 697
Porcelain and semiporcelain [1]	1 027 249	1 048 872	1 038 428
Electric and sanitary supplies	991 131	1 026 517	1 727 553
Miscellaneous	50 500	49 075	35 060
Total	$2 136 518	$2 196 054	$2 876 762

[1] Includes china tableware and cream-colored ware.

CRUDE CLAY

The clay produced in a few localities is not utilized by the original producers, but is shipped to others for manufacture, some of it going to points outside the State. This production, therefore, is listed separately from that of clay materials. The clays most extensively exploited for shipment are the Albany slip clay and the fire clay found on Staten Island. The slip clay is a variety of the ordinary glacial clays found in the Hudson valley in association with the brick clays, differing from the latter in its finer grain and higher content of alkaline constituents. It has a relatively low point of fusibility and when applied to clay wares as a slip, produces a rich, brown glaze. Stoneware clays are shipped in a small way from Onondaga county.

The records for 1912 show that the shipments of crude clay in that year amounted to 8583 short tons valued at $18,980. There were 5 producers engaged in this business. The corresponding total for 1911 was 14,193 short tons valued at $11,982. The difference in value indicated by the totals is accounted for by the varying proportions of the higher priced clays, slip and fire clays, included in the statistics for 1912.

EMERY

The emery business, which is confined to a few small operations near Peekskill, has not been very active in the last year or two. The shipments during 1912, as reported by the companies to whom they were made, amounted to 589 short tons, valued at $6479. In 1911 the shipments were reported as 769 short tons valued at $8810, and in earlier years were still larger, reaching as high as 1500 tons at one time.

The Peekskill emery is a hard, dense rock of rather variable composition and dark gray to black color. It occurs in small lenses, bands and irregular masses in the area of basic igneous rocks that outcrops south and east of Peekskill. The emery bodies are found mainly in the northern section of the area and apparently near the contact of the igneous, or Cortlandt, series with the sedimentary schists. They represent without much doubt segregations within the intrusive mass similar to the titaniferous magnetites that occur within the gabbros and anorthosites of the Adirondacks. The surrounding sediments may have been absorbed more or less into the igneous mass on its way to the surface, thereby contributing some of the aluminum which has crystallized out in the form of corundum and spinel. The intrusion took place after the deposition of the Hudson River strata which are made up largely of argillaceous materials.

The emery is a mixture of corundum, spinel and magnetite, with more or less of the silicate minerals that are found in the wall rocks. The proportion of the oxids varies greatly. In some places magnetite constitutes nearly the whole mass and such bodies have been worked in the past for their iron, though not with much success. Spinel (hercynite) is intimately associated with the magnetite, though its presence is seldom to be established without microscopic examination, being in finely divided particles scarcely distinguishable from the latter in the hand specimens. Its occurrence may account for the high aluminum percentages shown in analyses of the magnetites, even in the absence of corundum. The latter is a fluctuating constituent, constituting as much as 50 per cent of the emery in places, but usually considerably less. It appears in the form of thin prismatic crystals which are set off by reason of their light color and their relatively large size from the magnetite and spinel.

The mines consist of open cuts on the outcrop of the bodies, occasionally supplemented by a single underground level reached through an adit. They have little permanent equipment, being too small to warrant any considerable outlay for machinery; consequently there is a lack of stability and system to the operations. The present source of supply is mainly from one or two properties on the northern border of the Cortlandt area. The Keystone Emery Mills and the Blue Corundum Mining Co. have been the principal shippers of recent years. There are a number of mines in the section north of Dickinson hill and south of the east-west highway leading out of Peekskill, but most have been closed either on account of exhaustion or the unsuitable character of the material. Some of the more extensive workings are on the farms of John Buckbee and Oscar Dalton.

FELDSPAR

Feldspar is one of the minor products for which the market in this section hitherto has been rather limited. The pottery trade in which the better or more valuable grades find use has only recently come into prominence in New York, and the larger centers without the State, as those of Ohio, West Virginia and New Jersey, can usually be supplied more cheaply from other sources. Thus the principal quarries of pottery spar are found in New England, the Southern States and Canada. The local quarries in the Adirondacks and the southeastern metamorphic belt have never been able to compete very successfully in this branch of the business.

With the recent growth of the pottery business, now represented in many branches and in various parts of the State, there would seem to be opportunity for development of some of these resources to meet the requirements of the local market.

The uses of feldspar, aside from that of pottery manufacture, are sufficiently varied to afford a basis for regular quarry operations such as are carried on at present. One of the principal applications is in the preparation of roofing material, where it is employed as a surface coating with tar or some bituminous binder. The spar is crushed to pea size or a little coarser and by reason of its good cleavage yields flat surfaces that are of advantage in securing firm adherence. The purity of the material, however, is a subordinate factor; the pegmatite which contains more or less quartz, mica and other minerals, is crushed down to size just as it comes from the quarry. Besides the roofing grades, there is more or less fine material resulting from the crushing, which is sold for use in concrete and grout. A small quantity of the spar of the coarser size is sold for poultry grit. Crushed pegmatite for these purposes brings a low price, usually around $3 a ton.

The quarries and mills making roofing spar are situated in the Adirondack region, and include those of the Crown Point Spar Co. at Crown Point and the Barrett Manufacturing Co. at Ticonderoga. The methods of milling are simple, being based on a system of gradual reduction and sizing by screens. For the first step, a coarse crusher of the Blake type may be used, followed by rolls. At the mill of the Crown Point Spar Co., a higher grade of spar that is sold to enamel ware manufacturers is made by crushing to fine size in a chaser. The spar is first sent to the Blake machine, is then dried and instead of passing through the rolls, goes to the chaser.

Manufacturers of enamel ware, glazed brick and terra cotta consume considerable quantities of feldspar. The requirements for these purposes are more exacting than for ordinary roofing spar in that the material must be fairly free of iron or iron-bearing minerals and have a relatively low point of fusibility. The feldspar should also be fairly free of admixture with quartz, as the presence of the latter tends to raise the melting point. As soda feldspar or albite fuses at a slightly lower temperature than the potash varieties orthoclase and microcline, it has preference among the glazed brick and terra cotta manufacturers. The spar is prepared by fine grinding by a chaser or a pebble or ball mill, the operations in a pebble mill lasting about 5 hours and reducing the product to a size that over 90 per cent will pass a 100-mesh screen. The glaze is added to terra cotta by dipping or spraying with the prepared slip and then burning in a kiln.

Another use for the local product is in the manufacture of opalescent glass. This requires a spar of about the same quality as that for enamel ware, but may contain more quartz. The material is also ground to about the same size.

A considerable quantity of feldspar is employed as an abrasive, especially in the form of scouring soaps and powders. It is not readily apparent, however, why feldspar should be preferred to quartz for the purpose, unless it is on account of the cleavage which may, like the parting of garnet, provide sharp cutting edges. For scouring materials, the spar is ground to an impalpable powder. Feldspar is also an ingredient of emery, carborundum and corundum wheels, but here it serves rather as a binder than as an abrasive.

The output of feldspar showed a very large gain in 1912. In former years, it has ranged between 10,000 and 15,000 tons, according to the relative market conditions which were fairly stationary. Last year, however, it reached a total of 24,584 short tons, an increase of over 50 per cent in the twelve months, and in value amounted to $106,419. These figures include the unsorted pegmatite that is used for roofing material as above explained. The increase was contributed mostly by the Bedford Feldspar Co., which began operations during the year near the Kinkel quarries. The prices received for the product were on about the usual level: $3 a ton for sized roofing spar, $4.50 a ton for selected crude, and $6 to $8 for the ground spar used for enamel, glass manufacture, etc.

The Bedford Feldspar Co. opened a quarry just north of the Kinkel quarries at the base of the hill that marks the main outcrop of the pegmatite body. The continuation of the pegmatite in this direction was shown by drilling, being covered by soil and earth to a depth of about 15 feet. The present opening consists of a circular pit about 75 feet in diameter and 30 feet deep. A derrick is used to raise the rock to the surface. The pegmatite is somewhat stained and disintegrated in the upper part, but doubtless fresher material will be found in depth. It seems to carry more feldspar and less quartz than the average run of the rock exposed in the Kinkel quarries. The company has a mill at the quarry and all the output is shipped in ground state, to tile, enamel ware and glass manufacturers. The mill is equipped with ball mills and has a capacity of 35 or 40 tons a day.

The Kinkel quarries were operated during the year, but the product was shipped in crude form. The mill has been partly dismantled for the installation of new machinery, which will include pebble mills for the preparation of pottery spar. A considerable quantity of the no. 1 potash spar is stocked at the quarries until grinding can begin. The usual shipments of quartz were made from these quarries to the Bridgeport Wood Finishing Co., for use as wood filler. In addition, Kinkel & Son grind some quartz at a mill south of the quarries.

The latter company opened a new quarry in the spring of 1912, on the Bullock property, 2 miles south of the Bedford quarries. The opening lies west of the Hobby quarry on a parallel lens or dike. The pegmatite body measures about 30 feet in thickness, strikes northeast and dips 80° northwest. The wall rock as seen near the contact is a mica schist resembling the Manhattan schist farther south. The opening into the hill is about 75 feet long and shows a face 30 feet high. It can be deepened considerably without difficulty, as the present level lies near the summit of the hill. The feldspar differs from the Bedford varieties in that it is practically all of buff or cream-color and is shown by microscopic examination to consist of an intergrowth of microline and albite. The two kinds form alternating bands with the microline predominant, in the proportion of 2 or 3 to 1. In the Bedford quarries, the two varieties are segregated into a red microline and a white albite. There is very little intergrowth of feldspar and quartz and most of the product is shipped as no. 1 grade. The feldspar builds crystals that measure up to 2 or 3 feet in diameter and which occasionally show well-defined faces. The quartz is of smoky appearance. There is some muscovite in their scales and sheets associated with the feldspar, but it is mostly segregated. A black tourmaline and dark red garnet are among the accessory constituents.

GARNET

The production of abrasive garnet in the Adirondack region has continued from year to year with little change. The annual total usually is between 4000 and 5000 short tons, now and then slightly exceeding the latter figure. This seems to indicate a fairly stable market which affords the basis for a small and somewhat specialized industry, but which could hardly accommodate any large additional supplies of the mineral, as have been in prospect at different times, without radical readjustment of the present conditions. So far, no permanent or serious competition has developed as the result of mining operations in other sections of the country. For the last few years, however, there has been an importation of Spanish garnet which fills some of the requirements formerly met by the local product.

The active mines in the Adirondacks are situated in Essex and Warren counties. The North River Garnet Co., with mines and mill on Thirteenth lake, Warren county, southwest of North River, is the principal producer and carries on operations more or less continuously throughout the year. The garnet occurs in disseminated crystals in a hard, gneissoid hornblende — feldspar rock which has to be crushed and subjected to mechanical separation to recover the mineral, the separation being complicated by the slight difference in the gravity of the garnet and hornblende. The separation is effected mainly by jigs of special design and results in a very clean concentrate, with such variation of sizes as is required for abrasive purposes. The deposit, situated on the side of a mountain, is attacked by open-cut quarry methods which by reason of its large size and convenient position admit of great economy in breaking and transporting the rock.

The next most important source of garnet is on Gore mountain, a little west and south of North Creek, and some 4 or 5 miles southeast of the former deposit. The garnet here occurs in a band of dark hornblende gneiss, forming larger crystals than are found anywhere else in the Adirondacks. They measure a foot or even more in maximum diameter. The band of garnet gneiss is relatively narrow and is worked in open pits. The rock is broken down by sledges and the garnet, which has been shattered by regional compression, is readily picked out of the matrix by hand. These quarries are worked only in the open season. They are operated by H. H. Barton & Son Co. of Philadelphia.

Some production has been made from time to time from Garnet peak, in the town of Minerva, Essex county, about 3 miles from North River, on the Indian Lake road. The garnet is in small srystals, but plentifully distributed through the rock. In years past the American Glue Co. has been active at this locality, but made no output in 1912.

The Warren County Garnet Mills, Inc., of Riparius, have recently been active at a locality near Wevertown, south of North Creek. The mineral here is quite different in appearance from that produced in the other mines of this section, being partly granular or compact, rather pale in color, and lacking the tendency to break with smooth surfaces which is characteristic of the crystal garnet. It is also more or less intergrown with a green pyroxene. The material is hand-sorted and prepared for market by grinding to proper size.

Outside the rather limited area that includes the above named localities, the only occurrence of garnet that has recently attracted attention as a basis of mining operations is in northern Essex county, a few miles south of Keeseville. The deposits lie on Mt Bigelow, near the border but within the area of anorthosite — the basic igneous rock that forms the central part of the Adirondacks. They consist of bands, lenses and irregular bunches of granular or seemingly massive garnet which is fairly pure, except for inclusions of green pyroxene. They are inclosed directly within the anorthosite. Some of the bands or lenses as seen on the surface are 40 feet across, nearly solid garnet. They are worked in a rather small way by the American Garnet Co. of New York. A similar deposit is reported from the vicinity of Mt Pokamoonshine, southwest of Mt Bigelow.

The production of garnet by the different mines in the Adirondack region amounted last year to 4112 short tons valued at $117,325, as compared with 4285 short tons valued at $121,759 in 1911. These totals represent practically the extent of the industry in this country. Imports of abrasive garnet were reported by the collectors of customs at Boston and New Orleans, at which ports 548 tons valued at $9271 were received in the calendar year. The imports for 1911 were 693 short tons, with an invoice value of $10,526. With the exception of a small shipment of 1200 pounds from Nova Scotia, probably originating in Newfoundland, the garnet was all imported from Spain.

GRAPHITE

The graphite mines in the Adirondacks last year contributed about the usual product of refined crystalline graphite, but there were fewer developments than for some time. The output was 2,628,000 pounds and represented a value of $142,665. The total for 1911 was 2,510,000 pounds with a value of $137,750. There was little change in prices, the average having been 5.4 cents a pound, against 5.5 cents in 1911.

The American mine at Graphite, owned by the Joseph Dixon Crucible Co., continued as the main producer. This mine has had an enviable record, and is still the most successful of its kind in the State or in this country; it has been the pioneer in all that relates to the technology of treating the disseminated flake graphite which constitutes the principal source of the domestic production.

The Empire Graphite Co., with mines and mill in the town of

Greenfield, Saratoga county, made a small output which was obtained mainly from development work. The deposit has not been sufficiently opened to permit regular operations. At first the company attempted to secure an ore supply by open-cut methods, but owing to the decomposed condition of the outcrop the material thus obtained was unsuited for milling. During the past year an incline shaft was started to develop the deposit in depth. The company has a large concrete mill on the property.

The Saratoga Graphite Co. began operations last season in its mines near Kings Station north of Saratoga Springs.

The mines are open cuts along the outcropping edges of a quartz-graphite schist which occurs in broken areas within the Precambric formations that are otherwise represented by crystalline limestone, quartzite, amphibolite and gneissoid eruptives of granitic and basic character. They lie about one-half mile west of the Saratoga-Mt McGregor highway on the side and top of the ridge that marks the eastern boundary of the Precambrics as they fall off and disappear below the Paleozoic strata which border the Adirondack area. The first outcrop of the graphite rock on the north side of the ravine in which the mill is located shows from 10 to 12 feet in a single bed. The outcrop is much softened and iron stained through the decomposition of pyrite that is present in the fresh rock. This soft clayey material is of little value for milling purposes. The bed dips 30 degrees southeast, nearly parallel with the hill slope. The open cut is 50 feet long and 25 feet in width. Specimens of the less altered schist show an abundance of graphite, but in finely divided condition, most of the scales being less than 1 millimeter diameter. There is some brown mica present. About one-fourth mile farther west and higher up, a second area of the schist appears and has been opened by a pit which is 75 feet long by 30 feet in width. The schist here is not so thinly laminated and contains knots and stringers of feldspar. The beds dip to the southeast at a lower angle than in the easterly pit; they have a pitch to the northwest. The graphite here is somewhat coarser, the diameter of the flakes running up to 2 or 3 mm. The two areas are separated by a rather massive, dark hornblende gneiss that appears to be a metamorphosed gabbro. The output of refined graphite thus far has been small. The mill has the usual equipment of the Adirondack graphite mills. Stamps are used for final crushing and the separation is effected mainly by buddles, supplemented by air jigs and revolving screens for the final treatment.

GYPSUM

There was a noticeable, if not marked, improvement in the gypsum industry last year, as compared with the conditions noted in the preceding issue of this report. The market for gypsum and its products in 1911 was considerably depressed, and instead of showing the usual gain as for previous years, production fell below the total reported for 1910. The main reason for the dulness was the lessened activity in the building trades and the consequent smaller demand for wall plasters, the principal product of the local industry. The companies also reported a falling off in shipments of crude rock, of which the main item is represented by the sales to the portland cement plants and is second in importance only to the consumption by the calcining mills. In both these departments some betterment was apparent during the past season, not only with respect to the demand, but also to some extent in the prices received for the products. The gain came mostly in the latter part of the year and was well maintained to the close. The outlook at the beginning of the current year seemed favorable for the continuance of an active market, at least for the first part of the season.

The output of crude rock by the mines and quarries last year amounted to 506,274 short tons. This was the largest total on record; the next largest was in 1910 when it amounted to 465,591 short tons. In 1911, the output was reported as 446,794 tons. The increase for the year, therefore, was 59,480 tons or about 13 per cent.

The greater part of the output, as heretofore, was used at the mines for the manufacture of stucco and wall plaster. Most of the mining companies operate their own plants for milling and calcining the rock, their output entering the market only in finished form. A few, however, dispose of a part of their product in crushed or ground condition without further preparation, and one company ships all its rock in that form. The portland cement plants of New York, Pennsylvania and New Jersey take most of the raw gypsum, but some is shipped to plate glass manufacturers for bedding the glass sheets in polishing, and a small quantity is sold in ground form for agricultural uses. As it would be difficult to place a value on the rock that is manufactured directly by the producing companies, the plan has been adopted of reporting the total value in terms of the several products as they are marketed. Of the output last year, a total of 178,499 short tons was sold or held for sale as crude rock, as compared with 144,035 short tons thus sold in 1911. The value of the rock was $240,784 against $202,984 for the preceding year. The quantity ground for land plaster was 8213 short tons with a value of $17,779; as compared with 9959 short tons valued at $18,508 in 1911. The remainder represented approximately the amount calcined for stucco and wall plaster, of which the product amounted to 267,889 short tons valued at $928,282. The corresponding total in the preceding year was 262,249 short tons with a value of $871,106. The total value of the marketable products for the year thus amounted to $1,186,845 as compared with $1,092,598 in 1911.

Production of gypsum

MATERIAL	1911		1912	
	SHORT TONS	VALUE	SHORT TONS	VALUE
Total output, crude	446 794	....	506 274	....
Sold crude	144 035	$202 984	178 499	$240 784
Ground for land plaster	9 959	18 508	8 213	17 779
Wall plaster, etc. made	262 249	871 106	267 889	928 282
Total	....	$1 092 598	....	$1 186 845

The production of crude rock was contributed by relatively few companies, about ten in all, and was divided among the four counties of Onondaga, Monroe, Genesee and Erie. While in earlier years most of the output was made in the eastern section in Madison, Onondaga and Cayuga counties, by far the greater proportion now comes from the western deposits which are the basis of a prosperous calcining industry. The mines of that section rank with the largest and best equipped of their kind in the country.

In Onondaga county the output has fallen off in recent years, owing to the decline in the land plaster business, to which there has succeeded no commensurate development of other branches. Only one or two quarries are now operated out of the number that have been opened along the extensive outcrop of the beds. The present supply is derived from the vicinity of Lyndon, and mainly from the Severance quarry which has been worked by the Fayetteville Gypsum Co., for supply of rock to calcined-plaster works in New York. The rest of the output from this section was used locally by the land plaster mills at Fayetteville and Jamesville.

The large quarries at Union Springs, Cayuga county, were not active in 1912, but have recently been taken over by the Cayuga Lake Portland Cement Co. for supply of gypsum to their works at Portland Point, near the southern end of Cayuga lake. After pumping out the quarry pit in the spring, active shipments were begun about June 1st. The gypsum is rather low grade, but constitutes such a thick series of beds that it can be extracted very cheaply, and the situation is convenient for shipment to the portland cement plants of eastern Pennsylvania. The rock is taken from the quarry to a mill at the lakeside when it is crushed and loaded into cars.

The mines of Monroe county increased their production during the year, but there was little change otherwise in that section. The county ranked second to Genesee in quantity of rock mined. About two-thirds of the total was calcined at the mines and the rest sold crude to portland cement makers, or ground to land plaster. The Lycoming Calcining Co., the Consolidated Wheatland Plaster Co., and the Empire Gypsum Co. operated calcining plants, while the Oatka Gypsum Co. sold all its output in crude form.

At Mumford, the Delac Gypsum Products Co. did some prospecting and started construction work on a mill for the manufacture of the calcined plasters. The company secured options on the M. Skivington farm north of Mumford, where five test holes were drilled, in all of which gypsum was found. A hole located near the southern end of the property on the flat along Allen creek gave the following section, according to records in possession of Mr Skivington:

Material	Feet	Inches
Surface materials	8	6
Limestone	2	–
Ashes (shaly gypsum)	1	6
Rock	7	–
Gypsum and ashes	3	8
Limestone and ashes	9	4
Gypsum	2	–
Limestone	6	–
Gypsum	5	6
Limestone	8	–
Gypsum	5	–
Limestone	6	–
Ashes	1	6
Gypsum	4	6
Limestone	3	6
Gypsum	4	6
Limestone and ashes	2	6
Gypsum	2	–
Limestone and ashes	2	–
Total depth	85	–

The succession is scarcely comparable with that at Garbutt, the center of the mining industry in this part of the field, where the gypsum rock occurs in two beds, each from 5 to 8 feet thick, separated by a bed of limestone ranging from 6 to 12 feet in thickness.

The principal development in the Oakfield district, Genesee county, was the construction of a new calcining plant by the United States Gypsum Co. The plant has five vertical kettles, a very important addition to the manufacturing capacity of the company already the largest in the State.

On the extreme section of the gypsum belt, near Akron, the American Gypsum Co. maintained its usual operations, but the Akron Gypsum Co. closed its mines and plaster works in the fall. The existence of gypsum to the west of Akron was reported to have been proved by test holes; the discovery has not been succeeded as yet by any developments. A hole put down in the foot wall of the seam at Akron to a depth of 70 feet failed to show any workable deposit, though farther east, in Monroe county, two distinct beds are known to occur.

IRON ORE

Iron mining in the State resulted in about the same output last year as in 1911. There was a better inquiry for ore than the market showed during most of the year before, but prices were not correspondingly higher to furnish the necessary incentive to enlarged operations. No new mines entered upon the producing stage. Exploration and development work, however, continued active, specially in the Adirondack region, and brought to light substantial additions to the resources that eventually should be turned to account.

The production of iron ore during the last two decades is given in the accompanying table. The figures are based on lump ore and concentrates of commercial grades, and not on the mine output, which, by reason of the large proportion that is subjected to mill treatment, is considerably larger. The figures for ten years previous to 1901 have been taken from the volumes of the *Mineral Resources*. and the others compiled from reports submitted by mining companies.

Production of iron ore in New York State

YEAR	MAGNETITE	HEMATITE	LIMONITE	CARBONATE	TOTAL	Total value	Value a ton
	Long tons	Long tons	Long tons	Long tons	Long tons		
1892	648 564	124 800	53 694	64 041	891 099	$2 379 267	$2 67
1893	440 693	15 890	35 592	41 947	534 122	1 222 934	2 29
1894	....	....	....	....	242 759	....	.....
1895	260 139	6 769	26 462	13 886	307 256	598 313	1 95
1896	346 015	10 789	12 288	16 385	385 477	780 932	2 03
1897	296 722	7 664	20 059	11 280	335 725	642 838	1 91
1898	155 551	6 400	14 000	4 000	179 951	350 999	1 95
1899	344 159	45 503	31 975	22 153	443 790	1 241 985	2 80
1900	345 714	44 467	44 891	6 413	441 485	1 103 817	2 50
1901	329 467	66 389	23 362	1 000	420 218	1 006 231	2 39
1902	451 570	91 075	12 676	Nil	555 321	1 362 987	2 45
1903	451 481	83 820	5 159	Nil	540 460	1 209 899	2 24
1904	559 575	54 128	5 000	Nil	619 103	1 328 894	2 15
1905	739 736	79 313	8 000	Nil	827 049	2 576 123	3 11
1906	717 365	187 002	1 000	Nil	905 367	3 393 609	3 75
1907	853 579	164 434	Nil	Nil	1 018 013	3 750 493	3 68
1908	663 648	33 825	Nil	Nil	697 473	2 098 247	3 01
1909	934 274	56 734	Nil	Nil	991 008	3 179 358	3 21
1910	1 075 026	79 206	4 835	Nil	1 159 067	3 906 478	3 37
1911	909 359	38 005	5 000	Nil	952 364	3 184 057	3 34
1912	954 320	103 382	Nil	Nil	1 057 702	3 349 095	3 17

The output in 1912, as reported by all the mines that made shipments during the year, was 1,057,702 long tons, valued at $3,349,095. Compared with the total for the preceding year, there was a gain of 105,338 tons, or about 10 per cent, as against a decline of 206,703 tons in 1911. The value of the ore averaged $3.17 a ton, as against $3.34 for 1911; the falling off indicated by these figures was not solely a market decline, but was due in part to the large proportion of hematite shipped during the past year.

Of the output, magnetite constituted a total of 954,320 long tons and represented a value of $3,148,756. The quantity of hematite mined was 103,382 long tons, all from the Clinton belt, with a value of $200,339. There were no shipments of limonite ore from southeastern New York and none of carbonate, although these were actively mined a few years ago.

The output of magnetite was made up largely of concentrates, some of the mines in the Adirondacks shipping all their product in that form. A ton of concentrates, which on the average contains about 65 per cent iron, represents all the way from a little over one to three tons of crude ore. The actual amount of magnetite raised from the mines during the year was 1,174,295 long tons; and the total quantity of ore of all kinds hoisted was 1,277,677. In 1911 the total quantity hoisted was 1,258,873 tons.

The list of companies that were active in the industry last year included for the Adirondack region: Witherbee, Sherman & Co. and the Port Henry Iron Ore Co., Mineville; Cheever Iron Ore Co., Port Henry; Chateaugay Ore & Iron Co., Lyon Mountain; Salisbury Steel & Iron Co., Salisbury Center; and the Benson Mining Co., Benson Mines. The producers of magnetite in southeastern New York were the Hudson Iron Co., Fort Montgomery, and the Sterling Iron & Railway Co., Lakeville. The output of hematite was made by C. H. Borst, Clinton; Furnaceville Iron Co., Ontario Center; and Ontario Iron Ore Co., Ontario Center.

Mineville. The product of the mines at Mineville, the most important center of the industry, was a little below that reported in 1911, in actual figures 675,512 long tons against 734,353 long tons in 1911. Operations were conducted in the same mines as in the preceding year, including the Old Bed, Harmony and Barton Hill groups of Witherbee, Sherman & Co. and 21 and Welch shafts of the Port Henry Iron Ore Co.

The principal feature of the year's record of developments, perhaps, has been the progress of underground and surface work on the Barton Hill properties, as a result of which they have again resumed active production. These mines have contributed a considerable output of high-grade ore in the past, but for many years were neglected on account of the difficulties presented by their somewhat isolated position and irregularity. These difficulties have now been removed to a considerable extent by the driving of a tunnel on the course of the ore and well below the outcrop, which gives access to the lower part of the ore zone and provides an easy haulage way as well as natural drainage for ground above its level; and by the erection of an independent concentrating plant on the side of the hill to treat the output. The mill is the fourth of the series erected by Witherbee, Sherman & Co.; one of the others being erected on the Harmony mines and the two older ones on the Old Bed group.

Cheever mine. The operations at Cheever mine, just north of Port Henry, continued to afford a considerable output of concentrating ore, mainly from the southern section. Some bands of high-grade magnetite have also been encountered, but the main dependence is the leaner material left in the walls in the previous period of activity. The management has been very successful in dealing with the problems incident to the restoration of the old underground workings and in the treatment of the ore on the surface; and though not so large as some of the other Adirondack mines measured by output, the property is technically in the front rank. The surface equipment has been enlarged during the past year by the erection of a storage bin at the foot of the cable road on which the concentrates are lowered to the railroad for shipment.

Ausable Forks. Exploration of the magnetite bodies in the vicinity of Ausable Forks has been under way recently, with substantial results. The work was first directed to the old mines on Cook hill at Arnold where the ore zone has been tested by the diamond drill and by surface excavations for a long distance. A very large tonnage of concentrating ore is now known to exist there. In 1912 operations were conducted in the region to the north of Ausable Forks, beyond the Palmer Hill and Jackson Hill mines, an outlying field that hitherto has received little attention. A well-defined zone consisting of lenses or bands of magnetite arranged in series has been found to exist, a parallel occurrence to that on Cook hill. Of geological interest is the development locally of apatite-rich magnetites that recall the Old Bed ores at Mineville. On the northeastern end of the zone the lenticular or tabular form is less apparent, the bodies showing rather irregular shapes as seen on the surface, and the magnetite is in places a filling or cement to brecciated portions of the syenitic country rock.

Benson Mines. The production by the mines at Benson Mines was limited to experimental runs made for the purpose of testing out the new mill equipment. The plant has been largely rebuilt so as to make it more representative of current practice, and storage capacity provided for 10,000 tons of crude ore in order to insure better conditions of operation during the winter months. The company has also erected a power plant on the Oswegatchie river and will hereafter operate the mines and mill by electricity.

Southeastern New York. In the Highlands district the Hudson Iron Co. and the Sterling Iron and Railway Co. were the only operative companies and each contributed its normal quota.

A new enterprise was started during 1912 on the east side of the Hudson, back of Garrison in Putnam county. The Mt Summit Ore Corporation began exploratory work on a property that up to that time had remained practically undeveloped, though reported as belonging once to the Kingston Iron Ore Co. This property lies on the road to Tompkins Corners, high up on the ridge between the Hudson and the small valley occupied by Sprout brook. The ore is magnetite of granular to compact massive character and occurs in seams interbanded with the county gneiss; also in disseminated particles through the mass of the rock. The seams, of which the heaviest is 4 or 5 feet thick, are rich in places, but the general run, as shown by the accumulation of material on the surface, is of considerably lower grade. There is little to be seen in outcrop, as in fact exposures in that vicinity are quite limited. The county rock appears to be a laminated biotite-hornblende gneiss that has undergone injection by granite so as to exhibit as much of the latter as of the original mineral aggregate. The granite develops frequently a pegmatitic texture and is accompanied by bands of white vein quartz. The ore seams, with the included rock containing disseminated magnetite, conform in strike and dip. The latter at the surface is about 45° northwest but is said to become nearly vertical at the bottom of the prospecting shaft, which had reached a depth of 165 feet in June 1913. The strike is northeast with the prevailing trend of the Highlands Precambric formations. The company has erected a mill on the property for the purpose of concentrating the ore. The building is of sheet iron and is equipped with crushers, a dryer and magnetic separators. The latter are of the permanent magnet type, said to be a modified form of the Carter apparatus. The ore crushed down to 1.5 inch size, or less, falls in a thin stream in front of the horizontal magnets arranged one above another; the magnetite is diverted from the normal direction of fall by the attraction and passes into a separate receptacle, while the tailings continue their course downward from magnet to magnet without deflection. This method has the objection that the very fine particles of gangue are entangled more or less with the magnetite, as there is no jar or jigging movement to aid in their separation, which is secured by the common types of the drum and belt machines used in the Adirondack mills. To obviate this difficulty it is proposed to equip the last of the series of separators with an air-suction apparatus to draw off the dust from the falling stream of ore and tailings.

MINERAL WATERS

New York has held for a long time a leading position among the states in the utilization of mineral waters. The different springs, of which over two hundred have been listed as productive at one time or another, yield a great variety of waters in respect to the character and amount of their dissolved solids. There are some that contain relatively large amounts of mineral ingredients and are specially valuable for medicinal purposes; Saratoga Springs, Ballston Springs, Richfield Springs, Sharon Springs and Lebanon Springs are among the more noted localities for such waters. Numerous other springs are more particularly adapted for table use containing only sufficient mineral matter perhaps to give them a pleasant saline taste. Both kinds of waters are generally carbonated and sold in small bottles.

Of late there has developed an important business in the sale of spring waters which can hardly be classed as mineral in the common acceptance of the word, but which are extensively consumed for office and family use in the larger towns and cities. Their employment depends upon their freedom from harmful impurities, in which feature they are generally superior to the local supplies. In so far as such waters are an article of commerce they may well be included in a canvass of the mineral water industry. They are usually distributed in large bottles or carboys in noncarbonated condition.

Character of mineral waters. Among the spring waters that contain mineral ingredients in appreciable quantity those characterized by the presence of alkalis and alkaline earth are the most abundant in the State. The dissolved bases may exist in association with chlorin and carbon dioxid, as in the springs of Saratoga county, or they may be associated chiefly with sulphuric acid, as illustrated by the Sharon and Clifton springs.

The mineral waters of Saratoga Springs and Ballston are found along fractured zones in Lower Siluric strata, the reservoirs occurring usually in the Trenton limestone. They are accompanied by free carbon dioxid which, together with chlorin, sodium, potassium, calcium and magnesium, also exists in dissolved condition. The amount of solid constituents in the different waters varies from less than 100 to over 500 grains per gallon. Large quantities of table and medicinal waters are bottled at the springs for shipment to all parts of the country. The carbon dioxid which issues from the wells at Saratoga is likewise an important article of commerce.

The waters at Richfield Springs contain the elements of the alkali and alkaline earth groups together with sulphuric acid and smaller amounts of chlorin, carbon dioxid and sulphureted hydrogen. They are employed for medicinal baths as well as for drinking purposes. The springs issue along the contact of Siluric limestone and Devonic shales. Sharon Springs is situated to the east of Richfield Springs and near the contact of the Lower and Upper Siluric. Clifton

Springs, Ontario county, and Massena Springs, St Lawrence county, are among the localities where sulphureted waters occur and are utilized.

The Oak Orchard springs in the town of Byron, Genesee county, are noteworthy for their acid waters which contain a considerable proportion of aluminum, iron, calcium and magnesium, besides free sulphuric acid.

The Lebanon spring, Columbia county, is the single representative in the State of the class of thermal springs. It has a temperature of 75° F. and is slightly charged with carbon dioxid and nitrogen.

Ordinary spring waters. The greater quantity of spring waters consumed in the State belongs to the nonmedicinal, noncarbonated class, represented by such springs as the Great Bear, Deep Rock, Mount View, Sun Ray, Chemung etc. The waters are obtained either by flowing springs or from artesian wells and are shipped in carboys or in tank cars to the principal cities where they are bottled and distributed by wagons among the consumers. The essential feature of such waters is their freedom from noxious impurities. This is generally safeguarded by the care exercised in the handling of the waters which are also regularly examined in the chemical and bacteriological laboratories.

Carbon dioxid. This gas is given off in quantity by some of the wells at Saratoga Springs, and its collection and storage for shipment constituted for many years an important industry at that place. Over 30 wells have been bored there for gas alone. The industry has now been discontinued by force of a legislative enactment; it was considered that the pumping of the wells for the production of the gas was detrimental to the other springs that were utilized solely for their waters. For some time the value of the natural gas secured from the wells exceeded that of the mineral water sales.

List of springs. The following list includes the names and localities of most of the springs in the State that are employed commercially, as shown by a canvass of the industry:

NAME	LOCALITY
Baldwin Mineral Spring	Cayuga, Cayuga co.
Coyle & Caywood	Weedsport, Cayuga co.
Diamond Rock Spring	Cherry Creek, Chautauqua co.
M. J. Spicer	West Portland, Chautauqua co.
Breesport Oxygenated Mineral Spring	Breesport, Chemung co.
Chemung Valley Spring	Chemung, Chemung co.
Keeseville Mineral Spring	Keeseville, Clinton co.
Lebanon Mineral Spring	Lebanon, Columbia co.
Mt Beacon Spring	Matteawan, Dutchess co.

NAME	LOCATION
Mount View Spring	Poughkeepsie, Dutchess co.
Ayers Amherst Mineral Spring	Williamsville, Erie co.
Elk Spring Water Co	Lancaster, Erie co.
Beauty Spring Water Co	Lyons Falls, Lewis co.
Mohawk Springs	Amsterdam, Montgomery co.
Cold Spring	New York Mills, Oneida co.
Lithia Polaris Spring	Boonville, Oneida co.
Orville Risley	Whitesboro, Oneida co.
J. Wells Smith	Franklin Springs, Oneida co.
F. H. Suppe	Franklin Springs, Oneida co.
Geneva Lithia Spring	Geneva, Ontario co.
Red Cross Lithia Spring	Geneva, Ontario co.
Crystal Spring	Oswego, Oswego co.
Great Bear Spring	Fulton, Oswego co.
Os-we-go Spring	Oswego, Oswego co.
Mammoth Spring	North Greenbush, Rensselaer co.
Shell Rock Spring	East Greenbush, Rensselaer co.
Madrid Indian Spring	Madrid, St Lawrence co.
Massena Mineral Spring	Massena Springs, St Lawrence co.
Artesian Lithia Spring	Ballston Spa., Saratoga co.
Comstock Mineral Spring	Ballston Spa., Saratoga co.
Arondack Spring	Saratoga Springs, Saratoga co.
Geyser Spring	Saratoga Springs, Saratoga co.
Gurn Spring	Saratoga Springs, Saratoga co.
Chalybeate Spring	Sharon Springs, Schoharie co.
Eye Water Spring	Sharon Springs, Schoharie co.
Gardner White Sulphur Spring	Sharon Springs, Schoharie co.
Sulphur-Magnesia Spring	Sharon Springs, Schoharie co.
Red Jacket Spring	Seneca Falls, Seneca co.
Pleasant Valley Mineral Spring	Rheims, Steuben co.
Setauket Spring	Setauket, Suffolk co.
Elixir Spring	Clintondale, Ulster co.
Sun Ray Spring	Ellenville, Ulster co.
Vita Spring	Fort Edward, Washington co.
Briarcliff Lodge Association	Briarcliff Manor, Westchester co.
Gramatan Spring Water Co	Bronxville, Westchester co.

Production. The returns made by the spring water companies for 1912 showed sales of 9,682,447 gallons valued at $760,847. In the preceding year the sales amounted to 8,923,628 gallons valued at $756,147. There was thus a considerable gain in quantity but a very slight advance in value of the output, which may be attributed to the continued increase of the sales of nonmedicinal or fresh waters over the higher priced carbonated waters. The values as given are based on the wholesale prices at the spring localities, exclusive of the cost of bottling. No account is made of the waters used in hotels, sanitariums etc., run in connection with the springs, though this is an important item in the business in some places. The number of springs used for commercial purposes has declined during the past year or two owing to the inclusion of nearly all the important Saratoga wells in the new State reservation. Several of the wells have been thrown open to public use, but are not utilized for the sale of bottled waters.

Saratoga Springs. The commercial production of carbon dioxid, formerly an important product from the wells at Saratoga, has ceased altogether, as a result of the legal proceedings recently taken against the companies operating wells for the purpose. The lands of these companies also have now been incorporated in the State reservation. Of the large number of springs once so used for gas or for the sale of bottled waters, only a few, like the Arondack, Vichy and Gurn, are still held in private hands. The report of the Commissioners of the State Reservation, submitted in March 1913, indicates that there has been a marked improvement in the flow of many of the wells since the stoppage of pumping operations by private owners.

Of timely interest, in view of the proceedings looking toward the conservation of the mineral waters at Saratoga, is the report by James F. Kemp which appeared during 1912 as Bulletin 159 of the New York State Museum. After an introductory sketch of the historical features connected with the springs, the report describes the local geology in its bearing upon the methods of accumulation and storage of the waters, regarding which various views have been presented by geologists and chemists. There are chapters also on the composition of the springs, the carbon dioxid that accompanies their issue, temperature, gravity, classification, and variations that have been noted in the character of certain springs with the lapse of time. In the discussion of origin, Professor Kemp brings out the various data that appear to be related to the problem, upon which he bases the conclusion that the waters are essentially deep-seated, though taking their content of calcium and magnesian carbonates from the limestones near the surface and mingling with meteoric waters in their ascent. Numerous chemical analyses of the waters are appended to the text.

NATURAL GAS

The natural gas industry of New York has shown surprising vigor during the last few years. The State ranks as one of the first in which this valuable fuel was produced, but the resources have apparently not yet been developed to their maximum capacity, except perhaps in the oil well region which has been more thoroughly prospected than any other section. The gas fields, as distinct from those of oil and gas in the southern parts of Allegany and Cattaraugus counties, are mostly small as to area and by no means comparable in their yield to some of the natural gas fields of Pennsylvania and Ohio, but they bear evidence of great persistence when once tapped, which is a very important feature.

The production of the State is contributed by sixteen counties altogether, including Allegany, Cattaraugus, Chautauqua, Erie, Genesee, Livingston, Monroe, Niagara, Onondaga, Ontario, Oswego, Schuyler, Seneca, Steuben, Wyoming and Yates. These comprise the section west of the meridian of 77°, with an outlying area on the north and east near the eastern end of Lake Ontario. The existence of natural gas has been demonstrated for a number of other counties, as far north as Jefferson and as far east as Albany, but in too small quantity to have economic importance.

The supply of natural gas is derived from several geologic horizons, from the Potsdam sandstone in the Cambric to the Chemung strata at the top of the Devonic. The more productive formations include the Trenton limestone of the Lower Siluric, the Medina sandstone of the Upper Siluric, and the Portage and Chemung shales with interbedded sandstones belonging to the Devonic. With few exceptions the gas pools now producing occur in one or another of these formations.

The oil fields of Allegany and Cattaraugus counties have contributed, and still do contribute, considerable quantities of gas. The pools are found in sandstones at different horizons in the Devonic, such as the Bradford, Kane, and Elk " sands " of the Chemung. Some of the supply is consumed in the gas engines for pumping the oil, and the remainder is used for lighting and heating in the local towns or is piped to Buffalo. The distribution of the gas is mainly in the control of a few companies, like the Empire Gas & Fuel Co., of Wellsville, the Producers Gas Co., of Olean, and the United Natural Gas Co., of Oil City, Pa. Some of the local towns supplied from the fields are Olean, Andover, Wellsville, Friendship, Hornell and Geneseo. In the northwestern part of Cattaraugus county there is a small field of which Gowanda is the center and which extends across the border into Erie county. The gas is said to occur in the Marcellus and Onondaga formations of the Middle Devonic. The output is distributed by the Gowanda Gas Co. for use in Gowanda. Explorations have been under way recently in northern Cattaraugus county between Gowanda and Cattaraugus where pools are reported at depths from 2500 to 3300 feet in what is supposed to be the Medina sandstone.

In Chautauqua county, the productive area comprises a belt bordering Lake Erie from Silver Creek southwest to the Pennsylvania state line. Until quite recently, the supply has been obtained from wells a few hundred feet deep in the Portage and Chemung beds and the individual output was small, sufficing for a few families at most. Deep drilling during the past few years has resulted in the discovery of more productive pools, lying at depths from 1900 to 2300 feet in what is considered Medina sandstone. Some very large flows have been encountered in the vicinity of Silver Creek, Dunkirk, Forestville, Sheridan and Westfield. These wells are mainly owned by local companies who sell the output in the neighboring towns and villages. The principal operators include the Frost Gas Co., Silver Creek Gas and Improvement Co., South Shore Gas Co., and Welch Gas Co. During the past year, the United Natural Gas Co. has been engaged in exploration in the town of Arkwright east of Fredonia and is reported to have encountered gas in quantity at depths around 2100 feet.

Erie county contains several fields. A few wells have been put down within the limits of Buffalo. East Aurora, Collins, North Collins, Angola and Springville in the southern part are centers of a more or less active industry. Within the last fifteen years a field has been opened east of Buffalo in the towns of Cheektowaga, Amherst, Lancaster, Clarence, Alden and Newstead, which for some time has been the most productive in the State. The gas is found in the Medina sandstone at depths of from 1200 to 1600 feet, and the wells have proved quite persistent producers. It is transported in pipe lines to Buffalo, Tonawanda, Batavia, Lancaster, Depew, Honeoye Falls, and other towns in the vicinity. There are over 200 productive wells in the field.

In Genesee county a prolific field has been developed at Pavilion during the last five years. The gas is found in the same horizon as in Erie county, at depths of about 1700 feet. The Pavilion Natural Gas Co. and the Alden-Batavia Natural Gas Co. are the chief operators in the field and supply the gas to Pavilion, Leroy and Batavia.

In Wyoming county a few wells are in operation at Attica; in Livingston county at Caledonia, Avon and Lima; and in Ontario county in the towns of East Bloomfield and West Bloomfield. Further east in Onondaga county there are wells at Baldwinsville and Phoenix which supply gas for local use. The pools are found in the Trenton shales and limestone. Oswego county marks the eastern limit of the productive territory, with wells at Pulaski and Sandy Creek.

Production. The value of the natural gas production for the last four years is shown in the accompanying table which attempts also to divide it among the leading districts. The securing of figures from each county or district separately has become a matter of considerable difficulty in the last year or so, owing to the consolidations among the distributing companies who, operating in many fields, do not keep separate records.

The production for the year 1912 had a value of $1,882,297 and was much the largest that has been reported. The gain over the yield for 1911 was more than 20 per cent. That the increase really reflected a growth of the industry, not a mere rise of prices, is demonstrated by the returns of the companies in regard to the well flow which amounted to 6,564,659,000 cubic feet as compared with 5,127,571,000 cubic feet in 1911, 4,815,643,000 cubic feet in 1910 and 3,825,215,000 cubic feet in 1909. These amounts include estimates for some of the smaller producers who have no meters attached to their mains, but they are close approximations to the actual yield.

The average price received for the gas sold for general consumption was 28.7 cents a thousand in 1912, against 30 cents in the preceding year. This indicates a slight decrease in price, but may be accounted for largely by the larger gain of output in the western fields where the gas brings a relatively low price and little or no gain in the outlying districts that are favored by higher prices.

Production of natural gas

COUNTY	1909	1910	1911	1912
Allegany-Cattaraugus	$282 964	$337 427	$402 931	$1 503 274
Chautauqua	174 597	202 754	222 023	263 742
Erie [1]	461 531	717 038	813 279	[4]
Livingston [2]	59 888	60 997	73 357	81 740
Onondaga	12 310	12 733	12 972	14 260
Oswego	14 402	14 783	14 913	16 366
Wyoming [3]	40 001	65 967	7 602	2 915
Total	$1 045 693	$1 411 699	$1 547 077	$1 882 297

[1] Includes output of Genesee county for 1911 and part of it for the preceding years.
[2] Includes also Seneca, Schuyler, Steuben, Ontario and Yates.
[3] Includes Niagara and also some of Genesee except for 1909 and 1910.
[4] The production of Erie and Genesee counties in 1912 is included under Allegany-Cattaraugus.

The reports for the year 1912 covered a total of 1660 wells, besides the oil wells of Allegany and Cattaraugus counties that produce gas as a by-product.

Erie county has the largest output of any county in the State, but owing to the conditions obtaining there in the commercial distribution of the gas, its product for 1912 can not be definitely stated. Its output, with that of Genesee county, is included under Allegany-Cattaraugus counties. These four counties together contributed a total of 5,294,478,000 cubic feet with a value of $1,503,274. The district east of Buffalo continued to be the main producer in Erie county, but the most important developments of the year took place in the vicinity of Orchard Park, town of East Hamburg, south of that city. The Orchard Park Gas Co. drilled the first well in April, which was followed rapidly by others put down by the same company and by the Buffalo Natural Gas Co. Altogether 20 wells have been drilled, indicating a rather small but quite productive pool in that vicinity. The Iroquois Gas Co. of Buffalo took over, during the year, the interests and franchises of the United Natural Gas Co., one of the larger operators in the western fields, and also those of several of the smaller companies in Erie county.

In Chautauqua county, the lake shore district maintained its activity and yield. New wells were drilled by the Frost Gas Co., near Silver Creek; by the United Natural Gas Co. and its successors, the Iroquois Gas Co., in Arkwright township, and by other companies.

Good wells are reported to have been brought in at Red House, Cattaraugus county, the yield having been around 1,000,000 cubic feet a day.

PETROLEUM

The year 1912 witnessed exceptional conditions in the petroleum fields of the State. In the face of steadily advancing prices, production fell to the lowest stage reached since systematic developments were started in the Allegany county district about thirty-five years ago. Considered by itself, this seemingly discouraging situation might lead to the impression that the oil industry had nearly reached the end, so far as the local crude supplies are concerned; or at least that the latter were no longer capable of a sustained output. A study of the statistics of prices and production for the few preceding years, however, indicates that the decline may be explained rather by economic considerations than by the failure of the natural resources.

As a matter of fact, the oil pools long since reached their maximum capacity for production, but by continued redrilling of the proved territory the yield for the last two decades has been fairly well maintained. The oils are mostly of superior quality with a paraffin base, characteristic of the Appalachian fields, and bring the highest prices in the market, so that under normal conditions the industry is remunerative, even though the yield for each well is very small.

The average output until recently has remained nearly constant at a little over a million barrels a year. Fluctuations have depended mostly upon the state of the market. A severe slump in the latter took place in 1910, the prices declining steadily from month to month until the reduction amounted to over 50 cents a barrel. This practically put an end to development work, and pumping operations at many of the less productive wells were stopped. The effects of this depression were noticeable to some extent in the returns made for the year 1911, but the full force of it became manifest in last year's total.

With the falling off in yield which affected the Appalachian districts generally, prices began to strengthen and from the low point of $1.35 a barrel in January advanced steadily throughout the remainder of the year, reaching the price of $2 a barrel at the close. This was higher than New York crude sold for previous to the decline of 1910, so that development work should once more resume its normal course. An improvement in the productive industry may be anticipated for the current year, unless conditions show a sudden reversal.

The output of oil in the State during the last two decades is given in the accompanying table. The figures for the years 1893–1903 have been taken from the annual volumes of "The Mineral Resources" and those for the following years compiled from reports rendered by the pipe-line companies and shippers who operate in the State. The list of these companies is as follows: the Allegany Pipe Line Co., Columbia Pipe Line Co., Union Pipe Line Co., and Fords Brook Pipe Line Co., of Wellsville; Vacuum Oil Co., of Rochester; New York Transit Co., of Olean; Emery Pipe Line Co., Kendall Refining Co., and Tide Water Pipe Co., Limited, of Bradford, Pa.

Production of petroleum in New York

YEAR	BARRELS	VALUE
1893	1 031 391	$660 000
1894	942 431	790 464
1895	912 948	1 240 468
1896	1 205 220	1 420 653
1897	1 279 155	1 005 736
1898	1 205 250	1 098 284
1899	1 320 909	1 708 926
1900	1 300 925	1 759 501
1901	1 206 618	1 460 008
1902	1 119 730	1 530 852
1903	1 162 978	1 849 135
1904	1 036 179	1 709 770
1905	949 511	1 566 931
1906	1 043 088	1 721 095
1907	1 052 324	1 736 335
1908	1 160 128	2 071 533
1909	1 160 402	1 914 663
1910	1 073 650	1 458 194
1911	955 314	1 251 461
1912	782 661	1 338 350

The total production in 1912 amounted to 782,661 barrels, as compared with 955,314 barrels in 1911. The decrease was 172,653 barrels, or about 20 per cent. The output in 1910, which was 1,073,650 barrels, showed a drop of 158,336 barrels or about 15 per cent from that of 1909 when the first break in the market prices began. The value of the output last year was $1,338,350, an average of $1.71 a barrel, against $1,251,461 or an average of $1.31 a barrel in 1911 and $1,458,194 and an average of $1.36 in 1910 and $1,914,663, an average of $1.65 in 1909.

The record of field work as compiled monthly by the Oil City Derrick showed that 246 wells were drilled in the New York fields during 1912. This figure indicates a slightly increased activity over the preceding year, when the number completed was 195. The number of wells completed in 1910 was 283 and in 1909, when conditions were more normal, the number was 457. The increment of production from the new wells amounted to only 278 barrels, as compared with 201 barrels in 1911, 368 barrels in 1910 and 715 barrels in 1909. Of the number of wells completed, 66 were dry against 59, 61 and 32 respectively in the preceding years.

The oil pools found in the State constitute the northern extension of the Appalachian field which reaches its main development in

Pennsylvania, Ohio and West Virginia. They underlie small areas in Cattaraugus, Allegany and Steuben counties near the Pennsylvania border. The first well was drilled in Cattaraugus county in 1865, and Allegany county began producing about 1880. The oil is found in fine-grained sandstones of dark color belonging to the Chemung formation of the upper Devonic. In Cattaraugus county the productive area embraces about 40 square miles, mostly in Olean, Allegany and Carrolton townships. The pools of which the principal ones are the Ricebrook, Chipmunk, Allegany and Flatstone, occur at several horizons from 600 to 1800 feet below the surface. The oil district of Allegany county extends across the southern townships of Clarksville, Seneca, Wirt, Bolivar, Alma, Scio and Andover and is divided into several pools that are considered to be more or less independent. The Bolivar, Richburg and Wirt pools have been most productive. The oil is found at depths of from 1400 to 1800 feet. The Andover pool lies partly in the town of West Union, Steuben county, and is accountable for the production in that section. The reports of the "Mineral Resources" covering the year 1910 showed a total of 10,995 productive wells in the State, of which number Allegany county had 7859, Cattaraugus county 2917 and Steuben county 219. Practically all the wells are pumped and the average yield is less than one-third of a barrel a day.

There has been a great deal of exploration outside the districts mentioned, but up to the present time has not led to any positive additions to the productive area. Some of the more interesting and promising developments have been in northern Allegany county. A discovery of oil was reported a few years since in the town of Granger on the Livingston county border, considerably north of the other pools, and about 30 wells were drilled as a test. Some of these flowed under natural pressure, but they soon gave out, yielding less than 3000 barrels altogether. In the last year or two another section near Swain, town of Grove, has been under exploration. The original discovery was reported on the Fred Bennett farm where oil and gas were encountered in a well put down to 740 feet depth. Some other holes in the same vicinity were dry. Recently drilling has been under way on the Harman place, and two productive wells are reported to have been brought in of which the first produced from 5 to 6 barrels a day. The second was dry when drilled, but began to flow after having been "shot." The oil is said to be of a dark, heavy quality.

PYRITE

The pyrite deposits of St Lawrence county contributed an increased output of that mineral last year, though no new properties were under operation. The main factor in the industry was the St Lawrence Pyrite Co. at Stellaville where it owns extensive mining properties inclusive of the Stella, and a large mill for concentrating the ore. The company only recently attained its present stage of productive activity which places it among the more important producers and shippers of pyrite in the country. The output is mainly in the form of concentrates with a content of 40 per cent or more in sulphur, but a small proportion is shipped as cobbed ore or spalls, with a somewhat smaller tenor of sulphur. The pyrite is used by acid burners in the eastern states, and is considered a very desirable material for their purposes on account of its relative freedom from arsenic and other injurious impurities.

The Hinckley Fibre Co. continued work at the Cole mine near Gouverneur, making shipments of the crude pyrite to its sulphite pulp mills in the Adirondacks. The company has developed a process by which the low-grade material as it comes from the mine can be utilized successfully for making sulphurous anhydride and calcium sulphite, of which very large quantities are employed in the local pulp mills. It would appear that an extensive market for the St Lawrence county pyrite might be developed if the crude ore were generally applicable to sulphite manufacture.

An occurrence of pyrite in the town of Fowler, southeast of Gouverneur, received some attention during the year, and shipments of a few tons of the ore were made for experimental purposes. The locality from which the ore was taken is on the Kilburn place, near Little York. A band of quartz-amphibolite schist, apparently a part of the sedimentary or Grenville series, can be followed in outcrop for a mile or more, its surface being deeply stained by iron oxids. Pyrite occurs more or less abundantly scattered all through the schist and in places forms richer veinlike bands or irregular aggregates which are also distinguished by the coarse character of the mineral. Shallow pits have been sunk at one or two points from which the ore for experiment was taken. The deposits, like many of the other Adirondack occurrences, contain pyrrhotite along with the pyrite, but the former mineral is most in evidence in the southern part of the ore zone.

SALT

The production of salt is one of the larger and more stable branches of the mineral industry and has been carried on in New York State for upwards of a century. The occurrence of rock salt is widespread in the central and western counties, south of the Salina outcrop, but its exploration through mine shafts or wells is restricted to a few places that possess natural advantages for conducting these operations and for marketing the product. At present, 6 counties contribute to the output, with a total of about 30 individual mines and evaporating works.

Few changes in the industry have taken place recently and it is hardly to be expected that any notable developments will occur in the near future. The productive capacity of the local plants long since reached or passed the point of equilibrium with the market requirements. This condition has caused keen competition and brought about the extinction of some of the smaller and less favorably situated enterprises. The industry as a whole, however, seems to be on a firm basis and except for some uncertainty as to the results of the new tariff which proposes to remove the duty on foreign salt, the outlook for the immediate future is more encouraging than it has been in several years.

Reports from all the companies operating last year showed a production of 10,502,214 barrels of 280 pounds. This was the largest total that has ever been returned for a single year, the next largest having been in 1910 when it amounted to 10,270,273. Compared with the output of 10,082,656 barrels in 1911 there was a gain of 419,558 barrels or about 4 per cent. Converted to a tonnage basis, the product last year was equivalent to 1,470,309 short tons, against 1,411,572 short tons for 1910.

The value of the salt production as fixed by the figures reported by the companies was $2,597,260, exclusive of the cost of package and freight to market. From this, an average of 24.7 cents a barrel is obtained for the whole amount. The prices received for evaporated salt were generally higher than in the preceding year and in fact in any other year since 1907. Under the highly competitive conditions that have existed in the local markets as well as in those of other states where the New York producers have a foothold, prices had slumped steadily during the previous few years. In 1911, the average value was only 21.7 cents, whereas it was 22 cents in 1910, 23.3 cents in 1909, 23.7 cents in 1908 and 25 cents in 1907.

It is to be noted that the average values as given are for the entire amount of salt taken from the mines and wells, and that a certain and not inconsiderable part of this amount represents the salt contents of brine which is not evaporated, but converted directly into alkali products. On this part of the output a very low valuation, representing practically the mere cost of pumping, is placed. The production of this brine is confined to a single company, the Solvay Process Co., which has a number of wells in the town of Tully, Onondaga county, whence the brine is carried by pipe line to the alkali works near Syracuse.

The accompanying tables give the statistics of the salt production for recent years. For the years 1911 and 1912 the output is given according to grades, so far as the classification could be made without revealing the individual figures. The grades depend upon methods of manufacture and purposes for which the salt is used. Rock salt and salt in brine consumed by the alkali industry appear in the last item of the detailed tables which also includes small quantities of evaporated salt not specially classified in the returns. The evaporated salt is chiefly marketed under the grades of common fine, table and dairy, common coarse, common solar, and packers salt. Table and dairy salt includes the finest grades of artificially evaporated salt specially prepared for the table and for butter and cheese making; it brings the highest market price. Under common fine are listed the other grades of fine, artificially evaporated salt that are not specially prepared. Common coarse represents the coarser product from artificial evaporation. Coarse solar salt is made by evaporation of brine in shallow pans exposed to the sun's heat. This process is employed only by the manufacturers in Syracuse and vicinity, and can be carried on, of course, only in the summer months. Packers salt includes the product sold to meat packers and fish salters.

Production of salt by grades in 1911

GRADE	BARRELS	VALUE	VALUE A BARREL
Common fine [1]	1 143 886	$328 127	$.29
Common coarse	285 407	96 968	.34
Table and dairy	1 312 000	629 581	.48
Coarse solar	434 414	131 247	.30
Packers	40 721	11 402	.28
Other grades [2]	6 866 228	994 160	.14
Total	10 082 656	$2 191 485	$.217

[1] Common fine includes a small quantity of common coarse.
[2] Include rock salt, salt in brine used for soda manufacture, and small amounts of brine salt for which the uses were not specified in the returns.

Production of salt by grades in 1912

GRADE	BARRELS	VALUE	VALUE A BARREL
Common fine[1]	1 408 543	$519 844	$0.37
Common coarse	204 136	82 880	.41
Table and dairy	1 353 643	819 103	.61
Coarse solar	296 814	103 886	.35
Packers	72 771	30 564	.42
Other grades[2]	7 166 307	1 040 983	.15
Total	10 502 214	$2 597 260	$.247

[1] Common fine includes a small quantity of common coarse.
[2] Include rock salt, salt in brine used for soda manufacture, and small amounts of brine salt for which the uses were not specified in the returns.

The output in 1912 was contributed by 30 mines and works distributed among 6 counties of the State. Onondaga county was represented by the largest number of producers, having 20 in all. Livingston county was represented by 3, of which 2 were rock salt mines, the only ones now active. Schuyler, Tompkins and Wyoming counties each had 2 producers, and Genesee county had 1.

Production of salt in New York since 1887

YEAR	BARRELS	VALUE
1887	2 353 560	$936 894
1888	2 318 483	1 130 409
1889	2 273 007	1 136 503
1890	2 532 036	1 266 018
1891	2 839 544	1 340 036
1892	3 472 073	1 662 816
1893	5 662 074	1 870 084
1894	6 270 588	1 999 146
1895	6 832 331	1 943 398
1896	6 069 040	1 896 681
1897	6 805 854	1 948 759
1898	6 791 798	2 369 323
1899	7 489 105	2 540 426
1900	7 897 071	2 171 418
1901	7 286 320	2 089 834
1902	8 523 389	1 938 539
1903	8 170 648	2 007 807
1904	8 724 768	2 102 748
1905	8 575 649	2 303 067
1906	9 013 993	2 131 650
1907	9 657 543	2 449 178
1908	9 005 311	2 136 736
1909	9 880 618	2 298 652
1910	10 270 273	2 258 292
1911	10 082 656	2 191 485
1912	10 502 214	2 597 260

The large number of producers in Onondaga county is incident to the solar salt industry which is carried on extensively around Syracuse. The brine used by the solar evaporating works or salt yards is stored in glacial gravels and is pumped and distributed by central plants. The principal supply comes from the old Onondaga Salt Springs Reservation that was sold by the Indians to the State in 1788. The manufacture of salt was placed under State control in 1797 from which time complete records of the industry are available. At one time artificial evaporation was extensively practised but this has been given up almost entirely in recent years with the increased competition from other districts. The solar salt is sold through the agency of the Onondaga Coarse Salt Association.

With the exception of the salt made at Syracuse, the entire production is obtained from the deposits of rock salt which are found in the Salina formation, a succession of shales and limestones with intercalated beds of gypsum and rock salt. The Salina strata outcrop in an east-west belt across the State from Albany county to the Niagara river and is represented by a smaller separate area in southeastern New York. Well tests indicate that the salt deposits are restricted to the western section of the main belt beginning in Madison county; east of there the strata diminish in thickness to such an extent as to preclude their existence. They are encountered only at a depth of 1000 feet or more where there has been sufficient cover to protect them against solution by ground waters. As the whole stratified series has a dip uniformly toward the south, the mines and wells are all located on the southern side of the outcrop which lies about on the line of the 43d parallel. The dip averages 40 or 50 feet to the mile. The most easterly point where rock salt has been found is at Morrisville, Madison county. Between that place and Lake Erie it has been shown to exist in almost all counties of the middle tier.

The exploration of the rock salt beds dates from 1878 when a well bored for oil near Wyoming, Wyoming county, encountered 70 feet of salt at 1270 feet from the surface. Discoveries were subsequently made at Warsaw, Leroy, Rock Glen, Batavia and numerous places in Livingston, Wyoming and Genesee counties. Practically the whole valley of Oatka creek, from Leroy to Bliss and the Genesee valley south of Monroe county has been found to be salt-bearing. The region is now the most productive in the State. Livingston county has the largest annual output which is contributed by the two rock salt mines at Retsof and Cuylerville owned respectively by the Retsof Mining Co. and the Sterling Salt Co., and by the evaporating plant of the Genesee Salt Co., at Piffard. The other companies now active in this section include the Leroy Salt Co., of Leroy; the Rock Glen Salt Co., of Rock Glen; and the Worcester Salt Co., of Silver Springs.

In Schuyler county salt is obtained around Watkins. The Glen Salt Co. sank the first well there in 1893 and encountered a deposit at 1846 feet depth. The plant is now operated by the International Salt Co. The Watkins Salt Co. also has works at this place.

A well drilled at Ithaca, Tompkins county, in 1885 passed through seven beds of salt aggregating 248 feet in thickness at depths below 2244 feet from the surface. The discovery was followed by active developments at Ludlowville in 1891 by the Cayuga Lake Salt Co., and at Ithaca in 1895 by the Ithaca Salt Co. The plants were taken over in 1899 by the National Salt Co., which was merged in 1905 into the International Salt Co. The Remington Salt Co. later erected a plant at Ithaca which is now in operation obtaining its salt from three wells at a depth of about 2100 feet.

The Solvay Process Co. derives its supply of brine from a number of wells located in the town of Tully, 20 miles south of Syracuse. The brine is carried in pipe line to the works at Solvay.

In Erie county rock salt has been found at Eden Valley, Springville, Perry and Gowanda, but there is no output at present in that county. Among the localities where discoveries have been made may be mentioned Vincent and Naples, Ontario county; Dundee, Yates county; Seneca Falls, Seneca county; and Aurora, Cayuga county. None of these deposits are worked. A well put down in 1909 in the town of Burns, Allegany county, is reported to have passed through 75 feet of clean unbroken salt at 3050 feet depth.

SAND AND GRAVEL

The production of sand and gravel for use in engineering and building operations, metallurgy, glass manufacture, etc., is an important industry involving a very large number of individual operations. The building stone business is specially extensive as there are deposits suitable for that purpose in every section of the State, and nearly every town or community has its local source of supply. Such sand, of course, possesses little intrinsic value. The deposits of glass sands and molding sands are more restricted in their distribution and their exploitation is the basis of a fairly stable industry; certain molding sands are even shipped to distant points, as in the case of those obtained in the Hudson River region.

The sand and gravel beds of the State are mainly of glacial origin, as the whole territory within the limits of New York, in common with the northern section of the United States east of the Rocky mountains, was invaded by the Pleistocene ice sheet which removed all the loose material accumulated by previous weathering and erosion, and left in its retreat a mantle of transported boulders, gravels, sands and clays. In places these accumulations have the character of unmodified drift or morainal accumulations in which the materials are more or less intermixed, and are then of little industrial value. But more generally the deposits show a sorted stratiform arrangement due to having been worked over by the glacial streams and lakes. Such is the condition in many of the larger valleys like those of the Hudson, Champlain and Genesee where sands, gravels and clays occur separately in terraced beds extending far above the present water level. Later water action may have effected a beneficial re-sorting of the materials as instanced by the beach sands of Long Island and some of the lakes in the interior of the State.

A measure of the importance of the sand and gravel industry may be had from the accompanying table which, however, lacks something in the way of completeness and accuracy. The figures relating to the molding sand production are believed to be a close approximation to the actual totals, but those for building sand and gravel may vary considerably from the true quantities, perhaps understating them by as much as 25 per cent. The building sand operations are so widely scattered and in many sections carried on in such haphazard or fugitive manner that it is extremely difficult to cover them all in a statistical canvass.

Production of sand and gravel

MATERIAL	1910	1911	1912
Molding sand	$424 015	$420 780	$422 148
Core and fire sand	33 709	27 484	55 910
Building sand	1 016 598	*b* 750 000	1 156 002
Other sand *a*	65 835	*b* 50 000	*b* 75 000
Gravel	589 551	479 103	840 669
Total	$2 129 708	$1 727 367	$2 549 729

a Includes glass sand, filter sand, engine and polishing sand.
b Partly estimated.

Molding sand. The business connected with the locating, digging, grading and shipment to market of molding sands involves a degree of skill and experience on the part of the operator that makes it a rather specialized branch of the industry. Sands possessing the requisite qualities for employment in the molding of metals are also rather restricted in distribution. The business, therefore, has elements of stability and permanency not shared to any extent by most of the other branches.

The main output of molding sands in New York comes from the middle Hudson valley. The deposits that are actively worked extend along both sides of the river from Washington and Saratoga counties on the north to Orange and Dutchess counties on the south. The product is often spoken of as "Albany" molding sand, probably owing to the fact that Albany is near the center of the district. Albany county furnishes a large part of the output, most of which is dug in the southern townships of Bethlehem and Coeymans.

Throughout the region there is much similarity in the occurrence of the sand. It is always found directly below the soil, and where this is lacking, as in the sand dune tracts of Albany and Schenectady counties, the sand is also absent. The thickness of the soil cover, which has the character usually of a sandy loam, well sodded, averages about one foot. There is no sharp division between soil and molding sand, the change being manifested by a gradual decrease of plant fibers and carbonaceous matter as the valuable layer is reached. The underlying material consists of sand that is sometimes difficult to differentiate from the molding sand itself. As a matter of fact, there are no fixed standards determining the selection, and there is considerable variation in the physical qualities of the sands shipped by the different producers. The most valuable grades consist of the very fine sands which can be used for brass and stove castings; they are consequently most sought for and may be exploited exclusively even when accompanied by coarser kinds that have a more limited sale.

The most notable feature of the distribution geologically is that the sands occupy the site of the glacial Lake Albany. This lake, formed in late Pleistocene time, reached well up the slopes of the middle Hudson valley and the confluent branches and was fed by the flood waters resulting from the melting of the ice sheet in its northward retreat. These waters washed down the rock-waste of clays, sands and gravels made by the erosion of the ice and brought them into the lake when they were laid down in more or less sorted and stratified deposits. The deltas of the Mohawk and other large tributary streams of that period furnish the principal supplies of the molding sand.

The typical product of this region, that is the finer grades, is characterized by a degree of comminution and angularity of the particles unusual to water-worn sands. It is probable that these features are the result of ice erosion in the first place, but they may have been further developed by wind action after the retreat of the waters and before the deposits became fixed in place by vegetation. At least there are indications in places that the winds effected the final sorting and have deposited the sands in their present attitude which is quite different from that resulting from water work.

The molding sand does not mark the outcrop of any definite layer or layers within the series of interstratified clays and sands, but forms a mantle that follows the surface configuration. It rises and falls with the minor irregularities of the surface, showing a variation of elevation inconsistent with the regular order that would be expected from a water-laid deposit. The thickness of the molding sand is also quite variable, running from a few inches in some places to several feet in other localities. These features have recently been remarked by Stoller,[1] who bases on them a theory as to the secondary origin of the molding sand through the operation of surface agencies, specially oxidation and moisture. "It appears to be a necessary inference from this that surface conditions are a determining cause in the origin of the layer of molding sands. In dry seasons of the year when the surface soil has been largely deprived of water by evaporation, an upward movement of the ground water by capillarity takes place. If the ascending ground water carries iron in solution, the iron may be oxidized and precipitated as it approaches the surface. In this way, the film of iron oxid coating the particles of sand is formed. The porosity of sand, admitting air to a considerable depth below the surface and at the same time favoring evaporation, facilitates the process. In addition to the iron, it is probable that small particles of clay are carried upward by the moving ground waters and are fixed through cementation by the iron oxid. These processes continue from season to season through a long period of years, the layers of molding sand being periodically added to at the bottom until it

[1] Glacial Geology of the Schenectady Quadrangle. N. Y. State Mus. Bul. 154, p. 24 and 25.

attains such a thickness that surface influences no longer penetrate it."

That the weathering action incident to exposure of the sand to oxidation, hydration and physical agencies does work a beneficial change upon the molding sand admits of little doubt, though there is much uncertainty as to just what the process and its importance may be. It is, however, not simply a product of weathering upon the ordinary water-laid sands of this section, but the salient features of its occurrence and origin, at least in some places, are to be ascribed probably to the action of wind. The somewhat patchy distribution; the occurrence without relation to any horizon, but following the surface contours at least in minor undulations; the variable thickness; and the marked angularity of the quartz particles are suggestive of wind agency in the final accumulation of the deposits.

The main part of the product of the region, as stated, consists of the finer sizes. The companies who operate on a permanent basis and in various sections usually are able to supply the various grades for which a market demand exists. The grades are not standardized and their designation by different shippers lacks uniformity. Some five or six are shipped at present. They bear numbers, beginning with zero which represents fine brass sand and running up to no. 4 which is rather coarse. Perhaps the grade most shipped is no. 1 or stove-plate sand. A screen test on a representative sample of this grade from Selkirk gave the following results: through 100 mesh, 96.64 per cent; on 100 mesh, 2.62 per cent; on 80 mesh, .39 per cent; on 60 mesh, .04 per cent; on 40 mesh, .07 per cent; on 20 mesh, .21 per cent.

Aside from the Hudson River region, there is some molding sand obtained in the western part of the State, mainly in Erie and Chautauqua counties. The output there amounts to a few thousand tons a year.

For the year 1912, the returns received indicate a total production for the whole State of 469,138 short tons with a value of $422,148. The total has not varied much in recent years, having been 476,014 tons valued at $420,780 in 1911 and 471,351 tons valued at $424,015 in 1910.

Core sand used in connection with molding sand for the cores of castings is chiefly produced in Erie and Oneida counties. The product is listed with fire sand, the combined production of the two kinds last year amounting to 87,525 short tons valued at $55,910.

Glass sand. Sand for glass manufacture is obtained from the beach sands of Oneida lake and Long Island. The crude sand undergoes purification by washing to remove the clay, mica, iron oxid, organic matter, etc. The manufacture of window glass, once an important industry in the central part of the State in the vicinity of Oneida lake where the sand was obtained, is no longer carried on, as competition with the industry in regions more favored by fuel supplies rendered it unprofitable. The small product of a few thousand tons is shipped elsewhere for manufacture.

Building sand. The use of sand and gravel in building and engineering work calls for enormous quantities of these materials. The business of excavating and transporting them to market is a purely local one, except in certain parts of Long Island from which the supply for New York and its environs is mostly obtained.

A complete census of the sand industry can be obtained only with an outlay of labor and expense which the results would hardly justify. The figures given herewith are simply an approximation based on reports received from producers operating in the principal localities which sustain a more or less steady output. They no doubt understate the total, as there are a large number of small producers who do not report.

The combined value of the sand and gravel as returned for the year 1912 was $1,996,671. The total for the preceding year was $1,229,103. Of the amounts named, $1,156,002 represents the value of the sand and $840,669 that of gravel. Nassau county alone had an output of 2,411,866 cubic yards of sand and 546,687 cubic yards of gravel with a combined value of $1,539,621.

SAND-LIME BRICK

The sand-lime brick manufacturers experienced a very successful season in 1912, as evidenced by their large output. They were favored by an active demand for structural materials that obtained throughout most sections of the State, and it would appear also that the material has been gaining in popularity since its rather recent appearance on the market. There were fewer plants operated than in earlier years, but the average production was considerably larger.

The number of brick made within the year was 21,231,000, as compared with 15,178,000 in 1911. The total has never been exceeded; the largest output previously was in 1906 when it numbered 17,080,000. The value of the product for the last season was

$133,736, or an average of $6.30 a thousand. In the preceding year the value of the outturn was $92,064, an average of approximately $6 a thousand.

The active manufactures included the following: Buffalo Sandstone Brick Co., with a plant at Lancaster; Dyett Sand-Lime Brick Co., Port Jefferson; Glens Falls Granite Brick Co., Glens Falls; Paragon Plaster Co., Syracuse; and Rochester Composite Brick Co., with plant at Brighton. The Sandstone Brick Co.'s plant at Schenectady was inactive, but will probably resume operations during the current season.

STONE

The quarrying of stone and its preparation for the varied requirements of building, engineering construction, etc., holds a prominent place in the industrial activity of the State, and the value of the annual contribution ranks second only to that of clay among mineral materials. No other mineral industry includes so many individual enterprises or is so widely represented in the different sections. The resources are abundant and varied, comprehending all the principal varieties known to the trade. The greater number of quarries, however, are opened in the limestones and sandstones and supply material chiefly for engineering work, highway improvement and such purposes which do not entail any considerable amount of elaboration previous to shipment. In the development of the building, monumental and ornamental branches the local industry has not attained the relative importance that it deserves by reason of the natural wealth of materials adapted to those uses and the advantages for marketing; herein lies, it would appear, the principal field for future enterprise.

The statistics of production which have been collected from year to year show that the industry in general remains practically stationary; in fact lately it has taken a downward trend, falling below the average level of earlier years. This has been due in part to the recent business reaction that has affected practically all industries and in part undoubtedly to the gaining favor of cement and concrete for certain construction purposes. The latter has manifested itself particularly in the loss of trade among the bluestone quarries which supply flagstone to New York and other eastern cities. This branch of the industry has shown a marked decline in the last few years.

The total value of the stone quarried in 1912 was $5,718,994, as compared with a reported value of $5,560,355 in 1911. This indicated a gain of $158,639 or about 3 per cent for the year, against a decrease for the preceding year of $737,940 or 12 per cent. It should be noticed that the totals as given are not inclusive of slate, millstones or limestone used for cement manufacture, which are reported separately.

Of the different branches of the industry represented in the State, the granite trade showed a slight improvement, increasing from $148,633 in 1911 to $202,086 last year. The yield, however, was below the average of earlier years.

The limestone quarries contributed more than one-half of the total for the year, with a product valued at $3,510,495. The figures for 1911 were $3,174,161. The use of limestone for crushed stone accounts for its predominant importance, though it is also largely employed for lime making, furnace flux, and for building stone.

There was a slight falling off in the value of the marble quarried which amounted to $241,847, against $278,041 in the preceding year. The decrease was in the building stone supplied by the southeastern New York quarries.

The sandstone quarries contributed an output valued at $1,280,743 against $1,060,106 in 1911. The increase of about 20 per cent did not restore the industry to the high level reached a few years ago, but indicated a temporary check at least to the decline that has recently taken place, incident to the unsatisfactory conditions of the flagstone trade.

The trap quarries in the Palisades section reported an output scarcely more than one-half that of previous years, in actual figures, $483,863 as compared with $899,414 in 1911. The decrease has been due to the shutting down of some of the river quarries by their inclusion in the new Palisades Park.

Production of stone in 1910

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite	$40 911	$12 989	*a*	$91 988	$98 875	$244 763
Limestone	99 049	....	$3 888	1 815 809	1 327 061	3 245 807
Marble	252 965	88 684	....	....	231	341 880
Sandstone	387 408	....	480 132	225 408	358 848	1 451 796
Trap	....	....	....	908 931	75	909 006
Total	$780 333	$101 673	$484 020	$3 042 136	$1 785 090	$6 193 252

a Included under "All other."

Production of stone in 1911

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite	$30 684	$11 353	*a*	$72 401	$34 195	$148 633
Limestone	112 082	....	$11 989	1 936 292	1 113 798	3 174 161
Marble	171 748	79 115	....	....	27 178	278 041
Sandstone	327 587	....	526 074	23 883	182 562	1 060 106
Trap	....	....	....	896 164	3 250	899 414
Total	$642 101	$90 468	$538 063	$2 928 740	$1 360 983	$5 560 355

a Included under "All other."

Production of stone in 1912

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite	$65 487	$19 130	*a*	$49 307	$68 172	$202 096
Limestone	108 581	....	$5 481	2 176 368	1 220 015	3 510 445
Marble	155 411	84 511	....	....	1 925	241 847
Sandstone	363 055	....	615 846	45 301	256 541	1 280 743
Trap	....	....	....	483 863	....	483 863
Total	$692 534	$103 641	$621 327	$2 754 839	$1 546 653	$5 718 994

a Included under "All other."

GRANITE

Granite, in the strict sense, includes the coarser-grained igneous rocks which have quartz, feldspar and mica as their chief constituents. They are characterized by a massive appearance incidental to an even distribution of the mineral ingredients, though by compression during or after the period of consolidation they may develop a parallel arrangement, in which case the term granite gneiss is best applied to them. The feldspar of typical granite is an alkali variety, either orthoclase or microline, but some lime-soda-feldspar like oligiclase is usually present as well. Hornblende and more rarely augite may accompany the mica or substitute for it. The texture is even granular or porphyritic.

The definition as given is rather narrow for commercial usage and quarrymen often designate as granite widely different rocks which may serve more or less similar purposes. Thus in the Adirondacks not only granite, but syenite, anorthosite and various gneisses have been quarried and sold as granite. The broader usage will be followed here, so as to include practically all the crystalline silicate rocks, with the exception of trap which, owing to its somewhat specialized industrial features, will be treated by itself.

Granites and their igneous associates have a wide distribution in the Adirondacks and are represented rather extensively in the Highlands and in Westchester county. Some account of their distribution and present development for commercial use will be found in the preceding issue of this report. It may be said that the quarry industry in most localities is in a backward condition, neither commensurate with the resources which are sufficiently varied to meet most requirements for structural and ornamental granite, nor with the large local markets which exceed those of any state in importance. As a consequence, most of the building, monumental and ornamental granite for current use comes from the larger and better equipped quarries in New England and the southern states.

The production of granite for the last three years is shown in the accompanying table. The figures are compiled from reports of quarries operated for commercial purposes, but do not include the output by contractors on road improvement work, as such production is difficult to tabulate. The output in 1912 had a value of $202,096, against $148,633 in the preceding year and $244,763 in 1910. The largest item in the total was represented by building stone with a value of $65,487, followed by crushed stone valued at $49,307, rubble and riprap valued at $27,861 and monumental stone valued at $19,130. The granite sold for various other purposes was valued at $40,311.

Production of granite

	1910	1911	1912
Building	$40 911	$30 684	$65 487
Monumental	12 989	11 353	19 130
Crushed stone	91 988	72 401	49 307
Rubble, riprap	20 272	28 162	27 861
Other kinds	78 603	6 033	40 311
	$244 763	$148 633	$202 096

NOTES ON GRANITE QUARRYING IN NEW YORK

Peekskill. The Mohegan Granite Co., owning quarries east of Peekskill, supplied a large part of the architectural granite produced in the last year, shipping most of the output to New York for use in the Episcopal Cathedral. The company is enlarging its facilities for handling this material which has obtained much favor among architects and builders on account of its rare and attractive color. At present it has three derricks in the main quarry, which is an opening 300 feet long with a face from 40 to 50 feet high. Except for large inclusions of hornblende schist which occur here and there, the granite is free of knots and streaks. It has a slight tendency to sheeting and is intersected by two sets of vertical joints which occur at such intervals as to admit the extraction of blocks as large as can be handled. The company has recently erected a steel-frame cutting shed at the quarries, which will afford room for 40 or 50 cutters.

The yellow and brownish varieties which have been mainly quarried are developed in the upper surficial part of the granite boss, as a result of the seepage of iron oxid into the minute cracks and pore spaces of the stone. The iron is principally concentrated about the quartz grains. It seems to have been derived from alteration of the biotite in the overlying portion which has since been eroded away, as the quarried stone appears quite fresh when examined microscopically. The granite is rather porous, but in crushing strength compares favorably with other granites.

The normal or original color of the Peekskill granite is light gray, or pinkish gray, as seen in the quarries of Rudiger Bros. on Millstone hill, across the valley from the Mohegan Company's quarries and in a smaller quarry near Peekskill. The change from gray to brown takes place at a variable depth, usually 40 or 50 feet from the surface.

Kensico. Quarries have been opened in the last year at Kensico for the construction of the new reservoir which is to form a part of the Catskill water-supply system. The quarries are situated on the ridge that limits the reservoir on the east, about three-fourths of a mile from the dam location with which they are connected by a railway. The rock is Yonkers gneiss of medium grayish or brownish gray color and more massive texture than the usual average of the rock. The grain is medium or fine. Several acres have been cleared of overlying earth and soil, showing fairly uniform and fresh material at the surface. There are scattered inclusions of dark hornblende and biotite gneiss, probably the Fordham, but with this exception it is quite free of admixture and well adapted for building and general construction purposes. Its composition is that of a normal biotite granite. The gneissoid character is partly at least original, rather than assumed after the crystallization, and the texture is firmly knit like that of a massive rock. The effects of shearing and compression are observable, however, in restricted areas. The granite is quarried by drilling and blasting. The heavier blocks are used for cyclopean masonry, and the smaller material goes to the crushing plant, which is a large concrete and steel structure.

Mamaroneck. Quarry operations are conducted by Faillace Brothers in an exposure of grano-diorite in the town of Mamaroneck, a little west of the village of that name. The rock belongs to the large intrusion which extends northeasterly across Rye and Harrison townships into Connecticut where it is known as the Danbury grano-diorite. It is medium to dark in color, with abundant biotite which by its linear arrangement lends a gneissoid appearance to the mass. It has a fine grain, varied at times by porphyritic feldspars which measure up to an inch in length. The porphyritic phase resembles very much the augen-gneiss at Bedford in northern Westchester county.

The Faillace quarry consists of an opening along a northeast-southwest ridge, 200 feet in length and 30 to 50 feet in height. The grano-diorite is here rather dark, rich in biotite, and carries considerable garnet. It shows traces of sheet structure as exposed in the quarry, the sheets being from 6 to 8 feet thick and dipping slightly southward. The principal set of joints strikes northeasterly parallel to the foliation and dips 75° or so northwest. Another system crosses this at a high angle but is irregular and at times obscure. The rock is quite uniform in appearance, being fairly free of knots and streaks and pegmatitic injections. The color effect of the cut stone varies somewhat on the different sides. Parallel to the foliation the biotite is more in evidence than the feldspar and lends a very dark, almost black, color to that side. Across the foliation, the color is grayish, mottled by the white feldspar augen, which are more prominent in the horizontal plane. For building purposes, it is cut so as to present the lighter color, across the foliation.

In composition, the rock from this quarry is intermediate between granite and diorite. The feldspar in the ground mass is mainly plagioclase either oligoclase or andesine, while the porphyritic individuals which are clear and glassy have the characters of microcline. Quartz is fairly abundant and of smoky color. The reddish garnet occurs in scattered grains and large aggregates of grains, apparently a secondary development from the feldspar and biotite. A green hornblende occurs in small amount. The rock shows little weathering, except in the clouding of the plagioclase feldspar, and is a strong, tough building material.

The product of the quarries is mainly building stone which is cut and dressed by bush hammering at the quarries. The waste is used for riprap and crushed stone, a small crusher being set up on the property. Shipment is made by Mamaroneck station on the New Haven Railroad one-half mile distant from the quarries.

Campbell's quarry at Larchmont, which was described by Eckel in his paper "The Quarry Industry in Southeastern New York," has not been worked for a number of years and probably will not again be operated, as the vicinity is being rapidly developed for residence purposes. The grano-diorite is not so even in texture and rather more affected by weathering than at the other quarry localities.

A quarry has been opened along the ridge northeast of Campbell's quarry and one-quarter mile west of the New Haven Railroad. It has been idle during the last two or three years, but the waste is used in a crusher nearby. It has a face about 125 feet long on the strike of the grano-diorite gneiss and from 20 to 35 feet high. The rock contains more biotite and is therefore darker in color than that at the other quarries in this vicinity, while the foliation is more marked, resembling the structure of a typical gneiss. A few small bands and lenses of pegmatite afford the only noteworthy variation in the exposure. The strike of the foliation is northeast and the dip northwest at an angle of 75°. Two systems of nearly vertical joints run northeast and northwest respectively, besides which there is a fairly well-marked sheeting which dips 10° or so south. The joints divide the mass into cubical blocks that average 6 or 7 feet in each dimension. The product has been mainly used for building and other large structures. There is no equipment on the property at present.

LIMESTONE

The stone classified under the heading of limestone consists for the most part of the common grades of limestone and dolomite such as are characterized by a compact granular or finely crystalline texture and are lacking in ornamental qualities.

A smaller part is represented by crystalline limestone and by the waste products of marble quarrying which is sometimes employed for crushed stone, lime making or flux. Limestone used for the manufacture of portland and natural cement is, however, excluded from the tabulations so as to avoid any duplications of the statistics.

Limestones have a wide distribution in the State, the only region which is not well supplied being the southern part where the prevailing formations are sandstones of Devonic age. The monocrystalline varieties occur in regular stratified order in the Cambric, Lower Siluric, Upper Siluric and Devonic systems. In most sections they occupy considerable belts and have been little disturbed from their original horizontal position. On the borders of the Adirondacks and in the metamorphosed Hudson River region, however, they have been more or less broken up by faulting and erosion and in places have a very patchy distribution.

The Cambric limestones are found in isolated areas on the east, south and west sides of the Adirondacks. They are usually impure, representing a transition phase between the Potsdam sandstones below and the high calcium limestones above. The lower beds of the Beekmantown formation as originally defined are now known to belong to the Cambric system. The Little Falls dolomite is perhaps the most prominent member of the Cambric limestones and is extensively developed in the Mohawk valley with quarries at Little Falls, Amsterdam, and other places. It is a rather heavily bedded stone of grayish color, suitable more especially for building purposes. In Saratoga county the Hoyt limestone is in part the equivalent of the Little Falls dolomite; it has been quarried for building stone just west of Saratoga Springs. On the west side of the Adirondacks the Theresa limestone is described by Cushing as a sandy dolomite which may in part belong to the Cambric system. It is comparatively thin and has no importance for quarry purposes.

The Beekmantown limestone, which is now taken as including the middle and upper beds of that series as earlier defined, is mostly restricted to the Champlain valley. It occurs on the New York shore in rather small areas, usually down-faulted blocks, that are the remnants of a once continuous belt. It is also represented doubtless in the basal portion of the limestone area that extends across Washington and Warren counties. The only place where it has been extensively quarried is at Port Henry where the purer layers have been worked for flux. In the Lake Champlain region it is a bluish or grayish magnesian limestone occurring in layers from a few inches to several feet thick.

The Chazy limestone is found in the same region as the Beekmantown in discontinuous areas along the eastern Adirondacks from Saratoga county north to the Canadian boundary. It attains its maximum thickness in eastern and northeastern Clinton county, and has been quarried around Plattsburg, Chazy and on Valcour island. The Chazy is the earliest representative of the Paleozoic formations characterized by a fairly uniform high calcium content; it analyzes 95 per cent or more of calcium carbonate. It has a grayish color and finely crystalline texture. The fossiliferous beds afford attractive polished material which is sold as " Lepanto " marble. It is used also for lime and furnace flux. There are old quarries on Willsboro point, Essex county. On the west side of the Adirondacks the Pamelia limestone described in the areal reports of that section, belong to the Chazy series. It covers a considerable area in Jefferson county between Leraysville and Clayton, and has been rather extensively quarried for building stone and lime, though of subordinate importance to the Trenton limestones of that section.

In the Mohawkian or Trenton group are included the Lowville (Birdseye), Black River and Trenton limestones which have a wide distribution and collectively rank among the very important quarry materials of the State. They are represented in the Champlain valley but are specially prominent on the Vermont side; from the latter area a belt extends southwest across northern Washington county to Glens Falls in Warren county and is continued into Saratoga county. Another belt begins in the Mohawk valley near Little Falls and extends northwesterly with gradually increasing width across Oneida, Lewis and Jefferson counties to the St Lawrence river. There are isolated areas of Trenton limestones in the Hudson valley south of Albany. The limestones vary in composition and physical character according to locality and geologic position. They are often highly fossiliferous. In the northern section they are mostly gray to nearly black in color, contain little magnesia and run as high as 97 or 98 per cent calcium carbonate. The lower part of the group is heavy bedded and well adapted for building stone; the upper beds commonly contain more or less shale. They are used for various purposes including building and ornamental stone, crushed stone, lime, portland cement and flux. In the Champlain valley quarries are found near Plattsburg, Larabees Point and Crown Point; in Washington county at Smiths Basin; in Warren county at Glens Falls where there are extensive quarries that supply material for building purposes, portland cement and lime. The well-known black marble from Glens Falls is taken from the Trenton. Numerous quarries have been opened in Herkimer, Oneida, Lewis and Jefferson counties. The output of the last named county is specially important, including limestone for building and road construction and lime for manufacture of calcium carbide. The principal quarries in Jefferson county are at Chaumont.

The next assemblage of limestones in the order of stratigraphic occurrence includes the Clinton, Lockport and Guelph members of the Niagara group. The Clinton limestone has a variable importance in the belt of Clinton strata that extends from Otsego county a little south of the Mohawk river across the central and western parts of the State on the line of Oneida lake and Rochester to the Niagara river. East of Rochester the limestone is relatively thin, usually shaly and split up into several layers, but on the west end in Niagara county it becomes the predominant member and has a more uniform character. Large quarries have been opened recently at Pekin, Niagara county, for the supply of flux to the blast furnaces of the Lackawanna Steel Co. at Buffalo. The upper beds of bluish gray fossiliferous limestone from 10 to 12 feet thick are the purest and analyze from 90 to 95 per cent calcium carbonate. The Lockport is a magnesian limestone, in places a typical dolomite, and is rather siliceous in the lower part. It outcrops in a continuous belt, several miles wide, from Niagara Falls east to Onondaga county and then with diminishing width across Madison county. The upper layers are rather heavy and yield material suitable for building purposes, road metal and lime. There are quarries around Niagara Falls, Lockport and Rochester. It is worked to some extent in Wayne, Onondaga and Madison counties. The Guelph, also a dolomite, occupies a limited area in Monroe and Orleans counties and is worked near Rochester.

The Cayugan group includes among its members the Cobleskill, Rondout and Manlius limestones, which are economically important. They have furnished large quantities of material for the manufacture of natural cement, being the source of the cement rock in the Rosendale district and in Schoharie and Onondaga counties. The cement rock of Erie county is found in the Salina formation. The purer layers are employed in Onondaga county for lime-making. The Manlius limestone is used for portland cement in the eastern part of the State.

At the base of the Devonic system appears the Helderbergian group which is very prominent for its calcareous strata. Limestones of this age are strongly developed along the Hudson river in Albany, Columbia, Greene and Ulster counties. The Coeymans or lower Pentamerus and the Becraft or upper Pentamerus limestones afford material for building, road metal, lime and portland cement. The limestone for the portland cement works at Hudson and Greenport is obtained from Becraft mountain, an isolated area of limestones belonging to the Manlius, Helderbergian and Onondaga formations. The works at Howes Cave use both the Manlius and Coeymans limestones. Extensive quarries are located also at Catskill, Rondout and South Bethlehem.

The Onondaga limestone, separated from the preceding by the Oriskany sandstone, has a very wide distribution, outcropping almost continuously from Buffalo, Erie county, eastward to Oneida county and then southeasterly into Albany county, where the belt curves to the south and continues through Greene, Ulster and Orange counties to the Delaware river. It is in most places a bluish gray, massive limestone with layers and disseminated nodules of chert. The chert is usually more abundant in the upper beds. The limestone finds use as building stone and the less siliceous material, also, for lime-making. Quarries have been opened at Kingston, Split Rock (near Syracuse), Auburn, Waterloo, Seneca Falls, Leroy, Buffalo and other places.

The Tully is the uppermost of the important limestone formations and likewise the most southerly one represented in the central part of the State. Its line of outcrop extends from Ontario to Madison county, intersecting most of the Finger Lakes. Its thickness is not over ten feet, and on that account can not be worked to advantage except under most favorable conditions of exposure. For building stone it is quarried only locally and to a very limited extent. It finds its principal use in portland cement manufacture, being employed for that purpose by the Cayuga Lake Cement Co. in its works at Portland Point, Tompkins county.

Marl is a useful substitute for the hard limestones for some purposes and is rather extensively developed in the central and western parts of the State. It is found particularly in swampy tracts and old lake basins associated with clay and peat. In the Cowaselon swamp near Canastota the marl underlies several thousand acres and is said to be 30 feet thick. The Montezuma marshes in Cayuga and Seneca counties contain a large deposit which at Montezuma is 14 feet thick. In Steuben county the marls at Arkport and Dansville have been employed for lime-making. Until recently marls have been used extensively for portland cement and plants were operated at one time in the marl beds near Warner and Jordan, Onondaga county; at Montezuma, Cayuga county; Wayland, Steuben county; and Caledonia, Livingston county. Their principal use at present is for agricultural and chemical purposes.

Production of limestone. The limestone quarried for various uses constitutes more than one-half the total value of the quarry products of the State. The proportion would be even more in favor of limestone if the stone consumed in portland cement manufacture was reckoned in the total, but that is excluded in order to avoid duplication of the statistics.

The reports submitted by the quarry companies indicate a very large increase in the output for 1912, the total value of which amounted to $3,510,445 against a value of $3,174,161 in 1911. The advance raised the figures above those for any previous year; the next highest total was $3,300,383 in 1909. As in other branches of the industry, no account has been made of the stone quarried by contractors in connection with road improvement work, for which it is impossible to secure reliable data.

Production of limestone

MATERIAL	1910	1911	1912
Crushed stone	$1 815 809	$1 936 292	$2 176 368
Lime made	365 839	400 396	452 002
Building stone	99 049	112 082	108 581
Furnace flux	538 491	454 800	542 154
Rubble, riprap	30 819	20 328	10 696
Flagging, curbing	3 888	11 989	5 481
Miscellaneous	391 912	238 274	215 163
Total	$3 245 807	$3 174 161	$3 510 445

Erie county outranks all others in importance in this industry; its products are chiefly furnace flux, crushed stone and building stone. The value of the limestone quarried within the county last year was $923,847. The larger quarries are at North Buffalo, Clarence and Akron.

Onondaga county occupies second place, the result mainly of the operations of the Solvay Process Co., with its quarries at Jamesville which are among the largest and best equipped of any in the country. Besides the stone used by the company in the alkali works at Syracuse, it sells a large quantity for road making, cement and other purposes. The Lackawanna Stone Co. has quarries under development which will probably enter upon active production during the current year.

The other counties reporting a value of over $100,000 in 1912 were Dutchess, Rockland, Ulster, Genesee, Warren, Niagara, Albany and Schoharie, ranking in the order named. A large quarry to furnish flux is being opened near Gasport, Niagara county. This locality lies on the outcrop of the Clinton formation, the same as the flux quarry near Pekin, a little farther west. The quarry is to be operated by the Wickwire Limestone Co. It is reported that a limestone quarry is under development at Oriskany Falls, by Bardorf, Davis & Chapman.

The distribution of the limestone according to counties and also according to uses is shown in the accompanying tables for the years 1911 and 1912.

Crushed stone. Limestone finds its principal application as crushed stone in which form it is employed for road metal, concrete and railroad ballast. There are large quarries supplying crushed stone in Erie, Genesee, Dutchess, Ulster and Rockland counties, as well as many smaller quarries in other counties. The canal, highway and other public improvements in current progress have created large markets for the material and the production has shown a steady increase. A considerable quantity of the fines made by the crushing plants is sold for agricultural purposes as a substitute for burnt rock or lime.

The value of the crushed limestone for 1912 reached a total of $2,176,368 against $1,936,292 for the preceding year. As stated already, the total does not include the stone crushed by contractors for local use on the highway system. The actual quantity turned out by the crushing plants was 3,559,257 cubic yards, as compared with 3,116,958 cubic yards in 1911. Erie county alone made an output of 958,763 cubic yards valued at $607,107. The other leading counties were Dutchess, Rockland, Ulster, Onondaga, Genesee and Albany.

Lime. The value of lime made for market last year was $452,002 as compared with $400,396 in 1911. In quantity, it amounted to 93,176 short tons. In addition there was a large output made in connection with chemical manufactures, such as alkali, carbide etc., which, as it was not sold as such, has been included under " other uses." The principal quarries for lime manufacture are in Warren, Clinton, Washington, Lewis and Jefferson counties.

Building stone. The limestones found in the State have a limited sale for building purposes, and few quarries supply more than a local demand, so that their output fluctuates greatly from year to year. The restricted market seems to be due to the fact that the limestones are prevailingly of grayish color in medium to dark tints, whereas the present demand is for white or very light gray stone such as the Bedford stone. The extending use of concrete has also been a factor in the recent decline of the cut-stone trade, though it has increased the sale of crushed stone.

The total product of building stone, according to the returns for 1912, had a value of $108,581. This was a little larger than the value for 1911 which amounted to $99,049, but considerably less than the totals reported in some of the earlier years. Erie county as usual was first in this branch of the trade; its output was valued at $67,912. Cayuga, Onondaga, Montgomery, Warren and St Lawrence counties contributed smaller amounts.

Furnace flux. The output of stone for use in blast furnaces, foundry furnaces and other metallurgical operations has assumed large proportions. For such purposes, a relatively pure material is desired, though the presence of magnesia may not be detrimental to some applications as in iron smelting. The principal quarries of flux are in the Onondaga limestone of Erie and Genesee counties and the Clinton limestones of Niagara county. Smaller amounts of flux are obtained from the Precambric crystalline limestones in St Lawrence and Essex counties, the Chazy limestone in Clinton county, and other formations.

The production of flux in 1912 was valued at $542,154, representing a total of 1,032,481 tons. The corresponding figures for the preceding year were $454,800 and in quantity 792,248 tons. Niagara county had the largest production, with Erie in second place.

Production of limestone by counties in 1911

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany	$132 925	....	....	....	....	$132 925
Cayuga	28 494	....	....	$12 100	....	40 594
Clinton	12 192	$62 002	$9 511	625	$579	84 909
Erie	489 881	300	268 082	77 689	7 663	843 615
Genesee	204 896	....	....	....	....	204 896
Greene	2 625	....	2 000	....	....	4 625
Herkimer	9 283	2 603	....	....	....	11 886
Jefferson	16 749	*a* 18 625	....	....	40 220	75 594
Lewis	2 850	35 000	....	95	91	38 036
Madison	34 361	22 625	5 000	100	....	62 086
Monroe	16 133	18 780	....	3 291	994	39 198
Montgomery	39 000	....	....	5 338	11 184	55 522
Niagara	....	525	141 824	800	....	143 149
Onondaga	170 402	*a* 53	....	10 178	190 704	371 337
Rensselaer	16 556	....	100	....	1 268	17 924
St Lawrence	287	6 824	24 186	652	13	31 962
Saratoga	3 792	....	....	....	....	3 792
Schoharie	19 640	300	....	457	4 600	24 997
Seneca	5 650	22	61	487	74	6 294
Ulster	167 472	19 300	....	....	....	186 772
Warren	18 161	165 064	....	270	5 621	189 116
Washington	1 000	10 000	....	....	....	11 000
Westchester	....	21 072	253	....	4 027	25 352
Other counties *b*	543 943	17 301	3 783	....	3 553	568 580
Total	$1 936 292	$400 396	$454 800	$112 082	$270 591	$3 174 161

a Lime made by Solvay Process Co. and Union Carbide Co. included in " Other uses."
b Includes Columbia, Dutchess, Essex, Fulton, Oneida, Ontario, Orange and Rockland counties.

Production of limestone by counties in 1912

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany	$136 690	....	....	....	....	$136 690
Cayuga	32 620	....	....	$7 330	....	39 950
Clinton	8 694	$60 521	$13 423	600	$2 881	86 119
Erie	607 107	75	246 091	67 912	2 662	923 847
Genesee	214 310	6 750	54 557	....	6 000	281 617
Greene	3 250	....	6 000	....	....	9 250
Herkimer	14 826	....	....	....	....	14 826
Jefferson	18 865	*a* 17 942	....	....	....	36 807
Lewis	1 568	35 000	....	39	2 782	39 389
Madison	33 957	....	....	766	....	34 723
Monroe	28 079	6 600	....	2 307	....	36 986
Montgomery	17 794	....	....	7 259	1 886	26 939
Niagara	....	....	192 915	1 407	2 800	197 122
Oneida	51 507	14 280	....	....	....	65 787
Onondaga	204 998	*a*	....	6 407	208 914	420 319
Rensselaer	23 974	....	....	150	....	24 124
St Lawrence	1 035	5 277	24 612	5 149	....	36 073
Schoharie	96 000	....	210	2 089	1 658	99 957
Ulster	38 375	16 360	....	....	....	54 735
Warren	46 434	207 727	....	6 441	308	260 910
Washington	....	43 350	....	300	....	43 650
Westchester	....	11 695	100	....	1 000	12 795
Other counties *b*	596 285	26 425	4 246	425	449	627 830
Total	$2 176 368	$452 002	$542 154	$108 581	$231 340	$3 510 445

a Lime made by Solvay Process Co. and Union Carbide Co. included in "Other uses."
b Includes Columbia, Dutchess, Essex, Fulton, Ontario, Orange, Rockland and Seneca counties

MARBLE

Marble, in the commercial sense, like granite, includes a variety of rocks that lend themselves to building or decorative uses. Most commonly, the name signifies a crystalline aggregate of calcite or dolomite, as distinguished from ordinary limestones which at best are of indistinctly crystalline nature. At the same time it implies the feature of attractiveness by reason of color and the ability to take a lustrous polish. Rocks possessing all these features are marbles in the strict sense to which the name may be applied without qualification. Some compact or granular limestones that lack the elements of thorough crystallinity make, however, a handsome appearance when polished, and such are commercially classed as marbles. Fossil marbles, black marbles, and a few other kinds are commonly of the noncrystalline type. Serpentine marble, or verde antique, is made up for the most part of the mineral serpentine, a silicate of magnesium and iron, and is therefore not related to the varieties already described. Ophitic limestone, or ophicalcite, is a crystalline limestone or dolomite carrying grains and nodules of serpentine scattered more or less evenly through its mass. Its ornamental quality lies in the speckled or mottled pattern and the sharp contrast between the clear white ground mass and the greenish serpentine inclusions.

Marbles belonging to these various types find representation in the geologic formations of the State and are quarried on a commercial scale or have been so quarried in the past.

The true or crystalline varieties are limited in occurrence to the metamorphic areas of the Adirondacks and southeastern New York. They are of early geologic age, antedating the period of crustal disturbance and metamorphism which in the Adirondacks was brought to a close practically long before Cambric time and which in southeastern New York was completed in the Paleozoic. This thoroughly crystalline character is in fact a development of the strong compression accompanied by heat to which they have been subjected; having been originally, no doubt, ordinary granular or fossiliferous limestones similar to those so plentifully represented in the undisturbed formations outside the regions.

The crystalline limestones of the Adirondacks are most abundant on the western border in Jefferson, Lewis and St Lawrence counties where they occur in belts up to 4 or 5 miles wide and several times as long, interfolded and more or less intermixed with sedimentary gneisses, schists and quartzites. They are found in smaller and more irregularly banded areas in Warren and Essex counties on the eastern side, but have little importance elsewhere. The ophitic limestones that have been quarried at different times belong to the same series. The marbles of the Adirondacks comprise both the calcite class with very little magnesia and the dolomite class containing high percentages of magnesia. No definite relation is apparent in regard to the occurrence of the two and both may be found in the same area and in close association.

The southeastern New York marbles occur in belts which follow the north-south valleys, east of the Hudson, from Manhattan island into Westchester, Dutchess and Columbia counties. They range from very coarsely crystalline to finely crystalline rocks, are prevailingly white in color and belong to the dolomite class. They are interfolded with schists and quartzites, the whole series having steep dips like those of strongly compressed strata. The geologic age of the southern belts is probably Precambric, but on the north and east within range of the Taconic disturbance, they may belong to the early Paleozoic.

Bodies of practically pure serpentine of considerable extent are found on Staten Island and in Westchester county near Rye; they represent intrusions of basic igneous rocks whose minerals, chiefly pyroxene and olivine, have subsequently changed to serpentine. They are not important for quarry purposes, owing to the frequency of fissures and joints and the rather somber color of the exposed parts of the masses.

The microcrystalline or subcrystalline limestones that are sometimes sold as marbles include members of the regularly bedded unmetamorphosed Paleozoic limestones, which locally, show qualities of color and polish that make them desirable for decorative purposes. They range from dense granular varieties to those having a more or less well developed crystalline texture and are often fossiliferous. Inasmuch as they have never been subjected to regional compression or been buried in the earth deep enough to become heated, the crystalline texture, when present, may be ascribed to the work of ground waters. These circulate through the mass, taking the carbonates of lime and magnesia into solution, and redeposit them in crystalline form. Originally, the limestones were accumulations of lime-secreting fossils or granular precipitates, for the most part of marine origin. Some of the localities where these unmetamorphic marbles occur are on the west shore of Lake Champlain, around Plattsburg and Chazy (Chazy limestone), Glens Falls (Trenton limestone) and Becraft mountain and Catskill (Becraft limestone).

Production. The number of active quarries in the State is small and the annual output falls below that of other quarry materials, with the single exception of granite. There is considerable fluctuation, however, in the output, depending chiefly upon the activity in building operations, as the greater part of the product is sold as architectural stone. A single contract for a large structure may make a very apparent difference in the annual total.

In 1912, there were seven active quarries, with a product valued altogether at $241,847. Nearly one-half of the value, or $114,466, was reported by three quarries in the Gouverneur district. Two quarries in southeastern New York, with one at Plattsburg and one at Glens Falls, contributed the remainder. The figures for the last three years are shown in the accompanying table.

Production of marble

VARIETY	1910	1911	1912
Building marble	$252 965	$171 748	$155 411
Monumental	88 684	79 115	84 511
Other kinds	231	27 178	1 925
Total	$341 880	$278 041	$241 847

NOTES ON NEW YORK MARBLE QUARRIES

The marble resources of the State have been described only in a very general way, and the published information is mainly contained in the reports of the Tenth Census and Smock's bulletin on "Building Stone in New York" which reflect conditions as they existed twenty-five years or more ago. The following account of some of the developed quarries has been prepared from observations made in the summer of 1912, intended as a basis for a detailed geological, petrographical and chemical study of the subject.

Gouverneur district. The principal area of crystalline limestones with their interbedded gneisses, schists and quartzites, which together represent the Grenville series of the Adirondack region, is exposed in southwestern St Lawrence county and the contiguous part of Jefferson county in the interval between the Adirondack highland and the St Lawrence river. The area is irregular in outline, but is drawn out along a northeast-southwest direction which is the main structural trend of the region. The northeastern section in Canton and DeKalb townships, St Lawrence county, consists of a narrow belt a mile or so wide, but as it continues southwesterly into Gouverneur, it expands so as to cover most of that town and the adjoining towns of Macomb and Rossie on the north and west, narrowing at the county line and soon terminating in the towns of Antwerp and Theresa, Jefferson county. The total surface covered by this body of Grenville strata may be placed at approximately 175 square miles.

Throughout the area, the limestone is the most persistent and conspicuous member of the series, but it gives way locally to micaceous, pyritic schists, graphitic or glassy quartzites and dark hornblende gneisses and amphibolites. The several formations have the appearance of an interbedded but strongly folded, compressed and altered series of sediments. Subsequent to their folding and metamorphism, they have been subjected to profound erosion so that the present surface represents what once was the deeply buried portion of the strata. As a result of these vicissitudes there is little evidence remaining of the precise structural relations presented by the complex or of the order in which the various members were originally deposited.

Intrusions of deep-seated rocks, mainly granitic in character, occur within the area. They have a more or less gneissoid appearance but not the schistosity of the Grenville gneisses, are prevailingly reddish or gray in color and belong mostly to the biotite and hornblende varieties of granite. They form bosses of some size and also sills and dikes. In their vicinity the schists and gneisses are injected by small offshoots of the granites and their pegmatites which oftentimes assume the appearance of a perfect maze of interlacing veins so that the rock is as much igneous as sedimentary in character. Besides these clearly intrusive granites and granite gneisses, there are frequent bodies of gneiss in the forms of bands and lenses which stand in indefinite relationship to the Grenville and which, like some of the gneisses on the border of the area, must await more detailed study and mapping before they can be definitely classified.

The crystalline limestone of this area constitutes one of the larger bodies of high-grade calcium limestones found in the State. It is mainly an aggregate of coarse granular calcite, white in color, holding a few included minerals like phlogopite, graphite and pyrite in scattered crystals. The average content in carbonates exceeds 90 per cent. Though it is called a calcium limestone, there is always a small amount of magnesia present — from 1 to 3 per cent — and in places it has the character of a dolomite. The change to dolomite takes place rather abruptly but apparently without reference to structural lines that might suggest original variations of deposition. The occurrence of dolomite is, however, quite local and unimportant as compared with the great body of limestone. On the other hand, the limestone shows well-marked zones or bands in which quartz and silicates are abundant and which seem to be the result of impurities included when it was being laid down. A peculiar type is represented by an admixture of white quartz and calcite in nearly equal proportions, the two minerals occurring in alternating seams, lending the appearance of a schistose rock, or else in grains and masses thoroughly intermingled. Contact effects with the intrusive granites are manifested in the development of silicate minerals like tourmaline, vesuvianite, pyroxene, tremolite etc., which in restricted areas become very abundant. Of valuable minerals, hematite and pyrite occur in commercial quantity, while galena, sphalerite, fluorite and barite are found in smaller bodies.

The following analyses of the limestones are based on samples from the different marble quarries, but may be said to represent the general character of the rock when fairly free of admixture. Nos. 1, 2 and 3 are by R. W. Jones, made on samples collected by the writer in 1912. No. 1 is based on sample from the extra-dark quarry of the St Lawrence Marble Quarries; no. 2, quarry of Gouverneur Marble Co; no. 3, Rylestone quarry. No. 4 is an analysis of the marble in Northern New York quarry made some years ago but not hitherto published. No. 5 represents the dolomitic marble, formerly worked by the White Crystal Marble Co.; analysis made at Watertown arsenal.

	1	2	3	4	5
Insol	3.55	1.26	1.01	.....	.....
SiO_2	.....	.....	.....	1.58	.28
Al_2O_3	.13	.65	.23	.79	.10
Fe_2O_3	.08	.29	.63		
MgO	.....	.....	.....	3.49	20.64
$MgCO_3$	6.40	7.50	6.85	7.33	.....
CaO	.....	.....	.....	51.45	31.45
$CaCO_3$	87.06	87.47	88.94	91.88	.....
H_2O	1.68	1.46	1.74	.....	.....
CO_2	.....	.....	.....	42.56	47.38
S	.05	.02	.04	.03	.06

The typical Gouverneur marbles as illustrated in the first four analyses show a very uniform composition in respect to the lime and magnesia. On the other hand, the white marble shows a much larger amount of magnesia which reaches the proportions of a dolomite.

The Gouverneur marble all comes from a small area southwest of that town; the quarries, with one or two exceptions, lie along a narrow belt which extends for a little over a mile in a northeast and southwest direction. The greater number of openings are on the eastern section. The quarries lie on the outcrop of the marble "vein" or beds which dip northwest at an angle ranging from 15° to 30° on the eastern end to 80° or 90° on the western end. Besides the dip, there is a well-marked pitch that seems to be mainly southwest at an angle of 20° or 25°. The structure resembles that of an overturned pitching fold which has undergone deep erosion.

In color and texture, the marble shows variety, though the differences are not specially prominent between the several merchantable grades of stone. It is mottled white and grayish blue, or light and dark blue, running in places to almost dark blue which is the color most sought for. In the lighter mottled sorts, the grain is coarse and somewhat irregular, with the light and darker calcite segregated more or less into separate areas. The individual calcite grains mostly have a diameter of about 1 or 2 mm. In the dark blue marble, however, the grain is much finer, the calcite averaging only a fraction of a millimeter in diameter. The variation in color seems to be traceable to the presence of graphitic carbon which is scattered irregularly through the mass in submicroscopic particles. The presence of carbon was indicated in the chemical analysis, but no determination of it was made, the actual amount being extremely small.

The marble is susceptible of high polish and has a luster very much like that of some gray granites. It is well adapted for monumental work and the better grades are mainly used for that purpose. Its weathering qualities are attested by nearly a century of use as monumental and building stone. For building purposes it has found considerable sale in the large towns and cities of New York and adjoining states, especially for public structures, churches and fine residences.

The rock face which is most favored for buildings has a medium gray tone, while the cut or patent hammered surface of trimmings shows much lighter. The selling prices vary with the color and uniformity, and range up to about $4.70 a cubic foot which is the price received for the best quality of extra dark monumental stock, sand rubbed but not polished. The lighter grades of monumental stone bring from $1 to $2 less a cubic foot. The grades of the different quarries do not correspond closely, so that the terms dark, extra dark, etc., as used by the several companies are not strictly equivalent.

There seems to be some relation between the color of the marble and the stratigraphic features, though such relation may not be uniform or consistent throughout the belt. In general, however, the lighter and coarser marble is on top or in the northwestern section, while the fine-grained dark comes from the structurally lower beds on the southeast. This is indicated by the variation in the different exposures and by the results of drilling.

The St Lawrence Marble Quarries. The quarries owned by this company are near the northeastern end, two of which are close to the mill and are known as the St Lawrence quarries. The third quarry, called the extra-dark, is on a different vein to the south and east. Only the last was under operation at the time of the writer's visit. It is an opening 125 feet long and 80 feet wide and 20 to 30 feet deep. The marble here is of medium color, mottled or veined on top, but becomes dark blue in depth which is the grade particularly sought, as the other quarries supply lighter stock of good quality. The bedding structure dips northwest 30° and pitches southwest 25°. Two vertical systems of joints intersect the beds, the one running N. 30° W. and the other N. 65° E. A trap dike from 2 to 3 feet wide crosses the quarry in the latter direction which is nearly that of the strike; it dips south at a high angle. The dike shows a serpentinous groundmass, with lath-shaped feldspars, and is probably a diabase that has been considerably weathered.

The two St Lawrence quarries near the mill are vertical rock cuts with a surface of about 20,000 square feet each and a depth in the northerly quarry of 80 feet and of 40 feet in the southerly one. They have supplied large quantities of building marble of which examples are seen in Gouverneur, Watertown, Ogdensburg, Rochester and other places. The monumental stone is mainly the selected darker quality which is sold under the trade name of "St Lawrence" but includes some lighter stone called "Adirondack." Near these quarries, a drill hole was put down which penetrated the vein for 400 feet. The dip is here about 20°.

The quarries are well equipped with six channelling machines, two gadders, and three large derricks. The mill is the largest in the district, having sixteen gangs of saws, besides rubbing beds, lathes, and polishing machines. The mill is run by electricity derived from the Hailesboro water power station.

Northern New York Marble Co. The property of the Northern New York Marble Co. lies in the southwestern section of the belt, separated from the other quarries by a long stretch of undeveloped ground. It appears to be considerably south of the course of the principal marble beds, but is possibly a continuation of the vein developed in the extra dark quarry of the St Lawrence Company. This is segregated by the similarity in the product, as well as by the relative position of the two quarries. The structural features, however, are not uniform, as the strike becomes almost east-west and the dip is very high — about 80° N. at the more westerly property. There is the same westerly pitch of the beds.

The principal quarry opening is about 140 feet long and 75 feet wide and has been worked down to 210 feet depth. This has been abandoned on account of the depth. A second quarry 100 feet south of the first one and about the same length has been worked to a depth of from 40 to 65 feet. In 1912, the development of a third quarry was begun, situated to the west of the latter with which it will eventually connect. This covers an area of 100 feet square. The quarries are equipped with three channelling machines, two gadders and two derricks.

The marble is mostly of the darker grades, the average being darker than that found in the other quarries, and is also finer grained. It is sold under the name of "Northern New York," with three grades depending on the relative presence or absence of lighter streaks in the dark blue ground. It is mainly in demand for monumental work. A good proportion of the lighter grade is not polished, but hammer faced, and then makes a close imitation of granite.

In the upper 15 feet, the marble shows open joints and fissures along which more or less weathering and discoloration has taken place. A few fissures reach below that depth, but for the most part the stone is uniform and quite solid. There are a few knots in the quarry walls, which arise from silicate inclusions; they rarely exceed a foot in diameter. The surface of the marble shows deep groovings from glacial erosion.

The company's mill is situated at the quarries and is equipped with ten gangs and a rubbing bed. The larger part of the output of monumental marble is shipped in polished form.

The Gouverneur Marble Co. The Gouverneur Marble Co. owns quarries on the northeastern section, adjoining those of the St Lawrence Company. Its principal development is an opening 250 feet long and nearly as wide which has been worked to an average depth of 50 feet. This is being extended by a smaller connecting quarry 125 feet long and 50 feet wide on the southeast. The beds dip northwest 10° or so and have a pitch to the northeast. The jointing is mainly in two systems N. 40° W. and N. 50° E. dividing the marble into rectangular blocks. A test hole was put down in the smaller quarry to a depth of 95 feet and is said to have shown a good quality of marble for that distance.

The product runs mostly to the medium and light sorts, but some good dark is being extracted from the more southerly section. The lighter colors are often beautifully mottled or veined. A considerable part of the product goes for building stone which is shown in churches and schools in various parts of the State.

The quarry equipment comprises a derrick, two channelers and a gadder. The mill has eleven gangs of saws.

The Rylestone quarries. The Rylestone quarries, which were closed at the time of the writer's visit, lie a mile or so south of the main belt on a separate lead. They are situated on the side of a low hill and are not worked below the surface. The marble is a coarse medium to light stone, in which the blue and white are equally mixed. It lacks the uniformity of texture exhibited by the marble elsewhere and is subject to considerable loss in quarrying by reason of vugs that are apt to be disclosed in the midst of an otherwise sound block. These vugs range from very minute cavities lined with crystallized minerals to those a foot or two in length. Calcite, marcasite and brown tourmaline are the more common minerals found in them.

The quarry face is about 100 feet long at the base and 50 feet high. In the last operations, the stone has been quarried away by blasting. The product was sawed in a mill nearby equipped with eight gangs.

There are a number of quarry openings on the main belt which have been idle for some time, such as the Callahan quarry on the northeast end, the Sullivan quarry, near the St Lawrence quarries, and the quarry of the former Whitney Marble Co., on the southwest, near the property of the Northern New York Marble Company.

Southeastern New York. Crystalline limestone is found in the Highlands and the bordering metamorphosed area to the north and south. It is specially prominent on the east side of the Hudson, where it underlies many of the north-south stream valleys of Westchester, Putnam and eastern Dutchess counties. It is associated with schists, quartzites and thinly bedded gneisses, the whole series of interfolded metamorphosed sediments bearing much resemblance to the Grenville series of the Adirondacks. There is some doubt, however, as to the stratigraphic position that should be assigned to the limestone, if indeed it is to be regarded as an essentially continuous formation throughout the area.

In Westchester county the limestone is coarsely crystalline, white and usually dolomitic, but varying considerably in its magnesia content. The name "Inwood" limestone was first applied to it by F. J. H. Merrill, who later advocated the view of the general equivalence of the limestones in this section with those of western New England and withdrew that name in favor of the prior term "Stockbridge dolomite."

In the northern section in eastern Dutchess county, the limestone is fine in grain and shows often a bluish color, but is still prevailingly dolomitic.

The later investigations which have been carried out chiefly by Berkey indicate the possibility of the existence of two series of limestones in the region, one of which belongs to the coarser crystalline type as represented by the Westchester county rock. This is accompanied by strongly metamorphosed sandstones and argillaceous sediments known as the Lowerre quartzite and the Manhattan schist, the whole series showing no marked unconformity with the underlying gneisses. The age of the series, according to Berkey, is Precambric and may be called Grenville. The second assemblage of sediments includes the less metamorphosed representatives that are developed mainly to the north of the Highlands and include the Wappinger limestone, the Poughquag quartzite and the Hudson River slates of Cambric and Ordovicic age. Strong unconformity marks their contact with the underlying gneiss.

The limestones throughout the area are prevailingly magnesian, though they include bands and lenses that are characterized by low magnesia. In most of the developed marble quarries the stone approaches the composition of dolomite with 30 per cent or more of magnesium carbonate. The lime carbonate varies between the lower limit of 55 per cent found in the true dolomite to 70 per cent or a little more. The siliceous impurities are usually low, not over 2 or 3 per cent in the marbles. They are due to inclusions of quartz, mica, tremolite, diopside, and more rarely tourmaline. Pyrite is usually present in small amount.

The marble in this section is found in the more massive heavily bedded parts of the formation, such as are uniform in texture and nearly free of admixture with silicates. It is predominately white, either uniformly white throughout, or white clouded or banded with blue. It has been mainly used for building stone and both for exterior and interior work. There are numerous examples of it among the larger structures of New York City, especially those erected twenty or more years ago, as at that time it enjoyed greater favor among architects than any other native marble. Of recent years fashion or the exigencies of engineering technic in connection with the very large structures have brought about a change in favor of granite, limestone and terra cotta.

In durability, the marble from the different localities no doubt varies, and the ease with which some of the stone has weathered has caused much unfavorable comment. The tendency to rapid weathering which is announced by a roughening or pitting of the exposed surface seems to be inherent more especially in the marbles that have an even grain with the individual particles of square or rounded form. Such particles are not so well interlocked as those of prismatic shape. The weathering in most instances seems to be a mechanical process, simply a loosening of the bond through frost action or the expansion and contraction incident to changes of temperature. Normally, dolomite is harder and more resistent to the attack of solvents than calcium limestones.

South Dover Marble Co. Of the developed quarries in this section, the principal one in current operation is that of the South Dover Marble Co., situated near Wingdale, Dutchess county, a station on the Harlem Railroad. The area of crystalline limestone or marble lies on the flanks of a broad gneiss ridge which extends north and south along the New York-Connecticut boundary. The limestone shows a flat or slightly undulating surface in contrast with the rugged contours of the gneiss country. The quarries are about 2 miles in a direct line northeast of Wingdale, but somewhat over that distance by road. They are connected with the mill at the station by an electric tramway over which the large quarry blocks are transferred for cutting.

The company operates two quarries, the one being on the east slope of a low ridge facing the gneiss ridge and the second a little farther up the slope and northwest of the former. The lower quarry has an extreme length of 250 feet and a width of 150 feet in the southern half, but considerable less on the north. It is 135 feet in extreme depth. There are three derricks in place. The other opening is 150 feet long, 75 feet wide and about 60 feet deep. It has two derricks and an overhead cableway, the latter serving to convey the waste to the dump.

The marble is of medium texture, with prismatic and angular dolomite particles which measure from .75 to 1 mm. in diameter. It is practically pure white in color, and banding or veining is scarcely noticeable. The structure, as exhibited in the quarry walls, indicates an easterly dip of about 40° for the southern quarry and a westerly one of 50°–60° in the northern one, the reversal taking place in the distance of 100 feet. The marble is very compact, though in one place an open joint or water course extends to a depth of 50 feet. It shows slight exfoliation and weathering at the surface, with stained rock to a depth of 10 feet.

There is a little pyrite in evidence, mainly collected along stringers and occasional knots of silicates. The marble seems to be delimited on the west by a hard white quartzite which forms the higher part of the ridge and is exposed 75 feet west of the quarry opening. The strike of the marble beds is a little east of north. The quartzite intervenes between these quarries and that of the Dover White Marble Co.

At the cutting works at Wingdale, the company has a complete equipment for cutting, planing and polishing its product.

The Dover White Marble Company. The Dover White Marble Co. has a quarry and mill on the east bank of Tenmile creek about one and one-half miles northwest of the quarries of the South Dover Company. The quarry is about 100 feet square and 20 feet deep on the west or downhill side and 40 feet on the east side. The marble is rather uneven in appearance, showing small bands of gray which are more pronounced in the western section and which are regarded as variations of bedding. The bands are of sericitic and quarzitic nature, derived from argillaceous and sandy layers included in the limestone. The beds strike N. 10° E. and dip 80° E. They undulate in folds and the siliceous layers are often squeezed out into lenses around which the marble has flowed under pressure. An imperfect jointing is present along the direction of the bedding. Blind checks and seams cause considerable loss in cutting. The grain is finer than that of the South Dover product, averaging less than .5 mm.

The product has been employed mainly for veneer and wainscoting. The blocks are sawed across the bedding, or horizontally, as they lie in the quarry. The company ceased active work in April 1912.

In the southern part of the region in Westchester county and the Bronx no systematic quarry operations have been carried on in several years. Some of the quarries of this section, like those at Tremont, Tuckahoe and Pleasantville, were operated at one time on a large scale for architectural stone. The marble makes a good appearance, being mostly clear white, but is very coarse grained. On that account it is not so suitable for interior or polished work as the marble from the more northerly quarries. The only use that is made of the stone at present is for lime or crushed stone.

At the Tuckahoe quarries, formerly worked by Norcross Bros., the Emerson-Norris Co., of New York, has erected a plant for making artificial stone, using the waste from the former operations. The marble is used with white portland cement to make a very light-colored product, or mixed with darker rock, in which case the finished material is a close imitation of granite. The stone, after casting in molds, is usually hammer dressed.

The Kapailo Manufacturing Co. has a crushing plant at the old Tuckahoe Marble Company's quarry where it makes crushed stone, sand and dust for concrete and stucco. The company has recently pumped out the quarry which it intends to operate for its uses.

SANDSTONE

Under sandstones are included the sedimentary rocks which consist essentially of quartz grains held together by some cementing substance. Among the varieties distinguished by textural features are sandstones proper, conglomerates, grits and quartzites.

Of the sedimentary rocks which occur in the State, sandstone has the largest areal distribution, while in economic importance it ranks second only to limestone. Nearly all the recognized stratigraphic divisions above the Archean contain sandstones at one or more horizons. The kinds chiefly quarried are the Potsdam, Hudson River, Medina and Devonic sandstones. A few quarries have been opened also in the Shawangunk conglomerate and the Clinton and Triassic sandstones.

The Potsdam of the Upper Cambric is the lowest and earliest in age of the sandstones that have a fairly wide distribution and are utilized for building purposes. The most extensive outcrops are along the northern and northwestern borders of the Adirondacks, in Clinton, Franklin, St Lawrence and Jefferson counties. Other exposures of smaller extent are found in the Lake Champlain valley and on the southeastern edge of the Adirondack region. These latter areas represent the remnants of a once continuous belt that has been broken up by folding, faulting and erosion. The Potsdam sandstone has in many places the character of a quartzite, consisting of quartz grains cemented by a secondary deposition of quartz, and then is a very hard, tough and durable stone. The quartzite from St Lawrence county has sustained a crushing test of more than 42,000 pounds to the square inch. The color varies from deep red to pink and white. The principal quarries are near Potsdam and Redwood, St Lawrence county, and Malone and Burke, Franklin county. Besides building stone, which is the chief product, there is some flagstone sold, mainly by the quarries at Burke, for shipment to Montreal.

The so-called Hudson River group is essentially a group of sandstones, shales, slates and conglomerates, ranging in age from the Trenton to the Lorraine, but which have not been sufficiently studied to permit the actual delimitation of the various members on the map. The group is exposed in a wide belt along the Hudson from Glens Falls southward into Orange county and also in the Mohawk valley as far west as Rome. The sandstone beds are usually fine-grained, of grayish color and rather thinly bedded. Over wide stretches they provide practically the only resource in constructional stone and consequently they have been quarried at a great number of places to supply the local needs for building and foundation work. Some of the stone is crushed for road metal and concrete.

The Medina sandstone is found along the southern shore of Lake Ontario from the Niagara river east to Oswego county; in central New York it is represented by a coarse conglomeratic phase called the Oneida conglomerate. As developed in the western part of the State, where it is principally quarried, it is a hard fine-grained sandstone of white, pink and variegated color. The pink variety is specially quarried for building stone and has an excellent reputation. Many of the large cities of the country and most of the important towns and cities of the State contain examples of its architectural use. The large quarries are situated in Orleans county, near Albion, Holley and Medina, along the line of the Erie canal, but there are others at Lockport and Lewiston, in Niagara county and at Brockport and Rochester in Monroe county. The Medina sandstone also finds extensive application for curbing and flagging and for paving blocks. It is employed more extensively for the latter purpose than any other stone quarried in the State.

The Shawangunk conglomerate is more widely known for its use in millstones than for constructional purposes. It outcrops along Shawungunk mountain in Ulster county and southwesterly into New Jersey, with an outlier near Cornwall, Orange county. The quarries near Otisville have supplied considerable quantities of stone for abutments and rough masonry.

The Clinton sandstone is mainly developed in central New York, being absent from the Clinton belt in the western part of the State. It forms ledges of considerable extent on the south side of the Mohawk valley from Ilion to Utica and beyond. It consists of reddish brown and gray sandstones, of medium texture and hardness. The stone has been used for foundations and building in Utica and other places in the vicinity.

Of the Devonic formations which cover about one-third the whole area of the State, the Hamilton, Portage, Chemung and Catskill contain important sandstone members serviceable for quarry operations. These sandstones are popularly known as bluestone, a name first applied in Ulster county where they are distinguished by a bluish gray color. They are for the most part fine-grained, evenly bedded, bluish or gray sandstones, often showing a pronounced tendency to split along planes parallel to the bedding so as to yield smooth, thin slabs. For that reason they are extensively used for flag and curbstone, and a large industry is based on the quarrying of these materials for sale in the eastern cities. Most flagstone is produced in the region along the Hudson and Delaware rivers, where there are convenient shipping facilities to New York, Philadelphia and other large cities. The Hudson River district includes Albany, Greene and Ulster counties, but the quarries are mainly situated in the area that includes southern Greene and northern Ulster, with Catskill, Saugerties and Kingston as the chief shipping points. The Delaware River district includes Sullivan, Delaware and Broome counties; the shipping stations are along the Erie and the Ontario & Western railroads. The sandstone of this section ranges from Hamilton to Catskill age. In the area to the west the quarries are confined to the Portage and Chemung groups, with the most important ones in the Portage. There are large, well-equipped quarries near Norwich, Chenango county, and Warsaw, Wyoming county, which produce building stone for the general market. Numerous small quarries are found in Otsego, Chemung, Tompkins, Tioga, Schuyler, Steuben, Yates, Allegany, Cattaraugus and Chautauqua counties.

Production of sandstone. The quarrying of sandstone is carried on by a large number of individuals and firms, more in fact than is represented in any other branch of the quarry business. Most of these operate in the bluestone districts and specially in those where flagging and curbing are the principal products. The quarrying of these materials is practically a separate industry represented by several hundred more or less independent enterprises which are usually small, giving employment to two or three workmen each and having very little in the way of mechanical equipment. A statistical canvass of such small and temporary enterprises is a matter of great difficulty and is likely to afford very unreliable results. For that reason the statistics in this report are mostly based on statements furnished by dealers who operate in the bluestone districts and who act as middlemen between the individual quarries and the larger contractors or consumers in New York and other large cities. The larger part of the curb and flagstone in the Delaware and Hudson River districts is handled by such dealers.

The production of sandstone during the last two years is shown in the accompanying tables which give its distribution also among the leading districts.

The quarries of both bluestone and ordinary sandstone were slightly more active last year than in 1911. The combined value of all the sandstone quarried was $1,280,743 against $1,060,1c6 in the preceding year. The gain of $220,637 or about 20 per cent, did not restore the industry to its position in the year 1910, when the value of the output amounted to $1,451,796. The totals are exclusive of any sandstone quarried by contractors for use on the State highway system, for which it is impossible to assign any accurate figure.

Of the total value of the output for 1912, bluestone constituted a little less than two-thirds, in actual figures, $824,949. In the year 1911, it had a value of $718,777, indicating a good gain, but not counterbalancing the declines of preceding years. The flagstone industry has met with increasing competition from makers of cement walks and the output has shrunk to less than half of its former proportions. The total for flag and curbstones was $503,189 against $432,327 in 1911. The value of bluestone used for building purposes was $295,450 as compared with $280,300 in 1911. The other uses are relatively unimportant.

Sandstone other than bluestone constituted a value of $455,794 against $340,729 in 1911. The main item in the total was paving blocks valued at $188,802 against $162,220. Orleans county, which is the principal center of the Medina sandstone industry, accounted for a total value of $340,796, as compared with $225,862 in the preceding year.

Production of sandstone in 1911

DISTRICT	BUILDING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE RIPRAP	ALL OTHER
Bluestone						
Hudson river	$24 393	$218 216	....	....	$560	$200
Delaware river	31 775	204 629	....	....	1 775	1 245
Chenango co	72 933	9 482	....	....	250	1 210
Wyoming co	145 519	....	....	$600	910	....
Other districts	5 680	....	....	....	....	....
Total bluestone	$280 300	$432 327	....	$600	$3 495	$2 655
Sandstone						
Orleans co	$21 395	$83 519	$145 575	$1 081	$4 257	$35
Other districts	25 892	10 228	16 645	22 202	6 913	2 987
Total sandstone	$47 287	$93 747	$162 220	$23 283	$11 170	$3 022
Combined total	$327 587	$526 074	$162 220	$23 883	$14 665	$5 677

Production of sandstone in 1912

DISTRICT	BUILDING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE RIPRAP	ALL OTHER
Bluestone						
Hudson river	$9 674	$270 544	....	$4 000	$10 000	$1 216
Delaware river	42 944	220 601	....	....	5 367	997
Chenango co	85 622	4 876	....	....	250	2 237
Wyoming co	151 255	5 488	....	660	483	1 100
Other districts	5 955	1 680	....	....	....	....
Total bluestone	$295 450	$503 189	....	$4 660	$16 100	$5 550
Sandstone						
Orleans co	$35 660	$99 074	$185 432	$1 551	$6 723	$12 356
Other districts	31 945	13 583	3 370	39 090	15 930	12 080
Total sandstone	$67 605	$112 657	$188 802	$40 641	$21 653	$24 436
Combined total	$363 055	$615 846	$188 802	$45 301	$37 753	$29 986

The quarries in the Medina section were fairly active last year, favored by a good demand for materials used in street work. Curbstone and paving blocks constitute the main products of the quarries, considerably exceeding in value the building stone which once enjoyed wide popularity. These materials are marketed in Rochester, Buffalo, Cleveland and other lake cities, to which the stone is shipped by boat, as the barge canal passes directly through the district. For paving blocks the sandstone seems specially adapted by reason of its qualities of wearing evenly and not becoming readily rounded or "turtle-backed," which is a fault in many stone pavements. The use of blocks is superseding asphalt in paving between car tracks in city streets. There are a large number of quarries in the section from Medina to Holley, but many of these are closed at present. The tendency in the district has been toward a concentration of operations at a relatively few quarries which are well equipped and actively worked, in contrast with the small and scattered enterprises in the eastern bluestone districts.

TRAP

The quarrying of trap is a somewhat specialized branch of the stone industry which may be treated with advantage under a separate head. Trap is not a distinct rock type, but the name properly belongs to the fine-grained, dark-colored igneous rocks that occur as intrusive sheets or dikes. In mineral composition it differs from the other igneous rocks classed in the trade as granite, by the prevalence of lime-soda feldspars and higher percentages of the lime, magnesia and iron minerals and correspondingly lower amounts of silica, with little or no free quartz. The name is sometimes applied to fine-grained rocks of granite or syenitic composition and even to rocks of sedimentary derivation, but such usage is misleading and indefensible.

The particular value of trap is due mainly to its hardness and toughness. Its fine, compact homogeneous texture gives it great wearing powers and it is eminently adopted for road metal and for concrete of which heavy service is required. It has been used in this State to some extent as Belgian blocks. As a building stone it finds very little application, probably on account of its somber color. The expense of cutting and dressing trap is also an obstacle to its employment for building or ornamental purposes.

The trap quarried in New York is properly a diabase, made up of plagioclase feldspar in lath-shaped crystals and pyroxene as the main constituents, and amphibole, olivine and magnetite as subordinate minerals. The largest occurrence is represented by the Palisades of the Hudson, which begin near Haverstraw and extend southward into New Jersey. The Palisades represent the exposed edge of a sill or sheet of diabase intruded between shales and sandstones of Triassic age. The sheet is from 300 to 800 feet thick and about 70 miles long. Most of the trap quarried in this State has been obtained from this region, chiefly from the vicinity of Haverstraw and Nyack, but to some extent from near Richmond, Staten Island, where the sheet has its southern termination. Smaller occurrences of diabase are found in the Adirondacks and the bordering area. There are countless numbers of trap dikes in the interior of the Adirondacks, but very few have any considerable thickness and in general they are too remote from the market to be profitably quarried. In the outlying region the dikes at Greenfield, Saratoga county, and at Little Falls, Herkimer county, are the most notable. Quarries have been opened at the former locality and the trap is crushed for road material.

Production. The trap industry in Rockland county has been in an unsettled state during the past year, owing to the development of the plans for the Palisades Park. The lands to be set aside for the latter include a strip along the river that covers the more accessible part of the trap intrusions, and the abandonment of all operations in that section of Rockland county is in prospect. So far, only the property of the Manhattan Trap Rock Co., of Nyack, has been actually taken over and closed down previous to the opening of last season, but the contribution from other quarries was considerably reduced.

The value of the trap produced in 1912 was $483,863 as compared with $899,414 in 1911 and $909,006 in 1910. The whole output consisted of crushed stone, although in previous years building stone and paving blocks have also been produced to some extent. The quantity of crushed stone made was 675,309 cubic yards, of which 283,628 cubic yards, with a value of $207,957 was reported as sold for road purposes and 391,681 cubic yards valued at $275,906 for railroad ballast, concrete and other purposes. Altogether, there were six firms represented in the industry, of whom five operated in Rockland county and one in Saratoga county.

Production of trap

MATERIAL	1911		1912	
	CUBIC YARDS	VALUE	CUBIC YARDS	VALUE
Crushed stone for roads	850 322	$696 367	283 628	$207 957
Crushed stone for other purposes	267 930	199 797	391 681	275 906
Other kinds	185	3 250	....	....
Total	1 118 437	$899 414	675 309	$483 863

TALC

The talc mines in the Gouverneur district were under steady operation throughout 1912 and contributed about their usual output which was shipped for the most part in ground condition for use in paper, wall plasters and other purposes. The district has supplied for some time the greater part of the ground talc produced in this country. During the last twenty years the annual outturn has ranged from 40,000 tons as a minimum to a maximum of about 70,000 tons; the total quantity mined from the first may be placed at 1,450,000 tons with a value on the average market basis of approximately $12,000,000. This very considerable item in the mineral yield of the State has not caused any serious drain upon the resources, so far as can be estimated, for the development of new mines has fairly kept pace with the depletion of supplies in the older workings while there are still many possibilities for the occurrence of additional deposits within the long stretch of territory that constitutes the district.

The principal features of the occurrence of the talc and present methods of its mining and milling were described in the preceding issue of this report. The past season has witnessed no important developments which call for any revision of the information contained in the article, except that the list of active companies was increased by the entrance of the Standard Talc Co. into the field. This company, however, did not operate a new mine, but took over the old United States mine, at Talcville, which had been under lease to the International Pulp Co. The product was shipped to New Jersey for grinding, as the mill formerly connected with the mine was burned down some time ago.

The Uniform Fibrous Talc Co. which began production in 1911 was active throughout the year, continuing the development of its mines as well as preparing for an enlarged milling capacity. The mine has been developed practically from the surface. It lies a little west of Talcville on the north bank of the Oswegatchie river. The deposit appears to be nearly in the same horizon as that worked in the United States and No. 2½ mines at Talcville. The shaft is vertical for the first 90 feet, then follows the northerly dip of the talc; at the end of 1912 it had reached a depth of a little over 200 feet. The talc body has been explored for a width of 30 feet without coming into the unaltered tremolite schist which forms the walls. It yields a very white talc of fibrous nature. An addition to the mill recently completed, provides space for the crushing machinery, so that the crushing and grinding can be conducted in separate rooms, a great factor in relieving the dusty conditions that are often very objectionable if not unhealthful.

The International Pulp Co., whose activity in former years was divided among a large number of mining and milling properties secured by repeated consolidations and by leaseholds, has concentrated attention recently upon a few which are more advantageously situated. The principal mines now worked are No. 2½ and No. 3 at Talcville, and the Wight mine near Sylvia lake. The operation of No. 3 mine was hampered during the last year by the loss of the water power plant at Talcville, but a new steam plant has been installed. The mine is one of the largest in the whole district, having a depth of about 500 feet on the incline and a system of levels which extends nearly double that distance along the strike. The working thickness of the body ranges from 15 to 40 feet. The Talcville mill was burned down with the power plant and only No. 6 and the Columbia mill were steadily operated.

The Ontario Talc Co., with mine and mill near Fullerville, was a steady producer.

The new developments in talc mining at Natural Bridge have been attended with much interest as the first important undertaking of the kind outside of the Gouverneur district. The property began regular shipments of talc with the completion of the mill last season; and the initial operations are reported to have been very successful, as the product proved well adapted for paper manufacture. The St Lawrence Talc Co., Inc., the owner, has already begun the enlargement of its milling capacity and continued the development of the mine. The talc from this section, as has been already mentioned in earlier reports, differs from the characteristic Gouverneur product which for the most part is of fibrous nature with subordinate amounts of foliated or scaly talc. The material at Natural Bridge, however, has a massive appearance, or at most shows an indistinctly granular habit, and is really a complex of alteration products. The color is prevailingly grayish, but there is also more or less of a greenish waxy substance intermingled with the gray talcose minerals. The green comes in part from serpentine, but mostly is referable to a chloritic mineral which has a compact massive appearance, lacking the cleavage that characterizes ordinary chlorite. Chemical analysis confirms the presence of such a mineral which may be identical with the variety called pseudophite. The apparently massive talc resolves itself under the microscope into an aggregate of finely divided scales which are arranged into more or less distinct groups, at times of prismatic form and again quite irregular. There is some indication of the former presence of minerals of the amphibole and pyroxene families, but just what their proportions may have been or their contribution to the present mineral association can not be stated from the little study that has been given the specimens. The vicinity of the deposits has long been a familiar locality to the mineral collector and yields quite a variety of species that are, as a whole, characteristic of the limestones when intruded and metamorphosed by deep-seated intrusives.

The production of talc by the several companies above mentioned amounted last year to 61,619 short tons, valued at $511,437. The total was a little less than that for 1911 which amounted to 65,000 short tons with a value of $552,500. The prices ranged from $8 to $9 a ton for the grades sold to the paper trade, the principal product; for the other grades they were somewhat lower.

Production of talc in New York

YEAR	SHORT TONS	VALUE	YEAR	SHORT TONS	VALUE
1881	5 000	$60 000	1897	57 009	$396 936
1882	6 000	75 000	1898	54 356	411 430
1883	6 000	75 000	1899	54 655	438 150
1884	10 000	110 000	1900	63 500	499 500
1885	10 000	110 000	1901	62 200	483 600
1886	12 000	125 000	1902	71 100	615 350
1887	15 000	160 000	1903	60 230	421 600
1888	20 000	210 000	1904	65 000	455 000
1889	23 476	244 170	1905	67 000	519 250
1890	41 354	389 196	1906	64 200	541 600
1891	53 054	493 068	1907	59 000	501 500
1892	41 925	472 485	1908	70 739	697 390
1893	36 500	337 625	1909	50 000	450 000
1894	50 500	454 500	1910	65 000	552 500
1895	40 000	320 000	1911	65 000	552 500
1896	46 089	399 443	1912	61 619	511 437

ZINC

The Northern Ore Co. continued the development of its zinc property near Edwards, but did not engage in active commercial operations. By reason of the occurrence of pyrite in much of the ore, mill treatment is essential in order to dispose of the blende to advantage. There is, moreover, considerable low-grade material that should pay for concentration. A mill was erected at the mines early in the year and experimental runs were made which resulted in a small output of concentrates. The milling process was based on a combination of gravity and magnetic separation without preliminary roasting, the design being to save the pyrite as well as the blende. Though experimental runs seemed to indicate the feasibility of the process, difficulty was found in carrying it out on a working scale. The mill was intended to treat 50 tons of crude ore a day.

Exploration of the ore bodies was confined mainly to the southern end of the Edwards property, on the Brown farm, where a shaft had been under way in the preceding year. This was sunk to a depth of 350 feet measured on the dip which averages perhaps 35°. Though the band or vein of ore in which the shaft started was found to pinch below, other bodies were encountered so as to afford stoping ground for most of the distance to the depth mentioned. There appeared to be little change in the character of the ore. At the 100 foot level the ore band was explored by a drift to the southwest, which, 100 feet from the shaft, came out into the surface clays that fill the adjoining valley. An adit, extended to the northwest from the drift, ran into a second band that was followed for some distance. Exploration was conducted also at depths of 200, 300 and 350 feet along the vein, constituting a series of levels from which ore will be mined when active operations are begun.

A little work was performed also a little farther north in a second shaft situated across the ridge and about 600 feet distant from the first. At this point the ore at the surface is not in a solid band of sulphides, but occurs as a zone of crushed and brecciated material in which the blende and pyrite form angular disjointed blocks with limestone as the matrix or cementing substance. The width of the zone is about 15 feet in maximum. It has been followed in the shaft to a depth of a little over 100 feet.

The work at Edwards has served naturally to stimulate interest in the mining possibilities of the region. The belt of limestones which contains the ore bodies extends southwest across the town of Edwards to Sylvia lake in the town of Fowler, a distance of about 12 miles. Recent prospecting has resulted in the discovery of additional occurrences of zinc blende at different localities within the belt. For information as to some of the occurrences not hitherto mentioned, the writer is indebted to Mr Homer L. Drake, of Gouverneur.

The existence of zinc ore on the Balmat property, in the southwestern section near Sylvia lake, has been known since the early part of the last century and is probably the first to have been discovered in this section. The property belongs to the Northern Ore Co., but as yet has not been prospected to any extent.

A deposit that must have been known for some time but has escaped general attention occurs on the Streeter place, northeast of the Balmat. It has the form of a vein or band outcropping along the side of a low ridge which it follows apparently quite a distance. The deposit has been prospected in one place and shows a width of 4 or 5 feet. The ore resembles that at Edwards.

There is a small showing of blende on the Tamlin place, near the highway and east of the Balmat property.

Zinc blende in association with a massive or earthy hematite is found on the property of the Dominion Mining Co., near Sylvia lake. The deposit was once worked for iron ore which was used at the Fullerville furnace. The blende forms small grains which with pyrite are found in seams and nodules within the iron ore, but more specially along the contact of the iron ore and walls. The opening was pumped out and explored to some extent during the year. The company is mainly interested in talc which it has uncovered on the same property.

The existence of zinc blende is reported on the Cole place near the Potter talc mine, but has not been confirmed by the writer. Another reported occurrence that could not be confirmed is on the Sullivan place where blende and pyrite are said to have been found in the excavation for the water power development owned by the Uniform Fibrous Talc Co.

On the road from Edwards to Fullerville, about two miles southwest of the former place, there is a large outcrop of pyritic quartz schist which is very noticeable on account of the stained and burnt appearance of the ledges. On the McGill farm, nearby, crystalline limestone is exposed in several places and has been found to carry zinc blende. A prospect on a side hill south of the highway exposes a strip of the limestone about 9 feet long and 3 feet wide which is more or less charged with the sulphide. Another occurrence is found a little north of this. The limestone has not been sufficiently explored to indicate the extent of the mineralization.

It is worthy of note that the limestone in the vicinity of the sulphide bodies is always heavily charged with silicates, mainly talc and serpentine. The occurrences are usually close to some of the talc seams occurring nearly always on the southern or footwall side of the latter. The association of the silicates and sulphides is of considerable interest for the study of the derivation of the ores.

The zinc appears to have been introduced into its present place by underground circulations and deposited mostly as a replacement of the limestones, very little as a filling of open fissures. The view as to the secondary nature of the deposits is supported by their variable form, which ranges from narrow seams or bands to lenses and again to very irregular shapes. The seams, in places, also break across the bedding of the limestones. The horizon of the ore varies considerably within the limits of a single locality as at Edwards and in such a way as to be hardly explainable by structural disturbances of once continuous seams or beds.

That the ores have replaced the limestones is indicated by the lenticular or quite irregular forms assumed by the bodies, as above noted, by the gradation along the borders from the rich sulphides to leaner material and finally to barren limestone, and further by the absence of banding in the arrangement and of drusy cavities which characterize the fillings of open spaces. The ore body opened by the southern shaft at Edwards, however, has quite well-defined parallel walls as seen near the surface which may mark a fissured zone or channel followed by the ore-bearing solutions.

The specimens frequently exhibit nodules of talc and serpentine. These range from very small size — a fraction of an inch in diameter — up to nodules measuring a foot or more across. They are practically barren of sulphides, except such as have been fractured when the ore may be seen to extend into or across the nodules, following the seams. The nodules more often than not consist of a talc core with a surrounding shell of serpentine. The talc has a massive appearance in the hand specimens, not fibrous like the usual product of the talc mines in the vicinity; whether it has originated from alteration of tremolite or has possibly been formed directly from solutions in the period of metamorphism of the limestone can not be stated at this time. At any rate, the mineral associations indicate that the nodules, so far as represented by the talc cores, existed before the ores were deposited, though the serpentine is in part of later formation.

The serpentine which encrusts the nodules belongs to the massive variety and shows no evidence of being pseudomorphic after an anhydrous silicate. Its relations rather suggest a reaction product between the talc and the dolomitic limestone. Veinlets and threads of the same type of serpentine are found intersecting the sulphide bodies, the mineral here having been deposited from solution subsequent to the introduction of the ores.

Vein quartz is much in evidence around the ore bodies, specially those at Edwards; at this locality a band of white quartz 10 feet thick is exposed near the southern workings with a strike parallel to that of the ore bodies. There are numerous smaller stringers that intersect the limestone in all directions. Inclusions of talc were found in the quartz and it apparently represents a relatively late period of deposition.

The general association of the sulphides and accompanying minerals seems to bear evidence of the work of underground waters, which in an extended period of circulation through the limestones have introduced and deposited various ingredients. To the earliest stage of their activity is perhaps to be assigned the partial dolomitization and silication of the limestones which resulted in the formation of talc. It is recognized that the latter may have been derived from tremolite as is the case of most of the talc in the near-by talc district, but tremolite itself is a secondary mineral that was found either as the result of metamorphism of impure siliceous seams within the calcareous sediments or else from the reaction of silica-bearing solutions upon the limestones after their deposition and uplift. Without going into details of evidence, it may be said the latter view seems rather more probable. The underground waters next brought in iron and zinc, depositing them as sulphides in molecular interchange with the limestone. Following this, the limestones were subjected to compression which resulted in a brecciated condition, together with a certain amount of flowage, as shown in the Edwards exposures. The occurrence of quartz and serpentine stringers is to be assigned to a later period of deposition subsequent to that of the sulphides.

The compact nature of the ores, their fine granular condition and the general absence of characteristic vein types or structures, all suggest that they were deposited in their present place when the limestones were at considerable depth under cover of a heavy overburden. These conditions were undoubtedly present when the limestones underwent metamorphism and recrystallization, but that change seems to have been accomplished mostly previous to the formation of the ore bodies.

The occurrence of vein quartz of the same character as that associated with the granites and pegmatites of the surrounding region is the only indication, so far as observed, of the possible influence of igneous agencies in the introduction of the ores. The whole area of gneisses and schists bordering the limestone belt shows frequent intrusions of granite and pegmatite, offshoots apparently of some neighboring or underlying granite body. With the feldspathic pegmatites are found quartz veins in such relation as to indicate a common source. No close correlation in time can be made between the period of ore foundation and the invasion of the granite, but the latter can be confidently assigned to the later part of the Precambric. If the view as to the deposition of the sulphides in depth, rather than near the surface, is correct, then they also probably belong to the Precambric, as erosion has not been very marked upon the limestones since that period. The fact that the ores show effects of regional compression, though not to the same extent as their wall rocks, is a further argument in favor of a Precambric age, as there has been little disturbance of that nature in subsequent time. The intrusion of the granite, if not actually contributing to the body of underground waters, would have facilitated their circulation and added to their chemical efficiency.

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Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 24, 1912

Published fortnightly

No. 547 ALBANY, N. Y. JULY 15, 1913

New York State Museum

JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

Museum Bulletin 165

28TH REPORT OF THE STATE ENTOMOLOGIST

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1912

New York State Education Department
Science Division, February 15, 1913

Hon. Andrew S. Draper LL.D.
Commissioner of Education

Sir: I have the honor to transmit herewith the manuscript and accompanying illustrations of the annual report of the State Entomologist, for the fiscal year ending September 30, 1912, and I recommend the same for publication as a bulletin of the State Museum.

Very respectfully
John M. Clarke
Director

STATE OF NEW YORK
EDUCATION DEPARTMENT
COMMISSIONER'S ROOM

Approved for publication this 19th day of February 1913

A. S. Draper

Commissioner of Education

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Museum Bulletin 165

28th REPORT OF THE STATE ENTOMOLOGIST 1912

Dr John M. Clarke, Director of Science Division

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, 1912.

The past season was remarkable because of the superabundance of the common apple tent caterpillar in the Hudson and Mohawk valleys and on the borders of the Adirondacks. The pests were so numerous that most of the wild cherries on the roadside were defoliated and many orchards severely injured. There were reports of local damage here and there by the allied forest tent caterpillar; in several sections extended tracts were stripped of foliage. There is at least a fair probability of the insect being more abundant another season and possibly causing serious injury locally. The green maple worm, so numerous last year, attracted no attention the past season.

Petroleum compounds as insecticides. Dead and dying trees in several Greene county orchards which had been sprayed the preceding fall with a commercial preparation of petroleum, led to a careful study of the cases and the behavior of the trees through the season. A comparison was also made between the condition of these trees and injury of earlier years following applications of petroleum. We were unable to note any material difference between the two and, furthermore, observed a marked restriction of the damage to trees or even portions of trees which had received the application. A detailed discussion of our findings is given below, and after a careful study of the various phases of the matter we were forced to conclude that a certain measure of risk attaches to the application of mineral oils or preparations of the same to trees in a dormant condition.

Fruit tree pests. The experiments of the last three years against the codling moth have been continued in the orchard of Mr Thomas Albright, New Baltimore, and very satisfactory returns obtained. The check or unsprayed tree produced only 38.95 per cent of sound fruit, while other trees of the same variety, less than 100 feet away, yielded over 97, and in some instances, more than 98 per cent of worm-free apples. The results obtained in this experiment and those of earlier years were checked by a careful study of representative trees in the orchards of Messrs W. H. Hart, Poughkeepsie, and Edward Van Alstyne, Kinderhook. These latter were sprayed under strictly commercial conditions with no expectation at that time of their being subjected to a test later. The results in these commercial orchards were exceedingly gratifying. The northern spies belonging to Mr Hart produced an average of over 98 per cent of sound fruit, while the greenings and Baldwins on the Van Alstyne place gave an average of over 96 per cent of worm-free apples. The results of the past four years' experiments go far to show that under normal crop conditions one thorough and timely spraying for the codling moth should result in producing from 95 to 98 per cent of sound fruit. These tests are of great practical value to the fruit grower, since they afford a reliable basis for correctly estimating the value of spray applications.

The pear thrips, a minute insect which blasted or nearly destroyed the pear crop in a few orchards in the Hudson valley, was studied with special reference to conditions favoring injury, and the efficacy of spraying with a tobacco preparation demonstrated. The insect, potentially a very dangerous form, is discussed in this report. The work of the pear midge was investigated and a number of extremely desirable photographs of the larva and its work secured.

Gipsy moth. The danger of injury by this notorious pest was emphasized by the discovery of a small colony, practically restricted to a city block at Geneva. A personal examination of the locality showed that the infestation was probably of three or four years' standing. The chances are at least fair that the insect was introduced in that locality with nursery stock, though no undoubted evidence as to the source of the infestation has been adduced. We may expect the discovery of similar colonies from time to time, and for a period at least, no effort should be spared to exterminate such outlying infestations, as this policy is much cheaper and decidedly more advantageous to the general welfare than the adoption of repressive measures with the inevitable slow spread of the insect and shortly the greatly increased cost of controlling the pest incident to its being distributed over an extended area. Such measures are also advisable, since checking the normal spread is most advantageous for the development of introduced parasites, a number of which have already been established in this country.

The recent enactment of a national plant quarantine act, recommended by the Entomologist and his associates in other states, is an important step in advance and should prove of great service in restricting the spread of this and other injurious insects as well as preventing the introduction of dangerous pests.

Brown-tail moth. This species has attracted comparatively little attention the past season, though it has become established in the northwestern corner of Massachusetts and it is only a question of time before it will make its way into this State. The danger of this pest being introduced on nursery stock grown in infested sections still exists and should not be overlooked simply because a portion of the State is contiguous to infested territory. The winter nests are so characteristic that there should be little difficulty in identifying the insect and at the outset prevent its becoming excessively abundant.

Grass and grain pests. White grubs have been extremely numerous in portions of Albany, Columbia and Rensselaer counties, at least. They were so abundant in many places as practically to kill the grass over areas half an acre or more in extent. The roots were almost entirely destroyed and in many fields much of the sod was, as a consequence, torn loose where a horse rake was used. The outbreak was taken advantage of to study in representative spots, the work of the grubs, their habits and natural enemies, with special reference to methods of control. A detailed account of our investigations is given in this report.

The Hessian fly caused serious losses in the wheat-growing section of western New York, destroying entire fields and, in many cases, reducing the yield by 50 per cent. A personal investigation was made of the injury for the purpose of ascertaining any peculiarities in its inception and determining the probabilities of serious damage another year. A number of parasites were reared from infested wheat stems collected in representative areas. An extended discussion of this insect is given on a subsequent page.

The fall army worm, another grass and grain pest, was excessively abundant in the vicinity of New York City, seriously injuring lawns, destroying millet and corn and feeding upon a variety of grasses. This outbreak was also investigated and a detailed account of the insect has been prepared.

Shade tree pests. The widespread and severe injuries of earlier years by the elm leaf beetle in the Hudson valley in particular, amply justified extended observations the past season. It was found that the exceptional damage in 1911 resulted in a feeble growth and weakened trees the past season. The early portion of the spring was unusually cool and moist, and largely as a result of these conditions we believe injury by this pest was not so severe as last year. There was a marked irregularity in the work of the beetle, some trees in a locality and in certain cases some localities being almost exempt from injury, while in others the damage was relatively severe. A portion of this may be explained, possibly by more thorough spraying. Experiments were conducted with sweetened and unmodified arsenate of lead for the purpose of ascertaining if any material advantage was to be gained by the addition of a cheap sugar or molasses. There was no marked difference between the two series and our earlier work with poisons was confirmed in large measure.

The false maple scale continues abundant in the vicinity of New York City and was a subject of considerable correspondence during the summer. The cottony maple scale was also responsible for a number of complaints.

Forest pests. The hickory bark beetle has continued its destructive operations in the vicinity of New York City. The abundance of this pest and the hearty cooperation of Mr J. James de Vyver, Mount Vernon, made possible a series of tests for the purpose of finding some method which could be relied upon to destroy the insect after the beetles had entered the trees. Studies in the field showed that in some localities many of the grubs died within a few weeks after hatching and before they were able to cause material injury. A detailed discussion of this work, together with investigations upon the biology of the pest and its natural checks, is given on a subsequent page.

Many of the white pines in the vicinity of Albany have been killed in recent years by bark borers. A study of the conditions showed that in all probability this attack was the outcome of extreme droughts and very low winter temperatures. Persons having trees which were attacked by these pests have been advised to cut and burn all infested pines prior to the opening of another season.

Hosts of Ambrosia beetles belonging to the genus Platypus attacked freshly sawn, sappy mahogany in the yard of a veneer cutting company near New York City and inflicted severe loss besides causing grave apprehensions. An investigation showed that the insects originated from a shipload of logs from Panama. The infested material was removed and the few insects remaining soon disappeared.

The destructive work of the locust leaf miner, noticed in our preceding report, was studied the past season and additional information secured in relation to its habits and methods of control. The most severe injury, as in 1911, resulted from the feeding of the beetles.

The woolly bark louse of the white pines has been the occasion of several complaints during the past season, and an investigation showed that in some instances at least, large trees were seriously weakened, if not destroyed, by this insect.

A previously unknown though sparse colony of the periodical Cicada was located at Geneseo as an outcome of the interest aroused by the appearance of the enormous brood last year.

Flies and mosquitos. There has been a general interest in controlling the house fly and preventing the superabundance of mosquitos. Both of these insects have been the subject of correspondence, and a number of bulletins giving directions for remedying undesirable conditions have been distributed.

An unusual departure was the working out of the life history of a common blowfly, Phormia regina Meign., and a flesh fly, Sarcophaga georgina Wied., under controlled conditions. These two insects, though exceedingly common, were comparatively unknown except in a very general way. The details of this investigation, undertaken for the purpose of solving a specific problem, are given more fully in this report.

Gall midges. This large group of small flies has continued to receive attention. We have succeeded in identifying the wheat midge of Fitch, which proved to be an undescribed species, discovered and described a second form recorded as living in heads of American wheat, and reared another. The last was identified through the cooperation of European entomologists as Thecodiplosis mosellana Gehin. In addition, a number of new gall midges have been reared from various food plants and described. The outbreak by the Hessian fly, noted above, and an abundance of the pear midge in the vicinity of Albany afforded opportunity for additional studies of two economic forms.

Lectures. The Entomologist, as in past years, has delivered a number of lectures upon insects, mostly economic forms, before various agricultural and horticultural gatherings. This work enables him to become personally acquainted with the problems of various localities and has been greatly facilitated by a chart showing the results secured in codling moth experiments of recent years.

Publications. A number of brief, popular accounts of the more injurious species of the year were widely circulated through the agricultural and local press. The important publications, aside from the report for last year, are: *The Elm Leaf Beetle and the White Marked Tussock Moth* (Museum Bulletin 156), *Control of Insect Pests in Institutions, The Identity of the Better Known Midge Galls, The Fundamentals of Spraying* and several papers describing new species of gall midges. A list of the more important publications is given on a subsequent page.

Collections. There have been material additions to the collections through the efforts of members of the office staff, and also by exchange and donation. Through the courtesy of Dr Otto Nüsslin of Karlsruhe, Germany, we received an excellent series of European bark beetles. Mr Henry Bird of Rye, generously donated an admirable lot of reared stem borers belonging to Hydroecia or closely allied genera, a number of these forms being almost unrepresented outside Mr Bird's exceptionally fine collection. The work of arranging and classifying the museum collections has continued whenever opportunity offered. Mr Young did considerable miscellaneous work upon the beetles or Coleoptera, giving special attention to the flea beetles, Halticini of the Chrysomelidae and to the June beetles, Lachnosterna and its immediate allies of the Scarabaeidae. An excellent series of genitalic mounts was made in this latter group.

The value of the collections has been greatly increased by microscopic preparations. Specimens of the Scolytidae received from Doctor Nüsslin and noted above were put in balsam mounts. There were, in addition, two hundred such preparations of gall midges, mostly from reared material, and a number of scale insects, some previously unrepresented in the collections, which were similarly treated. The value of this material is much enhanced when placed in such preparations, since the latter are permanent in character and, in most of the species mounted, necessary for the identification of the insect.

The series of plant groups designed to serve as an embellishing and instructive feature of the enlarged exhibit now in preparation is practically completed. There has been special collecting for this exhibit.

The more ample facilities of the new quarters bring added responsibilities in the opportunity they offer of making the State collection of insects, both exhibit and reference, thoroughly representative. The magnitude of such a task is appreciated by very few. The Entomologist recently assembled, with the cooperation of recognized authorities in various groups, the best obtainable figures as to the number of American insects. The data is tabulated below.

Hymenoptera	10 000	Orthoptera	950
Coleoptera	11 255	Neuroptera and Pseudoneuroptera	2 000
Diptera	9 100	Thysanoptera	118
Siphonaptera	115	Other small orders	500
Lepidoptera	6 622		
Hemiptera	3 328		43 988

A recent catalog of the insects of New Jersey, a state with a considerably smaller area and lacking the climatic and other diversities of New York, lists over 10,000 species. It seems to us conservative to place the probable number of insect species existing in this State at twice that figure. A thoroughly representative collection of New York forms should therefore contain well toward 20,000 native species, and since each has at least four well-marked stages, some 80,000 different forms. Many species and a great number of the stages are unknown. There is ample to occupy a well-equipped corps of entomologists for many years, not to mention the much additional labor involved in assembling and maintaining greatly enlarged entomological exhibits.

Nursery inspection. The nursery inspection work conducted by the State Department of Agriculture has resulted in the office being requested to make numerous identifications and also recommendations in regard to the policy which should be pursued by the State. Many of the specimens submitted for name were in poor condition, and as they may represent any stage in insect development and frequently originate in a foreign country, such determinations are laborious and time-consuming. The correct identification of such material is, however, very important, since the disposition of large shipments of nursery stock must depend, in considerable measure, upon our findings.

Miscellaneous. In cooperation with the Division of Visual Instruction, an excellent and somewhat extended series of photographs, mostly of injurious or common insects, has been secured. This material was all taken in connection with other collecting, it only being necessary to pose the specimen for the photographer.

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. Several correspondents have aided in securing 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, most helpful cooperation on the part of all interested in the work of the office.

Respectfully submitted

EPHRAIM PORTER FELT

State Entomologist

October 15, 1912

INJURIOUS INSECTS

CODLING MOTH

Carpocapsa pomonella Linn.

Practical field work with the codling moth was continued the past season and the results of the previous three years of work very satisfactorily confirmed. The spraying of 1912 was confined to young and moderate sized Ben Davis trees on the farm of Thomas Albright, New Baltimore. A power sprayer was used and an effort made to do thorough work, yet the applications were by no means excessive. A check or unsprayed tree produced only 38.95 per cent of sound fruit, while those in the immediate vicinity and sprayed as described above, yielded from 97.53 to 99.53 per cent, or an average of 98.69 per cent, of worm-free apples. The other plot similarly treated comprised larger trees and produced from 95.17 to 98.77 per cent, or an average of 97.26 per cent, of sound fruit. Considering that this spraying was done under adverse conditions and the yield of individual trees by no means excessive, the results are all that could be expected. These returns were checked by examinations of the yields from representative trees in the orchards of W. H. Hart, Poughkeepsie, and of Edward Van Alstyne, Kinderhook. These trees were sprayed last spring in the ordinary practical manner and with no expectation that any of the trees would later be selected for test purposes. In the orchard of Mr Hart, his northern spy trees produced from 97.87 to 98.77 per cent, or an average of 98.23 per cent, of sound fruit. Mr Van Alstyne's trees, composed of Baldwins and greenings, yielded from 95.12 to 97.50 per cent, or an average of 96.20 per cent, of worm free apples. None of these trees were sprayed more than once during the season with a poison, and the applications were made within the week or ten days necessary to secure the best results. It should be recalled, in this connection, that our earlier work has shown that sprayings made about three weeks after the blossoms fall are only about one-half as effective as the applications after the dropping of the blossoms and before the calyx cup is closed.

Life history and habits. Before giving the details of the experimental work, it may be well to outline the life history of this pest, since a knowledge of its habits is essential to satisfactory control work. The apple worm or codling moth, as is well known, winters in a tough, silken cocoon, usually located under the rough bark of trees. With the appearance of warm weather in the spring, which in New York State means late April and early May, the caterpillars transform within their silken retreats to brown, apparently lifeless pupae, and a week or ten days after the blossoms fall the moths commence to emerge and continue to appear throughout the greater part of June. The minute, whitish eggs are deposited largely upon the leaves, though a number may be found on the young fruit. They hatch in about a week and, as a consequence, the young apple worms of the first brood may be entering the small fruit from early in June, approximately three weeks after the blossoms fall, to nearly the end of the month or even later. The caterpillars require about four weeks to complete their growth, at which time they desert the fruit, wander to a sheltered place, sometimes excavate an oval cell in the wood or bark and spin a cocoon. They transform once more to pupae and in about two weeks, namely the last of July or in August another brood of moths may appear. These in turn deposit eggs which hatch in due time and the young larvae usually enter the side of the fruit. Two broods appear to be the rule in the northern fruit-growing sections of the United States, though some investigators claim a third in the southwest.

Experimental work. May 29th two lots of trees were sprayed on the farm of Thomas Albright, New Baltimore; 2 pounds of arsenate of lead (15 per cent arsenic oxid) being used to 50 gallons of water and 1 gallon of a lime-sulphur wash to 40 gallons of spray. A straight discharge variable nozzle was used on one line of hose, while the other was equipped with two angle Friend nozzles, the extensions in each case being about 8 feet long.

Plot 1 comprised five moderate sized Ben Davis trees just back of the house and southwest of the barn. These trees are about 18 feet high with a spread of 20 to 25 feet and were well loaded with young apples, except tree C, one-half of which bore practically no fruit. The blossoms had mostly fallen, only a few remaining here and there. The trees were sprayed about ten o'clock in the morning, there being a high wind and some 70 gallons of mixture was applied to the five trees. There was considerable dripping and more spray material was used than really necessary, owing to the wind.

An examination of conditions on August 16th showed little of special significance and not enough apples on the ground to warrant picking up the fruit. On September 17th the fallen apples were picked up and classified, and again nothing particularly significant noted. The remainder of the fruit was secured October 14th. The data relating to all the trees is tabulated below:

Plot 1 Thomas Albright orchard, New Baltimore, N. Y. Variety, Ben Davis. 1912

TREE	DATE	TOTAL FRUIT		CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
A	Sept. 17	Drops	89	78	......	11	......	......	......	11	6	.....
	Oct. 14	Drops	80	74	......	6	......	......	......	6	3	.....
	Oct. 14	Picked	2991	2952	......	39	......	......	5	34	16	.....
			3160	3104	98.22	56	1.78	......	5	51	25	.....
B	Sept. 17	Drops	235	219	......	16	......	2	......	14	10	.....
	Oct. 14	Drops	86	81	......	5	......	1	1	3	3	.....
	Oct. 14	Picked	2366	2281	......	85	......	3	......	82	18	1
			2687	2581	96.06	106	3.94	6	1	99	31	1
C	Sept. 17	Drops	33	27	......	6	......	......	......	6	4	.....
	Oct. 14	Drops	76	71	......	5	......	......	2	3	4	1
	Oct. 14	Picked	1257	1215	......	42	......	3	4	35	17	.....
			1366	1313	96.12	53	3.88	3	6	44	25	1
D	Sept. 17	Drops	66	51	......	15	......	1	......	14	12	.....
	Oct. 14	Drops	81	74	......	7	......	......	......	7	7	.....
	Oct. 14	Picked	1012	978	......	34	......	2	2	30	9	1
			1159	1103	95.17	56	4.83	3	2	51	28	1
E	Sept. 17	Drops	106	102	......	4	......	......	......	4	4	.....
	Oct. 14	Drops	67	65	......	2	......	......	......	2	2	.....
	Oct. 14	Picked	2593	2565	......	28	......	2	2	24	8	.....
			2766	2732	98.77	34	1.23	2	2	30	14	.....
Grand total..			11138	10833	97.26	305	2.74	14	16	275	123	3

It will be seen by referring to these data, that the yield of the five trees in this plot was fairly uniform, though trees C and D produced only 1366 and 1159 apples, respectively, the others approximating 3000. The variation in percentage of sound fruit is not great and the average for the entire plot is excellent. It will be noted that a very large proportion of the wormy fruit, namely 291 out of the total 305, were side wormy, only 30 being end wormy and more than half of this latter number, namely 16, being both end and side wormy.

Plot 2 comprised seven small Ben Davis trees located in a lot north of the house next to the woods and west of a small creek. These trees are 15 to 16 years old, 10 to 17 feet high and about 30 feet apart. The check tree was in the southeastern portion of the plot, next the small creek and in a position where thorough spraying was not easy. The wind continued high and about five gallons of spray were used for each tree, the treatment being continued until there was considerable dripping. The spraying was followed by a heavy shower in the afternoon and rain during the night. This plot was moderately well laden with fruit, and our subsequent data show that there was a fairly uniform yield, except possibly in the case of the check tree.

An examination of this plot on August 16th showed there had been some spotting of the foliage by the work of a Hemipteron. It was estimated at that time that the check tree would produce 50 per cent of wormy apples and there was observed in this tree an apple tent caterpillar's nest, something not seen upon those which had been sprayed. There was nothing particularly significant about the trees at the time the fruit was picked on October 14th. It is barely possible that the tree selected as a check was not entirely representative, since its position was such that the spraying of the previous year could hardly have been as thorough as in the case of the other trees. There is also a possibility that certain wormy apples may have been swept down the stream from trees above. We believe both of these factors are comparatively insignificant, though they may have had an influence upon the yield. The tabulation of the data secured from this plot and the check tree is given on the following page.

Plot 2 Thomas Albright orchard, New Baltimore, N. Y. Variety, Ben Davis. 1912

TREE	DATE	TOTAL FRUIT		CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
A	Sept. 17	Drops	24	19	......	5	......	1	......	4	5	.....
	Oct. 14	Drops	7	5	......	2	......	1	......	1	1	.....
	Oct. 14	Picked	1828	1799	......	29	......	3	5	21	13	.....
			1859	1823	98.07	36	1.93	5	5	26	19	.....
B	Sept. 17	Drops	19	18	......	1	......	......	......	1	1	.....
	Oct. 14	Drops	8	7	......	1	......	......	......	1	1	.....
	Oct. 14	Picked	1036	1033	......	3	......	......	......	3	1	.....
			1063	1058	99.53	5	.47	......	......	5	3	.....
C	Sept. 17	Drops	32	30	......	2	......	......	......	2	2	.....
	Oct. 14	Drops	7	6	......	1	......	......	......	1	.....	.....
	Oct. 14	Picked	998	994	......	4	......	......	......	4	2	.....
			1037	1030	99.33	7	.67	......	......	7	4	.....
D	Sept. 17	Drops	19	14	......	5	......	......	1	4	5	.....
	Oct. 14	Drops	10	8	......	2	......	1	1	......	1	.....
	Oct. 14	Picked	1827	1788	......	39	......	3	5	31	10	.....
			1856	1810	97.53	46	2.47	4	7	35	16	.....
E	Sept 17	Drops	16	15	......	1	......	......	......	1	1	.....
	Oct. 14	Drops	9	9	......	......	......	......	......	......	.....	.....
	Oct. 14	Picked	1219	1204	......	15	......	3	1	11	7	1
			1244	1228	98.71	16	1.29	3	1	12	8	1
F	Sept. 17	Drops	11	11	......	......	......	......	......	......	.....	.....
	Oct. 14	Drops	3	2	......	1	......	......	......	1	1	.....
	Oct. 14	Picked	1157	1150	......	7	......	......	......	7	2	.....
			1171	1163	99.32	8	.68	......	......	8	3	.....
G	Sept. 17	Drops		......	......	......	......	......	......	......	.....	.....
	Oct. 14	Drops	9	8	......	1	......	......	......	1	1	.....
	Oct. 14	Picked	1790	1778	......	12	......	1	......	11	5	.....
			1799	1786	99.28	13	.72	1	......	12	6	.....
Grand total..			10029	9898	98.69	131	1.31	13	13	105	59	1
		Check tree										
	Sept. 17	Drops	124	12	......	112	......	35	51	26	68	5
	Oct. 14	Drops	42	3	......	39	......	6	26	7	22	.....
	Oct. 14	Picked	712	327	......	385	......	171	161	53	103	.....
			878	342	38.95	536	61.05	212	238	86	193	5

It will be seen by referring to the above table that the yield of none of these trees was excessive, they producing from 1037 to 1859 apples or a total of 10,029. The percentage of worm-free fruit varied from 97.53 to 99.53 with an average of 98.69. As in the preceding plot, the side wormy apples largely predominate, there being a total of 118, while the end wormy amounted to but 26, half of these being both end and side wormy.

The contrast between this data and that obtained from the check tree is striking. The latter produced only 38.95 per cent of sound fruit, 450 of the 536 wormy apples being end wormy, while the relatively small number of 324 were side wormy, 238 of the latter being both end and side wormy. It will be seen that the check trees practically reverse the relations obtaining between end and side wormy and that the major proportion of the protection from codling moth injury is due to the destruction of the caterpillars before they enter the blossom end.

Tests in commercial orchards. It was deemed advisable, in connection with the experiments described above, to check up results by comparison with those obtained in commercial orchards. The spraying in the two selected was made with no foreknowledge that any such data would be used, and the results could therefore be hardly better than most practical orchardists might hope to obtain.

The first of these practical tests was in a young orchard belonging to Mr W. H. Hart of Arlington, near Poughkeepsie and close to Briggs station on the Hopewell branch of the Central New England Railroad. The orchard is on a moderately high hill, the trees are thrifty, about 18 years old, 30 feet apart and from 17 to 19 feet high. The trees selected were all nothern spies and an effort was made to secure only those which were fairly representative of the orchard, which latter, it may be stated, is in excellent condition and represents an advanced type of orchard management. The trees were sprayed, we are informed, May 24th or 25th when the blossoms had fallen just enough so that there was no danger of poisoning bees. Mr Hart used 7 pounds of Grasselli's arsenate of lead and 4 gallons of a homemade concentrated lime-sulphur wash to 150 gallons of water. This latter sufficed for the treatment of 50 to 70 trees. Those selected for the test were somewhat larger than the average and probably received about 2¾ gallons each. The fruit was picked October 18th and everything upon the trees and under them carefully classified.

W. H. Hart orchard, Poughkeepsie, N. Y., October 18, 1912. Variety, spy

TREE	DATE	TOTAL FRUIT		CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
A	Oct. 18	Drops	363	348	......	15	......	......	......	15	3	.....
	Oct. 18	Picked	1344	1338	......	6	......	......	......	6	2	.....
			1707	1686	98.77	21	1.23	......	......	21	5	.....
B	Oct. 18	Drops	887	837	......	50	......	4	2	44	17	1
	Oct. 18	Picked	1890	1881	......	9	......	......	......	9	5	.....
			2777	2718	97.87	59	2.13	4	2	53	22	1
C	Oct. 18	Drops	158	149	......	9	......	......	......	9	4	.....
	Oct. 18	Picked	715	710	......	5	......	......	......	5	1	.....
			873	859	98.40	14	1.60	......	......	14	5	.....
Grand total..			5357	5263	98.23	94	1.77	4	2	88	32	1

It will be seen by referring to the above tabulation that from 97.87 to 98.77 per cent of all the fruit, or an average of 98.23 per cent was worm free. The end wormy, it will be noted, were extremely few, only six occurring upon one tree and two of these being side wormy. This very high percentage of sound fruit can hardly be attributed to an enormous yield, since it will be noted that no tree produced over 2800 apples, while one bore but 873, there being no very material variation in the percentage of wormy apples between the two.

The second of these practical tests was in the orchard of Mr Edward Van Alstyne at Kinderhook and was restricted to three rather small greening trees and two moderate sized Baldwins located in the portion of the orchard where we had conducted experimental work in earlier years. The trees were selected for the purpose of securing as nearly as possible a fair representation of the average conditions obtaining, both as to yield and infestation. Mr Van Alstyne informs us that the trees were sprayed the last week in May, just after the petals had fallen, with 3 pounds of arsenate of lead to 50 gallons of water and a lime-sulphur wash testing 25° on the Baumé scale and diluted 1 to 25. This spraying was done, as was the case of Mr Hart, with no foreknowledge that any practical test would be made later. The greenings were picked October 10th and the Baldwins October 30th and everything upon the trees and under them carefully classified.

Edward Van Alstyne orchard, Kinderhook, N. Y., 1912

TREE	DATE	TOTAL FRUIT		CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
Greening:												
A	Oct. 10	Drops	546	493	......	53	......	3	3	47	26	2
	Oct. 10	Picked	1997	1926	......	71	......	......	6	65	4	.....
			2543	2419	95.12	124	4.88	3	9	112	30	2
B	Oct. 10	Drops	69	54	......	15	......	2	3	10	4	.....
	Oct. 10	Picked	1556	1517	......	39	......	4	1	34	4	.....
			1625	1571	96.68	54	3.32	6	4	44	8	.....
C	Oct. 10	Drops	60	57	......	3	......	......	......	3	2	.....
	Oct. 10	Picked	540	528	......	12	......	......	......	12	1	.....
			600	585	97.50	15	2.50	......	......	15	3	.....
Baldwin:												
A	Oct. 30	Drops	3321	3176	......	145	......	8	6	131	45	6
	Oct. 30	Picked	1666	1625	......	41	......	2	6	33	27	2
			4987	4801	96.27	186	3.73	10	12	164	72	8
B	Oct. 30	Drops	1466	1408	......	58	......	3	2	53	21	1
	Oct. 30	Picked	738	721	......	17	......	1	4	12	6	2
			2204	2129	96.59	75	3.41	4	6	65	27	3
Grand total..			11959	11505	96.20	454	3.80	23	31	400	140	13

It will be seen by reference to the above tabulation that the greenings produced from 600 to 2543 apples per tree, and from 95.12 to 97.50 per cent of worm-free fruit. The two Baldwin trees yielded 2204 and 4987 apples, respectively, 96.59 and 96.27 per cent being wormless. The very large number of drops on these latter trees (*a* produced 6 barrels of dropped fruit and 4 barrels of picked fruit, while *b* yielded 3 barrels of dropped fruit and 2 of picked apples) is explained by the fact that the picking was greatly hindered by a spell of rainy weather accompanied by more or less wind and, as a result, a very large proportion of the apples lay on the ground. The five trees as a whole yielded from 95.12 to 97.50 per cent of sound fruit or an average of 96.20 per cent. This is a somewhat lower average than that for the Poughkeepsie orchard and is probably explainable in part by the occurrence of interplanted trees of other varieties and a slight crowding and larger size which prevented to some extent the very thorough work obtaining at Poughkeepsie. It will be seen by reference to this table that only 54 apples were end wormy, 31 of these being both end and side wormy, while 431 were side wormy. The obvious inference is that most of the reduction in infestation was due to the thorough spraying of the upturned blossom ends and the consequent destruction of nearly all worms attempting to enter the fruit at this point.

A DISCUSSION OF RESULTS

The work in the Hudson valley has now extended over four seasons in orchards belonging to four different parties in as many distinct localities, and in each instance the spraying equipment and force on the place was used, the experimenter simply selecting representative trees and insisting upon thorough, though not excessively thorough work. Baldwins, greenings, northern spy and Ben Davis were well represented in the experimental trees selected. The diversity of season, location, equipment and men, and the different varieties prevent these experiments being classed as local or exceptional. They show what the practical fruit grower can and should obtain as a result of systematic spraying in regions where codling moth conditions are practically identical with those obtaining in the Hudson valley.

A study of the habits of the codling moth shows three well-defined periods when applications of poison may be more or less effectual.

The first comprises a week or ten days after the dropping of the white petals or bloom and during which the green calyx lobes remain open and the young apples upright in such a condition that the calyx cavity can be more or less filled with poison.

The second period is about three weeks after blossoming and is the time when the young codling moth larvae or apple worms hatch, begin feeding and enter the fruit.

The third period is the latter part of July or early August and is of special importance because the larvae of the second brood, or young apple worms, are then hatching and feeding on the leaves or entering the fruit.

Yields of unsprayed or check trees. The product of the unsprayed or check trees may be the basis for comparison in all experimental work, and special pains were therefore taken throughout the series to secure for this purpose trees which were representative of average conditions and so located that there would be very little or no interference with the experimental plots. Owing to various limitations it was impractical to have our check plots of the same size as those sprayed, though otherwise conditions were practically identical.

Tabulation of yields from unsprayed or check trees

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
Check...	1	1909	3251	2366	72.73	885	27.27	312	302	271	......
Check...	2	1909	7015	5127	73.08	1888	26.92	674	630	584	......
Check...	1	1910	711	202	28.41	509	71.59	186	240	82	......
Check...	2	1910	2000	593	29.65	1407	70.35	700	324	383	......
Check...	1	1911	5337	4540	85.06	797	14.94	379	166	252	......
Check...	2	1911	14670	9860	67.21	4810	32.79	2048	949	1813	......
Check...	2	1912	878	342	39.95	536	61.05	212	238	86	......
Grand total............			33868	23030	67.99	10832	32.01	4511	2849	3471	21.73

It will be seen that the check plots during this four-year period gave an average percentage of sound fruit amounting to 67.99, the yield in individual plots varying from 28.41 to 85.06 per cent. The smaller yields of good fruit, it should be noted, occurred on trees producing relatively few apples. The average percentage of end wormy fruit for these plots is 21.73, a marked contrast, as will be seen later, to what was obtained from the sprayed trees. The returns from the unsprayed trees may be briefly summarized as follows: Approximately one-third of the fruit was wormy and nearly two-thirds of the wormy apples were entered at the end, in other words, were end wormy. The importance of this data will be more fully demonstrated as we consider the returns from the various plots.

Results obtained from spraying during the first period. This treatment is given within a week or ten days after the blossoms drop, preferably as soon as possible thereafter and before the calyx lobes have closed. Since the codling moth larvae or apple worms do not hatch till a week or ten days after the close of this period, namely, about three weeks after blossoming, we are unable to see that the second treatment prior to the closing of the calyx cup, as ordinarily recommended, materially affects the situation so far as the codling moth is concerned, provided the first application has been thorough. This is evident when it is remembered that all that can be done by spraying during the period is to place the poison where it will be eaten by the caterpillars or apple worms, to appear later, as they attempt to enter the blossom end. The additional amount placed upon the foliage if a second spraying be given during this period, as will be seen shortly, is of comparatively small value in destroying codling moth larvae.

Summary of four years' work with one spray for the codling moth

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT Total	CLEAN FRUIT Per cent	WORMY FRUIT Total	WORMY FRUIT Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
1.......	1.......	1909	30177	29818	98.81	359	1.19	33	18	308	......
4.......	1.......	1909	20313	20017	98.55	296	1.45	31	6	259	......
1.......	2.......	1909	21264	21042	98.96	222	1.04	23	18	181	......
4.......	2.......	1909	9852	9683	98.27	169	1.73	19	13	137	......
7.......	2.......	1909	19091	18617	97.52	474	2.48	51	32	391	......
1.......	1.......	1910	1839	1664	90.48	175	9.52	16	21	138	......
1.......	2.......	1910	8135	6677	82.08	1458	17.92	160	27	1271	......
1.......	1.......	1911	16638	16515	99.26	123	.74	19	12	92	......
1.......	2.......	1911	20802	20401	98.07	401	1.93	28	14	359	......
1.......	1.......	1912	11138	10833	97.26	305	2.74	14	16	275	......
2.......	2.......	1912	10029	9898	98.69	131	1.31	13	13	105	......
Grand total............			169278	165165	97.56	4113	2.44	407	190	3516	.353

The above tabulation shows that one spray during this period produced from 82.08 to 99.26 per cent of sound fruit or an average of 97.56 per cent for the four years, when comparisons are made between an equal number of plots in each year. In explanation it should be stated that the figures for several plots in 1909 were omitted simply to give a more nearly equivalent value to the returns obtained for the four-year period. Attention should be called to the low percentages of 1910, a season remarkable for the unusual destructiveness of the second brood and one presenting infrequent conditions which were further accentuated by the small yield of that year. Excluding the data for 1910, the lowest percentage of sound fruit obtained from one spraying was 97.52. It is worthy of note that only a little over ⅓ of 1 per cent (.353 per cent) of the wormy apples were end wormy. This, compared with the proportion of end wormy on the unsprayed trees, which latter amounts to 21.73 per cent, shows that the great reduction in wormy fruit was due to the destruction of the caterpillars or apple worms attempting to enter the apples at the blossom end, and indicates in a striking manner the importance of this early spray. The contrast is more evident if we raise the yield of the check or unsprayed trees to approximately that of the sprayed trees and the other data pro rata so as to present a fair comparison. In the following tabulation we have assumed that 400 apples would fill a barrel. This is an approximate figure and equally fair for both the sprayed and the unsprayed trees.

Comparative results of one spray during four seasons

TREATMENT	TOTAL FRUIT		TOTAL CLEAN		WORMY APPLES					
					End wormy			Side wormy		
	No.	Bbls.	No.	Bbls.	No.	Bbls.	Per cent	No.	Bbls.	Per cent
Sprayed........	169278	423	165165	412¾	407	1	.353	3516	8¾	2.19
Unsprayed......	169340	423¼	115150	287¾	22555	56¼	21.73	17355	48¼	18.37
Difference.......	62	¼	50015	125	22148	55¼	21.377	16839	39½	16.18

The contrast between sprayed and unsprayed fruit is evident at once from a scrutiny of the above figures. A yield of about 423 barrels should, if the trees are well sprayed but once, produce 412¾ barrels of sound apples, while unsprayed trees bearing an equal amount of fruit, would yield but 287¾ barrels of worm-free apples, a difference of 125 barrels. A comparison of the end wormy apples shows at once where most of the efficacy lies, there being but one barrel of end wormy fruit on the sprayed trees, while the others produced 56¼ barrels of such apples, a difference of 55¼ barrels. There is a marked, though not such a great contrast in the yield of side wormy apples. The sprayed trees, it will be seen, produced but 8¾ barrels of such fruit, while the unsprayed trees yielded 48¼ barrels, a difference of nearly 40 barrels. The same contrasts are also shown in the number of apples and the percentages of the various grades.

Results obtained from spraying during the second period. This treatment is given about three weeks after the blossoms fall and is applied at that time because the young caterpillars are then just beginning to feed and enter the fruit. Theoretically, making no allowances for peculiarities in habits, this spraying should give the best results, while as a matter of fact, returns indicate an efficiency approximately one-half that of the early treatment. Spraying at this time was done only in 1910 and 1911. The results are tabulated on the following page.

Results of one spray applied late

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
3.......	2......	1910	7594	4355	57.35	3239	42.65	1485	326	1428	......
4.......	1......	1911	8969	8393	93.57	576	6.43	186	95	295	......
4.......	2......	1911	16815	13113	77.98	3702	22.02	1422	578	1702	......
Grand total and per cent.			33378	25861	77.47	7517	22.53	3093	999	3425	12.26

The three plots receiving one late application during 1910 and 1911 gave an average percentage of sound fruit of only 77.47, there being a range for individual plots from 57.35 to 93.57. The average percentage of sound fruit is approximately midway between that obtained from one spraying and the yield of the check trees, namely, 77.47. The average benefit accruing from this one spray is approximately 10 per cent of the entire yield. The large percentage of end wormy, namely, 12.26, shows that this treatment lacks efficiency because of the failure to destroy caterpillars entering at the blossom end of the apples.

Results obtained from two sprayings. This means a treatment during the first period, that is within a week or ten days after the blossoms fall, and another spraying in the second period, namely, about three weeks after the blossoms drop.

Results obtained from two sprayings

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
2.......	1......	1909	10316	10206	98.93	110	1.07	4	7	99	......
5.......	1......	1909	19275	19084	99.01	191	.99	10	9	172	......
2.......	1......	1910	2846	2756	96.84	90	3.16	6	1	83	......
2.......	2......	1910	7316	6105	83.45	1211	16.55	127	10	1074	......
2.......	1......	1911	19994	19903	99.54	91	.46	5	3	83	......
2.......	2......	1911	34019	33510	98.50	509	1.50	53	54	402	......
Grand total and per cent.			93766	91564	97.65	2202	2.35	205	84	1913	.308

The six plots receiving two sprayings during 1909–11 produced from 83.45 to 99.54 per cent of sound fruit or an average of 97.65, the end wormy fruit being less than ⅓ of 1 per cent (.308 per cent). The average gain in sound fruit resulting from this second application, if compared with the average percentage of worm-free apples obtained during the four-year period, amounts to only .09 per cent and this was accompanied by only a slight reduction in the percentage of end wormy apples.

Results obtained from three sprayings. These applications were distributed so that one was given in each of the above designated periods, namely, one within a week or ten days after the blossoms fell, the second about three weeks after the dropping of the bloom and the third the latter part of July. The second was designed to catch the young caterpillars of the first brood just as they were beginning feeding, while the third was directed against the young apple worms of the second brood.

Results obtained from three sprayings

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
3.......	1......	1909	9680	9582	98.99	98	1.01	8	10	80	......
6.......	1......	1909	7710	7633	99	77	1	6	3	68	......
3.......	1......	1911	20926	20830	99.54	96	.46	17	2	77	......
3.......	2......	1911	31119	30852	99.14	267	.86	60	23	184	......
Grand total and per cent			69435	68897	99.22	538	.78	91	38	409	.185

It was unfortunate that in 1910 no plot received these three applications and, as a consequence, the average percentage for this treatment is somewhat higher than it should be. Even with this omission which, in a measure, is undoubtedly favorable to the three applications, the average percentage is 99.22, a gain for the third treatment representing only 1.57 per cent. It will be noted that there is a slight reduction in the average percentage of end wormy apples, this being approximately ⅕ of 1 per cent (.185 per cent).

COMPARATIVE SUMMARY

The following tabulation of comparative yields from the experimental plots during the first three years (1909—11) will prove instructive, since those from the plots sprayed three times, sprayed late and checks have been raised pro rata to make up for a deficiency in the number of plots or a reduced number of trees in the plots and the figures thus indicate fair comparative values. We have not included in this the returns from one spray during 1912, since there would be no material gain were this done as the figures are very nearly the same, and furthermore such inclusion would result in a disproportionate representation of trees receiving but one application. The figures in the tabulation given below for the plots sprayed three times are undoubtedly somewhat higher than they should be because there were none sprayed three times in 1910, a year when the second brood of the codling moth was extremely abundant and excessively injurious.

Comparative tabulation of yields for 1909-11

NUMBER OF SPRAYS	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT			
		Number	Per cent	Total	Total end wormy	Total side wormy	Total end and side wormy
1	98855	96117	97.23	2738	389	2459	110
2	93766	91564	97.65	2202	289	1997	84
3	104151	91863	99.22	807	272	596	50
1 late	66756	51722	77.47	15034	8184	8848	1998
Checks	98952	68064	68.78	30888	20730	17988	7833

Comparative savings as a result of spraying 1909-11

TREATMENT	WORMY APPLES ELIMINATED		GAIN		END WORMY ELIMINATED		GAIN	
	No.	Bbls.	No.	Bbls.	No.	Bbls.	No.	Bbls.
1 spray	28150	70¼	......	......	20341	50¾	......	....
2 spray	28686	71½	536	1¼	20441	51	100	¼
3 spray	30081	75	1395	2¾	20458	51	17	1/16
1 spray, late	15854	39½	......	......	12546	31¼	......	....

A study of the above data brings out the relative value of the various sprays in a somewhat different manner. Taking the check or unsprayed trees with their 98,952 apples or approximately 247¼ barrels as the standard, we find that one spraying in the first period reduces the number of wormy apples by 28,150 (70¼ barrels) or end wormy alone by 20,341 apples (50¾ barrels). The one late spraying three weeks after blossoming, takes 15,854 apples (39½ barrels) from the wormy column and but 12,546 apples (31¾ barrels) from the end wormy. The two sprays, one given just after blossoming and the second about three weeks later, reduced the number of wormy apples by 28,686 (72½ barrels) and the end wormy by 20,441 (51 barrels). This latter is not very different from the returns given by the first timely application, and in connection with the data for one late spray, shows at once that the latter is comparatively inefficient, so far as controlling codling moth is concerned. The three treatments, one spraying just after blossoming, a second about three weeks later and a third the latter part of July, eliminate from the wormy column 30,081 apples (75 barrels) and from the end wormy 20,458 apples (51 barrels).

It will be seen by referring to the above tabulation that the second spraying resulted in a gain of only 1¼ barrels, while three sprayings produced an additional gain over the two of but 2¾ barrels or a total gain over that secured from one application, of 4¾ barrels. The one late spraying eliminated only 39½ barrels from the wormy column, a saving of approximately 4/7. The above comparisons are based on approximate yields of an equal number of trees, and in all instances except in the case of the trees receiving the one late application, the total product of each plot was approximately 100,000 apples or 250 barrels. The above tabulations all show that by far the greater benefit resulting from spray operations accrues from the one treatment given within a week or ten days after the blossoms fall, and that the gains following subsequent sprayings are relatively insignificant. We do not undertake to imply thereby that one thorough timely spraying will control the codling moth satisfactorily in all sections of the country, though we believe that the possibilities of one treatment have habitually been underrated.

Single spray experiments by others. It may be claimed by some that the above returns from one spray are exceptional and can not be duplicated under other conditions. Prof. A. L. Quaintance of the federal bureau of entomology has recently compiled figures showing returns from one application and experiments conducted by him in different states over a period of several years. He finds that the average of the percentages of sound fruit from one spraying is 90.64 as compared with 96.19, the average of the percentages of sound fruit on the demonstration plots receiving from three to five applications in one season. The unsprayed trees in his experiments give an average of 57.79 per cent of worm-free apples.

He finds a considerably greater variation in the percentage of sound fruit from plots receiving one spraying than from those given three to five sprayings, this being particularly marked, as would be expected, under unusual seasonal conditions, such as injury to the fruit by hail storms. Substantiating this work of the federal bureau it is worthy of note that Professor Gossard of Ohio obtained 91.60 per cent of worm-free apples, while the check trees produced but 45.80 per cent of sound apples, and Professor Rumsey of West Vriginia, 97.40 per cent of worm-free apples (the unsprayed trees yielding only 65.9 per cent of sound fruit) as a result of one thorough spraying. These results are certainly not very different from those we obtained in the Hudson valley.

Both Professor Quaintance and Professor Rumsey also made observations upon the efficiency of this spray in the control of the plum curculio on apples, and Professor Quaintance summarizes the situation as follows: "It would therefore appear from the foregoing that for the control of the codling moth and plum curculio under eastern conditions a single thorough spraying is about as efficient as a schedule of treatment requiring three or more applications."

Control of the second brood. We have purposely emphasized the importance of thorough spraying within a week or ten days following blossoming, preferably in the earlier part of this period, because data available show that we must depend largely on this treatment for the control of the second brood of apple worms appearing the latter part of July, during August and September, and making small holes in the apples, especially where they touch each other or a leaf. Careful field studies by A. G. Hammer of the federal bureau of entomology showed that during 1909 second brood codling moth larvae at Northeast, Pa., began entering the fruit August 5th, were most abundant the latter part of that month and early in September, the last being observed about the 20th. Approximately the same conditions may be expected in western New York, though an abnormal season may result in the appearance of many young larvae unusually late, as appears to have been the case last fall in certain sections of New York State. These late appearing larvae should not be confused with the lesser apple worm, an insect recently discovered in the State and one comparatively harmless so far as we have been able to ascertain.

Referring once more to the comparative summary given above, an increase of 100 end wormy apples will be noted between plots sprayed twice and those sprayed once, accompanied by an increase of 562 side wormy apples; in other words, each apple worm successfully evading the first spray appears to have produced approximately 5.6 side wormy fruit later. Similarly, a difference of 217 end wormy and 1963 side wormy will be noted between plots sprayed three times and those sprayed once, there being a ratio of 1 to 9 between the increase of end and side wormy. Now, if we bear in mind the importance of the first application in reducing the end wormy (this comprises about two-thirds of the total wormy fruit on unsprayed trees) from 20.95 to .349 or .353 per cent (the former an average of three years' work with one spray, the latter the return from four years' work), we can hardly escape the conclusion that the very best way of controlling the second brood is to spray most thoroughly for the first. Some six years ago Professor Ball of Utah estimated that under conditions obtaining in that state, two sprayings during the first period mentioned above, namely, within a week or ten days after the blossoms fall, are worth six to sixteen times as much as three late ones. This ratio is approximately true for our conditions, though considerable variation may be expected from year to year. Checks in the fruit from hail storms, sun scald, or burning by insecticides or fungicides afford easy and safe points of entrance for second brood larvae and have a material bearing upon the production of sound fruit. All having practical experience with this pest know only too well how quickly the young apple worms take advantage of these opportunities. The development of such conditions as those just mentioned or the somewhat common occurrence of wormy apples in early July would be ample justification for a treatment the latter part of that month or early in August for the purpose of destroying second brood apple worms before they can enter the fruit.

Conclusions. A study of the data collected during the past four years justifies the conclusion for the Hudson valley at least, that in normal seasons when the crop is abundant or fairly abundant, one thorough early spraying within a week or ten days after the blossoms fall and preferably early during that period, should result in the production of 95 to 98 per cent of sound fruit. A slight gain will accrue from a second treatment about three weeks later, and additional returns may be secured from a third spraying the latter part of July. The benefit from the latter two is comparatively small, so far as the codling moth is concerned, though ample to meet the cost of the poison and, in many instances, probably the expense of treatment. There is no question as to the advisability of using poison in the later sprayings wherever there is sufficient fungous disease to warrant treatments for this purpose.

A small crop almost invariably means a larger percentage of wormy fruit, and if the prospects are even fair for good prices, the third spraying (the latter part of July) would at least justify itself because of the additional protection from possibly severe injury by the second brood. The treatment three weeks after the blossoms fall may be advisable, especially if the first application is not thorough for some reason or other.

Fungous diseases are of comparatively little importance in the Hudson valley. Many of our fruit growers have obtained fair results with one treatment, and the above data, we believe, show the reason why such is the case. Comparatively few have appreciated the importance of one thorough treatment at the proper time. With the information given above, we believe that our Hudson valley fruit growers can ascertain for themselves whether more than one spraying is advisable. There is no reason why the progressive fruit grower should not watch developments, and if wormy apples seem to be somewhat common in early July, protect himself against further possible injury by thorough spraying the latter part of that month and thus destroy many of the second brood larvae before they can enter the fruit. This supplemental treatment will hardly be necessary more than once in three or four years, unless a light crop and high prices justify efforts to produce the largest possible quantity of sound fruit. These results, while especially applicable to the Hudson river valley, should prove helpful in other regions, even though conditions may be somewhat different, since they emphasize the importance of thorough work during the first period. Other sprayings are more or less supplementary in nature and their relative value should be clearly recognized by the orchardist.

HESSIAN FLY

Phytophaga destructor Say

There is perhaps no important insect pest where nicer discrimination and a closer balancing of varied factors is necessary to the production of a profitable crop than in the case of the Hessian fly. This pest is very susceptible to climatic conditions; dry weather results in long periods of practical inactivity, while rains and the accompanying succulent growth are most favorable to the pest.

The character of the soil, drainage, fertility and tilth, the variety of wheat and the time of sowing all modify injury by this tiny midge with its remarkable adaptability.

The truth of the above was abundantly evident during the extremely severe outbreak of 1901 and the less extended damage of the past season. The wet spring of 1912 resulted in succulent growth most favorable for the development of maggots. To make matters worse, dry weather at the time the preceding crop was harvested, promoted shelling and subsequent moisture resulted in abundant volunteer wheat and a resultant large fall brood of flies, the descendants of these causing most of the injury in 1912.

Signs of infestation. The first indication of attack is found in the darker color of the leaves and a tendency among the young plants to stool freely. The broader lower leaves and the absence of a central shoot, it having been killed, are also characteristic of infested fields. As the attack advances the affected plants turn yellow or brown and die, and the maggots may be found at the base of the leaves near the ground. The spring brood attacks tillers or laterals which were unharmed in the autumn, dwarfing and weakening the stem so that the grain usually lodges before ripening or else fails to develop fully.

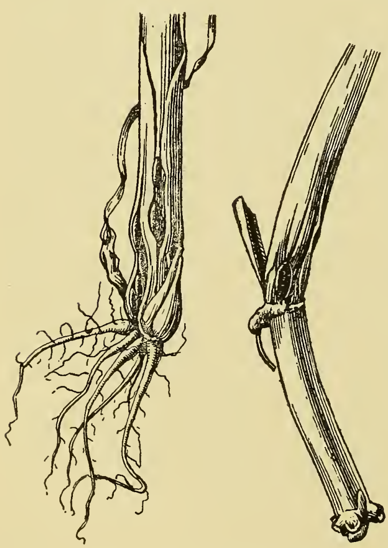


Fig. 1 Base of infested wheat stem showing " flax-seeds " or puparia under the leaf sheaths (original)

Causes of the outbreak. Extreme dryness at the time of the wheat harvest in 1911 promoted shelling and resulted in an unusually large crop of volunteer wheat, which latter was greatly favored by late summer rains. Reference to the weather reports of this locality shows that in July 1911 Le Roy was favored with a precipitation amounting to 2.86 inches, most of this occurring between the 15th and the 25th. There was an additional precipitation of nearly an inch in early August, followed by almost three-fourths of an inch in mid-August and nearly two inches the latter part of that month, while in September there were nearly three inches in the early part of the month and at least fair rains near the middle and the latter part, the total for September amounting to 4.39 inches. Such conditions are obviously well adapted to the early starting and vigorous growth of volunteer wheat and would result in the production of an abundant succulent tissue and thus produce a condition almost ideal for the development of this pest. There may easily have been a supplemental brood on many areas prior to the appearance above ground of the regularly sown wheat. This extra brood would mean a more severe infestation in the fall and consequently serious damage in the spring. It would appear as though the elements had combined to bring about an abundant crop of volunteer wheat, practically an extended sowing of a trap crop, which latter had not been plowed under early enough so as to destroy the pests and prevent further damage.

Losses in 1912. Winter injury should not be overlooked at the outset. Mr F. C. Walker of South Byron stated that ice remained on some of his fields from February through March and killed most of the grain. The writer saw many low wet spots throughout the region where grain had evidently been killed during the winter. Some growers held winter injury responsible for from one-half to all the loss. The writer is hardly prepared to accept such a high estimate for sections where the Hessian fly was rather numerous. There were places where this insect was abundant and its presence practically ignored. Severe damage appeared to be confined largely to Genesee county, though reports of injury were received from Livingston county, and the pest was observed somewhat abundant in Orleans county. We are unable to learn of ex tended injury in Erie or Niagara counties, including sections severely affected in 1901.

Erie county. At East Lancaster and east of Crittenden a very poor stand of wheat was observed from the train. Mr Gilbert Ayers of the latter place considers winter injury to have been responsible for most, if not all the damage.

Genesee county. Mr W. E. Harding, of Linden, reports, under date of July 3d, that at first he was inclined to believe there was no injury, but on further investigation learned that there was considerable damage. Later he estimated the crop for 1912 at 13 bushels an acre, the normal yield being 25 bushels, and stated that over 90 per cent of the fields were infested. He estimated the loss in the town at 40 per cent at least, and adds that one field of six acres showed no injury by the fly, though it was seriously damaged by ice and water, while in another of seven acres the yield was cut down 15 per cent by the Hessian fly and there was practically no injury by ice. Mr R. H. Hill, also of Linden, placed the yield at 15 bushels an acre, the normal yield being 20 bushels and the percentage of infested fields 75. He estimated the loss at 25 per cent.

Mr William Embt, of Linden, estimates the yield at 13 bushels an acre, a marked contrast to the normal yield which he places at 27 bushels. He states that all the wheat in that section was infested and estimates the loss at $20,000.

Mr J. Lathrop, of Morganville, under date of June 24th, reports the wheat crop as an entire failure in that vicinity, on account of the extreme cold weather of last winter when the fields were covered with ice, the little wheat escaping winter killing being damaged by the Hessian fly. There appeared to be no exemption as to variety or time of sowing. Later, Mr Lathrop states that from 34 acres of wheat he obtained only 115 bushels of grain and adds that the yield for the year will not be above 6 bushels an acre, the normal being 20. He estimates the loss for the town at 46,600 bushels and states that all the fields were infested.

Mr John R. Simmons, of Morganville, placed in mid June the loss at from one-half to three-fourths of the crop, number 6 and Klondike being the varieties affected. He estimates the yield in Genesee county at no more than 5 bushels to the acre with a possibility of total failure.

Mr C. N. Green, of South Byron, reported the yield at 8 to 10 bushels an acre, the normal being 20 to 25 bushels. He states that 80 per cent of the fields were infested and adds that their greatest trouble was not with the Hessian fly but the hard winter. He is of the opinion that if the wheat had come through the winter in good condition it would not have been destroyed by the fly.

Mr G. W. Miller, of South Byron, placed the loss the latter part of June at 60 to 75 per cent, the white wheat (number 6) being the variety affected. There was not, in his estimation, any apparent restriction of injury due to the character of the soil or the elevation. The latter part of September he estimated the yield at 8 bushels an acre, the normal being 20, reported 100 per cent of the fields infested and a loss for the town of 50,000 bushels.

Mr J. F. Rose, reporting in early June, estimated the injury at 25 per cent, all kinds being affected, though number 6 suffered most. The date of sowing apparently had no influence on the amount of injury. In September Mr Rose placed the yield at from

1 to 2 up to 20 bushels an acre, an average possibly of 8 to 10, the normal yield being 25 to 30. He reported all fields as being infested and estimated the loss at 25,000 bushels.

Mr H. W. Tyler, of South Byron, in early July estimated the injury at 20 per cent, which he found was confined mostly to number 6 and Klondike. He states that the injury was less apparent on the better soils. The latter part of September he reports a yield on his place of 16 bushels an acre, the normal being 30, and adds that 99 per cent or more of the fields were infested. He is of the opinion that the reduced yield was due as much to winter injury as to fly and estimates the average yield for the locality the past season at 10 bushels an acre.

Mr F. C. Walker, of South Byron, reported the yield the latter part of September at 8 to 10 bushels an acre, the normal being 25 to 30, and adds that 99 per cent of the fields were infested. In his judgment, only half a crop was secured and he states that the dry season of last year resulted in an abundant shelling and a large amount of volunteer wheat, in which latter the Hessian fly probably bred abundantly last fall.

An examination by the writer of a number of fields in Byron the latter part of June showed an extremely poor stand of wheat. Many had been plowed prior to our visit, while the grain in others would average only from 10 to 50 per cent of what it should, and of this more or less was liable to lodge or fail to produce a full crop. The large field belonging to Mr F. C. Walker was apparently looking well, yet an examination resulted in finding many infested stalks which will either fail to produce full heads or else are very likely to lodge. The wheat field of Mr C. N. Green was one of the best examined and yet there was a probability of a reduction of from 25 to 40 per cent in the crop.

Livingston county. John McNaughton, of Caledonia, placed the loss the latter part of June at from 10 to 20 bushels an acre, all varieties in his section being affected. No subsequent report or additional data have been received from this county.

Monroe county. Observations from the train and near Churchville and at Cold Water showed several very poor fields, most of the injury being due to winter killing though some may have resulted from attack by Hessian fly.

Niagara county. Mr Ralph Darrison, of Lockport, stated that he had talked with several farmers and none reported trouble with the Hessian fly.

Onondaga county. Mrs A. M. A. Jackson, of Warner, finds little evidence of the fly and no serious injury. We have been unable to learn of material loss in this county.

Orleans county. An examination of local wheat fields showed that from 25 to 75 per cent of many had been destroyed, 5 or 6 puparia being found at the base of some stalks. There were in these fields some rust, some smut and undoubtedly winter killing in low places. The latter was held by some to be responsible for most of the injury, though we are of the opinion that the work of the Hessian fly was greatly underestimated. Several poor wheat fields were also observed in Orleans county east of Albion, some of the damage, as in other places, being undoubtedly due to winter injury.

Mr Clark Allis, of Medina, reports some fields of wheat as being hardly worth harvesting on account of winter injury rather than damage by Hessian fly. We saw no evidence the latter part of June in that section of serious damage to wheat by insects.

Ontario county. Mr W. T. Case, of West Bloomfield, reports wheat "used up" in the western part of the county and much damage to barley. He can recall but one other occasion when it was so bad as this year though a few fields of Dawson's golden chaff escaped and produced a good crop.

Seneca county. Mr M. C. Brokaw reports in June the appearance of Hessian fly in gold coin wheat and adds that he is unable to estimate the damage due to insects and that wheat at best will make only a fair crop. Mr B. R. Hewlett, of Interlaken, estimates the yield at 20 bushels an acre, the normal being 30, and the percentage of infested fields ranging from 10 to 27.

Wayne county. Mr E. W. Catchpole, of North Rose, states that there was not enough wheat grown in that section to give a satisfactory estimate, though the injury was variously placed at 10 to 15 per cent more than usual.

Wyoming county. Mr P. A. Kemp, of Wyoming, states that the Hessian fly has caused considerable damage in the town of Middleburg, the most of it apparently being confined to the portion bordering on Bethany in Genesee county. He adds that Messrs A. C. and N. M. Ewell estimate the loss in Middleburg at several thousand dollars. These gentlemen, in a later communication, place the yield at 10 to 20 bushels an acre and the loss at 5, the normal being 20 to 25. They estimate that 75 per cent of the fields were infested and the loss at 33⅓ per cent. Some wheat fields appear to be somewhat more seriously damaged than others. Mr Henry D. Flach, of Attica, reports considerable damage in that section of the county though not all fields were injured; the loss in some amounted to 30 per cent.

Food plants. The Hessian fly was early recognized as a pest of wheat, rye and barley, and despite the fact that there are occasional records of its occurrence in timothy and other grasses and grains, there is no authentic evidence of its living in anything else except the grains named above and quack or witch-grass, Agropyron repens. This restriction in food plants is of considerable importance, since it materially simplifies the problem of control.

Life history. There are two generations in this latitude normally, though supplemental ones may occur. The adult fly deposits from 100 to 150 eggs, according to Marchal, placing them between the ridges on the upper surface of the blades of young wheat. Midges of the spring brood occasionally thrust their eggs beneath the sheaths of the lower leaves.

The flies may occur any time after wheat is up and possibly *between* killing frosts. The eggs hatch in about four days and the maggots then make their way down the leaf to the base of the sheath. They do not burrow but lie next the stem and absorb nourishment from the adjacent soft tissues which gradually become depressed and give way as the insect develops. The maggots are usually found in the fall close to the roots of winter wheat and at or beneath the surface of the soil, while in the spring they are more common about the second or third joints. The larval transformations occupy about twenty days, though their duration is much affected by weather conditions. The length of the pupal stage is exceedingly variable and greatly modified by the precipitation. Cold or heat and dryness tend to lengthen, and heat and moisture to shorten the duration of the different stages, especially the pupal. The winter is passed in the flaxseed or pupal stage, the spring brood of flies emerge in April or May and in turn deposit eggs on the more luxuriant leaves and another life cycle may be completed in about thirty days.

Number of generations. The short life cycle permits a number of broods in one season and apparently there may be as many generations as weather and food conditions permit. We may expect constant breeding during the growing season if continued damp weather enables wheat, barley and rye to grow luxuriantly. During midsummer, as a rule, only a little volunteer wheat is in a condition for the larvae to live on, though this was very different with barley in 1901, when continued moist weather, after the spring brood had developed to pupae, brought out hosts of flies. Eggs were laid in large numbers in the barley, especially the late sown, and in early July many fields in Genesee county were badly infested. The maggots were near the ground in the latest barley, and in that early sown occurred 10 to 12 inches above the surface, showing that the insect lives by preference in soft growth and inferentially that it thrives only indifferently in the older, harder growth. The relation between a rank, succulent growth and injury was further shown in a hilly patch of wheat. The grain on the gravelly, comparatively dry knolls was nearly immune, while in the more moist gullies the stalks of wheat were very scattered. The resistance of so-called " fly proof " wheats depends in large measure upon the relative hardness or maturity of the stalks at the time the flies appear and deposit eggs.

Emergence of flies. This is an exceedingly important matter because successful methods of preventing injury depend upon a correct understanding of the habits of the flies. The flight of the Hessian fly is dependent on weather conditions. The following rules will assist materially in forecasting probabilities:

1 The flies may remain an indefinite period in the " flaxseed " or pupal stage during dry weather.

2 " Flaxseeds " or pupae are very likely to develop flies in large numbers during damp, warm weather.

3 Adults are killed by heavy frosts though this is not true of larvae and " flaxseeds " or pupae, and hence flies may appear and deposit eggs *between* killing frosts.

4 Under certain conditions some of these insects may spend nearly a year in the flaxseed stage.

5 Recently emerged flies must, in all probability, deposit eggs shortly upon succulent grain.

The above rules show that egg-depositing flies may appear at any time during the growing season, provided weather conditions are favorable, though naturally we would expect them to issue in large numbers only at the first favorable period after a large brood had attained the " flaxseed " or pupal stage. Thus, as our springs are usually warm and moist, this means that ordinarily most of the flies will emerge the latter part of April or early May. Then there must be a sufficient period for the completion of a life cycle before another brood of flies can appear, and if at that time and for a considerable period thereafter the weather be hot and dry, comparatively few or no flies will appear till conditions change.

We know that early sown wheat is very apt to become badly infested in the fall, while late sown grain frequently escapes. In the first instance the young wheat is in a succulent condition and receives a deposition of eggs before or between killing frosts, while in the other case it escapes. If the flies emerge early and there is no grain available, the most of the insects perish and the infestation is very slight or negligible. Weather conditions must always be considered in sowing winter wheat. The general rule may be stated as follows: Moist, warm weather in early fall will permit the safe sowing of wheat at a relatively early date, but when the fall is dry delay sowing till the latest possible date. The normal or average date when wheat can be sown in New York without danger of its becoming infested with Hessian fly is about September 20th.

Parasites. The parasites of the Hessian fly are of much value in controlling this pest. The easiest way to determine the parasitism in a field is to take infested stalks and rear the insects. A net-covered jelly tumbler or fruit jar, taking care to avoid close covers and the resulting molds, will answer very well as a breeding cage. An examination of the " flaxseeds " late in the season after the parasites have emerged under natural conditions will give some idea of the relative numbers which have been killed by these beneficial insects. Sometimes fully 90 per cent are destroyed by parasites, and occasionally entomologists have experienced difficulty in obtaining midges from infested wheat because parasites were so abundant.

A representative sample of infested wheat was taken from the field of Mr F. C. Walker, of Byron, and the insects reared. It was found that 119 puparia were parasitized, 11 diseased and 37 in a normal condition. In other words, 70 per cent of the " flaxseeds " were parasitized, 8 per cent diseased and less than 12 per cent were in a condition to produce flies. The two most abundant parasites were Merisus destructor Say and Tetrastichus carinatus Forbes, numerous samples of both being reared. In addition, one specimen of Eupelmus allyni French, a species of Tetrastichus, one of Callimone, one of Pleurotropis and a Pteromalid were obtained. These determinations were made by Mr J. C. Crawford through the courtesy of Dr L. O. Howard and are interesting since they show just what forms were present in the wheat fields last summer.

In addition to the parasites mentioned above, there is a wingless species known as Boeotomus subapterus Riley, which was not obtained and appears to be exceptionally efficient in Missouri. Platygaster herrickii Pack. is recorded as a common parasite and a European species, Entedon epigonus Walk., should be of assistance in checking this pest. Pteromalis pallipes Forbes is another species which preys upon the Hessian fly.

An abundance of parasites means very few midges later and comparative immunity from injury in all probability. Wheat stubble or chaff containing numerous parasitized "flaxseeds" should never be burned, since this may result in more real damage than if nothing be done.

Preventive and remedial measures. *Late sowing.* The most important preventive is to delay sowing till after the flies have deposited their quota of eggs and perished. This means in New York State delaying sowing, as a rule, till September 20th or a little later. It will be seen by referring to a preceding paragraph that the precipitation in August and September may have an important influence in determining the time when the flies will appear. Rains in late summer and early fall mean an early emergence of the flies, and if the moisture does not come too soon, a correspondingly early disappearance. Should the rains be early enough to permit the development of a supplementary brood on volunteer plants before the main wheat crop is up, there may be a large increase in the number of flies attacking the grain. It requires, under the most favorable conditions, only about 30 days to produce a generation, hence this danger is far from theoretical.

Resistant varieties. Experience in 1900 and 1901 in western New York showed that varieties such as number 8, Dawson's golden chaff, white chaff, Mediterranean, red Russian, prosperity and democrat withstood attack very successfully, while the beardless, weak-stemmed white wheat known as number 6 was very seriously injured and, in many cases, totally destroyed. Resistance is only comparative and a wheat immune in one locality may be rather seriously affected in another. The only safe way is to sow resistant varieties even though the non-immune wheats are better producers.

Good culture. Culture counts for much in growing a good crop of wheat. The field should be thoroughly prepared and the land put in excellent condition before sowing. The aim should be to produce a growth of firm straw and plants vigorous enough so that if attacked they will tiller abundantly and thus prevent a serious decrease in yield. Badly drained soil with its accompanying succulent weak growth appears to be quite favorable to the fly.

Trap strips. There is no question as to the value of trap strips, especially in seasons when the Hessian fly is excessively abundant. This pest becomes numerous only when conditions are favorable, and it should not be difficult for the well-posted wheat grower to anticipate, in considerable measure, the probability of injury and to judge as to the desirability of sowing trap strips. These latter should be sowed early (approximately August 25th to September 10th in New York State) so as to attract the flies and induce the deposition of eggs before the main crop appears above ground. The infested wheat should then be turned under deeply so as to prevent the subsequent development of the insects. It is not necessary to have the trap strip on the sides of the wheat field, though such a location is preferable, as the chances of attracting most, if not all the flies, are better.

Burning stubble and chaff. The burning of stubble has been recommended by a number of writers, but in New York State at least, the common practice of seeding with wheat makes this inadvisable. Such an objection would not hold in regard to burning chaff from the thrashing machine and this might well be done in case the wheat is at all infested by the Hessian fly. This measure would also prove of service in controlling the allied wheat midge.

Plowing under stubble. The early plowing under of infested stubble before the flies emerge is advisable if it can be done without additional expense.

Destruction of volunteer wheat. This latter is a prolific source of breeding in some seasons and should be turned under wherever possible before the flies appear. In some instances it might be feasible to use a portion of the volunteer wheat as trap strips.

Rotation of crops. This is excellent agricultural practice and should be of service in reducing ravages by the wheat midge, especially if care is taken to locate the wheat fields of successive years at some distance from each other.

BIBLIOGRAPHY

A detailed account of this insect, with an extended bibliography is given in the report of the Entomologist for 1901 (N. Y. State Mus. Bul. 53) pages 705–30. The more recent literature has been listed by Paul Hayhurst in the Journal of Economic Entomology, 1909, 2:231–34.

FALL ARMY WORM

Laphygma frugiperda Sm. & Abb.

This sporadic pest attracted notice the past season for the second time in recent years on account of injury by the larvae to lawns. The earlier outbreak occurred in Buffalo in 1900, the caterpillars destroying the grass of lawns by cutting it off just below the ground. Several reports of injuries to lawns were received last fall from persons in New York City, while Mr Roy Latham, of Orient Point, stated that the caterpillars were very abundant under date of September 11th, occurring in corn, Hungarian and wild crab grass. The latter he considered a source of the pest and stated that acres of lawn and Hungarian had been ruined. The last part of September he reported thousands of caterpillars on corn, there being at that time many very young ones.

Characteristics of outbreaks. The work of the fall army worm is most easily recognized because it usually occurs much later than that of the true army worm. It feeds by preference upon a variety of grasses and, under certain conditions at least, seems to display a marked preference for lawns. This latter habit has not only been observed in New York State but also in Illinois and West Virginia. The caterpillar responsible for this trouble is smaller and more slender than the true army worm, Heliophila unipuncta Haw., and is peculiar in the somewhat narrower, nearly black head with a more or less distinct, inverted, Y-shaped mark in front bordering the eyes and extending down to the mouthparts.

Description. The moth is allied to that of the true army worm, Heliophila unipuncta Haw.. though quite different in coloration, since there is no minute, white spot on the forewings. These in the fall army worm are rather dull grayish brown, with indistinct, oval, lighter markings as illustrated in the accompanying figure.

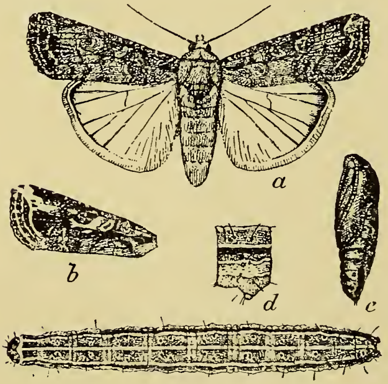
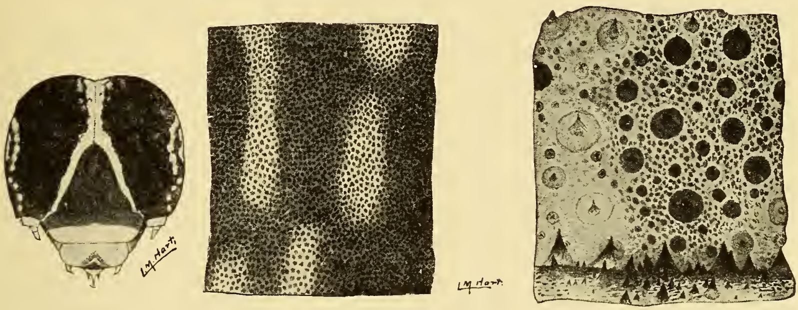


Fig. 2 Fall army worm. *a*, Moth, the plain, gray form; *b*, forewing of mottled form; *c*, larva extended; *d*, abdominal segment of larva; *e*, lateral view of pupa; *d*, twice natural size, others enlarged one-fourth. (After Chittenden, U. S. Div. Ent., Bul. 29, 1901)

The full-grown larva, as stated above, resembles that of the true army worm and may be best distinguished therefrom by the narrower head with its inverted Y-shaped mark well shown in the accompanying illustration.



a *b*. *c*.

Fig. 3 Fall army worm. *a*, Head of larva; *b*, *c*, surface of larval skin showing microscopic markings. (After Forbes, 23d Rep't, Ins. Ill. 1905)

The following descriptions of a half-grown larva and a full-grown one were drafted from living material.

Larva, half grown. Length one-half inch. Head shining black dorsally, the genae yellowish; clypeus fuscous yellowish and bordered on each margin by a distinct whitish line which is produced posteriorly over the head and forms a well-defined median line extending nearly to the posterior extremity. Labrum yellowish, labial palpi dark brown, antennae short, dark. Cervical shield shining black with distinct median and sublateral white lines. Body with the dorsal submedian areas a variably mottled chocolate brown and yellowish brown. This area is margined by a yellowish white lateral line. Laterally there is a broad stripe of dark chocolate brown variably marked with whitish and light brown and margined ventrally with a yellowish white stigmatal line. There is an indistinct substigmatal line, the substigmatal and ventral area being a variable yellowish brown; dorsally and laterally there are the usual series of large, shining, dark brown spiracles bearing short, black hairs; suranal plate shining black; truelegs shining black, prolegs fuscous yellowish.

A lighter specimen of about the same size, evidently recently molted, shows little of the characteristic markings described above, the head being yellowish transparent, the cervical shield and tubercles mostly light brown. The lighter longitudinal lines are only faintly indicated.

Full-grown larva. Length one and one-half inches. Head dorsally, yellowish, obscurely mottled with dark brown, the genae light brown, with irregular fuscous markings; clypeus fuscous yellowish, margined with a dull white which is produced posteriorly as a median line; labrum brownish transparent. Antennae light brown, prothoracic shield mostly dark brown, variably mottled with fuscous yellowish and with whitish median and sublateral lines. General color of the dorsal surface of the body a light brown variably and obscurely mottled with fuscous yellowish, the median and sublateral dull whitish lines rather obscure, the tubercles large, dark brown and the suranal plate mostly greenish yellow, the setae short, stout, fuscous, the lateral stripe a variable dark brown mottled obscurely with yellowish and reddish and margined ventrally with a broad, irregular, dull whitish stripe with distinct reddish mottlings; ventral surface mostly yellowish green, in some specimens the greenish predominating, variably mottled with yellowish white; truelegs mostly pale yellowish, apically reddish brown, prolegs pale yellowish green.

Another larva presents the same general appearance, differing mostly in exhibiting indistinct, submedian, purplish stripes about half the width of the lighter dorsal stripe described in the preceding form. The lateral area is also somewhat darker and more distinct.

Another light colored larva shows a distinct dominance of green in the thoracic and anterior abdominal segments, the dorsal and lateral lines hardly showing.

Detailed technical descriptions of the egg and larva have been given by Mr Chittenden in Bulletin 29, n.s., Division of Entomology, United States Department of Agriculture, pages 16–18, 1901.

Food plants. The original food plants of this species are with little question various grasses. The caterpillars display a marked preference for our small grains, such as wheat, rye, oats and millet, and are frequently abundant in some other field crops, such as alfalfa, clover etc., the injury to the different plants depending somewhat upon their immediate availability; that is, the outbreaks by the fall army worm undoubtedly, as in the case of the true army worm, begin with certain foci determined probably by the deposition of a considerable number of eggs upon preferred food plants. It is inevitable, when the latter are devoured, that the larvae should spread in the search of additional provender, and with such a general feeder as this species, there is usually comparatively little difficulty in securing something palatable and, as a consequence, severe injury may be inflicted upon a considerable variety of plants.

An examination of available literature shows that this species has been recorded as subsisting upon the following plants: alfalfa, apple, asparagus, barley, buckwheat, beans (velvet), cabbage, chick-pea (*Cicer arietinum*), clover, cockle-bur, corn, cotton, cow-pea, cucumber, grapes (gnawing stem and causing dropping of fruit) grasses (blue, Bermuda, creeping-bent, crab), hollyhock, kale, lamb's quarters, millet, oats, orange, peach, peas, pigweed. potatoes, purslane, rice, rye, sorghum, spinach, sugar beet, strawberries, sweet potatoes, Teosinte (*Euchena mexicana*) tobacco, tomato, turnip and wheat.

Life history. The life history of this insect has not been thoroughly worked out, though we know that several generations may occur in one season, that larvae are more likely to be injurious in the late fall, and that moths may be easily reared from such larvae. Adults were obtained the latter part of September or early in October from caterpillars transmitted to the office about the middle of September. Doctor Chittenden is of the opinion that the insects probably hibernate as pupae, with a smaller percentage possibly wintering as moths. He considers that all egg masses deposited late in the fall produce larvae, only a few of which may survive the winter. Transformation to the pupa occurs in oval cells from a quarter to not more than an inch and a quarter below the surface. Doctor Forbes observed three successive generations in central Illinois. This insect is a southern form, probably migrates northward annually, and may be unable to survive the climatic extremes of its more northern habitat.

Distribution. This species has been recorded from Maine to Kansas and Nebraska and even California, and is more abundant in the semitropical portion of the United States. It is a native of both North and South America, ranging from Brazil across Central America to the West Indies and must be regarded as normally a subtropical form.

Natural enemies. The caterpillars are preyed upon by various birds, there being records of sparrows and flickers feeding upon the pests.

The red-tailed Tachina fly, *Winthemia quadripustulata* Wied., is well known as a parasite of this species as well as of the caterpillars of the true army worm. An allied form, *Frontina frenchii* Will., has also been reared and there are several records of Hymenopterous parasites of doubtful identity living at the expense of this caterpillar. *Chelonus texanus*

Cress., interesting because of its ovipositing in the egg and the parasite developing in the larva of its host, is a very efficient check in the Southern states at least.

Ground beetles, especially species of Calosoma, undoubtedly feed upon the caterpillars, one of the common and efficient forms being the fiery ground beetle, C. calidum Fabr.

Remedial measures. The adoption of preventive or remedial measures must depend very largely upon conditions. Restricted outbreaks upon lawns can doubtless be controlled most efficiently by early and thorough spraying with an arsenical poison, using about 2 pounds of arsenate of lead (15 per cent arsenic oxid) to 50 gallons of water. If there are local reasons why a poison of this character should not be employed, many of the caterpillars could doubtless be destroyed by liberal, and if necessary, repeated applications of a kerosene emulsion, the standard formula diluted with 9 parts of water. It would be well if this latter were employed on lawns, to follow the application of the kerosene emulsion with a copious drenching of water. In some instances the use of a poisoned bait such as succulent clover dipped in Paris green water, or even a poisoned bran mash may be advisable. These latter, if used, may well be distributed just before dusk in order that they may remain fresh and attractive for the longest possible time.

Invasions from adjacent fields may be prevented by the use of mechanical barriers such as furrows, boards with strips of tar and other means employed for checking similar movements of the true army worm caterpillars.

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ELM LEAF BEETLE

Galerucella luteola Müll.

The season of 1911 was marked by exceptionally severe and widespread devastation by the elm leaf beetle. The damage was so serious that elm-shaded communities were most easily recognized in midsummer by the brown, dead foliage. The same condition prevailed in many roadside groups of trees. Numerous elms, unable to produce a second crop of leaves, had no opportunity to recuperate before the rigors of winter still further reduced their vitality. Some died while many others put forth a feeble leafage in 1912 only to have that nearly destroyed by midsummer. These trees are now in an extremely weakened condition and many may succumb during the winter. The tall elms with few branches and deficient foliage are the first to show the effects of elm leaf beetle attack. Moreover, they were not so easily protected by spraying and should therefore receive special attention if it is desirable to preserve them. The range of this pest is still extending as shown by the receipt of specimens from Ellenville and Gloversville, localities not previously known to be infested.

Beetle work in 1912. The season opened with every indication that extended and severe injury would result. Numbers of the beetles began feeding early and on June 5th their work on elms at Nassau was much more conspicuous than it had been for some years. Many of the leaves on the lower branches were badly riddled and those in the tops of the trees showed no perforations. The indications then were favorable for exceptionally severe damage. Egg masses were just being deposited, those observed being moderate to large size and containing from five to about thirty-five eggs. A period of relatively cool weather occurred the second week in June. The official records of the weather bureau state that in New York lower temperatures were recorded during that month than any previous June since the weather service was established. The maximum temperature at the Albany station dropped from 80° to 85° F. during the first few days in June to 70° and even 63°, the minimum falling as low as 41° on the 8th. Our studies of this insect in 1898 show that this markedly cool weather came at about the beginning of the ten-day period when the beetles should deposit approximately half of their entire quota of eggs. As a consequence of these abnormal conditions, oviposition was checked and the hatching of eggs greatly delayed with a corresponding backwardness in the feeding of the grubs. An examination of conditions at Nassau on June 24th showed that comparatively few egg masses had been deposited and there was little evidence of work by young larvae. Only a few about one-quarter grown were discovered. The same conditions appeared to prevail in Albany and up to that time, so far as our observations went, comparatively few eggs were found. On July 3d most of the grubs on Manning boulevard, Albany, were only about one-quarter grown, a few being half grown. On July 7th a few full-grown grubs were observed at Nassau, though a number of smaller larvae were still feeding. At Mount Vernon many grubs were only half grown July 10th, though pupae were rather numerous on a few trees and some recently transformed beetles were observed.

The season was also peculiar in the uneven character of the injury. The elm leaf beetle is well recognized as a local species. The season of 1911, as stated above, was marked by an unusually widespread defoliation. The beetles appeared to winter in excellent condition and one would expect similar general injury the following year. There was severe damage in 1912 in most localities where the beetle was very injurious the preceding year, but it was much more restricted and was not readily explainable by any local conditions. Some trees had the foliage practically skeletonized while others, though unsprayed, were but slightly damaged. A portion of this sporadic injury is doubtless explained by spraying or the lack of it, though even this factor does not account satisfactorily for all cases. The relative vigor of the trees also had an influence as pointed out above.

The elms of Catskill were very badly affected, especially just west of the main business street and particularly in the vicinity of the court house on Broad street and at the corner of Williams and Spring streets. Some of the trees were nearly bare July 19th, others had over half the foliage, while the remainder of the leaves were brown and nearly lifeless. Here and there elms could be seen which were in a fairly good condition. Some of these, we were informed, had been sprayed. There was comparatively little injury at a distance from the business center. The above was one of the most striking instances of damage observed the past season. At Mount Vernon a number of trees had brown, dead foliage, and the same was true of other communities in that general section, such for example as Tarrytown, Port Chester and New Rochelle. There was more or less injury here and there in cities and villages along the Hudson valley. There was rather severe injury in the village of Kinderhook, due to no spraying, and the same was true, though to a less extent, of the trees on the side streets of Lansingburg. There was mostly very severe injury to the elms at Valley Falls and some scattering damage to roadside and field trees.

The general condition of the elms at Hoosick Falls showed a marked improvement over that of last year, due largely to spraying. Elms which had been thus treated, whether on the street or on private grounds, were mostly in excellent condition, while the unsprayed trees on back streets, in back yards and especially in the section across the river from the main portion of the town, exhibited a marked contrast. The elms of Albany are in a much better condition than the preceding year, due to more thorough work in spraying. One of the perplexing elements of the situation is that many of the elms in Watervliet, though unsprayed, exhibit comparatively little injury. The trees of Mechanicville hardly show the effects of the beetle, and here, likewise, we were unable to learn of any spraying. Waterford elms, as a result of vigorous agitation, were sprayed for the first time this year and those treated show a marked benefit as a consequence. The elms of Stillwater were very severely damaged in 1911, and the past season injury was confined mostly to the outskirts of the village and to trees on private property, many having been sprayed as a result of an earlier agitation. The systematic spraying of elms has been continued at Saratoga and Glens Falls and, we have been given to understand, has been started in Fort Edward. The village of Ticonderoga sprayed its trees for the first time and those responsible for the work are convinced that it has been a material benefit.

Experiments with elm leaf beetle. It was thought that possibly a sweetening added to the poison might materially enhance its effectiveness, as has been reported for the related parent of the grapevine root worm, Fidia viticida Walsh. Small American elm leaves were sprayed May 15th with arsenate of lead (12½ per cent arsenic oxid) used at the rate of 4 pounds to 50 gallons of water, and other leaves were treated with the same poison to which was added a cheap grade of molasses used at the rate of 6 pints to 50 gallons of water. Another branch was sprayed with clear water, all being kept until the moisture had evaporated. The application was to the under as well as to the upper surface of the leaves, and in the case of the poisoned foliage at least, was rather abundant, though the amount present was not in excess of that frequently observed upon trees sprayed under field conditions. The application was made with a hand atomizer. Beetles which had been kept in a pasteboard box for the preceding five days were placed in jars with the above treated leaves at 2.45 p. m. These insects must have been moderately hungry and thirsty, though these conditions would hardly have been more severe than those obtaining in many houses where the insects winter. Four beetles were in each jar and for a time appeared well satisfied to walk about on the damp sand in the bottom of the jar, this being particularly so in the one containing leaves sprayed with sweetened poison. The sand was possibly a little more moist in the jar containing foliage sprayed with the unsweetened arsenate of lead and there seemed to be a little more poison on these leaves than on the others.

Arsenate of lead plain. One beetle dropped from the leaves at 3.45 and appeared sick, since it lay upon its back with spasmodic twitching of the forelegs. Another dropped at 4.30 and the remaining two at 4.50, all being dead the following morning.

Arsenate of lead sweetened. The first beetle dropped at 4.05 showing feeble evidences of life, a second at 4.45 and at 5 p. m. the other two were alive. The next morning a third was dead in the jar, the fourth remaining upon the foliage. It was alive at 10 a. m. May 17th and at 9 a. m. the 18th.

The insects confined in the jar with unpoisoned foliage continued in a vigorous condition till the 20th, even though the leaves were badly shriveled.

These experiments were duplicated, the only difference being that the sand was covered with blotting paper and the beetles placed directly upon the leaves at 2.15 p. m. May 16th.

Arsenate of lead plain. One beetle had dropped at 4.20, the others being alive at 5 p. m. The next morning another was dead, a second on the sand and moving a little, motion ceasing at 9.45. The last remained on the foliage and was alive on the 20th, being dead at 9 a. m. the 21st.

Arsenate of lead sweetened. At 3.30 p. m. one had dropped, at 3.35 another, and a third at 4.05, the fourth being alive at 5 p. m. and dead at 8.45 a. m. the following morning.

Two other beetles from the same lot as the preceding were put in a jar with a blotter saturated with the sweetened poisoned spray at 10.30 a. m. May 18th. They appeared to be imbibing the mixture and were found dead on the 20th.

The above experiments were conducted with beetles which had not fed since the preceding fall and were presumably very hungry. The results show that the insects succumb to poison quickly under such conditions, and that in some situations it may well pay to begin spraying as soon as the insects commence feeding, though it is doubtful if the results secured would warrant the general adoption of this plan.

Tests conducted by the writer over a decade ago showed that beetles collected from elm foliage and confined in jars containing leaves sprayed with poison, fed very little for a day or two, eventually being forced by starvation to devour the distasteful food, all finally succumbing within a week or two. These results are markedly different from those detailed above, and the experiments of 1899 were duplicated in part last spring and substantially the same data obtained. Arsenate of lead was used at the rate of 4 pounds to 50 gallons of water and the spray allowed to dry before the beetles were placed upon the leaves. There was very little feeding the first day, more the second and eventually the insects succumbed as recorded in 1899. The important point is that elm leaf beetles will feed upon poisoned foliage only when compelled by hunger and, as a consequence, thorough spraying is necessary if one would secure satisfactory results.

Results of spraying for elm leaf beetle in New York State. We have repeatedly stated that well-sprayed trees should keep their foliage green and vigorous throughout the season. Furthermore, trees weakened from injury by this insect should be able to regain their vigor in large measure. Systematic spraying for this pest has been in progress in some New York communities for over ten years, and it may be instructive to review the situation and see what has been accomplished. There is no question but that these annual applications have been of material service in protecting the trees. This is quite different from admitting that the spraying has in all cases been satisfactory. The defects in treatment as ordinarily practised were especially apparent in 1911, because the extreme drought of that season served to emphasize the work of the beetle and led many to question the efficacy of the application. The Entomologist at that time examined the trees in several communities and was forced to conclude that the unsatisfactory results were due to poor work. The foliage of many trees here and there and that of most of the lower branches were in relatively good condition, while numerous trees had much of the foliage badly browned, this being especially true of the upper branches in the taller trees. Too many have tacitly assumed that any kind of spraying would give results, whereas, as shown by experiments detailed above, nothing but the most thorough work will result in keeping the trees in full vigor.

The elm leaf beetle, as is well known, first became well established in the lower portion of the Hudson valley. There are a number of cities and villages in that section where elms, especially the Scotch and English elms, are conspicuous by their absence. A very large proportion of such trees have succumbed to this pest in the city of Troy since 1895. The writer has watched this process of destruction in Albany and vicinity for over fifteen years. The earlier portion of this period was marked by extensive local injuries to European elms which were subsequently approximated only in 1911 when the beetle was so generally destructive to American elms. It was a time when the necessity of spraying was not generally appreciated. Systematic work against this insect began in the city of Albany about 1900 and was shortly thereafter undertaken in Troy under private auspices. The spraying of earlier years was with a moderate power outfit and a nozzle which would throw only a short distance, consequently much climbing was necessary if the trees were thoroughly sprayed. The ultimate outcome was that most of the poison was applied to the foliage of the lower limbs, while the tops were nearly untouched, and in years when the treatment, for some cause or other, was so late as to be comparatively ineffective, most of the leaves were destroyed on many trees. Furthermore, there have been times when the application to the lower limbs, even when timely, was not sufficiently thorough. The result of this policy has been a progressive weakening of many trees with the death of numerous elms here and there. Practically all those affected should have remained in full vigor for a generation or two, aside from the relative few which may have succumbed to adverse urban conditions, such as leaky gas pipes, poor insulation of wires, the cutting of roots, etc. None of these trees can be replaced in less than twenty-five years and most of them represent active growth for half a century.

A clearer idea of the condition may be gained by a few concrete examples. A canvass of the trees in Washington park, Albany, in August 1911 showed that over ninety elms of the approximately 275 in that recreation area had been severely injured by this pest. The foliage of all these trees had been badly browned, many of the leaves had dropped or there was a considerable amount of dead wood. This was in a section where elms should find most satisfactory conditions for growth, aside possibly from a slightly polluted atmosphere. The area lying between the Capitol and Madison avenue, Eagle and Lark streets is another striking illustration of these unfortunate conditions. In June 1912 ten dead elms were observed on Hamilton street between Lark and Eagle streets, a distance of only five blocks. There were four dead trees on South Hawk street within two blocks of Hamilton street and four dead or practically dead elms on three sides of the block in which the Albany Medical College stands. The last named block appears to have been exceptionally unfortunate, since the preceding year three stumps of what were magnificent trees were to be seen on Lancaster street, and three similar ones just around the corner on Eagle street. Most of the elms noted above have perished as a result of repeated injuries by the elm leaf beetle. This wholesale destruction can hardly be characterized as less than inexcusable and, in the estimation of some, might well be termed criminal negligence. It should be stated that the above conditions are not representative of all sections of the city, though they are typical of certain regions and important in that they give a concrete idea of what may be expected in other communities if the elm leaf beetle is allowed to multiply unchecked or is fought in a more or less desultory manner. It should be further noted that the lamentable conditions on Hamilton street and vicinity, noted above, are in an area which has been sprayed more or less thoroughly, mostly the latter, we fear, for over a decade. This injury is not the result of one season's neglect but is the cumulative effect of severe injury, in spite of spraying for a series of years. We would also add in this connection that the spraying in Albany during 1912 has given materially better results.

The selection of a spray outfit for community work is a somewhat difficult matter. Elms, even large trees, can be thoroughly sprayed with a hand outfit, provided the pump is of a good type, there is plenty of hose, the tree is climbed and the distribution is thorough. Work with a hand outfit is slow, costly and can be recommended only when comparatively few trees are to be sprayed. There are a number of light power sprayers equipped with engines of 1½ to 4 or 5 horse power which have been extensively used in shade tree work. These are generally provided with plenty of hose and much climbing is usually obligatory, especially if a nozzle delivering a fine spray is employed. The latter is ideal, though on account of the large amount of labor necessary in order to bring the nozzle sufficiently close to the foliage, spraying in this manner is costly. This has resulted in the gradual change from the fine spray to the coarse spray, and from that to a modified solid stream and eventually to a solid stream. The latest development along this line has been the large outfit with a 10 horse power engine capable of delivering the insecticide at the mouth of a nozzle one-quarter of an inch in diameter or thereabouts at a pressure of 200 pounds. The nozzle generally used with this equipment is about six feet long and is capable of throwing the insecticide to the top of the tallest trees even when the operator is standing upon the ground. This outfit makes possible the very rapid treatment of many trees and greatly reduces the cost of application, which amounts to only ten to twenty cents a tree. Experience has shown that this high pressure stream breaks up into fine particles and gives a much better distribution than we would at first expect. More poison is used than with the smaller type of nozzle, and on narrow streets in particular, more or less drifting of the spray and consequent annoyance or even damage is almost inevitable. This can be mitigated to a considerable extent by skill on the part of the nozzleman. This type of sprayer was designed in particular for woodland work and is almost equally valuable on wide streets and park areas. Further experience is necessary before recommending it unqualifiedly for the average city street. A serious objection, especially in small communities, is the expense of the equipment, such an outfit costing about $1200. Some villages have partially solved the problem by using the lighter outfit and a smaller solid stream nozzle adjusted to the limited capacity of the engine. This arrangement reduces climbing greatly and, so far as tried, has given very good results.

WHITE GRUBS AND JUNE BEETLES

Lachnosterna species

The extremely severe injury to grassland, corn, potatoes and strawberries last spring was, with very little question, the outcome of a great abundance of May or June beetles in 1911. The large, brown or dark brown, blundering beetles partly defoliated many forest trees and were so numerous then as to make nuisances of themselves by invading lighted rooms. The insects soon disappeared but evidently not till after millions of eggs had been deposited in the grasslands as shown by severe and extended injuries caused by the grubs. Collections made in May and June 1911 show that Lachnosterna grandis Sm., L. fusca Froh., L. hirticola Knoch and L. hirsuta Knoch were the species most abundant, while the usually rare Polyphylla variolosa Hentz. was reported very common at Schenectady.

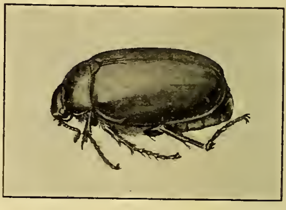

Fig. 4 A common May or June beetle, Lachnosterna fusca, natural size (original)

Characteristics. Our native species are brown or dark brown, stout beetles ranging from one-half of an inch long in L. tristis Fabr. to an inch long in L. grandis. Our more common form is L. fusca Froh., a species of average size and measuring about three-quarters of an inch in length. A study of this genus shows there is a large number of very similar species which are separable only with difficulty. The light brown Polyphylla variolosa Hentz. is more slender than the typical Lachnosterna and easily recognized by the light yellowish brown, irregular mottlings. A common and closely allied form is the spotted grapevine beetle, Pelidnota punctata Linn., easily recognized by its brick red color and the strongly contrasting six circular spots on the wing covers. The goldsmith beetle, Cotalpa lanigera Linn., is another allied form readily distinguished by its similarity in structure and the brilliant golden color. There

Fig. 5 Spotted grapevine beetle (original)

is, in the southern part of the State, another ally of the June beetles known as the fig eater, Allorhina nitida Linn., peculiar because of its dull greenish color, the wing covers being usually margined with yellowish brown, and on account of the peculiar locomotion of the larvae; these latter turn on their backs and travel rapidly by a series of undulating movements which are made very effective by the short, stout dorsal spines.

New York species. The following species of Lachnosterna have been recorded from New York State: L. glaberrima Blanch., L. gracilis Burm., L. gibbosa Burm., L. crassissima Blanch., L. micans Knoch, L. fusca Froh., L. arcuata Sm., L. dubia Sm., L. grandis Sm., L. marginalis Lec., L. fraterna Harr., L. nova Sm., L. knochii Gyll., L. rugosa Mels., L. hirsuta Knoch, L. balia Say, L. nitida Horn, L. hirticula Knoch, L. ilicis Knoch, L. crenulata Froh., and L. tristis Fabr. That the above list is not exhaustive is evidenced by the thirty-one species recorded from New Jersey, presumably as a result of special collecting which has not been possible in this State.

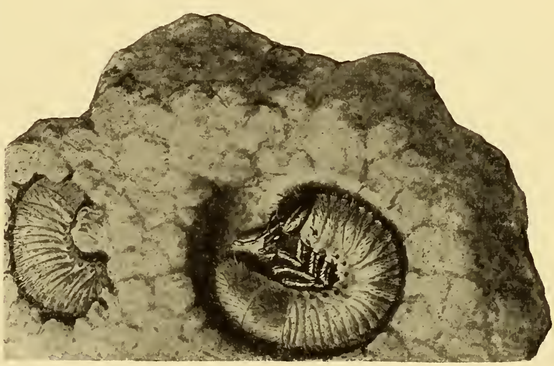

Fig. 6 White grubs in earthen cells (original)

White grubs. The term white grub is more than generic, since it is applied indiscriminately to a large number of Coleopterous larvae found under grass sod and in decaying organic matter. These larvae resemble each other in a general way and it is not surprising that they should be confused in the popular mind. The white grubs of the entomologist comprise an aggregation of forms normally living on grass roots and referable, as shown by rearing the adults, to several genera. Unfortunately, our knowledge of the immature stages is such that beyond a few general characteristics it is impossible to identify the various species of Lachnosterna as larvae. Large, stout, white, curled grubs, half an inch to an inch in length, with brown heads, and living on grass roots or those of closely allied plants in this latitude, are mostly referable to the genus Lachnosterna. Even the recently hatched grubs present practically the same characteristics as the nearly full-grown individuals so numerous occasionally under sod which has been killed by these pests. The principal difference is that the smaller grubs are whiter, owing to the fact that there is proportionately less dark vegetable matter within the small body.

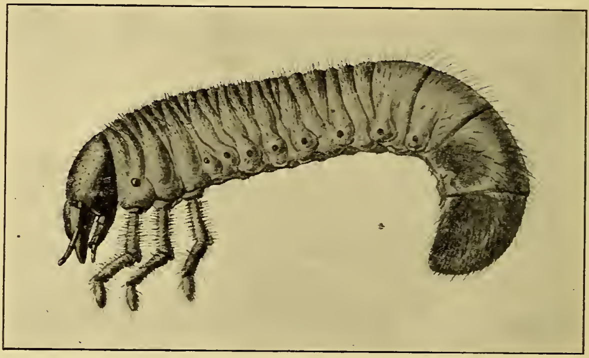

Fig. 7 White grub or larva of May or June beetle, enlarged (original)

Injuries in 1912. Many pastures and meadows as well as certain cultivated crops in Albany, Columbia and Rensselaer counties at least, were very severely damaged the past season by white grubs, and similar injury was reported from portions of Washington county. The pests were so prevalent in the southern part of Rensselaer county that most of the grass roots were cut off over considerable areas; in some instances grass on half an acres or even larger fields was totally destroyed, the sod being torn up wherever the horse rake was used. Such conditions were common in the towns of Schodack, Nassau and Kinderhook, to mention only a few localities where personal investigations were possible. Similar injury was reported by William H. Wanzer from Slingerlands near Hurstville in Albany county. The grubs not only devoured all the grass roots but frequently attacked those of nearby shrubs and trees, while rose bushes in one area were so badly eaten that the plants were readily torn from the ground. Mr B. D. Van Buren informs us that on his farm at Niverville the roots of a recently set apple tree were so badly eaten that it was easily pulled up. Corn planted on infested sod land was destroyed, and in one such locality a sample digging in October resulted in finding thirteen living grubs in an area of about one square foot, while we were informed that in July some boys collected over twenty grubs in one hill of corn. Adjacent to this area the pulling of corn stalks in the field resulted frequently in exposing two or three nearly full-grown grubs just at the base of a stalk and within an inch or two of the surface. Reports of injuries to strawberries and potatoes were also received.

An investigation of the damage in several localities showed that, as a rule, most of the injury was in spots where there was more moisture and presumably better grass. The affected areas were generally near the foot of a gentle rise and frequently in a small gulley. It appeared as though the beetles, when ovipositing in 1911, had been attracted to the denser patches of grass and oviposited therein very freely. In August many grubs were to be found just under the sod in cells one or two inches below the surface, as many as five to seven or eight occurring in one square foot. Investigation about the middle of October showed that comparatively few of the grubs were near the surface and that most of them were from seven to ten inches below. This was especially marked in grassland and by no means so evident in corn fields.

Life history. The extended life cycle of white grubs and the fact that a large proportion of their existence is subterranean, makes it very difficult to work out the life history of the various species in detail. This difficulty is further accentuated by the possible occurrence of several closely allied forms at the same time, the grubs being practically indistinguishable one from the other. The parent insects, as their common name indicates, appear in May or June and remain abroad about four weeks. The beetles feed upon the leaves of a considerable variety of plants and display a marked preference for poplar, willow, oak, chestnut, elm and apple, though they may also work upon the foliage of quite a number of trees and shrubs. The eggs, which hatch in about four weeks, are deposited in grassland, and in the case of the beetles appearing in 1911 there was an obvious selection of the richer, more luxuriant spots. The slowly developing grubs feed upon the roots of various grasses and allied plants. At the end of the first season the young grub may be only about a quarter of an inch long, while at the close of the second season the grubs are about a half to three-quarters of an inch long and present the familiar appearance of the depredator so commonly found at the roots of strawberry and other more highly prized cultivated plants. The grubs, whether small or large, burrow down into the earth on the approach of cold weather and remain until the following spring. In July of the third summer they construct oval cells and change to pupae, the latter transforming to beetles the following August or September and the perfect insects appearing during May and June of the next year.

Natural enemies. White grubs are most acceptable prey to pigs and also that much avoided and generally abused animal known as the skunk. Both dig in badly infested fields and swine are generally credited with being exceedingly efficient destroyers of these pests. They will frequently root up and devour practically all the grubs in badly infested areas to which they have access.

Crows are well-known enemies of the white grub. Mr William H. Wanzer of Slingerlands reported that in his locality these birds had discovered the infested areas and were digging out and devouring the grubs in grass and potato fields. Similar operations have been observed in Illinois, while studies by Dr F. E. L. Beal in 1894 showed that crows ate either beetles or grubs in every month from March to October inclusive. Blackbirds are also reported as feeding upon the grubs.

A common parasite of the white grub in Illinois is known as Tiphia inornata Say. The cocoon of this species is oval, brown and about three-quarters of an inch long. It is easily recognized by the slight neck or constriction at one extremity. These cocoons were found in small numbers in one infested field in Schodack. Another large parasite known as Myzine sexcincta Fabr. also preys upon the white grubs and forms a cocoon similar to that of the Tiphia noted above, though differing in their greater smoothness and lacking the loose, fluffy coating of silk. This species, according to recent investigations, appears to be fully as efficient a parasite as the Tiphia. Another parasitic Hymenopteron which has been reared from white grubs is Ophion bifoveolatum Brulle. The genus Ophion is rather common in New York State and there is no reason for thinking that other species may not prey at least occasionally upon the white grub.

A number of parasitic flies also depend in considerable measure for sustenance upon white grubs. A bee fly, Sparnopolius fulvus Wied. has been reared in Illinois from white grubs, and the same is true of the peculiar Pyrgota undata Wied., a species which unfortunately seems to be not very abundant in New

York State. A large white maggot about an inch long and possibly a species of Erax was abundant in what had been badly infested sod at East Schodack, the maggots being in the proportion of four to one of the white grubs. This insect appears to be a very efficient natural enemy. There are doubtless a number of other insects which live at the expense of white grubs and which have not been reared, owing to the fact that parasitized white grubs are very apt to be overlooked in making examinations of the soil.

The peculiar white grub fungus, Cordyceps ravenelii Berkl., was found upon the farm of Mr W. S. Miller, East Greenbush. Infected grubs are easily recognized by the slender, hornlike processes arising from beneath the head and frequently attaining a length three to four times that of the grub. These growths are at first green and later they turn brown. Mr Miller states that infected grubs were easily found over a considerable area.

Preventives and remedies. The extended life cycle of these insects and their practical restriction to grasslands make it apparent that systematic rotation of crops is one of the most important preventive measures that can be employed. It does not follow from the above that new seedings may not be occasionally attacked, as was the case last year, since numerous beetles emerging from old meadows in some instances deposited numerous eggs in recent seedings and, as a consequence, serious damage developed the following year. A rotation of crops which does not allow land to remain in sod for more than two or three years, if generally followed in a neighborhood, will result in reducing the danger of injury from these pests to a minimum. Such a method of farm management is also advisable from the general agricultural standpoint.

The danger of planting corn, potatoes or strawberries upon recently turned sod, especially if the latter is infested by white grubs, should be more generally recognized. The severe damage frequently following such practice is due to the great restriction in the number of plants per acre and the inevitable concentration of the grubs upon the small amount of food available. There is no evidence to show that the larvae or white grubs migrate to any extent through the soil. They may make their way for a distance of possibly one or two rods but hardly farther. Grassland badly infested with white grubs should, if plowed, be sowed with some such crop as rye which would grow with sufficient vigor to withstand any reasonable injury and produce a crop, or if an ordinary hoed crop must be planted on such land, use an extra amount of seed and feed liberally, supplementing this with good cultivation in order to enable the crop to withstand successfully the probable injury

There is no practical method of destroying white grubs in the soil, aside possibly from giving pigs the run of the field prior to planting time. Experience has shown the practicability, in the case of recently set strawberry fields, of digging out and destroying the grubs working at the base of individual plants. This latter is somewhat costly and is practical only after the injury has developed to such an extent that one can detect affected plants. It can be advised only in cases where it is impractical to avoid such conditions.

Numerous white grubs in a lawn or in a garden where values are relatively high can be destroyed by the use of a dilute kerosene emulsion, say 1 part of the standard formula to 9 parts of water. A liberal amount of the spray should be applied and then followed by a thorough soaking with a garden hose in order to wash the emulsion down, bring it into contact with the grubs and eventually carry it beyond the reach of most of the root fibers. Carbon bisulphid has also been advised for the destruction of grubs about plants. This material, if employed, should be used with care and be preceded by a few experiments to determine the possibilities under given conditions, since the danger of injuring vegetation would depend in considerable measure upon the texture of the soil and the amount of moisture present.

HICKORY BARK BORER

Eccoptogaster quadrispinosa Say

The destructive work of the hickory bark borer in the Hudson valley, begun some three years ago, has been continued the past season. A number of dying trees were observed in the immediate vicinity of New York City, while many others have been seriously infested during the past season. A personal examination of conditions at Tivoli showed that similar conditions prevailed in that section.

Signs of infestation. The preliminary signs of injury, such as wilting leaves and dead twigs during July and early August, are exceedingly important because they indicate the presence of a destructive pest before matters have passed the remedial stage. The attack, as characterized above, simply indicates that the beetles are about to enter the tree and that if affected twigs are numerous, the pests may destroy the hickory. Examination of injured trees in the fall or during the winter may show particles of brown or white sawdust in the crevices of the bark, and in the case of some trees, a few to many circular holes appearing as though they had been made by number 8 buckshot. The recognition of this sawdust is a decided advantage, since the dark brown or black, rather stout, cylindric beetles about one-fifth of an inch long invariably start their galleries under a protecting scale of bark and the sawdust mentioned above is therefore the only external evidence of injury. Such trees are more dangerous to the welfare of adjacent living hickories than others which may be fairly peppered with numerous exit holes. The external evidence cited above should be followed up by cutting down to the sapwood. The exposure there of longitudinal galleries one to one and one-half inches long, about one-eighth of an inch in diameter and with numerous fine, transverse galleries arising therefrom and gradually spreading out somewhat fan-shaped, is conclusive evidence as to

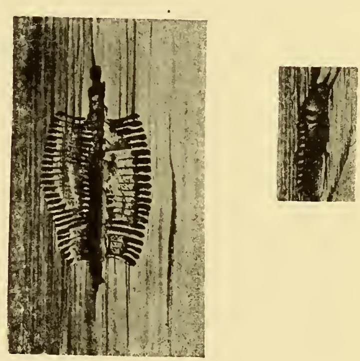

Fig. 8 Hickory bark beetle. The smaller figure shows the gallery of the adult and the egg notches, the larger the galleries of young larvae (original)

the identity of this pest. In very early stages of the attack the longitudinal gallery described above, with a series of minute notches for the reception of eggs on either side, may be all that can be found. Only a little experience is necessary before one can recognize the characteristic galleries of this borer. They are almost invariably to be found somewhere upon infested trees, since an attack is rarely discovered before at least some of the grubs have commenced working across the bast fibers.

Fig 9 Hickory bark beetle, galleries made by the adult and the full-grown larvae (original)

Life history and habits. The life history of this borer may be summarized as follows: The beetles appear from the last of June till the last of July and may be found in New York State up to the middle of August. Observations at Bronxville on July 10th showed numerous dead leaves and tips of branches upon affected trees. The beetles were then just beginning to enter the bark. On August 5th a number of beetles were still working in the leaf stem, others were entering the bark and some had evidently become well established. The beetles bore the young twigs and burrow in the terminal buds and green nuts, evidently for food, and in this manner frequently cause the wilting of leaves and the death of twigs. Later they attack the bark of the trunk and the larger branches, each female making a vertical gallery an inch or more in length, along the sides of which she deposits in small notches, 20 to 40 or 50 eggs. These galleries of the adults are usually very regularly placed, their position apparently being determined in large measure by the long cracks in the rougher bark of the trees. The eggs soon hatch and the grubs work in the tissues, at first at nearly right angles to the primary galleries and later the borers turn in either direction till they run nearly parallel with the wood and produce a rather characteristic fan-shaped series of galleries. The burrows of the grubs or larvae rarely cross each other. On October 1st most of the larval galleries observed were from one-half to three-quarters of an inch long and the grubs about one quarter grown. They winter in a partly grown condition, transform to pupae the last of May and the beetles begin to appear about a month later. There is no evidence to show that more than one generation occurs in New York State, at least.

Experimental work. The following field work was conducted at Bronxville in cooperation with Mr J. James de Vyver of Mount Vernon.

Barcurol. A 10 per cent solution of this proprietary material was applied July 12th to certain hickory trees which were examined August 5th. It was then evident that this compound had a distinct hardening effect upon the outer bark of the tree though there was no penetration by the beetles, a fact confirmed by subsequent observations October 1st. An examination of a few burrows made by the beetles prior to the application showed that the discoloration of the inner bark was confined to the immediate vicinity of the galleries and occurred to an almost equal extent on untreated trees. The brown tissues in the latter instance extended to within about an inch of where living grubs were working. Another tree treated with a 50 per cent solution of this material was examined August 5th and it was seen that the application had destroyed the borers.

Kerosene emulsion. One tree was painted with an undiluted stock kerosene emulsion July 25th. An examination on October 5th showed very little penetration of the bark in the vicinity of the galleries and no living insects were to be found in the burrows started prior to the treatment. Some beetles were entering the bark at the time of our examination and were evidently not deterred therefrom by the earlier application.

A 50 per cent kerosene emulsion was sprayed upon another tree the same date, and observation on August 5th showed that the insects were destroyed in the burrows and that there was also some penetration of the adjacent tissues. The outer bark did not seem to be affected in the least.

Scalecide. A 20 per cent solution of this proprietary compound was applied to infested trees September 7th and an examination on October 1st showed living grubs in four out of five burrows. In one case the larvae had made their way to a distance of two inches from the gallery made by the female. This had a thicker bark than the one treated with Barcurol or carbolic acid and the comparison was therefore not exactly fair. It is likewise probable that the treatment was made too late in the season to give the best results, since the grubs were evidently some distance from the female gallery and therefore mostly out of reach of the application.

Carbolic acid. This was prepared by diluting a gallon of soft soap with an equal amount of hot water and stirring therein a pint of crude carbolic acid (½ pint refined), allowing it to set over night and then adding 8 gallons of soft water. This solution was applied to trees on September 7th, and examination on October 1st showed discolored areas on each side of the main gallery for a distance of about three-quarters to one and one-quarter inches. There were very few or no grubs found alive and the adjacent tissues were healthy and apparently uninjured. This treatment was made to a thinner barked tree than the one treated with scalecide and the grubs were therefore somewhat more accessible.

Black leaf 40. A few trees were treated with this material used at the rate of 1 to 200 and adding thereto 3 pounds of soap to each 50 gallons of water. The trees were sprayed September 7th. An examination on October 1st showed the presence of some living larvae under the rather thick bark. This treatment, as in the case of others given at this date, was too late for us to expect the best results, and in this particular instance was limited to trees with a thick bark, the latter rendering the penetration by the insecticide more difficult.

The above experiments, while by no means conclusive, give sufficient data to warrant a continuance of the work, particularly with a preparation of oil or carbolic acid for the purpose of destroying the beetles or the recently hatched grubs before they have had an opportunity to bore any distance from the egg chambers. This treatment, it should be stated, can be recommended only for specially valued trees on lawns or in parks. It is possible that a spray with a whale oil soap solution, a lime-sulphur wash or even a thick whitewash just before the beetles begin to enter the bark of the trunk would prove of considerable service in preventing attack and be nearly as effective as the treatments tested above. This problem can be settled only by further experimental work.

Mr Henry Bird, of Rye, informs us that in his opinion the treatment of infested trees after oviposition seems feasible in certain cases. He found that spraying with a strong whale oil soap solution just before the females began to enter the trees, seemed to drive away the insects and prevent infestation. This, he states, proved to be the case with one large tree which during the month of July, was infested by hundreds of beetles feeding upon the leaf petioles. He found spraying with arsenate of lead of no service and a similar report was received from Mr de Vyver, though the treatment by the latter was, in our opinion, too late to be of material service. Mr Bird found from experience that treatment of individual galleries was less laborious than he had supposed. He personally went over several trees between the 20th and 23d of August in an area where the insects were abundant, the trees being 40 feet high and having between 200 and 300 galleries in the bark. He used a small squirt can oiler and about a quart of gasolene to the tree, only enough being injected to destroy the females or the eggs. This treatment he found caused no appreciable injury to adjacent tissues. His work with this oil was limited to moderate sized trees a foot or more in diameter and some thirty-five years old. It would undoubtedly be more difficult to treat larger trees in this manner, though in the case of highly valued hickories one could hardly class this method as impractical.

Preventive measures. It is well known that plants are more susceptible to the attack of various insects when in an unthrifty condition. It is probable that the excessive droughts and extremely low winter temperatures of recent years have had an important effect upon many trees, lowering their vitality and presumably making conditions more favorable for insect attack. This unfortunate condition may be accentuated in certain localities as, for example, in southeastern Westchester county, by the abundance of canker worms or other leaf feeders, since repeated destruction of the foliage would weaken the trees and, in the case of developing leaves, might cause serious injury without attracting much attention. Mr Henry Bird believes that he has detected a connection between successive attacks by canker worms and injury by the hickory bark beetle.

Another factor which may be more important than many realize, is forest fires or burnings. It is unfortunately the practice in some communities to burn over pasture and woodlands rather freely in the mistaken notion that benefit accrues. It is true that such procedure is followed by a more vigorous growth of grass and is generally accompanied by the destruction of leaf mold or humus, not to mention the killing of numerous small trees and injuring some of the larger ones. Moreover, this humus is a most important ingredient in maintaining the fertility of the soil and also of much service in protecting the roots of trees from excessively low temperatures, and by conserving moisture mitigates in considerable measure, the severity of droughts. The greater exposure to extreme temperatures and the additional severity of droughts following the annual practice of burning, may well result in reducing the vitality of the trees and bringing about a condition favorable to attack by borers. Such procedure is at least indefensible from the standpoint of the forester and should be condemned and avoided wherever possible.

Generally speaking, we may expect the least trouble from injurious insects where normal forest conditions prevail and the trees as a whole are in a thriving condition. All practical measures which result in the removal of sickly and dying trees and provide better conditions for those allowed to remain will, in a general way, reduce the liability of serious injury by insects.

Remedial measures. A serious infestation, indicated by dying trees or branches, can be controlled only by cutting out all badly infested trees or portions of the same and destroying the bark before the following June in order to prevent the grubs then in the trees from maturing and changing to beetles which might another season continue the work in previously uninfested trees. It is particularly important to locate hickories which have died wholly or in part the past summer, because it is these trees which contain living grubs. General cooperation over an extended area, in the cutting out of infested trees and burning of the bark as outlined above, will do much to check this deadly enemy of hickories. It is a method which has been tried in some sections with marked success and is more practical on large holdings than where the cooperation of numerous owners must be secured. This destruction of the insects does not prevent the utilization of the wood and timber commercially, provided the bark is destroyed within the above given time limits. Slabs from sawlogs and firewood with the bark on should all be burned during the winter. If it is impractical to work up the logs and burn the slabwood, the borers can be destroyed by a prolonged submergence in water or by removing only the bark and burning that.

The possibility of protecting trees which have been entered the past season, is discussed under experimental work. Such treatment can never be advised for ordinary woodland conditions.

PEAR THRIPS

Euthrips pyri Daniel

The pear thrips is a slender, dark brown insect only about one-twentieth of an inch long and with very delicate, narrow, long-fringed wings (Plate 3). It appears with the opening of the leaf buds and when numerous may literally blast the developing blossoms and destroy the crop. This new pest was discovered in California in 1904, has been under investigation in that region for the past eight years, and was found in the Hudson valley by Professor Parrott in 1911. Evidence at hand renders it very probable that this insect has been in New York State for some time and that the mysterious failures of the pear crop in recent years attributed to "blossom blight" or some obscure cause may have been due to the work of this minute enemy.

Widely distributed in the Hudson valley. Early in May we found the pear thrips in an apple orchard near Ravena and very abundant in a pear orchard at Coeymans Hollow. Specimens were also received from Grapeville several miles distant. The insect is generally distributed about Germantown and was very abundant in the orchard of Spencer Brothers at Hudson. It has also been found back of Poughkeepsie and at Milton, Marlborough and Newburgh.

Injuries. Personal examinations at Geneva and Hudson in company with Professor Parrott, showed a nearly total destruction of the fruit buds in a number of orchards. The young leaves had assumed a characteristic spoon shape, the tips were browned or black, while the blossom buds were partially wilted masses of browning tissue. Some 200 seckel pear trees in the orchard of Spencer Brothers were full of just such fruit buds, the loss amounting to about 400 barrels of fruit.

A local pest. Though widely distributed in the Hudson valley, this insect is a local pest which may be very injurious in one orchard or even a portion of an orchard and hardly noticeable elsewhere. The restricted character of the outbreak was very well shown in the orchard of Spencer Brothers. Here a large block of vigorous seckel pear trees, some 200 in number, had practically all the bloom destroyed, while Kieffers, lying west of the seckels and also down on the hillside, were comparatively unaffected. Those east of the seckel block and farther up the hill had most of the blossoms in the upper part of the tree destroyed. It would seem from this as though these insects drift with the wind and were probably carried from the seckels to the Kieffers by light breezes which would naturally sweep up the hill.

A marked restriction, though not on such an extended scale, was likewise observed in an orchard at Coeymans Hollow and also in that of Mr William Albright about two and one-half miles from New Baltimore Station. In the latter instance injury was particularly marked in a hollow and extending part way up on a knoll, while those on the knoll and beyond were not seriously affected though the pest was to be found even there in small numbers.

Description. The fruit growers will recognize this insect most easily by its operations as characterized above, nevertheless, for an accurate determination, especially in the case of outbreaks at a distance from known infested areas, the microscopic characteristics of the adult must be recognized and on this account we reproduce below the excellent original description:

Female. Length, 1.26 mm; width of mesothorax, .32 mm; general color, dark brown. Head about as long as broad; cheeks convexed; anterior margin broad, acutely angular; back of head transversely wrinkled, and bearing a few minute spines. Eyes medium, black, with light borders rounded or oval in outline, coarsely faceted, hairy. Ocelli yellow, margined inwardly with reddish brown crescents, widely separated, posterior ones contiguous, with light borders around eyes; one very long slender spine on each side midway between ocelli. Mouth cone pointed, tipped with black; maxillary palpi three-segmented. Antennae eight-segmented, approximate, slightly over twice the length of head. Length of segments: 33, 43, 55, 52, 35, 50, 8, 10. Antennae brown, except segment 3, which is yellow. Spines pale, conspicuous, special sense organs on segments 3 and 4.

Prothorax longer and wider than head; bears many prominent spines, the one at each anterior angle, and the two at each posterior angle are longest. Color, yellow-brown; faintly cross-striated.

Mesothorax approximately as wide as antennae are long; front angles obtusely rounded; metanotal plate bears four spines close to front edge, middle pair equal in size and prominence to those at the angles of prothorax, the others are small; pterothorax yellow-brown, transversely wrinkled.

Wings present, extending slightly beyond abdomen, about twelve times as long as wide, pointed at ends; surface of wings thickly covered with minute brown spines; both longitudinal veins and costa of forewings thickly set with quite long, brown-colored spines, placed regularly on costa and hind vein; costa has from 29 to 33 spines, forevein 12 to 15, and hind vein 15 to 16; veins not prominent; costal fringe of forewings about twice as long as costal spines.

Legs moderately long, scarcely thickened; femora and all except the terminal part of tibia brown; terminal part and tibia and tarsi yellow, a double row of twelve strong spines on the inner side of hind tibia, several inconspicuous spines on fore and middle pairs.

Abdomen about two and one-half times as long as width of mesothorax, cylindrical to eighth segment, then abruptly pointed. Spines on sides and around tip of abdomen dark brown, conspicuous; those on last two segments are long and approximately equal. Color of abdomen dark brown, connective tissue yellow.

The young closely resemble the adult structurally, though there is a variation in size, and this stage is also characterized by the absence of wings.

Life history. Investigations on both sides of the continent show that this pest winters in the soil, appearing upon the trees as the young leaves push from the buds, and feeds by preference upon the more tender and essential parts of the fruit buds. The slender, dark brown thrips may be found crawling between the partly opened leaves and working their way to the base of clusters of fruit buds. This habit of sheltering themselves among the growing tissues materially lessens the efficacy of spray applications. Buds thickly infested with thrips become sticky, the blossom buds assume a brown, blasted appearance, the bud scales drop in unusual numbers, while affected blossom clusters gradually shrivel and fall. The stems of the young fruits are also injured, frequently resulting in an early dropping. The affected leaves are small, more or less crinkled, and with a characteristic spoon-shaped development. This condition may be true of extended areas, limited to a few trees here and there in an orchard, or confined to portions of trees and, in the latter instance, result in a very uneven setting of fruit (see plates 1, 2).

The microscopic eggs are deposited in minute slits in 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. The insects produce small wounds on the foliage, the affected tissues drop out or break and seriously injured leaves are, as a consequence, badly perforated and quite ragged in appearance.

Food plants. This minute enemy attacks a variety of deciduous fruits, having been recorded from apple, apricot, cherry, fig, grape, peach, pear, plum, prune, quince and the English walnut. The principal damage, as indicated by the common name, is to the pear.

Distribution. This insect was first discovered in California, has been recorded from a number of localities in the Hudson valley and at Geneva, and also reported from England. Its minute size and the probability of its being carried in soil with young trees, greatly favors the dissemination of the pest and will undoubtedly result shortly in its general distribution, even if it has not already become established in most of the more important fruit-growing regions.

Preventive measures. An examination of conditions in the orchard of Mr William Albright near New Baltimore resulted in our learning that several years before, this pear orchard had been affected in a similar manner, and that the injury at that time, as well as that of last spring, occurred during seasons when the orchard had not been cultivated early in the spring. An examination of infested orchards at Coeymans Hollow, at Germantown and at Hudson showed that without exception the injury occurred on a heavy soil where early and thorough cultivation was presumably difficult or impossible. The pear thrips appears to be absent from orchards on the lighter, sandy soil of Kinderhook. It may be only a coincidence, yet the fact that this delicate insect winters in the soil and has been in at least one instance seriously injurious to orchards which were not cultivated till late, suggests that in early cultivation, where practical, we may find a feasible method of preventing injury and avoid the relative costly repeated sprayings necessary where the insect is numerous.

Remedial measures. The appearance of hosts of thrips in the early spring and their rapid work upon the developing leaves and fruit makes promptness an essential in the control of the pest. Experience has shown that the thrips, when abundant, may practically destroy a crop in a few days and, furthermore, that most of those which can be reached by a spray succumb readily to the use of a tobacco extract such as black leaf 40 employed at the rate of ½ pint to 100 gallons of water to which was added 2 pounds of soap. Mr William Albright sprayed with this solution about 11.30 in the morning, shortly before it began to rain. It rained until about 2 p. m., and an examination thereafter showed numerous dead or dying thrips. The best results will be secured when this insecticide is applied as a coarse forcible spray, the nozzles being adjusted so as to throw the material down into the clusters of leaves and blossom buds. In the case of bad infestations, namely, where 10 to 15 thrips may be found in a single blossom cluster, a second spraying may be necessary the following day and a third possibly after the petals drop, for the purpose of destroying the young before they desert the trees and enter the soil.

The most effective spraying is while the buds are swollen and before they have opened sufficiently to produce crevices in which the thrips may find shelter and after the blossom clusters have separated so as to expose the thrips sheltering among the stems of the young fruit.

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QUEEN BLOW FLY

Phormia regina Meign.

A study of the queen blow fly was undertaken for the purpose of obtaining data which could be used as a basis for estimating the period a human body had lain exposed to the elements in midsummer. We found so little definite in available literature concerning the biology of the blow fly, and especially the duration of the various stages, that it was necessary to work out the life history before attempting a moderately accurate estimate of the age of certain maggots taken from the corpse. It was supposed at the inception of the work that the so-called common blow fly, Calliphora erythrocephala Meign. was the more prevalent species at Nassau, the place where these investigations were conducted. Our experiments resulted in rearing only the above named species, kindly determined by Mr C. W. Johnson of the Boston Society of Natural History, and a flesh fly, which latter will be discussed subsequently. There seems to be comparatively little known concerning this blow fly. Mr G. N. Hough records this species as very common everywhere in this country, though it appears to be rare in Europe. Aldrich lists it from such widely separated localities as New Jersey, Montreal and New Mexico. It is worthy of note in this connection that Mr J. H. Paine reared this species in larger numbers from city garbage in Boston, Mass., than either the common house fly or the bluebottle fly, Lucilia sericata, though it should be noted that Phormia was present in fewer lots and that by far the most came from one lot, concerning which there seems to be no special record except that no house flies were obtained and the material was collected in August.

Methods. The head of a recently killed calf was procured about 6 p. m. August 1st, and on account of the low temperature prevailing for that season, no ova were deposited upon the head that evening. It was exposed throughout the next day which was moderately cool, in a place protected from larger animals, and at 5 p. m. there were hundreds of eggs about the mouth and in the hair at the base of the horns. Several flies were observed in the immediate vicinity. This was the source of the material upon which the following notes are based, since flying insects were excluded after this primary infestation. Observations were made and material collected about 7 a. m. and 6 p. m. during most of the period. The temperature conditions prevailing at the time the following observations were made are tabulated below, together with a transcript for the corresponding period of the official weather bureau records at Albany for the purpose of comparison.

Temperature records

DATE		ALBANY		NASSAU [1]	
Month	Day	Max.	Min.	Max.	Min.
August	1	74	57	....	64
	2	76	52	....	....
	3	71	58	....	....
	4	72	56	65	56
	5	76	52	69	50
	6	78	52	72	62
	7	77	54	70	58
	8	79	61	68	58
	9	79	67	69	66
	10	79	69	71	67
	11	85	68	81	78
	12	84	69	90	72
	13	87	68	86	71
	14	86	70	91	69
	15	82	62	89	72
	16	71	55	83	64
	17	72	48	77	51
	18	65	59	79	62
	19	76	60	63	63
	20	81	65	80	67
	21	73	58	83	60
	22	83	62	....	....
	23	73	60	....	....
	24	77	59	....	*a*68
	25	88	68	*b*76	....
	26	84	67	88	66
	27	77	57	86	67
	28	72	51	87	48
	29	74	54	87	58
	30	68	47	75	45
	31	64	43	75	45
September	1	64	54	68	45
	2	65	58	63	59
	3	68	59	67	58
	4	78	64	68	59
	5	78	64	81	61
	6	80	67	80	64
	7	82	64	80	62
	8	82	60	85	62
	9	80	60	82	59
	10	80	54	83	53
	11	83	58	82	54
	12	70	50	83	52
	13	75	54	83	52
	14	72	63	79	53
	15	81	68	71	63
	16	73	52	83	62
	17	70	57	72	46

[1] Records from August 1st to 11th inclusive are based on morning and evening readings and therefore do not represent the true maximum and minimum, though approximating thereto.
a This is a minimum record for the preceding two days during which readings were not taken.
b This is a maximum recoid for the preceding three days during which readings were not taken.

Biology. Hundreds of eggs were noted at 5 p. m. August 2d and the next morning. Though the night was cool, hatching was in progress and at 6 p. m. the same day most of the eggs had hatched and the young maggots, about 2 mm long, were collected in a slight depression on the cut surface of the head. These conditions persisted unchanged except that the maggots became possibly a little more active with the progress of time till the morning of August 6th when there were many second stage maggots about 3.5 mm long and some first stage maggots about 3 mm long. The difference in size between these two stages was so slight that the change from one to the other occurred without attracting particular notice. The night of the following day, August 7th, the second stage maggots were some 6 mm long and perceptibly larger. There was also observed one larger third stage maggot having a length of about 13 mm. The following morning, August 8th, four or five large third stage maggots were observed, and by night one-third of them had similarly changed. The following morning, August 9th, most of the maggots visible, namely, some seven-eighths, were in the third stage and moving actively over the cut surface of the head. The maggots at this time were distinctly negatively heliotropic and when kept in darkness showed little tendency to burrow into the tissues. They collected in a hemispheric mass an inch or more in depth on the upper cut surface and remained so long as it was kept dark, scattering only with the admission of light. This negative heliotropism was mare marked as the larvae developed and by the time they attained full size there was a speedy scattering on admission of light, even though the mass of maggots when exposed to illumination had a depth of an inch or more and covered the ten or twelve square inches of surface. The following day, August 10th, no small maggots were observed and all were evidently nearly full grown and ready to desert the carrion, such migration occurring the following morning. The maggots remained for several days in the upper layers of adjacent moist soil, being so numerous for a time as to transform this part into a heaving, animated mass. The larvae began to become sluggish prior to pupation on the morning of August 13th, and that night puparia were numerous though there were still many full-grown larvae. Phormia larvae persisted in decreasing numbers till August 16th, and on the 25th numerous adults were obtained. The insects continued to emerge in large numbers for several days.

The duration of the various stages is approximately as follows: eggs, 12 to 24 hours, much depending upon temperature conditions.

The first larval stage lasted about three days, probably being somewhat prolonged by the rather low temperatures prevailing. The second stage persisted two to three days, while the period of active feeding in the third stage was limited to about three days, though the transformation to puparia did not occur till three days later.

Description. *Egg.* Length 1.5 mm, elongate, elliptic, tapering slightly toward one extremity. The eggs are deposited in agglutinated masses of varying number.

Larva, general characters. White, narrowly conical, the posterior extremity subtruncate, length 2 to 13 mm.

First stage. Length 2 to 3 mm, diameter .3 mm, tapering slightly to the anterior segments, which latter taper sharply, the segmentation distinct and marked with a series of transverse bands of short, dark, chitinous points on each body segment. The cephalo-pharyngeal skeleton is very characteristic in this stage The mandibular sclerites are slender, nearly rectilinear, and at the anterior extremity there may be found a pair of stomal plates, each with six minute teeth; dental sclerite rudimentary; hypostomal sclerite slender, slightly curved; lateral pharyngeal sclerite with a long, rectilinear anterior process, the main part being a broad dorso-ventral bar of chitin produced posteriorly at both the dorsal and ventral angles as a tapering and relatively narrow process. The dorsal sclerite is slender, strongly looped and unites the two lateral pharyngeal plates (plate 4, figure 1); posterior spiracles (plate 5, figure 1) with one well-developed, narrowly oval orifice and apparently a rudimentary second.

Second stage. Length 3.5 to 6 mm, diameter about 1 mm. General characters as in the preceding stage. Cephalo-pharyngeal skeleton: mandibular sclerites moderately heavy, somewhat decurved and irregular; dental sclerite moderately heavy, short, broadly triangular; hypostomal sclerite shortened, heavy, irregular and united with its fellow by a moderately broad dorsal process; lateral pharyngeal sclerite consisting of a broad dorso-ventral plate with a curved, tapering process on the anterior ventral angle; a short, broad, truncate process posteriorly on the dorsal angle and a longer, tapering process posteriorly on the ventral angle, the dorsal sclerite rather broad and strongly arched (plate 4, figure 2); structure of anterior spiracle indistinct; posterior spiracles (plate 5, figure 2), each with two slightly curved, well-chitinized orifices.

Third stage. Length 13 to 17 mm, diameter about 3 mm. General structure about as in the preceding stages. Cephalo-pharyngeal skeleton: mandibular sclerites stout, heavily chitinized, strongly decurved; dental sclerite small, broadly triangular; hypostomal sclerite short, irregular; lateral pharyngeal sclerite broad, with a long, slender, slightly curved process at the anterior ventral angle, a broad subtruncate process posteriorly along the ventral line and a longer, broad process from the posterior-dorsal portion, the distal part of the latter tapering suddenly to a subacute apex; dorsal sclerite short, slender (plate 4, figure 3); anterior spiracle distinct, broad, with ten or eleven radially arranged orifices; posterior spiracles, each with three rather broad, heavily chitinized, subparallel orifices (plate 6, figure 2). The subtruncate posterior portion has a well-developed truncate lobe on the ventral surface and a distinct, cup-shaped dorsal cavity guarding the spiracles and margined with irregular and rather minute, fleshy lobes.

Puparium. Length 9 to 9.5 mm, diameter 3 to 4 mm. Color light brown, turning to a dark brown, almost black. The anterior extremity is narrowly rounded and somewhat constricted subapically, each segment with a double transverse band of chitinous points; posterior extremity contracted subapically and easily recognized by the submedian spiracles located in a somewhat illy defined depression margined with irregular, short, broad, chitinous tubercles.

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GEORGIAN FLESH FLY

Sarcophaga georgina Wied.

A number of this large, grayish, yellowish or red-tailed flesh fly were reared in association with Phormia regina Meign. and provisionally identified by Mr C. W. Johnson of the Boston Society of Natural History.

One of the earliest notices of this form is by Harris, who characterizes the species as one of our largest viviparous flesh flies which appears toward the end of June and continues till the middle of August or perhaps later. It has been recorded by the late Doctor Smith as common throughout the state of New Jersey and is listed by Aldrich from Georgia, Massachusetts and British America. It has been reported as parasitic by Prof. C. M. Webster on grasshoppers in Wyoming. The record states that the maggots of this species were abundant in a mass of " dead disintegrating and decaying bodies " of Melanoplus differentialis Thos.

The discussion of methods and conditions under Phormia apply equally well to this species, except that the presence of the larvae were not observed till considerably later and manifestly when conditions were quite different.

Biology. On August 12th, a time when the disintegration of the carrion was in an advanced condition, a very few small, and at that time supposed to be first stage maggots, were observed on the calf's head in association with full-grown Phormia larvae. The following day it was noticed that there was a fairly good colony of Sarcophagid larvae clustering as before and evidently the product of a recent and presumably accidental ovi or larviposition. The next day, August 14th, most of these young larvae were small though a few appeared to be in the second stage, a transformation which was more marked August 15th. On the afternoon of the 16th there were many small, probably second stage maggots and one very large, probably third stage maggot, the latter being more abundant the following morning and on the 18th. August 19th at 6 p. m. nearly one hundred of these large larvae had escaped from the bucket containing the carrion and had established themselves just below the surface of the loose soil near a door sill where there was moderate protection from light. These larvae displayed a much greater activity in wandering than was the case with the earlier reared Phormia larvae. The maggots were placed in a fruit jar containing earth and remained moderately active and in the larval condition till the 25th, at which time a few recent puparia were found. Most of the maggots were then at the bottom of the soil in the jar and not on the surface, as was the case with many of the Phormia larvae. The Sarcophagid larvae transformed slowly to puparia and no flies were reared till September 15th, others appearing on the 16th and 17th.

Summarizing, an examination of material shows that the first stage had nearly passed before the maggots were observed. The second larval stage lasted about four days and the third three days, the prepupal condition persisting for about six days and the insects remaining in puparia 22 to 23 days.

Description. *First stage.* Length 2 mm, diameter .3 mm, whitish, slender, hardly tapering anteriorly, subtruncate posteriorly, the segmentation distinct and marked with a series of transverse bands of short, dark, chitinous points. The cephalo-pharyngeal skeleton is very similar to that of Phormia, the mandibular sclerites are slender, nearly rectilinear; the stomal plates rather large, the teeth irregular; hypostomal sclerites slender, slightly curved, lateral pharyngeal sclerite transverse, broad, and with tapering dorsal and ventral processes posteriorly, the former being somewhat longer; the dorsal sclerite is slender, strongly lobed and unites the two lateral pharyngeal plates; posterior spiracles apparently with two weakly chitinized openings.

Second stage. Length 5 to 6 mm, diameter .6 to 1 mm, whitish, slender, tapering slightly to the anterior extremity. Cephalo-pharyngeal skeleton: mandibular sclerites heavy, rather strongly decurved, basal portion broadly triangular; dental sclerite short, stout, strongly curved, free; hypostomal sclerite moderately short, stout, and united with its fellow by a broad, chitinous bar; lateral pharyngeal sclerites, anterior portion broadly transverse, subrectangular and with long ventral and dorsal processes posteriorly, the latter somewhat longer and more tapering; posterior spiracles each with two, moderately chitinized, orifices. Cuticular chitinization mostly equally bidentate.

Third stage. Length about 16 mm, diameter 2½ to 3 mm, whitish, slender and tapering from the obliquely truncate posterior extremity to a slender apex. Cephalo-pharyngeal skeleton: mandibular sclerite stout, decurved, the basal portion with a triaangular lobe ventrally; dental sclerite short, irregular; hypostomal sclerite short, irregularly triangular; lateral pharyngeal sclerite broad, the anterior portion with a length greater than its width and with broad, irregular processes posteriorly at the dorsal and ventral angles, that at the dorsal angle somewhat longer and more tapering (plate 7, figure 3); anterior spiracles yellowish brown, expanded and opening in about 18 small, radially arranged orifices (plate 7, figure 2); posterior spiracles (plate 7, figure 1) with three narrow, somewhat radially grouped orifices located in a distinct cup-shaped depression, much more marked than in Phormia and guarded by a series of fleshy tubercles and ventrally with a median lip, the latter with fleshy processes at the lateral angles.

Puparium. Length 9.5 mm, diameter 4 mm, color light brown, turning to a dark brown. The anterior extremity tapers rather sharply and is subtruncate, while the posterior extremity tapers gradually to a deep, cup-shaped depression surrounded by an irregularly tubercled wall.

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THE USE OF OILS ON DORMANT TREES

Spraying dormant trees with oils, especially mineral oils, is one of the more recent developments of insect control work. The late Dr J. B. Smith, late state entomologist of New Jersey, was one of the foremost advocates of this practice and at one time took the position that petroleum was "harmless to the most tender varieties and the youngest trees." It should be added that later this pronouncement was modified to "a reasonably safe, economic and effective material." Injury was noted following petroleum applications, and shortly the miscible oils were placed on the market and used probably much more generally than was the case with petroleum, either pure or in mechanical emulsions. The great advantage of the miscible oils is that they make possible a nearly uniform emulsion of known strength and there has been much less apparent injury following their use. The ideal in these latter is a stable emulsion which can be kept indefinitely, diluted to any desired strength and which will destroy scale and other insects without injuring the tree or plant. Some enthusiasts have almost gone so far as to assert that injury could not follow the use of even large percentages of some of the miscible oils.

Safety a prime essential. A fruiting orchard represents a considerable investment, and we believe that most fruit growers rightly consider the safety of the trees of more importance than the destruction of an insect pest or the prevention of possible injury. The remedy should not be worse than the disease and the treatment should most certainly not jeopardize the investment. We are unwilling to sanction, even by implication, the use of compounds which may result in material injury and, in some cases, disaster to the orchard.

Injury by petroleum. The writer's experience with petroleum and mechanical emulsions of petroleum in 1900 to 1903 inclusive, shows that serious injury might result in the latitude of Albany, especially if the application was made in the fall or in the spring if followed immediately by a spell of humid weather. One fall treatment resulted in such penetration and discoloration of the inner bark that grave fears were entertained for the safety of the trees. A similar condition developed in the spring when the spraying was followed by several days of foggy weather.

Others have noted deleterious effects following the application of petroleum to various trees in widely separated sections of the country. This is so generally recognized that an exhaustive discussion of the evidence seems entirely unnecessary. It should suffice to note in passing, that most competent observers who have studied the effects of petroleum upon trees, emphasize the variability of the results and attribute much of this to climatic conditions prevailing at the time of spraying and for some days thereafter.

Signs of injury by petroleum. Spraying dormant trees with petroleum, pure or emulsified, may retard their development in the spring. This may be comparatively slight and followed by enlarged lenticels, a discoloration, death and cracking of the outer layers of the bark and be accompanied the first season by abnormally large, dark green leaves. The last has frequently been regarded as an evidence of benefit though it apparently results from overstimulation and may be followed, if there be successive annual treatments with oil, by smaller and eventually undersized pale foliage.

Applications followed shortly by adverse climatic conditions, such as a severe winter or several humid days immediately after spraying, may cause an extremely late starting of growth with destruction of buds, limbs, or even large portions of the tree. There is then apparently more penetration by the oil which, in extreme cases, may kill the vital tissues to the sapwood or even below. The inner bark turns dark brown, may remain sappy under certain conditions for a considerable period and have a sour or acid odor. Trees thus affected may have limbs girdled near the middle with a dead inner bark and die gradually toward each extremity, or dead branches may show a similar, well-marked, girdled or dead area at the base, while badly affected limbs exhibit localized injury to the inner bark on portions most exposed to the spray or in connection with external rough places, which latter greatly facilitate the absorption of oil. Young fruit trees may have the bark badly blistered in the late spring and early summer, the underlying tissues being soft and evidently unhealthy. The death of affected trees or portions of the same may occur the following spring, drag through the summer or be deferred for a year or more. Even the buds fail to develop in some instances, while in other cases the leaves may push out and attain a length of half an inch or more before dying. In other cases the leaves may attain full size and the tree succumb slowly in midsummer, the extent and the rapidity of the withering probably being dependent in considerable measure upon climatic conditions. The vigor of the roots and the lower portion of the trunk, which latter frequently escapes injury probably because of the thicker bark hindering penetration of vital tissues, is shown by the numerous sprouts on the lower part of badly affected trees. This new growth may be moderate in character or extremely vigorous, much depending upon the vitality of the tree and the number of sprouts developing.

Miscible oils. An emulsion is defined as "a mixture of liquids insoluble in one another, where one is suspended in the other in the form of minute globules." There is no hint of a chemical change, the oil is simply more finely divided and, as a consequence, more evenly distributed through the preparation. It is still oil and possesses the properties of oil, as is readily seen on the disintegration of the familiar kerosene emulsion. The term "miscible oil" has been employed in economic literature to designate emulsions or preparations of oils, usually petroleum, mixing readily with water. A number of these have been placed on the market under various trade names. Experience has demonstrated the utility of a general designation for this class of products. The commercial emulsions are usually more stable, that is, they disintegrate less readily than the homemade kerosene emulsion. They contain oil in practically an unchanged condition so far as chemical and physiological properties are concerned, and may be expected to produce effects upon plants corresponding to the amount applied, other conditions being uniform.

Injury by miscible oils. Many have been repeatedly assured that miscible oils, especially certain commercial preparations, can be applied to plants without injury. One manufacturer states that it is "absolutely impossible" for his product "to injure a tree where the simplest directions are followed." Miscible oils can and have been used under conditions which would seem almost to preclude the possibility of injury. Nevertheless, we believe there is a risk in employing these materials, largely because of our ignorance of the physiological condition of the tree and the kind of weather which may follow the spraying, both of which appear to be important factors. In addition some varieties seem to be much more susceptible to injury of this character than others. Our observations upon petroleum, noted above, appear to indicate much greater danger of penetration during the winter season, a time when the pressure of sap is greatly lessened. A sudden drop in temperature in the spring checks the flow of sap and, following an application of oil, is very liable to result in greatly increased penetration by the insecticide, sometimes with disastrous results. It is very likely that the apparent immunity of different varieties depends in considerable measure upon seasonal variations in the pressure of the sap, due to an early or late ripening of the wood and possibly to differences in the penetrability of the bark.

Record of injury following applications of a miscible oil. The following records are not intended to be exhaustive and are made public simply to establish the fact that serious injury may follow the use of oil preparations upon dormant trees.

In June 1911 our attention was called to the serious condition of many hard maples in Mount Vernon, sprayed the preceding spring with a miscible oil. Some of the trees most infested by insects, it is stated, were sprayed March 24th and again May 20th. There were some 2136 hard and soft maples which received this application. The soft maples were practically unharmed, while many of the hard maples, in fact all marked as having been sprayed, which we examined June 20th, showed evidence of recent serious injury, many being practically dead. This was true of small trees three inches in diameter, as well as of maples some eight inches in diameter, all, with very few exceptions, appearing as though they had been in full vigor the preceding season. Trees on one side of the street or on one block were affected, while unsprayed trees of the same variety on the opposite side of the street or on adjacent blocks were in normal condition. In some instances the damage was limited to limbs most easily reached by the usual type of spraying outfit. We were unable to find sufficient evidence of injury by insect pests or damage following general adverse conditions to account for the sudden death of so many trees in a closely restricted area. Additional details of our findings at that time are given in the report for last year (27th report of the State Entomologist, New York State Museum Bulletin 155, pages 88–92).

Personal observations during July and August of last season (1912) showed that practically all the trees noted as being badly injured the preceding year, had been removed and replaced by small trees. We were informed that 449 maples had been reset. Furthermore, some of the trees less seriously injured in 1911 showed dead limbs or patches of dead bark, and the prospect is fair that more of such trees will die or parts of large limbs break off in a year or two. Our attention was also called to several large sugar maples now dead, which were marked as having been sprayed the preceding year and had not been removed last year because it was supposed that they had not been seriously affected by the application. An examination of a number of representative trees here and there only served to confirm our findings of the preceding season and to exonerate injurious insects from direct responsibility in the wholesale destruction of sugar maples. The local character of the injury and the difficulty of attributing the trouble to malnutrition, overcrowding or other general adverse conditions is strongly illustrated by small to moderate sized hard maples standing in front of numbers 125, 151 and 157 Cottage avenue. The lower limbs of each of these trees had evidently died the preceding year and had been removed, although the maples stood in thrifty lawns some distance from the street and where conditions were most favorable for a vigorous growth.

After we had made examinations of the Mount Vernon maples and reached certain conclusions, we learned of similar injury following the application of a miscible oil a few years earlier to sugar maples in the vicinity of Philadelphia. There were about 100 trees sprayed, sugar maples and Norway maples alternately, and at least 75 per cent of the former, we are informed, died soon after the treatment. Those conversant with the conditions in this latter case attribute the injury to the application of oil.

The sensitiveness of the sugar maple to oil and the possibility of the rapid death following treatment therewith, is evidenced by a photograph taken by the late Professor Slingerland in July 1903 and kindly placed at our disposal by his successor, Prof. G. W. Herrick. The photograph shows several dead sugar maples and the original record is as follows: "Effect of kerosene bands on maple trees. Maple trees treated with a band of kerosene in 1902 in front of fraternity house on Seneca street (W. H. Sage home). Taken in July 1903. Trees practically dead." A band saturated with kerosene is quite different from a trunk sprayed with petroleum or miscible oil. Nevertheless it is possible to conceive of conditions under which enough oil, either pure or as an emulsion, might be left upon the trunk after the evaporation of water or other emulsifying fluids and bring about a condition nearly identical with that produced by oil-saturated bands.

The unfortunate developments on sugar maples, following the application of a miscible oil, find their counterpart in the case of certain fruit trees. The early history of the use of miscible oils in New York State contains several instances of severe, though somewhat restricted injury following treatment. In one instance young trees were dipped when the temperature was below 40° F. The buds were killed and the stock ruined. In another case a number of trees died after a fall application followed by a heavy, wet snow which remained on the trees for a day or two and undoubtedly promoted penetration by the oil.

The most extended injury following spraying with a miscible oil came to our attention last June. An apple orchard at Athens, set twelve years ago, was sprayed Thanksgiving week or the one following in 1911 with a miscible oil used at the rate of 4 gallons to 50 gallons of water, and about 160 trees, mostly Baldwins, were dead or in a dying condition at the time of our examination (plate 3, figure 2). There was severe and general injury to a considerable proportion of the orchard thus treated. Nine-tenths of the apple trees in one representative section were dead or nearly so. One tree said to have been sprayed with the wind from the north had most of its branches on that side killed. The restriction of the injury on other badly affected trees was such as might be expected if the damage were caused by spraying. Furthermore, dying limbs were girdled by dead inner bark near the middle or at the base, the affected tissues being dark brown, sappy and with a sour or acid odor. Many of the twigs had a reddish brown bark with some discoloration of the wood. The buds on some of the limbs failed to start, while many had only sufficient vigor to develop leaves about one-quarter the normal size. Later in the summer, with the approach of drought conditions, some of the badly affected trees and most severely injured branches succumbed. About the middle of July there was an abundant development on the dead wood of a fungus identified by State Botanist Peck as Naemospora croceola Sacc., a species which subsists only on dead bark. Numerous vigorous shoots appeared on the trunk and the larger limbs of the badly affected trees in early summer, and by fall had made a fair to extremely good growth, thus eliminating the probability of root injury. Trees most severely affected were practically free from San José scale or other insect pests which might have been a possible cause of the trouble. A number of smaller trees just to the west of one part of the badly affected area were sprayed at the same time, the insecticide being used at the rate of 3 gallons to 50 gallons of water and here there was little or no injury. Numerous other trees in the same general region and growing under practically identical conditions, excepting that they were not sprayed with the above mentioned insecticide, were in a vigorous condition (see plates 8 and 9).

Many trees on an adjacent farm were also sprayed with the same insecticide and at about the same time, it being used in this instance, however, at the rate of 3 gallons to 50 gallons of water. A few of these trees were seriously injured. One large spy tree escaped with injury to the outer branches, those in the center being so well protected that they probably received little of the application. A large Gravenstein was badly affected on one side and it was stated that this tree was sprayed with a south wind and the injury was practically confined to the south side of the tree.

Another person in the immediate vicinity used the same material at the rate of 3 to 50, spraying at about the same time and treating many pear trees and a number of apple trees. Many of the Baldwins, in particular, died and a number of the pear trees showed unmistakable evidence of severe injury. Our attention was called to several young pear trees having extended blistered areas, and examinations later in the season showed that in some cases this was followed by death of the affected bark, and in one instance at least, by the death of the tree.

An orchard badly infested by San José scale was also sprayed in this neighborhood and there was much less injury to the trees and marked benefits so far as destroying the scale is concerned.

More disastrous conditions were noted in a Baldwin orchard some two miles distant and set nineteen years before. This orchard was sprayed with the same miscible oil, used at the rate of one gallon to 15 gallons of water, the application being made early in December, probably the 10th to the 13th inclusive. Practically all the trees sprayed at this time, over one hundred, were in a nearly ruined condition and most of them were subsequently cut down by the owner. The line of injury was very sharply defined. Trees in wet places which could not be reached on account of the soft condition of the land, and others which were not sprayed because the engine broke down, escaped without injury. Even here there were one or two trees sprayed from but one side and showing injury only on the treated portion. An examination of the dying limbs and trunks of the affected trees showed a discoloration of the inner bark and irregular spotting of vital tissues practically as noted above (see plate 8, figure 1).

We deem it advisable, in this connection, to reproduce the records of the local weather bureau, kindly placed at our disposal by the authorities.

Climatological data at Athens 1911

MONTH	DAY	TEMPERATURES		PRECPT.	CHARACTER OF DAY
		Max.	Min.		
November	26	40	28	.04	Cloudy
	27	47	28	....	Clear
	28	56	36	T	Cloudy
	29	53	33	....	Cloudy
	30	38	23	....	Clear
December	1	44	29	....	Clear
	2	40	30	T	Cloudy
	3	40	26	....	Cloudy
	4	34	18	T	Clear
	5	28	12	....	Cloudy
	6	43	21	....	Clear
	7	44	21	....	Clear
	8	41	25	....	Partly cloudy
	9	45	28	T	Cloudy
	10	51	34	....	Cloudy
	11	60	44	....	Partly cloudy
	12	60	50	....	Cloudy
	13	59	40	....	Partly cloudy
	14	40	27	....	Cloudy
	15	39	33	.38	Cloudy
	16	40	35	.30	Cloudy
	17	43	38	.10	Clear
	18	40	30	....	Partly cloudy
	19	31	26	....	Clear
	20	32	17	....	Clear

Subsequently we learned of injuries very similar to the above in Dutchess county. The application of a miscible oil was made the last week in November and some twenty greening and northern spy trees, set ten or twelve years before, were dead by midsummer, and as many more showed evidence of more or less injury. The damage was confined, we are informed, to trees sprayed one afternoon when the sky was overcast. An examination of samples received from the affected trees showed conditions practically the same as those described above for the Athens orchards. The bark was variably cracked on a limb from a tree in a dying condition and showed here and there well-marked dead areas with greener tissues on either side. There was the familiar enlargement of the lenticels and an unhealthy, brownish condition of the inner bark. The samples were just being entered by the fruit tree bark beetle, Eccoptogaster rugulosa Ratz.

The above applications to fruit trees in Greene county were made with modern apparatus and, so far as we were able to ascertain, for the sole purpose of controlling San José scale in a satisfactory manner. We are assured by the various parties that the manufacturer's directions were carefully followed. A fruiting apple tree may be conservatively valued at $25 and upward, so that the death of one hundred trees means a loss which can hardly be estimated at less than $2500, a sum most fruit growers would miss. The possibility, we do not say probability, of such extended injury should make the fruit grower careful as to what spray material he applied.

Contributory causes. Several adverse factors have been mentioned in the above discussion, and it is only fair to attempt correctly to estimate their value, even though these inimical conditions are unavoidable in most cases. A blanket of wet snow or several days of foggy weather following spraying hinder evaporation and favor injury on account of the increased penetration likely to result. A long winter with vital activities at a minimum is undoubtedly favorable to penetration, and the same is true of a cold spell in the spring, checking growth and prolonging the period of least resistance on the part of the tree. Some trees have a thicker outer bark than others, and this dead tissue is of much value in preventing oil entering the vital tissues beneath. Variability in the thickness of this outer bark occurs not only in trees of different species but even those of the same kind. Observations go far to show that other things being equal, the thin-barked trees or branches succumb first.

It may be that excessively low winter temperatures favor penetration by oils and thus increase injury. We know that under certain conditions the vitality of trees may be destroyed by extreme cold. This is well known as winter injury and is occasionally a serious factor. It is conceivable that less severe weather might reduce the vigor of a tree to such an extent that penetration by oil and consequent injury would be greatly facilitated. Extreme winter weather is to be expected and unless there is noticeable winter injury to the same variety of trees in the section, we believe low temperatures can not be held responsible to any material extent for dying or dead trees presenting practically identical conditions and which, without exception, had been previously sprayed with an oil preparation or other insecticide known to be dangerous under certain conditions to plant life.

The fact that serious injury followed the application of oil to sugar maple trees, while spraying at the same time caused little or no injury to soft maples, suggests that the time of application may be extremely important in the case of some trees. The soft maple begins growth in the spring earlier than the sugar maple, and it is very possible that the marked variation in results was due largely to the difference of vital activities then obtaining.

Conclusions. The use of oils or oil preparations on dormant trees has been followed in several cases by severe injury.

Trees, as living organisms, respond to climatic and cultural conditions and as a consequence their power of resisting penetration and injury by oils undoubtedly varies with the season and probably from year to year.

Since certain weather conditions promote injury by oils, it appears impossible to be sure that deleterious effects may not follow spraying dormant trees with an oil or oil preparation.

Fall treatment with an oil appears to be more hazardous than spring applications.

Other things being equal, we believe there is less danger of penetration by oil and consequent injury if the applications are made in the spring shortly before active growth begins and presumably offers greater obstacles to entrance by oil or quickly replaces destroyed and necessary vital tissues.

NOTES FOR THE YEAR

An interesting case of myiasis interna was reported from Kingston. The infestation presumably arose from canned sardines which had probably been left exposed for a time, since four out of six boxes examined contained eggs or larvae within the body cavities of the fish. This is more probable than to assume that the infestation occurred prior to the sealing of the cans. From the material sent us the common house fly, Musca domestica Linn., was reared.

The following brief accounts relate to some of the more injurious or interesting species coming to our attention during the year.

FRUIT TREE INSECTS

Fruit tree bark beetle (Eccoptogaster rugulosa Ratz.). This common pest, a small, brownish black beetle, about one-sixteenth of an inch long, displays a marked preference for sickly or dying limbs of peach, plum, pear and apple in about the order named. The feeding holes made by the beetles in peach bark frequently bleed freely and as a result there may be numerous masses of gummy matter adhering to a rather large portion of the trunk or limb. The beetle makes a gallery about an inch long, deposits eggs on either side and the grubs hatching therefrom make irregular, obliquely transverse galleries for a distance of about half an inch or more, the full-grown grub changing to a pupa at the extremity of the boring and emerging through a circular orifice. The pests are frequently so abundant as fairly to destroy the inner bark and outer sapwood, and on deserting the tree the numerous circular exit holes give the bark an appearance of having been riddled with fine shot. It is on this account frequently termed the shot-hole borer. There are at least two generations annually.

Fig. 10 Work of fruit tree bark beetle, the upper part showing one gallery (original, enlarged)

This pest is best controlled by promptly cutting and burning all sickly or infested limbs. It is very bad orchard practice to allow trimmings to lie around, since brush piles may easily produce thousands of the beetles and, when abundant, the pests may attack comparatively vigorous trees.

Apple tent caterpillar (Malacosoma americana Fabr.). Numerous complaints were received of the excessive abundance of this common pest upon wild and chokecherry trees in particular, though its conspicuous nests were rather abundant in apple trees here and there. This condition was reported from Long Island localities and various places in the Hudson valley, from Utica, Herkimer and Rome in the central part of the State, and from such Adirondack localities as Glens Falls, Lake George, Ausable Forks, Malone, and Ogdensburg. The pests were so numerous in southern Rensselaer county as to defoliate most of the roadside wild cherry trees and many of the unsprayed apple trees, not excepting in some instances almost entire orchards. The caterpillars were so abundant that they would frequently strip adjacent vegetation before attaining maturity. In some instances ropes of silk leading to the nests were to be observed on the trunks of the trees. The injury was so great in some places that parties feared it would be followed by the death of the trees. This is far from the case with both wild cherry and apple, as was evidenced by the development of a good second crop of leaves subsequently.

The caterpillars complete their growth the latter part of May or early in June, deserting the trees and spinning the familiar whitish cocoon in almost any available shelter. The moths fly from about the middle of June till the middle of July and deposit their dark brown egg belts on the smaller twigs. The eggs usually remain unhatched until the following spring. An examination of local conditions at Nassau shows that there are an unusually large number of eggs upon the trees at the present time, and as a consequence serious injury is probable another season. This caterpillar is easily distinguished from the related forest tent caterpillar by the broad, white stripe down the middle of the back and the large, silken webs invariably constructed in the forks of the trees. The outbreak described above is one of the irregularly periodic oscillations of insect life and may continue for another year or two.

The ravages of this pest are greatly facilitated by farmers generally allowing wild cherry trees to grow along roadsides and fences. The keeping of the brush cut in all such places would not only relieve the adjacent land of an unnecessary drain but prove an important factor in controlling this common pest. It is perhaps needless to add that thorough and early spraying with a poison, such as arsenate of lead, for the control of the codling moth will prevent serious injury by the apple tent caterpillar.

Resplendent shield bearer (Coptodisca splendoriferella Clem.). Oval, whitish or yellowish, flattened objects less than 1/8 an inch long, may frequently be observed in midsummer, during the winter or in early spring upon the branches and trunks of apple trees. These are the cases of this insect, a species which is widely distributed and occasionally abundant though rarely injurious. It was commonly present last August in the orchard of Mr J. P. Van Ness, East Greenbush. The small caterpillars of this insect mine the apple leaves and form an irregular, dark colored blotch upon the foliage. The full-grown caterpillar cuts away the upper and lower walls of its mine, fastens them together to form a secure retreat and then crawls slowly to branch or trunk, the affected leaf having a somewhat characteristic oval hole, both extremities of which are usually pointed. The adult is about three thirty-seconds of an inch long. The head is nearly concealed by a dense tuft of golden scales, while the brown antennae are trimmed with silvery white scales. The latter are also numerous on the thorax and the base of the wings, though here they have a golden reflection. The distal part of the wing is remarkable for its striking coloration, there being irregular areas covered with golden yellow scales, a transverse band broken near the middle of silvery white scales and margined on either side with dark brown scales. On the posterior margin of the wing and extending nearly to its tip as well as near the apical middle part of the wing there are relatively large areas covered with rich dark brown scales. The posterior margin of the wing and the extremity are fringed with long, pearly gray scales. The hind wings are a rich deep gray margined with a long, yellowish brown fringe. The legs are clothed with silvery and light brown scales. There are two broods yearly, the moths appearing in May and again in July and August. This insect, though small, is preyed upon by a parasite. We have yet to observe a case where this species was sufficiently numerous to cause material injury and remedial measures are therefore inadvisable.

Apple leaf miner (Tischeria malifoliella Clem.). The trumpet-shaped mines of this common apple insect were exceedingly abundant in mid-August in the orchard of Mr J. P. Van Ness of East Greenbush. This insect is common though rarely numerous enough to cause material injury. The owner informs us that there had been no spraying since 1900, at which time an effort was made to destroy forest tent caterpillars with a contact insecticide. The work of this apple enemy is easily recognized by its trumpet-shaped mine which commences as a glistening spot where the egg was laid, continues for a short distance as a narrow line, gradually expanding and then suddenly widens into an irregular expanded portion. The mine is on the upper side of the leaf and when old, turns brown and is scarcely seen from the under surface. It is inhabited by a greenish, footless, active caterpillar. The upper and lower walls of the mine are densely lined with silvery white silk forming a winter retreat for the larva, which latter transforms in the spring to the pupa at one end of the mine and in a short time forces its way partly out through the upper surface of the mine and then the moth emerges.

This species appears on the foliage so late in the season that comparatively little injury is caused and, as a rule, remedial measures are unnecessary. One method of controlling this insect in case of necessity is to burn the fallen leaves which, as stated above, contain larvae or pupae, and thus reduce the number of insects another season. Spraying the foliage in summer with 10 to 15 per cent kerosene emulsion has also proved of value in destroying the larvae in their mines.

Palmer worm (Ypsolophus ligulellus Hüb.). The small, pale green or yellowish green, active, striped caterpillars of this species aroused much interest in 1900 because of their extreme abundance in orchards in Genesee county. This insect ordinarily escapes attention and, prior to the above mentioned outbreak, had scarcely been noticed subsequent to 1853. Palmer worm larvae were rather generally present the latter part of June 1912 in orchards in and about Byron and were found in small numbers upon apple trees at Nassau. Apples with freshly eaten irregular holes were noted near caterpillars, and one was found in a position which suggested that it had just been feeding upon the fruit.

The full-grown caterpillar is about half an inch long and is then usually of a pale green or yellowish green color with a dusky, subdorsal line. The head may be either yellowish or blackish. Though there is considerable variation in color the larva is not difficult to recognize, since it is very active and drops much in the same manner as does the canker worm when disturbed. Leaves partly skeletonized by this insect soon turn brown, curl and present an unsightly, ragged appearance. It is interesting to note that the increasing numbers of this species correspond with the greater abundance of the forest tent caterpillar, Malacosoma disstria Hübn. This latter insect, it may be recalled, was extremely abundant and injurious about 1900 and reports received for the past season indicate that it is again becoming numerous.

Palmer worm caterpillars appear to be somewhat resistant to arsenical poisons, though this may be explained in part possibly by their feeding upon leaves or portions of leaves likely to be missed when spraying. Furthermore, comparatively little of the insecticide adheres to the fruit, and once under the skin the caterpillar has nothing to fear from poisons. There are good reasons for believing that thorough spraying with arsenate of lead for the control of the codling moth will at least prevent the Palmer worm from becoming sufficiently abundant to cause serious injury.

Pear midge (Contarinia pyrivora Riley). This European pest became established in this country about 1877 and has been known as a pear enemy in the vicinity of Albany for a number of years. Its injuries are extremely local and usually confined to a small number of trees, as will be seen from the following record. An examination of a beurre bosc pear tree about three days after the blossoms had fallen resulted in finding young larvae at the base of the pistils or in adjacent cavities which they had excavated. The larvae were semitransparent and only about 1 mm long. The infested fruit could be easily distinguished at that time by its being about one-half larger than the normal pears and decidedly more globular. Mr Thomas Albright of West Coxsackie states that the midge had seriously injured the fruit on this tree for a number of years and also had been more or less destructive on adjacent trees. The pear tree favored by the midge showed a large percentage, possibly 75, infested by the midge larvae. It is located near a fence and in sod, while others which were much less seriously affected were in cultivated land. It is possible that the lack of cultivation may be an important factor in enabling the midge larvae to hibernate successfully. On May 27th the larger size and more globular shape (plate 10, figures 1, 2) of the infested pears was still apparent though the fruit was beginning to be slightly lopsided, a development prior to its

Fig. 11 Section of beurre bosc pear showing crevice beside pistils (original)

cracking and the escape of the larvae. The maggots at this time were more than twice the size they were six days before, ranging from 1.25 mm to about 2 mm in length. They were yellowish white and appear much more active than earlier. The breastbone was quite distinct, the anterior margin being well chitinized.

Doctor Schmidberger, who studied this insect in Europe, states that he found midges laying eggs as soon as the white petals showed between the lobes of the calyx, the petals being pierced by the long ovipositor. Only four days, according to his observations, were necessary between deposition of eggs and the finding of young larvae in the fruit. An examination of a young pear shows that the eggs can be deposited near the middle of the developing fruit if the female midge simply reaches down between the pistils and the thickened fleshy walls of the small pear. Mr Albright states that the beurre bosc, Bartlett and seckel pears are injured in about the order named, and an examination shows that the former two have a somewhat larger cavity at the base of the pistils. The larvae doubtless begin work at the bottom of the cavity and with comparatively little effort make their way into the developing fruit upon which they subsist. June 3d a few of the beurre bosc pears received from Mr Albright were in fair condition, several were in such a state that a little pressure resulted in rupture, while in one or two the decay had advanced so far as to involve and discolor a portion of the external walls. It was only a question of a few days before many of the affected pears would rupture and the larvae escape. The full-grown maggots were at this time about 3 mm long, moderately stout, whitish or whitish orange and with a well-developed breastbone. The subsequent escape of the maggots from the infested fruit depends much upon climatic conditions, being greatly hastened by rain which results in the speedy cracking of the infested fruit. Specimen pears received from Mr Albright June 6th showed a black discolored area on one side and in a few instances this extended nearly around the pear, and in

Fig. 12 Section of pear injured by pear midge (original)

one case included the entire fruit. The larvae were full grown and a number had deserted the pears.

Owing to the local habits of this midge and the ease with which the infested fruit can be recognized, it is probable that one of the best and most effective methods of keeping this insect in control would be the early picking and destruction of the infested pears. This would involve no loss, since the fruit attacked by the midge can not develop. The only expense would be that attendant upon the collection and destruction of the young pears, a comparatively small item in the case of young trees and one which would doubtless become quite insignificant if this treatment was systematically followed year after year.

FOREST INSECTS

Forest tent caterpillar (Malacosoma disstria Hübn.). Reported injuries by this insect in 1911 led us to notice the species briefly and call attention to the possibility of its becoming more numerous this season or within a year or two. Some twenty acres of standing oak were defoliated at Bridgehampton, according to P. B. Matthews, while Messrs Isaac Hicks & Son reported under date of June 6th injury to oak on the Godfrey place in Old Westbury. The characteristic larvae were somewhat abundant though not destructive at Nassau. Specimens were received the latter part of June from A. E. Norman, Fillmore, Allegany county, while a number of reports were received from Adirondack localities. Prof. C. L. Williams observed the insect, though not excessively abundant, in the vicinity of Glens Falls. Mr A. N. Robson recorded it as present in increasing numbers at Lake George. There was serious injury to forest trees, probably by this species, at Ausable Forks according to George Chahoon, and the same was presumably the case at Jay, since Mr F. O. Bartlett reported extended defoliation, a portion of which was probably due to this species, since it was recorded as numerous in that locality the preceding year. Miss Bertha L. Paddock, Franklin Academy, Malone, observed the caterpillars feeding upon maple, mountain ash and hornbeam.

It would appear from the tenor of reports received from widely separated localities, that this insect is becoming more abundant, and it is possible that there may be extended injury another season. The probability of severe injury can be accurately forecast by examining hard maple twigs in particular and noting the relative abundance or scarcity of egg masses. This can be done easily from the ground if one has good eyesight, though a powerful field glass is of material service. As noted elsewhere, egg masses of the apple tent caterpillar are unusually abundant in one section and it would not be surprising if investigations showed the same was true of the forest tent caterpillar. Apple trees in the vicinity of forests are particularly likely to be injured in case there is an outbreak. An early spraying with arsenate of lead, using at least 2 pounds to 50 gallons of water, would be advisable under such conditions for the purpose of destroying the hosts of young caterpillars before material injury results.

Locust leaf miner (Chalepus dorsalis Thunb.). Serious injury by this species was observed at Syosset and in that vicinity in August and September 1911, the beetles confining their operations largely to trees less than 30 feet high. An allied form, the rosy Hispa, C. nervosa Panz., was associated with and, in certain localities at least, more abundant than the parent of the locust leaf miner. The depredations of last season were continued this year, though in early July there was practically no injury by the beetles. Full-grown larvae of the locust leaf miner were then common in locust leaves and a few adults were observed. There were no signs of the allied C. nervosa. Early in August a totally different condition of affairs prevailed. The leaves of many of the larger trees, especially the apical ones, were brown, a condition due almost entirely to the feeding of the beetles. The latter were extremely abundant, two, four, six and even eight occurring on individual leaflets, the larger number being in the more sheltered situations. The small trees were more seriously affected than the larger ones, and from reports received subsequently it was evident that serious injury was inflicted. The extensive feeding at this season is evidently followed by the beetles going into hibernation, since there seems to be but one generation annually in this section. A more detailed account of this insect is given in our preceding report, New York State Museum Bulletin 155, pages 59–63. Serious injury by this insect was also recorded at Locust Valley by the Rev. William M. Cook.

It is evident from observation of local conditions that thorough spraying with an arsenate of lead the latter part of July or early in August, at the time the beetles begin feeding upon the foliage, would result in protecting the trees from serious injury. This treatment can be advised only for the more highly prized trees on lawns or possibly along roadsides.

Bronze birch borer (Agrilus anxius Gory). The destructive work of this pest at Lansingburg, northern Troy, was recorded last year and observations the present season show that the tops of the infested trees have succumbed. Furthermore, this borer is well established in the southern part of Troy and in Washington park, Albany. It is probably becoming well distributed in this section, and the history of white birches in recent years in the western part of the State may be shortly duplicated in the Hudson valley.

The signs of injury are well marked and are first evidenced by the thin foliage and dying condition of the upper branches. A more detailed examination may result in finding well-marked annular ridges around some of the smaller branches, frequently accompanied by reddish or rusty brown spots here and there on the white bark, indicating the operation of a borer beneath. This can be confirmed by cutting into the tree, especially where there are ridges and disclosing in the inner bark or sapwood a flattened, usually more or less sinuous channel. The only practical method of controlling this insect is to cut out and burn all affected wood prior to early May, since the beetles appear the latter part of that month or early in June and may then attack other trees. A more detailed account of this insect is given in the writer's report for last year.

Pine bark borer (Ips pini Say). This medium size to small bark borer is one of the most destructive of these forms in this section. An examination of conditions in the outskirts of Schenectady resulted in finding many dead white pines here and there in groves. They almost invariably had succumbed to attacks by this bark borer and the operations of its allies. The dead pines seen here and there had been killed earlier, while some showing needles were nearly dead and still others were found to be very badly infested though there was no appreciable change in the character of the foliage. The latter trees had the inner bark fairly riddled the last of August with the longitudinal galleries of the beetles and the irregular transverse expanding burrows of the grubs. Practically the only external evidence of the injury at that time was inconspicuous particles of brown or white sawdust thrown out by the beetles as they were entering the trees, and an occasional pitch tube. The latter is about a quarter of an inch high and in diameter and is made by the beetle bringing out particles of pitch and piling them around the point of entrance. The presence of pitch tubes is indisputable evidence of the beetles attacking living trees. At this time there were under the bark many grubs, numerous pupae and a few recently transformed beetles. Some of the beetles were about ready to desert the tree and it was evident that most of the others would leave the trunk within a week or two and attack some adjacent tree. Observations in 1900 showed that about eight weeks were necessary to complete the life cycle, so there was a fair chance of the recently emerging beetles attacking other trees and their progeny attaining maturity before they would be obliged to suspend activities because of approaching cold weather.

There has been a material increase in injuries to trees by bark borers during the past decade or more. Hundreds of pines, most of them magnificent specimens, have succumbed to these insidious enemies in the near vicinity of Albany. It is probable that the excessive droughts and extremely low winter temperatures of recent years have had an important effect upon many trees and resulted in lowering their vitality and probably making conditions more favorable for insect attack. These changes have, furthermore, been accentuated in suburban sections by the cutting out of many trees and the sudden exposure of previously shaded trunks to full sunlight. These factors have probably had an important effect upon insects habitually preying upon the trees.

The recognition of the causes may make it possible, in some measure at least, to avoid trouble in the future. It is obviously impossible to bring about speedy changes in climatic conditions, nevertheless the general adoption of a program which would result in the reforestation of areas now producing very little or nothing, should eventuate in welcome changes. Well-distributed, thrifty forest areas would tend to reduce the violence of our floods, mitigate the extremes of temperatures and conserve much needed moisture for the midsummer months. This would result in better growing conditions for our trees and enable them in turn to resist more successfully their insect enemies.

There is no practical method of destroying this bark borer if it has become well established in the tree, unless possibly in the case of highly prized pines standing upon lawns or private grounds. The important fact to recognize is that infested trees are not only doomed but may produce millions of beetles which will speedily attack others in the vicinity. The preservation of pines now remaining must depend in large measure upon the recognition of bark borer injury at an early stage and the prompt destruction, preferably by burning, of at least the bark with its contained insects. All should understand that the most dangerous pines, so far as adjacent trees are concerned, are those which show little or no discoloration of the foliage and very few exit or "shot holes," since these are the trees which contain the largest number of destructive borers. Pines which died the preceding year or earlier, while infested more or less by other borers, are not a menace to living trees. Furthermore, if satisfactory results are to be obtained by cutting out and destroying infested pines, it is essential that there should be cooperation on the part of all, since the bark borers fly readily for considerable distances.

Platypus punctulatus Chap. Numbers of this Central American borer were taken last August on Panama logs which had been shipped around the Horn and were then in the lumber yard at Astoria. The beetles were coming out in large numbers and attacking freshly sawn sappy mahogany in the yards, running longitudinal and, in some instances, vertical galleries into the wood. It was estimated that the injury in early August was as high as $200 a day. Another Ambrosia beetle, namely, Xyleborus torquatus Eich., was also taken in some numbers on the mahogany logs. With the above were associated species of Aulonium bidentatum Fabr., Xuthia brevipes Sharp and Palorus melinus Herbst. The Scolytids were kindly identified by Doctor Hopkins through the courtesy of Doctor Howard, while the other Coleoptera were determined by Doctor Schwarz, both of Washington.

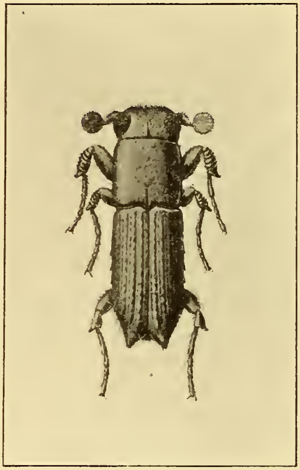

Fig. 13 Dorsal view of Platypus punctulatus, x 7½ (original)

Pine bark aphid (Chermes pinicorticis Fitch). Early in July our attention was called to some eight or nine large pine trees in the western end of Albany. These pines were very badly infested by this bark louse, the upper portion of the trunk and the under side of the larger limbs being nearly covered with the white cottony excretion. One tree was dead, probably having succumbed to earlier attacks, while a second was in a dying condition. An examination of the latter showed that various borers had begun work under the thicker bark, and that in all probability the tree would die before the end of the season. It is possible that these trees, as in the case of park trees observed in earlier years, may have had their vitality reduced somewhat by unfavorable conditions, not exempting very severe droughts and extremely low winter temperatures. These, however, must be considered only as predisposing factors, since the primary injury appears to have been caused by this insect. The conditions observed the past season have been duplicated in earlier years in Albany and vicinity. This aphid is also injurious to pine seedlings and has been observed on balsam. Fortunately it is very liable to attack by our various species of ladybeetles which are undoubtedly of material assistance in keeping it in control.

The aphid winters as yellowish brown eggs well protected by a copious, waxy secretion, the young appearing in the latitude of Albany from the middle to the latter part of May. The full-grown female is dark grayish purple and about one-thirty-second of an inch long.

It is very probable that this pest can be controlled satisfactorily by a forcible spray of cold water which would wash off large numbers of the insects. Experiments have shown that thorough spraying with a kerosene emulsion, the standard formula probably diluted with 9 parts of water, was very effective when the application was made in May. It is probable that a whale oil soap solution, using 1 pound to 4 gallons of water would be equally satisfactory. In either event the spray should be coarse and forcible so as to drive the insecticide through the woolly protective matter and bring it into contact with the underlying insect.

MISCELLANEOUS

Hawthorn sawfly (*Trichiosoma tibialis* Steph.). A cocoon of this European species was received April 10, 1911 through the State Department of Agriculture. The specimen was removed from Crataegus which had been imported from Holland. The adult was reared and the provisional identification confirmed. A badly crushed cocoon, apparently of the same species and taken from rose sticks imported from England, was transmitted for identification by the Commissioner of Agriculture November 27, 1912.

Fig. 14 Hawthorn sawfly (original)

This insect is closely allied to the native elm sawfly, *Cimbex americana* Leach, a species which is rather common in New York State and is found especially upon elm and willow. This European sawfly is about half the size of the Cimbex referred to above and may be recognized by its nearly uniform, black color and the dull rufous tarsi. The body is about three-quarters of an inch long, the wing spread one and one-half inches; the head, thorax and the base of the abdomen are thickly and irregularly clothed with rather long, tawny hairs. The general characteristics of the adult are shown in the accompanying figure.

The cocoon is about three-quarters of an inch long, subcylindric, with rounded ends, the posterior usually being narrowly so. The walls of this cocoon are composed of yellowish or tawny, matted silk more or less covered with foliage. The insect escapes by forcing off a lid at the broadly rounded anterior extremity.

The young larva, according to Cameron, has a black head and a green body, the color usually being concealed by a powdery, whitish excretion. The full-grown larva is bright greenish yellow with a darker dorsal line. The yellowish head has a large, brownish orange mark on the vertex. The legs are pale whitish green, the claws brown and the spiracles reddish. The skin is covered with minute warts and sparsely dusted with a white powder.

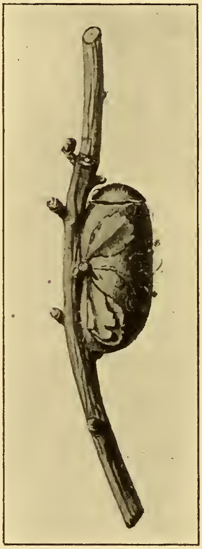

Fig 15 Cocoon of hawthorn sawfly (original)

The hawthorn is given as the preferred food plant, though judging from the synonomy it also occurs upon birch. We have followed Gillanders in the use of tibialis as the specific name, though Cameron assigns this, together with leucorum Westw. and crataegi Br. & Zad. as synonyms of betuleti Klug. Owing to this species being restricted in its food plants to species of relatively small economic value, it is hardly likely that it could become, even if established, a serious pest in America.

Neuroterus saltatorius Hy. Edw. A white oak leaf bearing numerous specimens of this interesting gall, a globose, unilocular swelling less than 1 mm in diameter and on the under side, was received under date of July 24, 1912 from Mr R. M. Taylor, instructor in pathology, Michigan Agricultural College, Ann Arbor, Mich. Mr Taylor called attention to the snapping or jumping habit of the galls, and careful listening enabled us to detect a low snapping or crackling, evidently due to the activity of the insect within the gall. This was easily demonstrated at a distance of an inch or two from the ear, and in spite of the fact that the specimens had been in press a week before they were forwarded. Mr Taylor also stated that these galls, when laid upon the table, jumped around more or less as a result of larval activities. The single chamber in the gall, according to Mr Taylor, contains a large, white, legless larva, its anterior extremity being attached to the inner wall. This species has been reported from New York State, though the identity of the eastern gall with the Californian deformity originally described by Mr Edwards is questioned (see William Beutenmueller, Amer. Mus. Nat. Hist. 1910, 28:125).

Two-spotted ladybeetle (Adalia bipunctata Linn.). This small ladybeetle was extremely abundant on a Norway maple at Nassau, which appeared to be only moderately infested with Chaitophorus aceris Linn. Scattering colonies of this plant louse were to be seen upon most of the lower leaves at least, and the grubs of this ladybeetle were commonly found, there being on July 7th, two or three partly grown grubs or pupae on most of the lower leaves. The injury by the plant louse was so reduced that there was practically no dropping of leaves in spite of the extremely dry weather of the last three weeks or thereabouts. This ladybeetle was also abundant though not quite so evident on apple and cherry trees, both of which were somewhat infested by plant lice.

This beneficial form was likewise quite abundant June 10th at Mount Vernon. One sugar maple was seen with seven or eight pupal skins or pupae on one leaf. A Norway maple in Washington Park, Albany, observed the 11th, had many of these beneficial insects upon the leaves, one, two or more grubs on individual leaves being not uncommon.

Two-spotted Anomala (Anomala binotata Gyll.). A specimen of this southern form, listed as occurring in New Jersey and Indiana, was taken in Albany from a box of presumably New Jersey strawberries. This species has not been recorded from New York State, though it may possibly occur in the extreme southern or southwestern section. This record is of interest mainly as an illustration of the effect commerce may have upon the distribution of insects.

Mosquito control. The interest in this phase of applied entomology continues, the shore communities being especially active. The village of Rye, as a result of the excessive abundance of salt marsh mosquitos in 1911, contracted with a company for the thorough drainage of the salt meadows and such upland territory as afforded natural breeding places for mosquito larvae. The work on the salt meadows, we are informed by a local correspondent, proved particularly effective and throughout the entire village mosquitos were very scarce during the season. The scanty rainfall of the early summer was also of service in that breeding pools remained small, and though the drainage work was not completed until September, a marked decrease in the number of mosquitos was observed. The expense of this work was $4250. This was met in part by subscription, the village contributing $2000 from the tax budget.

Other shore communities in New York State have obtained striking benefits as a result of systematic drainage, which latter involves a moderate annual expenditure for the maintenance of the ditches in good condition. The value of this work, owing to the migratory habits of the common salt marsh mosquito, is greatly increased if it be made general throughout a section where such breeding conditions obtain. The pioneer work of communities along this line can not be indorsed too highly and should serve as a marked stimulus to those adjacent. There is no question as to the practicability of eliminating almost entirely the mosquito nuisance, even in the immediate vicinity of salt marshes. The village of Lawrence, with salt marshes almost contiguous on three sides of the residential section, is a striking example of what may be accomplished by systematic and thorough work. The material benefits accruing from such undertakings will become more evident with the progress of time and we confidently expect that within a few years mosquito-ridden salt marshes and the almost intolerable mosquito nuisance will be found only near a few unprogressive communities.

Cotton moth (Alabama argillacea Hübn.) The remarkable flight of this insect in 1911 was duplicated in considerable measure the present season, though in some localities the moths were not so numerous as a year ago. The first record of the season we have is September 18th, based on an observation made by Mr E. P. Van Duzee at Buffalo. Mr Bird reports the largest number at Rye, Westchester county, from October 8th to 12th. The moths were seen by a number of competent observers in widely separated sections of the State between October 10th and 12th and later. The fresh, unrubbed condition of the insects was noted by several, and this, in connection with the nearly simultaneous appearance of thousands in localities remote from any known food plant, would seem explainable only by the moths rising in hosts from the cotton fields and drifting hundreds of miles in the upper air before alighting.

Detailed records from New York localities are given below:

Richmond county. Mr William T. Davis records the appearance of some moths October 11th, and on the 12th stated that they were quite abundant about the lights at St George Ferry Landing on Staten island.

Westchester county. Mr Henry Bird states that the moths appeared in the largest numbers October 8th to 12th, though at no time did they appear to be so numerous as last year. He first observed a few scattering moths October 3d, their numbers increasing daily up to the 11th, at which time they appeared to be present in maximum numbers. They displayed a marked preference for well-ripened Concord grapes, a little jarring of the trellis being sufficient to flush a cloud of moths from the vines, to which they would promptly return. Most of the specimens were in perfect condition and in shady woodlands he observed them flying considerably during the day. The local flight, as observed by Mr Bird, was of short duration and extended but a few yards. The last examples observed at Rye were seen on October 15th.

Orange county. Mr Bird states that at Middletown numbers were observed on October 14th and he was informed that they had been more numerous for two or three days previous. They seemed to be more abundant than at Rye and were in evidence until the 22d.

Otsego county. Prof. I. P. Bishop of Buffalo advised us that he learned of the appearance of the cotton moth in thousands about October 10th at Index. The moths were reported as being so numerous that it was necessary to sweep them from the slippery railroad tracks.

Ontario county. Prof. P. J. Parrott of the Geneva station states that the cotton moths were exceedingly abundant at Geneva October 10th and 11th, being so numerous as to collect in the gutters to the depth of about three to four inches near the coke and gas works on the eastern side of the city. He also adds that they appeared on the same dates at Canandaigua.

Monroe county. The moths were extremely abundant at Rochester, according to press reports based upon an identification by Prof. P. J. Parrott of Geneva.

Genesee county. Press dispatches record the appearance of millions of these moths at Batavia before daylight on October 12th. They were so numerous that merchants were credited with having "swept them from the sidewalks and sides of their stores in basketfuls."

Chenango county. Mr Harry J. Mosher, New Berlin, October 11th, forwarded specimens which appeared in great numbers. Mr Miller states that they were seen about five o'clock in the morning, as near as he could ascertain. "Earlier risers found underneath an arc light at the very center of the village, on the ground, a solid mass of these millers or moths, several inches in depth and covering a space at least a rod across. The adjoining buildings and trees were also literally brown with them."

Wyoming county. Mr M. S. Baxter reports the presence of the moths at Warsaw.

Livingston county. Prof. G. W. Bailey of the State Normal School, Geneseo, forwarded a moth under date of October 9th, with the statement that he saw from fifteen to twenty under an arc lamp. He reports that on October 11th thousands of the insects were found on Main street, they were being swept from windows and walks, and a great number were observed resting on trees, windows and even in the street. He adds that they were practically limited to two lights at the south end of the town, only a few occurring at four other lights farther up town. The specimens seemed to be in perfect condition.

Erie county. The first cotton moths observed in Buffalo were seen by Mr E. P. Van Duzee on September 18th. They were most abundant October 11th, when many windows of the down-town stores were well covered with the insects. Mr Van Duzee had never seen so many of this species before. Mr M. S. Baxter, 75 State street, Rochester, also reported an abundance of this moth in Buffalo on October 10th. Prof. I. P. Bishop of the State Normal School, Buffalo, reported the appearance of this moth at Buffalo October 11th, stating that as many as one hundred could be counted upon a window. Mr Bishop found the flight limited in considerable measure to certain sections of the city, namely, Main street from the harbor to North street with stray individuals farther north and for two blocks either side of Main street for the greater part of the same distance; near the harbor, west of Main street and on Exchange street near the New York Central and Erie stations; in the vicinity of Niagara street and the city line, and also in the northwest part of the city. A few, he states, were reported from Depew.

City Forester H. B. Filer reported the appearance of large numbers of the moths on the afternoon of October 10th, the insects being present in large numbers the following day, the next two days and disappearing for the most part by the 13th and 14th. He states that they seem to come with a southeast wind along with a rain storm, and were so numerous that the gutters of the lower part of Main street were literally covered with dead insects.

Niagara county. Mr M. F. Burke, assistant inspector of the State Department of Agriculture, observed this moth to be very numerous in the city of Lockport at about the same time it was so extremely abundant in Buffalo, namely October 10th to 12th.

Albany county. A few specimens of this moth were observed on the office window October 12th and the presence of the moth was reported from other parts of Albany. The specimens seen were in perfect condition.

Schenectady county. Mr Richard Lohrmann saw the first specimen at Schenectady on September 18th, the next on the 23d, swarms appearing October 7th to 12th, and the last individual was noted on October 17th. The shop windows of the General Electric Light Company were covered with the moths, though not very many were noted about the street lights.

Otsego county. Specimens were received October 15th from Oneonta through the courtesy of Mr G. G. Atwood of the Department of Agriculture.

Saratoga county. Mr H. T. Wakely of Corinth states that the cotton moth made its appearance there in thousands on the evening of October 11th. They were abundant on the 12th and ceased flying on the 13th though one was taken alive on the 16th.

Clinton county. Prof. G. H. Hudson of the State Normal School has kindly placed at our disposal his records relative to the earlier appearance of the cotton moth at Plattsburg. The data are tabulated below:

1886	September	28,	4 specimens
1886	September	29,	1 specimen
1891	October	7,	1 specimen
1891	October	13,	1 specimen
1893	September	19,	1 specimen
1893	September	20,	1 specimen
1893	September	22,	1 specimen
1893	September	23,	2 specimens
1893	October	10,	1 specimen

Professor Hudson adds that he has not been able to look for the insect since 1893, though he believes it to be a rather regular visitor. Apparently it was not abundant in that section last October.

The flight of the cotton moth was closely followed in some localities by the appearance of numerous specimens of the lime tree winter moth, Erannis tiliaria Harr., a species mistaken by some for the cotton moth. This latter form was reported by Mr E. P. Van Duzee as unusually abundant at Buffalo on October 22d. It was numerous around the electric lights of Schenectady in the week of October 10th, according to Richard Lohrmann. Numerous specimens were also observed about the same time in different sections of Albany. The same phenomenon, though perhaps not to such a marked extent, was noted by Henry Bird at Rye.

Southern captures. In connection with the record given above relating to the large flights of the cotton moth, Alabama argillacea Hübn., we deem it advisable to place on record the capture by Mr Henry Bird at Rye of the following three species of southern Noctuids: Autographa oxygramma Geyer, Anomis erosa Hübn. and Anticarsia gemmatilis Hübn. Mr Bird states from observations covering a period of twenty-eight years, that he has not previously noted these insects in that locality.

Periodical Cicada (Tibicen septendecim Linn.). The appearance of a large brood of this insect in 1911 aroused much interest, and as an indirect outcome, we received from Prof. G. A. Bailey June 11, 1912, a report that he had found several nymphs of this insect emerging from the ground on Major Wadsworth's estate at Geneseo. Subsequently adults were forwarded and there can be no question as to the identity of the insect. Professor Bailey states that the few observed occurred within a narrow radius in a piece of second growth timber. There is a record of a colony of brood 12, the one which appeared in such large numbers in the Hudson valley in 1911, in the northern part of Pennsylvania and not so very distant from Geneseo. Should the insects noted above belong to this brood they must be considered as stragglers, otherwise it is necessary to associate them with brood three, no colony of which has been recorded nearer New York State than central-western Ohio and the northern portion of West Virginia. This seems to be a weak colony, since we have been unable to obtain any information respecting the earlier appearance of the insect in that section.

The occurrence of belated individuals is amply substantiated by records kindly placed at our disposal by Mr W T Davis of New Brighton, who found periodical Cicadas on Staten island in 1895 and again in 1912. They were likewise found the past season by Mr Davis at West Point. In all cases they were undoubtedly belated individuals from the brood which appeared in such large numbers in 1894 and 1911. Mr Davis has also collected specimens of this brood in 1893 and 1910, one year in advance of the normal time for emergence. Mr Henry D. Lewis of Annandale informs us that no belated individuals were observed by him in 1912, though he had seen them following earlier appearances of this insect.

Juniper bug (Pentatoma juniperina Linn.). This large, green, reddish or pinkish margined stinkbug is comparatively rare in New York State. It was found in unusual numbers on small pines at North Chatham May 11, 1912, eight to ten occurring on individual trees only three to four feet high. The insects did not seem to be feeding. They had evidently recently emerged from hibernation and were associated with specimens of Brochymena and Euschistus.

Mite migration. An interesting specimen of Helobia punctipennis Meign., a small fly only about three-sixteenths of an inch long, was taken at Albany June 25, 1911. The abdomen of this specimen bore six relatively large mites, several of them ranged one behind the other in a regular series. This mite was submitted to Doctor Howard for determination and identified by Mr Banks as a Gamasid belonging to the genus Seius and probably undescribed. Mr Banks points out that these mites were probably upon the fly for migratorial purposes and were not parasitic, despite the fact that mites are frequently observed upon insects and commonly supposed to be parasitic.

PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the Entomologist during the year 1912. The titles,[1] time of publication and a summary of the contents of each are given. Volume and page numbers are separated by a colon.

Dying Hickory Trees. Auburn Advertiser, November 3; Buffalo Commercial, Middletown Argus, New York Tribune, November 5; Geneva Times, Lockport Union-Sun, Ossining Citizen, Watertown Standard, Schenectady Star, Amsterdam Recorder, November 6; Glens Falls Times, Catskill Mail, Rome Sentinel, November 7; Greenwich Journal, Yonkers News, Oxford Times, November 8; Phoenix Register, Peekskill Union, Norwich News, Perry Record, November 9; Cortland Standard, Randolph Register, Rensselaer Eagle, Tioga County Record, November 10; Saratoga Eagle, Yonkers Gazette, November 11; Kingston Freeman, November 17; Catskill Examiner, Pelham Sun, Brooklyn Times, November 18; Washington County Post, November 24, 1911

The characteristic work of the hickory bark borer, *Eccoptogaster quadrispinosa* Say, is described and the destruction of infested wood during the winter advised.

Codling Moth. New York State Department of Agriculture, Bulletin 28, 1911, pages 237–50 (issued December 14, 1911). Reprinted as Circular 40

A summarized discussion of *Carpocapsa pomonella* Linn. and methods of control in the light of recent experiments.

New Species of Gall Midges. Economic Entomology Journal, 1911, 4:546–59

The following new species are described: *Leptosyna quercus* [*quercivora*], *Asphondylia eupatorii*, *A. thalictri*, *Uleella* [*Bruggmaniella*] *mexicana*, *Contarinia spiraeina*, *Dicrodiplosis coccidarum*, *D. gillettei*, *Mycodiplosis carolina*, *M. coccidivora*, *M. cucurbitae*, *M. spinosa*, *Youngomyia quercina*, *Y. vernoniae*, *Hyperdiplosis fungicola*, *Parallelodiplosis clarkeae*, *Cecidomyia cerasiphila*, *C. hopkinsi*, *Itonida cucurbitae*, *I. spiraeina*, *I. taxodii*, *I. pugionis*, *I. cincta* and *I. canadensis*.

[1] Titles are usually given as published. In some instances articles appearing in a number of papers have been given different titles by the various editors.

The Seventeen-year Locust. American Year Book, 1911. 1912, pages 498–99

Summary account of the 1911 appearance of the periodical Cicada, Tibicen septendecim Linn.

The Identity of the Better Known Midge Galls. Ottawa Naturalist, 1912, 25:164–67, 181–88

Lists some of the earlier described species of Lasioptera, Neolasioptera, Asteromyia, Rhabdophaga and Dasyneura.

Biology of Miastor and Oligarces. Science, February 16, 1912, 35:278–80

A summarized account giving the American distribution, recognition characters and observations on the biology and natural enemies.

Bronze Birch Borer. Garden Magazine, February, 1912, 15:36

A summary statement of injuries with a discussion of control measures for Agrilus anxius Gory.

Control of Insect Pests in Institutions. Journal Home Economics, February, 1912, 4:16–26

A general discussion of the more important household insect pests with special reference to their control in institutions.

Shade Tree Prospects. Middletown Times, Albany Times Union, New York Tribune, March 11; Glens Falls Times, Knickerbocker Press, March 12; Syracuse Journal, Greenwich Journal, March 13; Washington County Post, March 22; Schenectady Gazette, March 30; Troy Press, April 4, 1912

The serious injury by the elm leaf beetle, Galerucella luteola Müll., the preceding year is briefly characterized and thorough spraying urged.

Fight Against Codling Moth. Rural New Yorker, March 16, 1912, 71:355, 393, 395

Summary account of experimental work and methods of controlling this pest.

Save the Trees. Troy Budget, March 17, 1912, page 24

A general discussion of the shade tree situation with special reference to methods of controlling the elm leaf beetle.

Save the Hickories. Troy Times, March 30; Glens Falls Times, April 1; Utica Herald Dispatch, April 2; Ogdensburg Journal, Auburn Advertiser, Lockport Journal, Poughkeepsie Union, Amsterdam Recorder, April 3; Warwick Advertiser, Ithaca

Journal, April 4; Binghamton Press, Poughkeepsie Eagle, Syracuse Herald, April 5; Albany Sunday Telegram, April 7; Hudson Falls Herald, Schenectady Gazette, April 11; Cortland Standard, April 17; Catskill Recorder, Suffern Recorder, April 19, 1912

The characteristic work of the hickory bark borer, Eccoptogaster quadrispinosa Say, is described and the prompt destruction of infested trees urged.

Early Leaf Feeders. Knickerbocker Press, April 4; Utica Observer, April 6, 1912

The work of the early leaf feeders, such as the apple tent caterpillar, the canker worms, the bud moth and the case-bearers, is briefly described and remedial measures advised.

Spraying Apples. Utica Press, Knickerbocker Press, April 11; Utica Observer, Albany Argus, April 12; Watertown Herald, Yonkers Herald, Rome Sentinel, April 13; Binghamton Herald, Troy Times, April 15; Orange County Record, Yates County Chronicle, Cortland Standard, April 17; Washington County Post, Plattsburg Press, April 19; Poughkeepsie Eagle, April 20; Hoosick Falls Democrat, Penn Yan Express, April 24; Cobleskill Index, April 25; Catskill Recorder, Waterloo Observer, April 26; Hudson Falls Herald, May 2; Ithaca Journal, May 3; Warwick Dispatch, May 8; Oswego Gazette, May 9, 1912

The results from one thorough spraying with arsenate of lead are summarized and arsenate of lead, 2 pounds to 50 gallons of water and a pressure of 125 to 150 pounds or more, advised.

New West Indian Gall Midges. Entomological News, April 1912, 23:173-77

The following species are described: Uleella [Bruggmaniella] pisoniae, Mycodiplosis pulvinariae, Arthrocnodax meridionalis and Hyperdiplosis producta.

Practical Methods in Controlling the Codling Moth. Western New York Horticultural Society Proceedings, 1912, pages 74-82

A summary discussion of the results obtained in 1909-11.

Spraying for Codling Moth. New York State Fruit Growers' Association Proceedings, 1912, pages 190-97

General summary of experimental work in 1909-11, with special reference to Hudson valley conditions.

Recent Experiments with the Codling Moth. Economic Entomology Journal, 1912, 5:153-59

A summary discussion of experimental work.

Lasiopteryx manihot n. sp. (Diptera) Canadian Entomologist, 1912, 44:144

Original description of a species reared from Cassava, *Manihot utilissima*.

Pear Thrips. Albany Journal, May 4; Catskill Mail, May 6, 1912

Injuries by this pest are noted and spraying with a tobacco soap preparation advised.

Plant Lice — A Warning. Troy Times, Ossining Citizen, Middletown Times, Utica Herald Dispatch, May 4; Knickerbocker Press, Times Union, Yonkers Herald, May 6; Schenectady Star, Oneonta Star, May 7; Warwick Dispatch, Penn Yan Express, May 8; Fonda Democrat, Utica Press, May 9; Suffern Recorder, Madison County Times, Penn Yan Democrat, Randolph Register, Oneida Dispatch, Rensselaer County Standard, Catskill Recorder; Poughkeepsie Eagle, May 10; Saratoga Eagle, May 11; New York Tribune, May 13; Watkins Review, May 15; Hudson Gazette, May 16; Hudson Falls Register, May 23, 1912

A warning notice advising early and prompt spraying before aphids become excessively abundant.

Control of Elm Leaf Beetle. Schuylerville Democrat, May 15, 1912

A somewhat extended discussion of the fundamentals involved in the satisfactory control of this insect.

Spraying Elms. Albany Journal, Troy Record, May 21; Troy Press, Saratoga Sun, Times Union, Knickerbocker Press, May 22; Catskill Mail, Hudson Register, May 23; Troy Times, Catskill Enterprise, May 25, 1912

Thorough spraying of the elms is urged and at least 4 pounds of arsenate of lead to 50 gallons of water advised.

Spraying Apparatus. Schenectady Star, May 28, 1912

A brief discussion of the cost and relative advantage of various types of spraying apparatus. Villages and municipalities should obtain as good results spraying as tree protecting firms. Arsenate of lead is advised as the best poison.

Insects and Shade Trees. The American City (New York) May 1912, 6:731–32

A summary discussion of the shade tree problem in the northeastern United States.

Forest Tent Caterpillar. Albany Journal, June 3; Schenectady Star, Glens Falls Times, Troy Record, Newburg News, June 4; Middletown Argus, Albany Argus, June 5; Keeseville News, Rensselaer County Standard, June 7; Fort Plain Free Press, June 11; Port Jervis Gazette, June 12; Warwick Advertiser, Fulton County Democrat, June 13; Catskill Recorder, June 14; Utica Advocate, June 15; Binghamton Herald, June 19; Warrensburg News, Massena Observer, June 20, Owego Gazette, June 27, 1912

A warning notice in regard to possible depredations by this insect.

27th Report of the State Entomologist on Injurious and Other Insects of the State of New York. New York State Museum Bulletin 155, pages 1–198, plates 27 (issued June 13, 1912)

Contents

Diarthronomyia californica n. sp. Pomona College Journal of Entomology, 1912, 4:752

Description of a midge reared from subconic leaf galls on Artemisia californica.

Observations on the Identity of the Wheat Midge. Economic Entomology Journal, 1912, 5:286–8

Prodiplosis fitchii and Itonida tritici are described as new. A detailed description is given of Thecodiplosis mosellana Gehin.

Anthrenus verbasci. Economic Entomology Journal, 1912, 5:297

Records the continued breeding of this insect in dried corn for a period of ten years.

Priority vs Nomina Conservanda. Science, July 5, 1912, 36:17–18

A general discussion with special reference to the Itonididae. Adherence to the strict law of priority is urged.

The Fundamentals of Spraying. New York State Department of Agriculture Bulletin 37, pages 1413–20, 1912

A summary discussion of materials and methods.

Elm Leaf Beetle and White-marked Tussock Moth. New York State Museum Bulletin 156, pages 1–35, plates 8, 1912 (issued July 11, 1912)

Contents

New Itonididae. New York Entomological Society Journal, 1912, 20:102–7

The following new species are described: Campylomyza truncata, Corinthomyia gracilis, Johnsonomyia cincta, Asynapta americana, Camptomyia aestiva, Porricondyla vernalis, P. dietzii, P. porrecta, Dasyneura eugeniae and Youngomyia pennsylvanica.

Itonida inopis O. S. Economic Entomology Journal, 1912, 5:368–69

A general biologic account with descriptions of all stages.

White Grubs. Knickerbocker Press, August 16; Kinderhook Courier, August 22, 1912

A brief record of severe injury in southern Rensselaer and northern Columbia counties, with observations upon their habits and methods of control.

Scraping Trees. Guide to Nature, August 1912, 5:13

The common practice of scraping the rough bark from shade trees is considered of practically no benefit.

Damage By White Grub and the Chinch Bug. Albany Evening Journal, October 2; New York Farmer, October 10, 1912

A summary account of injury by the white grub, with suggestions for reseeding, and a notice of an outbreak by the chinch bug, Blissus leucopterus Say.

Some Large Problems in Economic Entomology. Cornell Countryman, October 1912, No. 1, pages 3–7

A general discussion of entomological problems, with special reference to the need of national quarantine and the desirability of protecting shade and forest trees from insect depredations. Data are given regarding the number of insects, their varied stages and food habits and the difficulties attendant upon the recognition of the numerous forms.

Observations on Uleella Rübs. Entomological News, 1912, 23: 353–54

The characters of the adults of this genus are established and U. pisonifolia described in both sexes, together with the gall, larva and pupa.

New Gall Midges or Itonididae. New York Entomological Society Journal, 20:146–56, 1912

Several midges are recorded from spiders' webs and the following species described: Coccidomyiaerii Oligotrophus betheli, Janetiella coloradensis, Asteromyia grindeliae, Lasioptera verbenae, L. diplaci, Asphondylia diplaci, A. enceliae, Thecodiplosis zauschneriae, Clinodiplosis araneosa, Coquillettomyia knabi and Karschomyia townsendi.

Scientific notes. Economic Entomology Journal, 5:398, 403, 411, 1912

Brief notes on outbreaks by white grubs (Lachnosterna species), fall army worm, Laphygma frugiperda Sm. & Abb. and the locust leaf miner, Chalepus dorsalis Thunb.

Arthrocnodax occidentalis n. sp. Economic Entomology Journal, 5:402, 1912

Original description of a midge reared from red spider, Tetranychus.

ADDITIONS TO THE COLLECTIONS, OCTOBER 18, 1911–OCTOBER 15, 1912

The following is a list of the more important additions to the collections:

EXCHANGE

There were received from Dr Otto Nüsslin, Zoologisches Institut, Karlsruhe, Germany, two or more specimens of each of the following species:

Eccoptogaster scolyta Fabr., E. ratzeburgi Janson, E. carpini Ratz., E, multistriata Marsh, Hylastes ater Payk., Dendroctonus micans Kugl., Myelophilus piniperda Linn., M. minor Hartig., Hylesinus crenatus Fabr., H. fraxini Panz., H., vittatus Fabr., Polygraphus polygraphus Linn. Crypturgus cinereus Herbst., Ips sexdentatus Boern., I. acuminatus Gyllh., I. curvidens Germ., I. laricis Fabr., Pityogenes chalcographus Linn., P. bidentatus Herbst. and Xyleborus saxeseni Ratz.

There were received from Prof. J. M. Aldrich, Moscow, Idaho: Ephydra hians Say, adults pupae and larvae; E. gracilis Pack, adults; E. subopaca Lw., adults; E. millbrae Jones, adults; Caenia bisetosa Coq., adults.

DONATION

Hymenoptera

Thalessa atrata Fabr., black long sting, adult, June 17, G. C. Lewis, Lockport

Apanteles congregatus Say, cocoons and adults, July 29, Arthur Dummett, Mount Vernon. Same, cocoons on Ampelophaga myron Cram., August 7, E. W. De Long, Crown Point

Cynips strobilana O. S., lobed oak gall, October 12, W. L. McAtee, Pickens, Miss.

Andricus seminator Harr., wool sower, gall on white oak, June 21, C. C. Laney, Rochester. Same, June 24, Miss Ruth H. Sherman, Glens Falls

Neuroterus saltatorius Hy. Edw., galls on white oak, July 24, R. M. Taylor, Ann Arbor, Mich.

N. umbilicatus Bass., oak button gall on Quercus michauxii, October 12, W. L. McAtee, Pickens, Miss.

Cimbex americana Leach, elm sawfly, larva on elm, September 20, Miss E. S. Blunt, New Russia

Tremex columba Linn., pigeon tremex, adult, September 11, A. G. Woodard. Through State Conservation Commission

Caliroa cerasi Linn., pear slug, larvae on pear, August 12, E. C. Brooks, Athens

Kaliofenusa ulmi Sund., elm leaf miner, larva on elm, June 13, A. N. Robson, Lake George. Same, June 15, Neil Rutledge, Greenwich. Same, June 19, W. L. Devereaux, Syracuse. Same, larvae and work on elm, June 24, J. G. Ward, Cambridge

Trichiocampus viminalis Fall., larvae, August 29, Harry Vail, New Mulford

Coleoptera

Eccoptogaster quadrispinosa Say, hickory bark beetle, work on hickory, February 9, W. J. Matheson, Huntington. Same, larvae and work, March 12 and June 17, H. W. Merkel, New York City. Same, work, June 22, E. H. Anderson, Scarsdale. Same, adults and work, July 1, J. J. de Vyver, Mount Vernon. Same, work, July 30, F. P. Dwyer, Yonkers

E. multistriata Marsh, imported elm bark borer, work, adults and larvae, October 5, J. W. Chapman, Dorchester, Boston, Mass.

Pissodes strobi Peck, white pine weevil, work on pine, July 11, Ferruccio Vitale, New York City

Thricolepis simulator Horn, gray, bark-eating weevil, adult on apple, May 2, Thomas Cunningham, Vancouver, B. C.

Pomphopoea sayi Lec., Say's blister beetle, adults on wild cherry, May 31, C. J. Herrick, Elsmere

Coptocycla ? clavata Fabr., larva on morning glory, July 9, G. H. Hawley, Castleton

Galerucella luteola Müll., elm leaf beetle, adults, April 18, M. H. Gardner, Brewster. Same, May 10, Mrs W. H. Crittenden, Cornwall. Same, eggs on elm, June 14, J. T. Young, Watervliet. Same, adults, larvae and pupae on elm, July 11, A. Gaskell, Ellenville. Same, larvae and work on elm, July 16, L. A. Tate, Gloversville. Same, work on elm, August 5, W. M. Cook, Oyster Bay

Glyptoscelis alternata Cr., leaf beetle, adult on apple, May 2, Thomas Cunningham, Vancouver, B. C.

Elaphidion villosum Fabr., oak and maple pruner, larva and work on oak, July 24, Mrs J. O. Rooney, Scarsdale

Monohammus confusor Kirby, sawyer, adult, July 10, Chatham Courier, Chatham. Same, adult on pine, July 17, Mrs George Wend, Albany

Lachnosterna, June beetle, larva in grass sod, August 11, Mrs Matthew Bender, jr, Niverville. Also from W. M. Woodward, North Chatham

Psephenus lecontei Lec., larva, September 25, R. M. Moore, Rochester

Dermestes vulpinus Fabr., leather beetle, all stages, March 26, W. G. Van Name, Albany

Megilla maculata DeG., spotted ladybeetle, adults, December 13, Charles Bernstein, Rome

Diptera

Thecodiplosis ananassi Riley, galls on cypress, September 12, W. L. McAtee, Marksville, La.

Caryomyia caryae O. S., gall on hickory, July 22, G. L. Dale, Mount Kisco. Same, July 24, Mrs J. O. Rooney, Scarsdale

Caryomyia persicoides Beutm., on hickory, July 24, Mrs J. O. Rooney, Scarsdale

Contarinia pyrivora Riley, pear midge, larvae on pear, May 27, Thomas Albright, New Baltimore

Asphondylia betheli Ckll., male, female, larva and pupa on Opuntia, April, C. F. Baker, Claremont, Cal. Same, gall, male and female on Cactus, May 22, E. Bethel, Denver, Col.

Simulium sp., blackfly, larvae, June 19, W. D. Rhines, Linlithgow

Eristalis tenax Linn., bee fly, larvae, August 27, Charles Bernstein, Rome

Musca domestica Linn., housefly, larvae from cases of Myiasis interna, September 9, J. R. Gillett, Kingston

? Agromyza sp., adult on Wisteria buds, March 23, E. O. Amundsen, San Diego, Cal.

Lepidoptera

Polygonia ? comma Harr., hop merchant, eggs on hop, June 5, Principal, Schoharie High School, Schoharie. Through State Department of Agriculture

Euvanessa antiopa Linn., spiny elm caterpillar, larva on elm, June 25, Mrs I. D. F. Delafield, Greenport. Same, July 1, J. A. Sweigert, Comstock

Sphecodina abbotii Swain, larva on woodbine, July 10, J. H. Dodge, Rochester. Same, July 29, Arthur Dummett, Mount Vernon

Ampelophaga myron Cram., grapevine hog caterpillar, larva on grape, August 7, E. W. De Long, Crown Point

Samia cecropia Linn., Cecropia moth, cocoon, December 28, H. Gaut, Glen Cove

Telea polyphemus Cram., American silk worm, eggs, June 6, Mrs A. M. A. Jackson, Warner

Callosamia promethea Dru., Promethea moth, cocoons, May 10, Miss M. R. Wilbor, Old Chatham. Same, larvae on lilac, August 5, Mrs Martha W. Martin, Albany

Diacrisia virginica Fabr., Virginia ermine moth, adult, June 20, A. E. Worman, Fillmore. Through State Conservation Commission

Arctia caja Linn., garden tiger moth or woolly bear of Europe, larva, October 26, L. F. Strickland, Lockport. Through State Department of Agriculture

Alypia octomaculata Fabr., eight-spotted forester, larva on woodbine, July 10, C. C. Woolworth, Castleton

Laphygma frugiperda Sm. & Abb., fall army worm, larvae and pupae on lawn, September 11, Robert Mostow, New York City; Roy Latham, Orient Point; Samuel Parsons, New York City, also September 21

Agrotis ypsilon Rott., black cutworm, larva, June 10, T. F. Niles, Chatham

Mamestra picta Harr., zebra caterpillar, larvae on pear, July 16, F. E. Rogers, Oswego

Papaipema appassionata Harvey, P. necopina Grt., P. frigida Sm., P. sciata Bird, P. inquaesita G. & R., P. maritima Bird, P. rigida Grt., P. marginidens Gn., P. moeseri Bird, P. duplicata Bird, P. cerussata Grt., P. duovata Bird and Apamea erepta, var. graminea Bird. Contributed by Henry Bird, Rye, August 14

Alabama argillacea Hübn., cotton moth, adults, October 9, G. W. Bailey, Geneseo. Same, October 11, H. J. Mosher, New Berlin. Same, October 13, I. P. Bishop, Buffalo

Catocala sp., caterpillar, June 19, A. H. Green, Shushan

Datana integerrima Grt. & Rob., black walnut worm, larvae on English walnut, August 5, M. T. Richardson, New York City. Same, caterpillars, August 22, C. H. Smith, Mohegan Lake

Schizura concinna Sm. & Abb., red-humped apple caterpillar, larvae on apple, July 9, J. W. Wiltse, North Chatham

Tolype laricis Fitch, larch lappet moth, larva, August 8, J. H. Dodge, Rochester

Malacosoma americana Fabr., apple tent caterpillar, larvae, June 12, T. L. Coventry, Utica. Same, larvae on oak, June 19, P. B. Matthews, Bridgehampton. Through State Department of Agriculture. Same, adult, July 7, Whitcomb of the Commonweal, Greenwich. Same, cocoons, July 13, George Chahoon, Ausable Forks

M. disstria Hübn., forest tent caterpillar, larvae, June 10, Isaac Hicks & Son, Westbury. Same, larvae, June 20, A. E. Worman, Fillmore. Through State Conservation Commission

Erannis tiliaria Harr., basswood inch worm, larvae on elm and basswood, June 8, G. C. Vosburgh, Moravia

Thyridopteryx ephemeraeformis Haw., bagworm, larvae on purple beech, August 2, Miss Helen A. Brown, Brooklyn

Sibine stimulea Clem., saddleback caterpillar, September 3, G. R. Felten, Cementon. Same, larva on blackberry, September 24, J. B. Mulholland, Kingston

Zeuzera pyrina Linn., leopard moth, work on hickory, October 26, Isaac Hicks & Son, Westbury. Same, larva, December 24 and 27, E. T. Mulligan, New York City. Through State Department of Agriculture. Same, larva, March 17, Miss Mary L. Lobdell, Woodhaven

Mineola indigenella Zell., leaf crumpler, larval cases, February 24, C. L. St John, Canajoharie

Ephestia cautella ? Walk., larvae and adults on English walnuts, November 20, Ogden Stevens, Albany

Evetria ? frustrana Comst., caterpillar on pine, August 30, W. F. Smith, Valhalla

E. ? comstockiana Fernald, pitch twig moth on pine, June 12, H. T. Fernald, Amherst, Mass.

Tmetocera ocellana Schiff., bud moth, larvae in pear buds, May 8, R. Scofield, Coeymans

Tortrix fumiferana Clem., spruce bud moth, larvae on spruce, June 3, G. E. Emmons, Schenectady

Coleophora caryaefoliella Clem., larvae and work on hickory, July 13, F. M. Weld, New York City

Bucculatrix canadensisella Cham., birch leaf skeletonizer, molting cocoons, August 29, Cadwallader Evans, Stellarton, Nova Scotia. Also, larvae, cocoons and work on birch, September 18

Phyllonoryter hamadryella Clem., oak blotch leaf miner, mines on oak, July 29, David Harrison, Staatsburgh. Same, work on oak, August 5, Miss Anne R. Wier, Garrison

Gracilaria near violacella Busck, larvae on azalea, March 7, D. Clark's Sons, Fordham Heights, New York City. Through State Department of Agriculture

Neuroptera

Corydalis cornuta Linn., horned Corydalis, adult, July 1, I. L. Nixon, Rochester

Thysanoptera

Euthrips pyri Dru., pear thrips, adults on apple, May 1, G. E. Ward, Ravena

Hemiptera

Tibicen septendecim Linn., seventeen-year cicada, adult and pupal case, June 14, G. A. Bailey, Geneseo

Cicada ? linnei Grossb., harvest fly, adult, August 26, J. H. Dodge, Rochester

Phylloxera caryaecaulis Fitch, hickory gall aphid, old galls on hickory, October 26, A. B. Buchholz, Geneva. Through State Department of Agriculture

Chermes pinicorticis Fitch, pine bark aphid, adults on pine, July 5, H. N. Armer, Ballston Spa. Through State Conservation Commission. Same, July 12, W. P. Judson, Broadalbin. Same, August 8, M. F. Duhamel, Poughkeepsie

Hormaphis hamamelidis Fitch, witch-hazel cone gall, galls on witch-hazel, August 5, A. M. Baker, Oneonta

Pemphigus populi-transversus Riley, gall and young on poplar, June 18, Mrs R. S. Banks, Albany

Schizoneura americana Riley, woolly elm leaf aphis, young on elm, June 18, C. E. Olsen, Maspeth. Same, adults and young on elm, June 21, Miss Alice C. Hareford, Watertown. Same, adults and work on elm, July 18, A. R. Fuller, Malone

S. lanigera Hausm., woolly apple aphis, young on apple, November 8, Mrs S. H. Niles, Coeymans. Same, nymph on apple, August 26, J. A. Delehanty, Albany

Chaitophorus aceris Linn., work and young on Norway maple, July 6, D. T. Marshall, Hollis. Same, nymphs on Norway maple, July 11, W. W. Gibson, Watervliet

Callipterus ulmifolii Mon., elm leaf aphis, adults on elm, July 1, R. S. Waterman, Ogdensburg

Mindarus abietinus Koch., work on balsam, July 1, G. L. Barrus, Paul Smiths

Aphis nasturtii Kalt., adults and nymphs on nasturtium, October 3, Roy Latham, Orient Point

Gossyparia spuria Mod., elm bark louse, males and females on elm, May 29, J. G. Brock, Binghamton

Eriococcus borealis Ckll., adults, October 7, T. D. A. Cockerell, Boulder, Col.

Phenacoccus acericola King, false maple scale, males on maple, June 11, Samuel Hessberg, Albany

Trionymus violascens Ckll. (part of type), adult on Agropyron, October 2, T. D. A. Cockerell, Glenwood Springs, Col.

Pseudococcus citri Risso, mealy bug, adult, July 20, C. E. Olsen, Maspeth

Pulvinaria vitis Linn., cottony maple scale, adults and young on soft maple, July 6, D. T. Marshall, Hollis

Lecanium sp., Lecanium scale, adult and young on Tecoma radicans, November 1, Tioga County. Through State Department of Agriculture. Same, adults on oak and chestnut, June 8, E. E. Carpenter, Morris

Asterolecanium variolosum Ratz., golden oak scale, adult, June 14, Woodlawn Cemetery, New York City. Through State Conservation Commission

Toumeyella liriodendri Gmel., tulip tree scale, young on tulip tree, February 12, J. H. Livingston, Tivoli. Same, adults on tulip, July 29, A. G. Harris, North Pelham. Same, July 29, Miss Annis E. Thomson, Yonkers

Eulecanium ? canadense Ckll., adults on elm, May 27, S. M. Clark, Warrensburg

E. ? persicae Fabr., peach scale, adults and eggs on crimson rambler rose, June 17, Silvanus Van Aken, Port Ewen. Same, July 2, Mrs Robert Lown, Idlewild

Chionaspis furfura Fitch, scurfy scale, eggs, March 5, J. Heavey, Buffalo

Chionaspis americana Johns., elm scurfy scale, egg on elm, February 6, J. J. Levison, Brooklyn

C. pinifoliae Fitch, pine leaf scale, egg on Austrian pine, February 6. J. J. Levison, Brooklyn. Same, adults on pine, September 16, Mrs Harriet A. Duff, Kinderhook

C. spartinae Comst., grass scale, on Spartina glabra alterniflora, November 11, Roy Latham, Orient Point

Diaspis carueli Targ.-Tozz., juniper scale on juniper, May 16, Rochester. Through State Department of Agriculture

Aspidiotus pernicious Comst., San José scale, young, March 5, J. Heavey, Buffalo. Same, May 24, C. L. Williams, Glens Falls

A. ancylus Putn., Putnam's scale, half grown, April 19, D. D. Stone, Oswego

Chrysomphalus aonidum Linn., rubber scale insect., adults on rubber plant, April 22, Roy Latham, Orient Point

Lepidosaphes ulmi Linn., oyster shell scale, egg on willow, December 28, H. Gaut, Glen Cove. Same, eggs, March 5, J. Heavey, Buffalo. Same, old scales on apple, May 11, Fred Henkes, Watervliet. Through State Department of Agriculture. Same, young, June 22, Levi Hasbrouck, Ogdensburg. Same, adults on white birch, July 20, C. E. Olsen, Maspeth

Parlatoria theae Ckll., adult on Japanese maple, April 25, from Schenectady. Through State Department of Agriculture

Haematopinus piliferus Beurm., sucking dog louse, adults on dog, April 8, Miss Lillian C. Overton, Albany

Blissus leucopterus Say, chinch bug, adults and young, September 26, C. L. St John, Canajoharie

Acholla multispinosa DeG., spined assassin bug, nymph, August 13, Edwin Buchman, Valley Falls

Cimex lectularius Linn., bedbug, adult, May 12, G. J. Briggs, Macedon

Lygus pratensis Linn., tarnished plant bug, work on dahlia, July 17, C. L. Williams, Glens Falls

Poecilocapsus lineatus Fabr., four-lined leaf bug, adults on currant, June 19, L. F. Strickland, Lockport

Benacus griseus Say, giant water bug, adult, June 10, Roy Latham, Orient Point

Orthoptera

Diapheromera femorata Say, walking-stick, adult, August 20, Arthur Dummett, Mount Vernon

Thysanura

Lepisma domestica Packard, silver fish, adult, October 25, J. E. Stagg, Buffalo. Through State Department of Agriculture

Acarina

Eriophyes pruni Schoene, plum mite, galls on plum, July 22, G. E. Osterhout, Windsor, Col.

Phyllocoptes quadripes Shimer, bladder maple gall, galls on soft maple, June 11, G. W. Herrick, Ithaca. Same, June 24, H. N. Babcock, Elmira

APPENDIX

A STUDY OF GALL MIDGES

The gall midges comprise an immense family of small flies or Diptera known as the Itonididae or Cecidomyiidae, represented in America by about 900 known species, approximately half having been reared from the deformities or galls they produce or matter upon which they live. The species referable to this family may be recognized by the tibiae being unarmed apically, the coxae not produced, and the wings usually with but three or four long veins and no crossveins. Extreme forms may have six or seven long veins and one crossvein or, as a result of reduction, the wing veins may be nearly absent.

There are in this family a number of important insect pests, such as the Hessian fly, Phytophaga destructor Say; the wheat midge, Itonida tritici Felt; the pear midge, Contarinia pyrivora Riley; the clover midge, Dasyneura leguminicola Lintn.; the violet gall midge, Phytophaga violicola Coq.; the rose midge, Dasyneura rhodophaga Coq.; and the grape blossom midge, Contarinia johnsoni Sling. In addition to these there are a number of other potentially injurious midges, not to mention European species, which may become established in this country at almost any time and cause serious losses in somewhat the same way as did the Hessian fly in earlier years.

Our knowledge of American gall midges was in a very unsatisfactory condition in 1895. The following discussion of the Lestremiinae and Heteropezinae comprises a systematic descriptive account of these groups.

LESTREMIINAE

The members of this subfamily are almost invariably medium to small, dark brown or black species, easily distinguished from all other Itonididae by the five tarsal segments, the metatarsus being longer than the following segment, and the presence of the fourth long vein, which latter may be either forked as in Lestremia or simple and obsolescent as in Campylomyza. The antennae may be moderate as in Lestremia and Campylomyza or extremely short as in Tritozyga and Microcerata. The circumfili, so characteristic of the higher groups, are entirely wanting in this

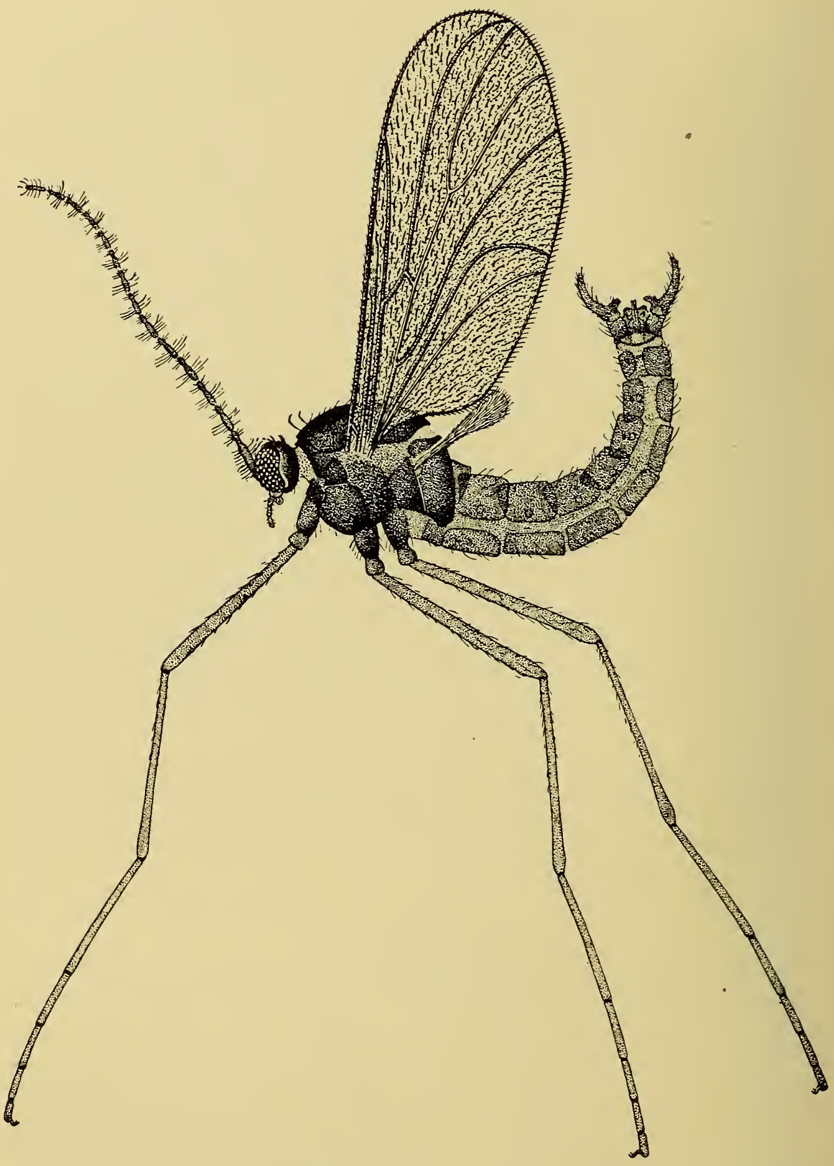

Fig. 16 C a t o c h a a m e r i c a n a , side view, enlarged. (original)

subfamily. The members of this group appear to depend to a considerable extent upon the olfactory organs. Many of the species falling in this division subsist in the larval stage on dead or decaying vegetable matter.

This group is a connecting link with the Mycetophilidae from which it is most easily distinguished by the absence of tibial spurs and the moderate development of the coxae.

Lestremiinariae

The members of this tribe are separable from all other Itonididae by the forked fourth vein and by the generalized character of the antennae. These organs may be moderately well developed as in Lestremia and Catocha, or greatly reduced as in Tritozyga and Microcerata.

Key to living genera

a Antennae at least moderately developed, with 11–16 segments, the second not decidedly enlarged
  b Costa continuous and extending beyond the apex of the wing...... Catocha Hal.
  bb Costa not attaining the apex of the wing, practically disappearing at its union with the third vein................Lestremia Macq.
aa Antennae greatly reduced, only 8–10 or 11 segments
  b Second antennal segment greatly enlarged; flagellate segments very short
    c Fork of the fourth vein with the two branches even........ Microcerata Felt
    cc Fork of the fourth vein with the branches irregular........ Tritozyga H. Lw.
  bb Second antennal segment normal
    c Flagellate segments not greatly reduced........Neptunimyia Felt
    cc Flagellate segments sessile, with a length only a little greater than the diameter............................Neocatocha Felt

Catocha Haliday

Macrostyla Winn.

1833 **Haliday, A. H.** Ent. Mag., 1:156
1840 **Westwood, J. O.** Introduct. Class. Ins. Syn., p. 127
1846 **Rondani, Camillo.** Nouvi Ann. Sci. Nat. Bologna, ser. 2, v. 7; separate, p. 7 (Furcinerva)
1846 **Winnertz, J.** Stett. Ent. Zeit., 7:20 (Macrostyla)
1862 **Osten Sacken, C. R.** Dipt. N. Am. Mon., 1:177
1864 **Schiner, J. R.** Fauna Austriaca Dipt., 2:412
1870 **Winnertz, J.** Vehr. z.-b. Ges. Wien., 20:27–28
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 17
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:143

1892 **Theobald, F. V.** Acct. Brit. Flies, p. 51, 87
1895 **Kieffer, J. J.** Soc. Ent. Fr. Bull. p. 319
1897 ——— Syn. Cecid. Eur. & Alg., p. 52
1900 ——— Soc. Ent. Fr. Ann. 69:438, 443 (Furcinerva)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 308–9
1911 ——— N. Y. Ent. Soc. Jour., 19:31

The species referable to this genus are easily recognized by costa being continuous and extending beyond the tip of the third vein, which latter unites with the margin at the apex of the wing. The fourth vein is forked, the cell usually being much shorter than in Lestremia. The antennae differ greatly from those of Lestremia, being in the male of C. americana (figure 17) distinctly binodose, while in the case of C. slossonae the segments are long, slender and distinctly stemmed. There are 16 antennal segments in the two known American species. Type C. latipes Haïid. Europeans forms are recorded as having 14 to 16 antennal segments in the male and 10 to 12 segments in the female. The genitalia of our American species are of a quite different type from that found in Lestremia.

Nothing is known concerning the life history of American forms. Kieffer states that the larvae of the European C. muscicola Kieff. occur on mosses. It is probable that these forms are sylvan as in the case of Lestremia and allied genera. Our species are doubtless boreal in habitat.

Key to species

a Length 4 mm; antennae binodose, terminal clasp segment long, appendiculate basally.....................americana Felt, C. 929
aa Length 4 mm, antennae uninodose, terminal clasp segment short........ barberi n. sp.
aaa Length 1.5 mm; antennae uninodose......slossonae Felt, C. 931

Catocha americana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 309

This species, received for study through the courtesy of the United State National Museum, was taken at Franconia, N. H., by that well-known collector, Mrs A. T. Slosson.

Male. Length 4 mm. Antennae nearly as long as the body, thickly haired, dark brown; 16 segments, the third with the basal enlargement somewhat produced, the fourth and following, each slightly binodose, the basal subcylindric enlargement with a length nearly four times its diameter (figure 17). Palpi; the first segment, irregularly subquadrate, with a length fully twice the diameter, the second about two-thirds the length of the first, the third more than twice the length of the second and the fourth a little longer than the third. Mesonotum dull black, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum and

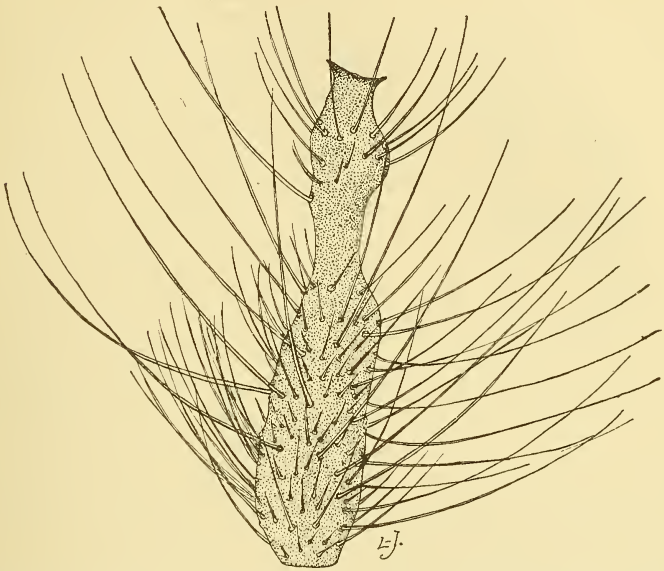

Fig. 17 Catocha americana, sixth antennal segment of male, much enlarged. (original)

abdomen dark brown. Wings hyaline, costa light brown; membrane thickly clothed with fine hairs; venation shown in fig. 16. Halteres fuscous yellowish. Legs dark yellowish brown; claws stout, with a series of three or four stout teeth basally, the pulvilli hardly extending beyond the base of the claws. Terminal clasp segment long, appendiculate basally. Type Cecid. 929.

Catocha barberi n. sp.

Two midges belonging to this species were taken flying in the woods during cold weather, the temperature being below 30° F., near Crab Lake, Vilas county, Wis., by Mr H. S. Barber, in December 1907.

Female. Length 4 mm. Antennae one-quarter longer than the body, sparsely haired, dark brown; 16 segments, the fifth with a slender stem over twice the length of the subglobose basal enlargement, the latter with a thick whorl of long, slender setae near the middle; terminal segment reduced. Palpi; first segment narrowly oval, with a length two and one-half times its diameter, the second to fourth subequal, sparsely setose and with numerous transverse rows of short, stout spines. Head and thorax probably dark brown. Abdomen light brown. Wings hyaline. Halteres pale yellowish, the legs a variable yellowish brown; claws stout, strongly curved, the pulvilli rudimentary. Type in U. S. National Museum.

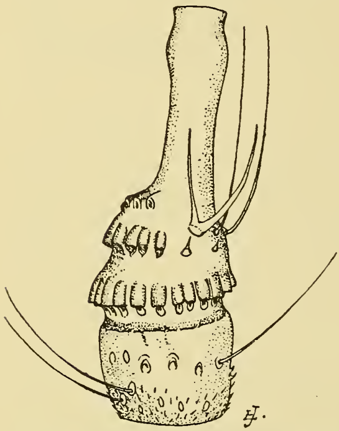

Fig. 18 Fifth antennal segment of Catocha slossonae, enlarged. (Original)

Catocha slossonae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 309

This form, received through the courtesy of the United States National Museum, was taken by Mrs Slosson at Franconia, N. H.

Male. Length 1.5 mm. Antennae as long as the body, sparsely clothed with long hairs; 16 segments; the fourth with a smooth stem about as long as the subcylindric basal enlargement; near the middle a crenulate whorl of long, slender setae, apically several circular orifices and long, trilimbate processes. Palpi; the first segment presumably short, stout, subrectangular, the second rather stout, with a length about two and one-half times its diameter, the third stout, subrectangular and with a length about three-fourths greater than its diameter, the fourth tapering distally, a little longer and more slender than the third. Mesonotum shining dark brown, the submedian lines very sparsely haired. Scutellum reddish brown, postscutellum a little darker. Abdomen dark brown, the genitalia fuscous yellowish. Wings hyaline, costa light brown. Halteres yellowish transparent, slightly fuscous apically. Legs light fuscous yellowish; claws rather long, stout, the concavity finely denticulate, the pulvilli longer than the claws. Type Cecid. 931.

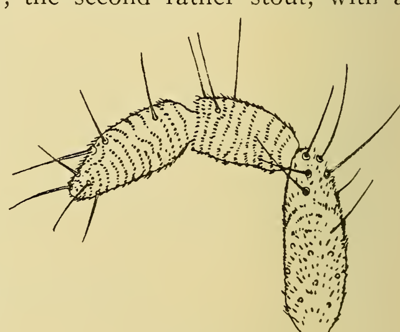

Fig. 19 Palpus of Catocha slossonae, enlarged. (Original)

Lestremia Macq.

1826 **Macquart, J. M.** Dipt. Nord. de la France, 1, 123
1826 **Meigen, J. W.** Syst. Beschr., 5:308
1834 **Macquart, J. M.** Hist. Nat. Ins. Dipt., 1:157
1840 **Westwood, J. O.** Introduct. Class. Ins. Syn., p. 127
1844 **Loew, H.** Stett. Ent. Zeit., 5:324 (Cecidogona)
1846 **Rondani, Camillo.** Nouvi Ann. Sci. Nat. Bologna, ser. 2, v. 6; separate, p. 7 (Furcinerva), 10 (Mimosciara)
1856 ———— Dipt. Ital. Prodr., 1:198 (Yposatoea)
1860 ———— Atti Soc. Ital. Sci. Nat. Milano, 2:287 (Molobraea)
1862 **Osten Sacken, C. R.** Dipt. N. Am. Mon., 1:178
1864 **Schiner, J. R.** Fauna Austriaca Dipt., 2:413
1870 **Winnertz, J.** Vehr. z.-b. Ges. Wien, 20:30
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 17
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales, Proc., 3:144
1892 **Theobald, F. V.** Acct. Brit. Flies, p. 52, 87
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1900 ———— Soc. Ent. Fr. Ann. 69:437, 442 (Mimosciara), 443 (Cecidogona, Furcinerva)
1904 **Meunier, F.** Soc. Sci. Brux. Ann. 28:9, 31
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 308, 310
1911 ———— N. Y. Ent. Soc. Jour., 19:31

This genus is easily recognized by the characteristic fork of the fourth vein, by costa not attaining the apex of the wing, and by the antennae being well developed, those of the male having 16 and those of the female 11 segments. Certain European species are credited with having 15 antennal segments in the male and 12 in the female. The antennal segments in the female are short, subcylindric or subconical and in some species at least, ornamented distally with thick rows of short, stout, chitinous sensory processes. The male antennae are provided with a distinct stem nearly as long or longer than the basal enlargement, which latter is ornamented by one or more crenulate whorls from the base of which arise long, curved setae. The genitalia are very characteristic. Type L. cinerea Macq.

Nothing is known concerning the life history and habits of members of this genus, aside from the fact that they are most abundant in the vicinity of forests. Kieffer states that the European L. leucophaea Meign. occurs in decaying beech wood and it is very probable that our American forms breed largely in rotting ligneous tissues.

Lestremia leucophaea Meign. occurs in America according to Coquillett,[1] having been taken in the White mountains by Mrs Slosson. This identification is open to question, since the species of this genus resemble each other superficially very closely.

Key to species

a Antennal segments 11; females
  b Abdomen reddish brown
    c Scutellum dark brown; basal segment of ovipositor with a length fully twice its width; terminal segment small, narrowly oval and distinctly shorter than the basal segment..................... elongata Felt, C. 933
    cc Scutellum yellowish brown; basal segment of ovipositor broadly triangular, its length not more than one-half greater than its width; terminal segment nearly as long as the basal one, narrowly oval..........................barberi Felt, C. 934
  bb Abdomen fuscous yellowish
    c Length 3 mm
      d Terminal segment of ovipositor orbicular; claws minutely denticulate..........................sylvestris Felt, a1642
    cc Length 1.5 mm
      d Fourth palpal segment one-quarter longer than the third; basal segment of the ovipositor one-half longer than broad....... sambuci Felt, C. 743
      dd Fourth palpal segment twice the length of the third; basal segment of ovipositor a little longer than broad.............. kansensis Felt, C1261
aa 16 antennal segments; males
  b Stems of antennal segments two-thirds or three-quarters the length of the subcylindric basal enlargement
    c Dorsal plate short, broad, triangularly emarginate, the 4 palp segments successively longer..............pini Felt, C. 562
    cc Dorsal plate broad, tapering, roundly emarginate, the third and fourth palp segments not longer than the preceding.......... acerifolia Felt, C. 71
  bb Stems of antennal segments as long as the basal enlargement
    c Basal clasp segment with a conspicuous setose basal lobe internally...................solidaginis Felt, C. 700, 633, 691
    cc Basal clasp segment with no well-developed basal lobe internally
      d Fourth palpal segment as long as the third
        e Scutellum fuscous yellowish; dorsal plate not convolute, nearly truncate distally..............setosa Felt, Sc. 22
      dd Fourth palpal segment one-half longer than the third
        e Abdomen dark brown; scutellum reddish brown; dorsal plate convolute, broadly rounded distally and margined posteriorly with moderate setae........spiraeina Felt, C. 274
        ee Abdomen dark yellowish brown; scutellum yellowish brown; dorsal plate obliquely truncate distally and margined posteriorly with stout, divergent setae......................... franconiae Felt, C. 930, 937

[1] 1896 Ent. News, 7:263

bbb Antennal stem one-quarter longer than the basal enlargement
c Abdomen dark reddish brown; scutellum yellowish brown; basal enlargement of antenna with 2 crenulate whorls and with a length about twice its diameter; terminal clasp segment bidentate apically............................dyari Felt, C. 935
cc Abdomen dark brown; scutellum dark reddish brown; basal enlargement of antenna with one crenulate whorl and with a length a little greater than its diameter; terminal clasp segment acute distally..................vernalis Felt, C. 1260

Lestremia elongata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This species, received through the courtesy of the United States National Museum, was taken on the Argus mountains in May 1891.

Female. Length 3 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 11 segments, the fourth with a very short stem, irregularly cylindric, with a length about one-half greater than its diameter; other segments somewhat produced, the terminal one with the basal portion broadly oval and separated from the short, stout apical part, by a distinct constriction. Palpi; the first segment stout, with a length fully three times its diameter and a conspicuous sensory organ internally, the second two-thirds the length of the first, more slender, the third a little longer and more slender than the second, the fourth more than twice the length of the third, more slender. Mesonotum dull brown, the submedian lines sparsely haired. Scutellum and postscutellum dark brown. Abdomen reddish brown. Wings hyaline. Halteres pale yellowish. Coxae and femora dark reddish brown, tarsi fuscous yellowish. Ovipositor short, the terminal lobes biarticulate, the basal lobe with a length fully twice its diameter, expanding and truncate distally, the terminal lobe small, narrowly oval, both thickly setose. Type Cecid. 933.

Lestremia barberi Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This species, loaned for study by the United States National Museum, was taken August 8th by H. S. Barber at Las Vegas, N. M.

Female. Length 2.75 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 11 segments, the fourth with a length about one-half greater than its diameter, the terminal segment produced, strongly constricted near the distal third, irregularly rounded apically. Palpi; the first segment, with a length about two and one-half times its diameter, somewhat expanded distally and with a conspicuous sensory organ on its internal face, the second about as long as the first, stout, irregularly subrectangular, the third one-quarter longer than the second, more slender, the fourth one-half longer than the third, more slender, dilated apically, eyes large, black. Mesonotum dark brown. Scutellum yellowish brown, postscutellum dark brown. Abdomen reddish brown. Wings hyaline. Halteres yellowish transparent. Legs dark yellowish brown. Ovipositor short, biarticulate, the basal lobe irregularly and broadly subtriangular, the terminal lobe nearly as long as the basal one, narrowly oval, both thickly setose. Type Cecid. 934.

Lestremia sylvestris Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102; separate p. 5–6 (Catocha)
1908 ——— N. Y. State Mus. Bul. 124, p. 311

This species was taken September 23, 1906 in a forest hut at Davidson's River, N. C.

Female. Length 3 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown, basally pale yellowish; 11 segments, the fifth with a stem one-quarter the length of the basal enlargement. Palpi; the first segment somewhat curved, swollen and thickly clothed distally with stout, capitate setae, the second segment one-half longer than the first, the third and fourth each nearly twice the length of the second; face pale yellowish, eyes large, dark brown. Mesonotum dark brown, submedian lines dark yellowish, narrow, uniting posteriorly in a median dark yellowish area. Scutellum pale yellowish orange, postscutellum dark brown. Abdomen yellowish brown, incisures and pleurae pale salmon, terminal segments pale yellowish. Wings hyaline; halteres whitish transparent. Coxae pale yellowish, femora semi-transparent, tibiae and tarsi fuscous yellowish; claws with a series of minute teeth along the concavity. Ovipositor short, lobes orbicular, thickly setose. Type Cecid. a 1642.

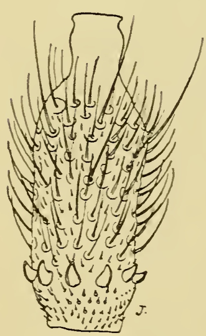

Fig. 20 Fifth of Lestremia sylvestris, enlarged. (Original)

Lestremia sambuci Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101–2; separate, p. 5 (Catocha)
1908 ——— N. Y. State Mus. Bul. 124, p. 311

This species was taken August 6, 1906 at Albany on elder, Sambucus canadensis.

Female. Length 1.5 mm. Antennae one-third the length of the body, sparsely haired, dark brown, fuscous yellowish basally; 11 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length thrice its diameter. Palpi; the first segment broadly rounded, subquadrate, the second as long as the first, subquadrate, the third more slender, one-half longer and the fourth one-quarter longer than the third; face fuscous yellowish, eyes fuscous. Mesonotum reddish brown, submedian lines indistinct. Scutellum and postscutellum a fuscous reddish yellow. Abdomen fuscous yellow, membrane and pleurae lighter; ovipositor

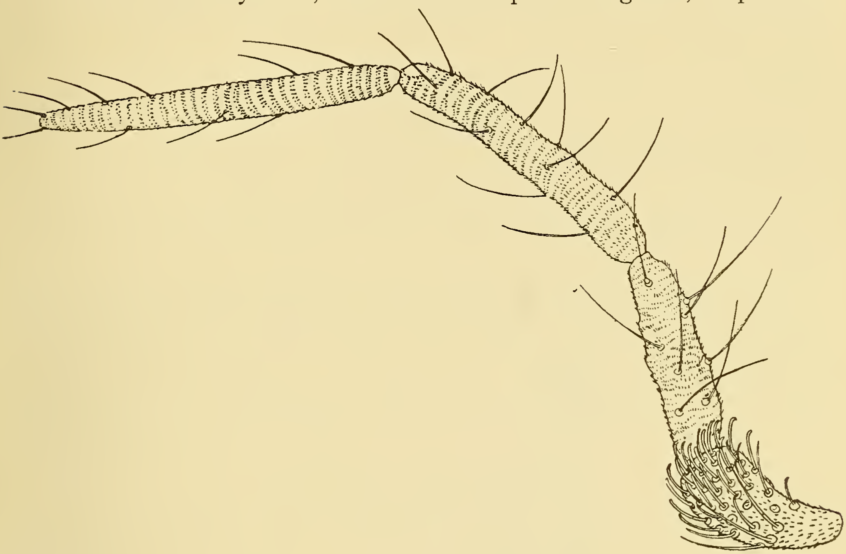

Fig. 21 Palpus of Lestremia sylvestris, enlarged. (Original)

slightly fuscous. Wings hyaline. Halteres yellowish basally, fuscous apically. Legs dark fuscous yellowish, the first tarsal segment as long as the following segments; claws apparently finely dentate. Ovipositor short, terminal lobes broadly subquadrate, slightly constricted basally, thickly setose. Type Cecid. 743.

Lestremia kansensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species was taken in Douglas county, Kansas, by Mr E. S. Tucker in May.

Female. Length 1.5 mm. Antennae extending to the third abdominal segment, thickly haired, light brown, yellowish basally; 11 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length a little over twice its diameter; terminal segment with a length about four times its diameter, distal part slender, irregularly fusiform, apically with a fingerlike process. Palpi; the first segment short, stout, narrowly oval, second segment slender, with a length one-half greater than the first, the third one-half longer than the second and more slender, the fourth about twice the length of the third, slender. Mesonotum dark brown. Scutellum and postscutellum yellowish brown. Abdomen fuscous yellowish, sparsely haired, ovipositor slightly fuscous. Wings hyaline. Halteres yellowish transparent. Coxae, femora and tibiae a variable yellowish brown; tarsi light reddish brown, the distal tarsal segments darker; claws simple, the pulvilli almost rudimentary. Ovipositor short, the terminal lobes biarticulate. Type Cecid. 1261.

Lestremia pini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 103; separate, p. 7
1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken July 16, 1906 on pine, Pinus, at Albany, N. Y.

Male. Length 1.5 mm. Antennae probably as long as the body, sparsely haired, dark brown; 16 segments, the fifth with a stem

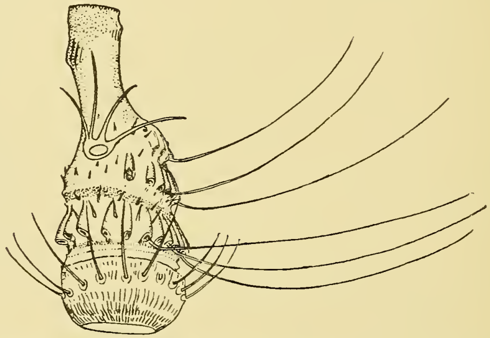

Fig. 22 Fifth antennal segment of Lestremia pini, enlarged. (Original)

three-fourths the length of the basal enlargement, which latter has annular constrictions at the basal fourth, near the middle and at the distal fourth; terminal segment prolonged basally, the stem short, narrowly conical. Palpi; the first segment short, subquadrate, the second longer, broadly oval, the third nearly twice the length of the second, stout, the fourth one-half longer than the third, slender distally, the fifth one-half longer than the fourth, slender. Mesonotum dark brown, sparsely white haired. Scutellum light brown, postscutellum yellowish brown. Abdomen grayish brown, the terminal segments darker. Wings hyaline. Halteres whitish transparent. Coxae, femora and tibiae whitish transparent, tarsi fuscous; claws with three or four long teeth. Genitalia; dorsal plate short, broad, broadly incised; ventral plate apparently fused with the preceding. Harpes long, slender, widely separated. Type Cecid. 562.

Lestremia acerifolia Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 5 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken May 21, 1906 on soft maple, Acer, at Albany, N. Y.

Male. Length .4 mm. Antennae longer than the body, sparsely haired, dark brown; 16 segments, the fifth with a stem two-thirds the length of the obpyriform basal enlargement; terminal segment produced, irregularly subconic. Palpi; the first segment long, stout, subelliptic, the second twice the length of the first, slender, the third two-thirds the length of the second, the fourth a little shorter than the third. Mesonotum dark brown, the light submedian lines setose. Scutellum yellowish brown, postscutellum darker. Abdomen light brown. Wings hyaline. Halteres yellowish transparent. Legs mostly dark brown; claws pectinate. Genitalia; dorsal plate broad, tapering, roundly emarginate, the lobes broadly rounded; ventral plate indistinct. Harpes stout, tapering, the extremities approximate and slightly curved; style slender, distally with a pair of recurved, chitinous teeth. Type Cecid. 71.

Lestremia solidaginis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102; separate, p. 6 (Catocha)
1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was captured sweeping grass, sedge or Solidago at Newport, N. Y., July 25, 1906. It was also reared August 6, 1906, from a jar containing whorled loosestrife, Lysimachia quadrifolia, the latter probably an accidental occurrence.

Male. Length .75 mm. Antennae nearly as long as the body, thickly haired, dark brown; 16 segments, the fifth with a stem as long as the cylindric basal enlargement; terminal segment produced, constricted at the basal and apical thirds, an apical knob. Palpi; the first segment short, quadrate, the second broadly oval, the third a little longer, subrectangular, the fourth one-fourth longer and more slender, the fifth one-half longer than the fourth, more slender. Mesonotum dark brown. Scutellum dark carmine, postscutellum lighter. Abdomen fuscous yellowish, distal segments somewhat darker. Wings hyaline, costa dark brown. Halteres pale yellowish. Legs pale fuscous yellowish, tarsi dark brown; claws simple. Genitalia; basal clasp segment short, broad, with a rather conspicuous rounded setaceous lobe basally; dorsal plate narrowly rounded; ventral plate broad, deeply and narrowly emarginate, the lobes narrowly rounded. Harpes tapering, curving, subacute; style long, slender, acute. Type Cecid. 700.

Lestremia setosa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species was taken July 24, 1906 on maple at Albany, N. Y.

Male. Length 2 mm. Antennae as long as the body, sparsely haired, light brown, yellowish basally; 16 segments, the fifth with a stem as long as the pyriform basal enlargement; terminal segment produced, constricted near the distal third and apical fourth. Palpi; the first segment, short, stout, irregularly subquadrate, the second a little more slender, one-half longer, subrectangular, the third about twice the length of the second, more slender, the fourth about as long as the third, more slender; face yellowish. Mesonotum olive brown, the submedian lines broad, yellowish, poorly defined. Scutellum fuscous yellowish, postscutellum yellowish. Abdomen a light fuscous brown. Genitalia fuscous yellowish, sparsely clothed with fuscous setae. Wings subhyaline. Halteres yellowish basally, slightly fuscous apically. Legs a pale fuscous yellowish; claws simple, the pulvilli shorter than the claws. Genitalia; dorsal plate long, broad, broadly emarginate, the lobes broadly rounded. Harpes long, broad, convolute, roundly truncate; style long, slender, narrowly rounded. Type Sc. 22.

Lestremia spiraeina Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102; separate, p. 6 (Catocha)
1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken June 15, 1906 on spirea at Albany, N. Y.

Male. Length 1.5 mm. Antennae as long as the body, thickly haired, dark brown, yellowish basally; 16 segments, the fifth with a stem as long as the subglobular basal enlargement; terminal segment produced irregularly, subconical, slightly constricted at the basal fourth, near the middle and at the apical fourth. Palpi; first segment subquadrate, prolonged, the second shorter, stouter, the third twice the length of the second, more slender, the fourth one-half longer than the third, slender; eyes small, black. Mesonotum dark brown, with indistinct submedian yellowish lines, sparsely setose. Scutellum reddish brown, slightly fuscous apically, sparsely setose; postscutellum reddish brown. Abdomen dark brown, rather thickly setose. Genitalia fuscous yellowish. Wings hyaline, costa and subcosta dark brown. Halteres yellowish transparent. Legs a nearly uniform pale straw, the articulations carmine; tarsi slightly darker, the first segment as long as the four following; claws stout, the concavity denticulate. Genitalia; dorsal plate broad, narrowly incised, the lobes irregularly rounded; ventral plate long, broad, triangularly emarginate, the lobes divergent, truncate. Harpes triangular, obtusely spined basally, tapering and approximate apically; style slender, narrowly rounded. Type Cecid. 274.

Lestremia franconiae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species, loaned by the United States National Museum for study, was taken by Mrs A. T. Slosson at Franconia, N. H.

Male. Length 1.75 mm. Antennae as long as the body, sparsely haired, dark brown; presumably 16 segments, the fourth with a stem as long as the fusiform basal enlargement. Palpi; the first segment subrectangular, with a length nearly three times its diameter and with a conspicuous sensory area distally, the second nearly twice the length of the first, more slender, the third almost twice as long as the second, more slender, and the fourth one-half longer and more slender than the third; eyes large, black. Mesonotum reddish brown. Scutellum light yellowish brown, postscutellum darker. Abdomen a dark yellowish brown; genitalia yellowish. Wings hyaline; halteres yellowish transparent. Legs a pale yellowish brown, the tarsi slightly darker; claws simple, the pulvilli distinctly shorter than the claws. Genitalia; dorsal plate long, broad, deeply and triangularly emarginate, the lobes widely divergent, broad, somewhat excavated. Harpes long, slender, swollen near the distal third, tapering, narrowly rounded; style stout, tapering, narrowly rounded. Type Cecid. 930.

Lestremia dyari Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This form, loaned for study by the United States National Museum, was taken June 7th at Caslo, B. C., by Dr H. G. Dyar.

Male. Length 1.75 mm. Antennae as long as the body, sparsely haired, dark brown, yellowish basally; 16 segments, the fourth with a stem one-fourth longer than the subcylindric basal enlargement, which latter has a length twice its diameter; terminal segment with the basal portion produced, the distal stem rudimentary. Palpi; the first segment, with a length three times its diameter, the second a little longer than the first, more slender, the third about twice as long as the second, more slender, the fourth a little longer and more slender than the third. Mesonotum dark brown, the submedian lines pale yellowish. Scutellum yellowish brown, postscutellum reddish brown. Abdomen dark reddish brown, sparsely clothed with fine hairs, genitalia dull orange. Wings hyaline, costa light brown. Halteres yellowish transparent. Coxae, femora and tibiae fuscous yellowish, tarsi dark brown; claws stout, the concavity finely denticulate, the pulvilli shorter than the claws. Genitalia; dorsal plate long, broad, broadly and roundly emarginate, the lateral angles produced; ventral plate apparently absent. Harpes long, slender, tapering, narrowly rounded; setose; style stout at base, tapering, narrowly rounded. Type Cecid. 935.

Lestremia vernalis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species was taken in April at Wichita, Kansas, by Mr E. S. Tucker.

Male. Length 1.5 mm. Antennae a little longer than the body, thickly haired, dark brown; 16 segments, the fifth with a stem one-fourth longer than the subglobose basal enlargement, which latter has a length a little greater than its diameter, terminal segment reduced, narrowly oval, obtuse. Palpi; the first segment long, rather stout, subrectangular, the second as long and more slender than the first, the third one-half longer and more slender than the second, the fourth twice the length of the third, more slender. Mesonotum dark brown, the submedian lines inconspicuous. Scutellum and postscutellum dark reddish brown. Abdomen dark brown. Genitalia dark reddish brown. Wings hyaline, costa dark brown. Halteres yellowish basally, light brown apically. Coxae, femora and tibiae fuscous yellowish, the segments irregularly brownish at the extremities; tarsi mostly light brown, the distal segments darker; claws simple, the pulvilli shorter than the claws. Genitalia; dorsal plate long, broad, broadly emarginate, the lobes separated, broadly rounded. Harpes apparently fused to form one large, convolute organ; style long, slender, broadly rounded. Type Cecid. 1260.

Microcerata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 309
1911 ———— N. Y. Ent. Soc. Jour., 19:32

This genus includes a number of small forms remarkable on account of the greatly reduced antennae. These organs in the male are composed of but 8 to 11 short segments, the second being greatly enlarged, subglobose and in general appearance much resembling those of the Campylomyzine genus Micromyia. The genitalia also differ from those of Lestremia. The one female known has very small antennae composed of 10 joints, the second being somewhat enlarged. This insect has been described as M. perplexa and appears to be closely related to M. diervillae and may possibly be the female of this species. Type Micromyia corni Felt.

Nothing is known concerning the life history and habits of members of this genus, though it is presumable that they are analogous to those of allied forms. It is very probable that the various species breed in decaying vegetable matter.

Key to species

a Antennal segments 8
  b Fourth palpal segment more than twice the length of the third; harpes broadly rounded apically...... j o h n s o n i Felt, C. 802
  bb Fourth palpal segment nearly twice the length of the third; harpes subacute apically............... c o c k e r e l l i Felt, C. 932
aa Antennal segments 9
  b Wings small, narrow, subcosta uniting with the margin before the basal half; palpi quadriarticulate....... c o r n i Felt, C. 459
  bb Wings rather large, broad, subcosta uniting with the margin at or beyond the basal half
    c Scutellum dark brown, the legs a variable fuscous; palpi triarticulate, stout................ d i e r v i l l a e Felt, C. 490
    cc Scutellum dark reddish brown, the legs a variable yellowish brown; palpi quadriarticulate, slender........... s p i n o s a n. sp., C. 1295
aaa Antennal segments 10
  b Length 1.5 mm, body dark brown; female.... p e r p l e x a Felt
  bb Length 1.25 mm, body dark brown; male.... b o r e a l i s n. sp., C. 1374
aaaa Antennal segments 11
  b Scutellum yellowish brown; abdomen fuscous brown t e x a n a n. sp., C. 1294

Microcerata johnsoni Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This form was taken August 2, 1891 by Prof. C. W. Johnson at Philadelphia, Pa.

Male. Length 1.75 mm. Antennae sparsely haired, pale yellowish; 8 segments, the fourth and following segments each somewhat more produced than the preceding, the sixth to the eighth with few or no subapical appendages. Palpi; the first segment, short, stout, subrectangular; the second a little longer, stouter, the third one-half longer than the second, more slender and the fourth more than twice the length of the third. Mesonotum dark brown, almost black. Scutellum, postscutellum and abdomen dark brown. Wings hyaline, costa reddish brown. Halteres yellowish basally, slightly fuscous apically. Legs a nearly uniform fuscous yellowish, tarsi slightly darker. Metatarsus more than two and one-half times as long as the following segment, the distal tarsal segment with a sparse subapical row of long, stout setae; claws rather long, stout, slightly curved, with a rather conspicuous tooth dorsally at the basal third and the concavity with several long, slender denticulations; pulvilli longer than the claws, thickly setose. Genitalia; basal clasp segment long, slender, terminal clasp segment swollen at the base, with several short, stout apical and subapical spines; dorsal plate broad, short, broadly and slightly emarginate; ventral plate apparently wanting. Harpes well separated, tapering, broadly rounded; style long, stout, tapering, broadly rounded. Type Cecid. 802.

Microcerata cockerelli Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This species, placed at our disposal through the courtesy of the United States National Museum, swarmed at Mesilla, N. M., in August and was collected by Prof. T. D. A. Cockerell.

Male. Length 1.75 mm. Antennae short, sparsely haired, dark brown; 8 segments, the fourth flattened basally and apically, with a length three-fourths its diameter, tapering, the other segments successively shorter, the terminal one fusiform, with a constriction

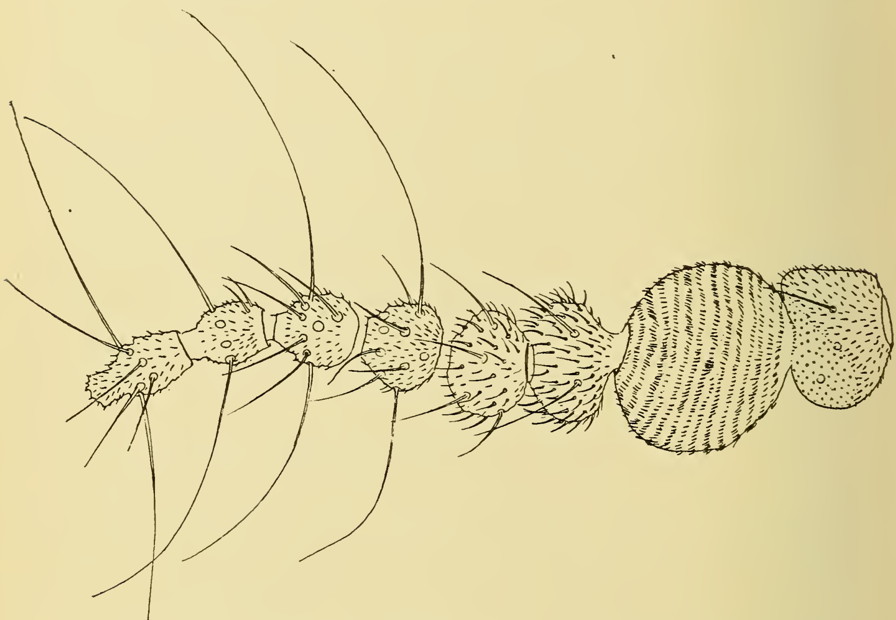

Fig. 23 Antenna of male Microcerata johnsoni, enlarged. (Original)

near the distal fourth. Palpi; the first segment stout, the second a little longer and more slender, the third one-half longer and more slender than the second and the fourth nearly twice the length of the third. Body dark brown. Wings hyaline, costa light brown. Legs light fuscous yellowish; claws stout, slightly curved, simple, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender, slightly curved, roundly truncate; terminal clasp segment long, tapering, the apex obtuse, spined; dorsal plate long, broad, broadly and roundly emarginate, the lobes divergent; ventral plate long, broad, tapering, irregularly rounded. Harpes long, slender, subacute; style long, slender, acute. Type Cecid. 932.

Microcerata corni Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102–3; separate, p. 6 (Micromyia)
1908 ———— N. Y. State Mus. Bul. 124, p. 310

This species was taken at Albany, N. Y., July 6, 1907 on Cornus.

Male. Length 1.5 mm. Antennae short, sparsely haired, dark brown; 9 segments, the fourth subglobose, with a length less than its diameter; terminal segment nearly three times the length of the preceding. Palpi; the first segment short, quadrate, the second as long as the first, slightly stouter, the third about as long as the second, more slender, the fourth nearly twice the length of the third. Mesonotum dark brown, the submedian lines with pale setae. Scutellum and abdomen dark brown, the latter nearly naked and with a distinct reddish tint distally. Wings hyaline, costa dark brown. Halteres pale orange basally, dark orange distally. Legs dark reddish, the tarsi dark brown; claws simple. Genitalia; basal clasp segment long, slender, obliquely truncate; terminal clasp segment stout, long, tapering, the apex spined; dorsal plate apparently simple, broad, tapering, narrowly rounded; ventral plate apparently similar. Harpes broad, stout, narrowly rounded; style long, slender. Type Cecid. 459.

Microcerata diervillae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 103; separate, p. 6–7 (Micromyia)
1908 ———— N. Y. State Mus. Bul. 124, p. 310

This species was taken at Karner, N. Y., June 5, 1907 on bush honeysuckle, Diervilla trifida.

Male. Length 1.5 mm. Antennae short, sparsely haired, dark brown; 9 segments, the third pyriform, the fourth with a very short stem; terminal segment produced, nearly twice the length of the preceding, pyriform. Palpi; the first segment stout, with a length twice its diameter, the second narrowly oval, a little shorter, the third one-half longer than the second, more slender. Mesonotum dark brown. Scutellum, postscutellum and abdomen dark brown, the latter slightly yellowish distally. Wings hyaline, costa light brown. Halteres fuscous yellowish. Legs a variable fuscous, the posterior tarsi tinged with carmine; claws simple, the pulvilli longer than the claws. Genitalia; basal clasp segment long; terminal clasp segment short, stout, the apex recurved; dorsal plate broadly rounded; ventral plate broad, incised, the lobes narrowly rounded. Harpes long, stout, tapering; style long, slender, narrowly rounded. Type Cecid. 490.

Microcerata spinosa n. sp.

This species was taken at dark in an oat field at Plano, Texas, in May 1907 by Mr E. S. Tucker.

Male. Length .75 mm. Antennae as long as the head, composed of 9 segments, the fifth pyriform; terminal segment somewhat produced, fusiform, with a length about twice its diameter. Palpi long, the first and second segments subequal, subrectangular, the third one-half longer, more slender and the fourth twice the length of the third; eyes large, black. Mesonotum dull dark brown.

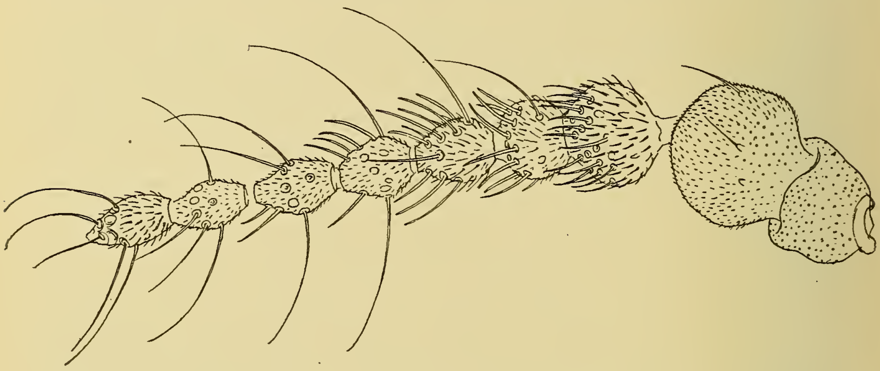

Fig. 24 Antenna of Microcerata spinosa, enlarged. (Original)

Scutellum dark reddish brown, postscutellum a little darker. Abdomen dull dark brown, the genitalia fuscous yellowish. Wings rather large, hyaline, costa yellowish brown. Halteres yellowish transparent. Legs a variable yellowish brown, the tarsi a little darker; claws simple, pulvilli large. Genitalia; basal clasp segment long, slender, tapering distally; terminal clasp segment rather long, swollen basally and tapering slightly to an obtuse, curved, thickly haired apex; dorsal plate tapering, broadly rounded and thickly setose apically; ventral plate tapering to a narrowly rounded apex; style long, slender, acute distally. Type Cecid. 1295.

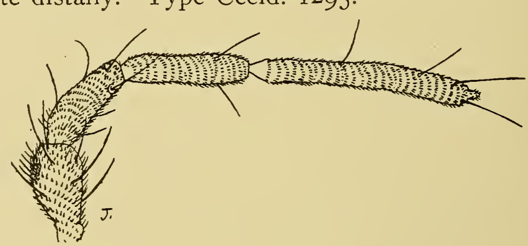

Fig. 25 Palpus of Microcerata spinosa, enlarged. (Original)

Microcerata perplexa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

The female representing this species was taken on the office window July 19, 1907, and was presumably reared from some material in the office.

Female. Length 1.5 mm. Antennae short, sparsely haired, dark brown, 10 segments, the fourth with a length about three-fourths its diameter, greatly dilated near the basal third and roundly tapering to the broad apex; terminal segment produced, strongly constricted near the distal third and broadly rounded. Palpi; the first segment long, expanded distally and with a conspicuous sense organ on the internal distal third, second segment nearly as long as the first, more slender, the third one-half longer and more slender than the second, the fourth one-half longer and more slender than the third. Entire body nearly uniform dark brown. Wings hyaline, costa dark brown. Halteres presumably fuscous. Legs presumably a fuscous brown; claws simple, the pulvilli a little shorter than the claws. Ovipositor short, the terminal lobes indistinctly triarticulate, the basal segment indistinct, the second broadly rounded, the third irregularly oval. Type Cecid. 1375.

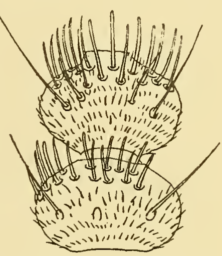

Fig 26. Fourth and fifth antennal segments of Microcerata perplexa, enlarged. (Original)

Microcerata borealis n. sp.

This species was taken by Mr D. B. Young at Speculator, N. Y., July 27, 1909.

Male. Length 1.25 mm. Antennae extending to the base of the anterior coxae, sparsely haired, dark brown; 10 segments, the fifth subglobose, slightly pyriform, with a length slightly greater than its diameter. Terminal segment subcylindric, with a length two and one-half times its diameter. Palpi; the first segment stout, rectangular, with a length twice its diameter, the second a little longer, swollen distally, the third a little shorter than the second, narrowly triangular, the fourth one-half longer than the second, irregular, compressed. Thorax and abdomen a nearly uniform dark brown. Wings hyaline, costa light brown. Halteres yellowish brown; coxae dark brown; femora, tibiae and tarsi a dark yellowish brown; claws long, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, tapering; terminal clasp segment rather stout, recurved apically; dorsal plate long, tapering, narrowly rounded; ventral plate divided, the lobes divergent, roundly truncate and thickly setose; style long, slender. Type Cecid. 1374.

Microcerata texana n. sp.

This species was taken at Plano, Texas, July 1907 by Mr E. S. Tucker.

Male. Length 1.25 mm. Antennae hardly extending to the base of the abdomen, thickly haired, fuscous brown, composed of 11 segments, the fifth pyriform; the stem one-fourth the length of the enlargement, the tenth and eleventh segments fused though separated by a distinct stem. Palpi probably quadriarticulate, stout, the first segment subrectangular, slightly swollen distally, the second a little longer, rather stout, the third probably longer than the second, more slender. Mesonotum dark brown, the submedian lines sparsely haired and irregularly tuberculate. Scutellum yellowish brown, postscutellum and abdomen fuscous brown, genitalia dark fuscous yellowish. Wings hyaline, costa yellowish brown. Halteres yellowish transparent, legs a variable yellowish or yellowish brown, the distal tarsal segments somewhat darker; claws probably simple. Genitalia; basal clasp segment rather stout, with a distinct lobe basally and tapering to a subtruncate apex; terminal clasp segment rather stout at base and tapering to a subacute, thickly setose apex; dorsal plate rather long, broad, broadly rounded and thickly setose apically; ventral plate long, slender, subtruncate distally; style long, slender, acute apically. Type Cecid. 1294.

Tritozyga H. Lw.

1862 **Loew, H.** Monog. Dipt. N. Amer., 1:177, 178–79
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 18
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:44, 143
1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 53
1900 ———— Soc. Ent. Fr. Ann., 69:447–48
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This peculiar North American form was made the type of a new genus by H. Loew, who refrained from bestowing a specific name because of the mutilated condition of the specimen. Through the courtesy of Mr Samuel Henshaw it has been possible to study the type, now in the Museum of Comparative Zoology at Cambridge, Mass. This species is more closely related to the author's Microcerata than to any other known genus. It is easily separated from Microcerata by the uneven fork of the fourth vein, the posterior branch being a nearly straight continuation, while the anterior branch arises at nearly a right angle and describes a broadly S-shaped curve before uniting with the margin. This character alone suffices to distinguish it from all other Itonididae. The fourth, fifth and sixth veins are distinctly heavier than in Microcerata, the last having a somewhat sinuous course. The antennae are composed of but 9 segments, the second being somewhat enlarged and the terminal segment, evidently composed of 3 rather closely fused, distinctly produced and with a length fully six times its diameter. The palpi are plainly stouter than in Microcerata.

Tritozyga sackeni Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This unique form represents a valid species, and though mutilated it seems preferable to bestow a specific name and publish the characters so far as they can be determined, particularly as this procedure fixes the identity of the genus beyond all question and removes the danger of another synonym being added to an already overburdened nomenclature.

Male. Eyes black; occiput brown. Antennae short, with 9 segments, the basal ones pale yellowish, the distal brown; first segment small, subglobose, the second distinctly enlarged, ovate, the third subcylindric, with a length three-fourths its diameter, the fourth with a length a little greater than its diameter, the fifth about the same length as the fourth, with a scattering subbasal whorl of rather short, curved setae; subapically, on the posterior face there is an irregular group of oval, tuberculate elevations, possibly a special sense organ. Terminal segment evidently composed of three closely fused segments, with a length fully six times its diameter and whorls of stout setae similar to the subbasal one above described near the basal fourth, the middle and the distal fourth of this compound segment. Palpi yellowish, probably quadriarticulate, the first probably with a length one-half greater than its diameter, the second short, the penultimate cylindric, with a length about four times its diameter, the terminal as long as the preceding, slightly dilated apically and with a few coarse setae; three small ocelli. Mesonotum dark brown. Scutellum yellowish, sparsely setose. Wings hyaline, length 1.5 mm; costa dark brown, rather densely haired; subcosta uniting with the anterior margin near the basal third, the third vein apparently united with subcosta near the basal fourth and joining the anterior margin near the distal third; both this and subcosta heavy, dark brown and sparsely haired. The fourth vein rather distinct, slightly curved, its posterior branch an almost direct continuation of the basal portion, while the anterior branch arises at a nearly right angle, and after describing a broadly S-shaped curve, unites with the anterior margin near the distal fifth; fifth vein nearly straight, joining the posterior margin at the distal fourth, the sixth vein stout, irregularly curved and uniting with the posterior margin near the basal half. Halteres probably yellowish, the stem long, curved, the distal portion spatulate. Coxae yellowish; femora, tibiae and tarsi yellowish brown, the latter with five segments, the first longer than the second, the claws probably simple. Type in the Museum of Comparative Zoology.

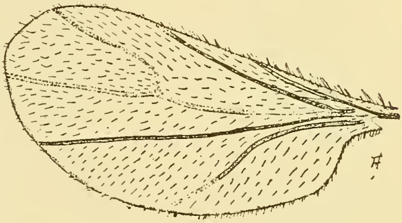

Fig. 27 Wing of Tritozyga sackeni, enlarged. (Original)

Neptunimyia Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:237

This genus represents a unique form intermediate in development between Lestremia and the highly reduced antennal structures of Microcerata and Tritozyga. It is more closely allied to the former though easily separated therefrom by the normal second antennal segment, the digitate antennal appendages and the stoutly pectinate claws. The type species is N. tridens n. sp.

Neptunimyia tridens Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:237–38

This most interesting female was reared April 17, 1911, from a jar containing maple leaves infested last year with the larva of Cecidomyia ocellaris O.S. It is possible that the

Fig. 28 Fifth antennal segment of Neptunimyia tridens, enlarged. (Original)

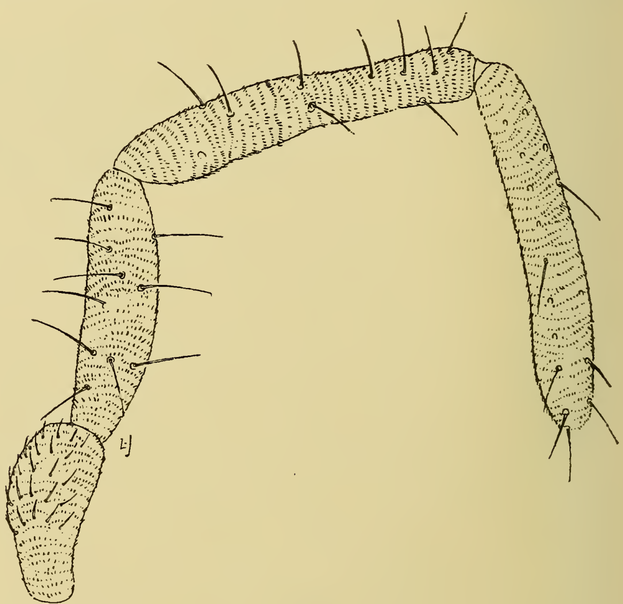

Fig. 29 Palpus of Neptunimyia tridens, enlarged. (Original)

insect developed from the very slight amount of decaying organic matter brought in with the sand. We are unwilling to believe that it is the parent insect of the semitransparent larvae producing in midsummer the numerous ocellate galls on soft maple leaves. Paridris nigricornis Brues was reared from this jar and may be a parasite of C. ocellaris O.S.

Neocatocha Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:236

This remarkable form has the venation of Catocha and the greatly reduced antennae of Microcerata, from which latter it is easily distinguished by the normal second antennal segment. The short, sessile, flagellate antennal segments and the characteristic venation serve to separate this genus from Neptunimyia. Type N. m a r i l a n d i c a .

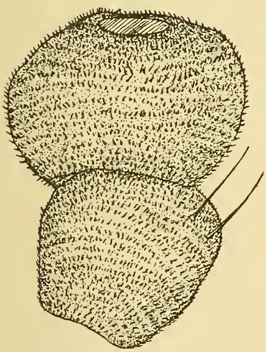

Fig. 30 First two antennal segments of N e o c a t o c h a m a r i l a n d i c a, enlarged. (Original)

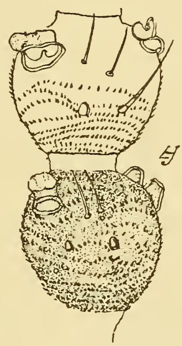

Fig. 31 Two flagellate antennal segments of N e o c a t o c h a m a r i l a n d i c a, enlarged. (Original.)

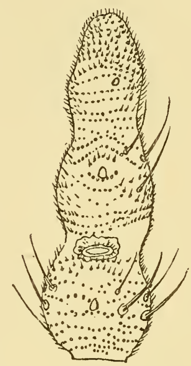

Fig. 32 Distal antennal segment of N e o c a t o c h a m a r i l a n d i c a, enlarged. (Original)

Neocatocha marilandica Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:236–37

One female was taken by Dr W. L. McAtee on Plummers island, Maryland, March 24, 1907.

Female. Length 1.75 mm. Antennae short, dark brown; 8 segments, the first and second normal, the fifth sessile, subglobose, with a length slightly greater than its diameter, irregularly and sparsely clothed with short setae and subapically with a whorl of probably four short, stout, fleshy appendages; terminal segment compound, composed of three closely fused, and with a length about four times its greatest diameter. Palpi; first segment irregularly quadrate, the second and third subequal, each with a length 2 and one-half times the diameter, the fourth a little longer, more slender. Eyes moderate, black, coarsely granulate; ocelli present. Mesonotum dark reddish brown. Scutellum yellowish brown, postscutellum slightly darker. Abdomen mostly dark yellowish brown. Wings hyaline.

Halteres yellowish brown. Legs mostly dark yellowish brown; claws moderately stout, strongly curved, simple, the pulvilli as long as the claws. Ovipositor short, the lobes triarticulate, the distal segment suborbicular. Ventrally, on the ninth segment, there is a pair of submedian, fuscous, pyriform appendages. Type C. 1390.

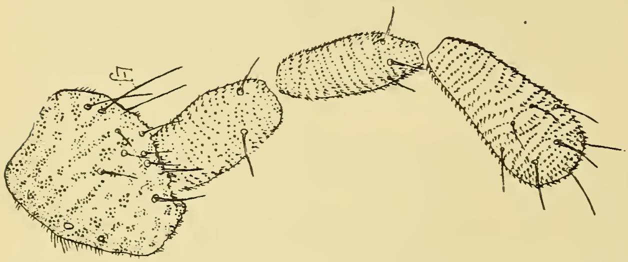

Fig. 33 Palpus of Neocatocha marilandica, enlarged. (Original)

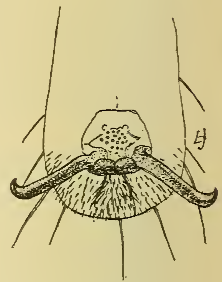

Fig 34 Claws of Neocatocha marilandica, enlarged. (Original)

Neocatocha spinosa n. sp.

This remarkable female was found in the National Museum collection labeled "with specimens sent by A. R. Barber, December 16, 1873."

Female. Length 2 mm. Antennae extending nearly to the base of the abdomen, sparsely haired, yellowish brown; 10 segments, the fifth with a short stem one-fourth the length of the oval basal enlargement, which latter has a length fully one-half greater than its diameter, a sparse basal whorl of long, stout setae and subapically a partial whorl of thickly set, short, stout, curved spines; terminal segment reduced, with a length one-half greater than its diameter, narrowly rounded apically. Palpi; first segment short, subquadrate, the second with a length twice its diameter, the third a little longer than the second, the fourth one-half longer than the third, dilated apically. Ocelli present. Thorax dark brown. Abdomen yellowish brown, the terminal segments dark brown. Ovipositor short, triarticulate, the distal segment narrowly oval, thickly setose. Wings hyaline, irridescent. Halteres and legs yellowish brown, the distal tarsal segments darker. Claws stout, evenly curved, simple, the pulvilli about one-third the length of the claws. Type Cecid. 1415.

Lithomyza Scudd.

1877 **Scudder, S. H.** U. S. Geol. Geog. Surv. Terr. Bul. 3, p. 746

1890 ———— Tert. Ins. N. Amer., U. S. Geol. Geog. Surv. Terr. Rep't, v. 13, p. 600–01

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This genus was erected by Scudder for a single specimen found in the Chagrin Valley, White River, Colorado. It is evidently closely allied to Lestremia. The illustration of the wing shows that subcosta unites with the margin near the basal third. The first branch of media, which in Lestremia has disappeared, joins costa a little beyond the middle. The second branch of media joins the margin a little before the apex and is united to subcosta by a short, well-defined crossvein, evidently the vein present throughout the Lestremiinariae, Campylomyzariae and Epidosariae. The third and fourth branches of media which, for convenience sake we have designated in this work the fourth vein, is forked as in Lestremia; the fifth and sixth veins are free. The short nine-jointed antennae indicate a close affinity with Tritozyga O.S. and Microcerata Felt. Type Lithomyza condita Scudd.

This genus, if correctly placed, is the most generalized Cecidomyiid known and must be regarded as a connecting link between this group and the Mycetophilidae.

CAMPYLOMYZARIAE

This tribe is easily separated from the Lestremiinariae by the simple, nearly obsolescent fourth vein.

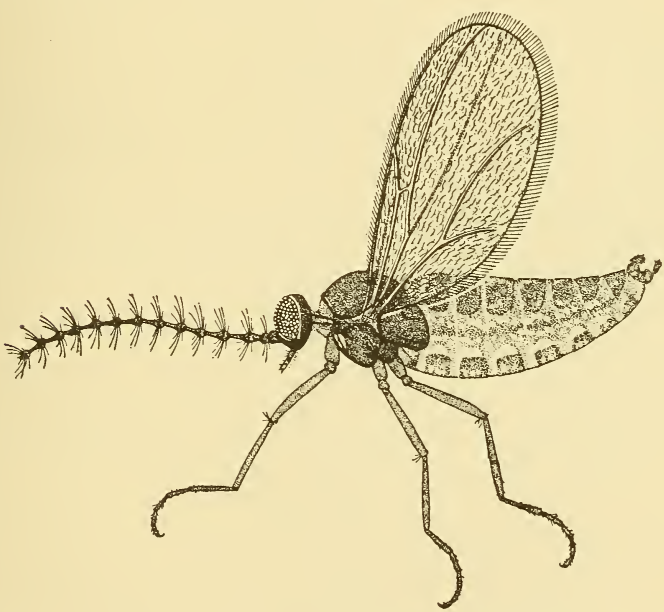

Fig. 35 Cordylomyia coloradensis, enlarged. (Original)

The typical genus, Campylomyza Meign., was erected in 1818, four species, C. flavipes, C. bicolor. C. atra and C.

aceris being named. Kieffer in 1896, holding that the genus as characterized by Meigen comprised a group, designated C. munda Winn. as the type. An examination by the writer, of specimens in Meigen's collection deposited in the Natural History Museum of Paris, representing the four species originally assigned to this genus, showed that the specimens are in such poor condition that they can hardly be used to advantage in establishing the identity of the generic type. The form designated by Kieffer as the type of the genus, namely, C. munda Winn., unfortunately has not been characterized with sufficient fulness so that it can be separated from allied forms. Under the conditions, we are compelled for the present to treat Campylomyza Meign. as a supergenus, referring thereto forms which can not be readily assigned to some of the more recent genera. Owing to the paucity of our reared material in this group, we have been unable to make a critical study of the generic characters, though the little data we have obtained in this manner would seem to justify the existence of the recently established genera.

Key to genera

a Wingless, or if wings are present, the fifth vein simple
  b Claws with long, parallel teeth, the pulvilli very short.............. Strobliella Kieff.
  bb Claws denticulate, the puvilli absent ....Wasmanniella Kieff.
aa Winged, fifth vein forked
  b Third vein usually well separated from costa and frequently uniting therewith at or beyond the apex
    c Flagellate antennal segments globose, stemmed in both sexes and ornamented only with whorls of long hairs
      d Fourth vein present
        e Palpi tri- or quadriarticulate
          f Wings normal, slender, antennal segments, male 14, female 11. Joannisia Kieff.
          ff Wings broad, not twice as long as wide, antennal segments, female 12 ....Projoannisia Kieff.
        ee Palpi biarticulate, the male with 14 and the female with 13 antennal segments, the claws strongly bent, dilated subapically....................................Peromyia Kieff.
      dd Fourth vein wanting
        e Antennal segments stemmed...............Trichopteromyia Will.
        ee Antennal segments sessile, the second enlarged, globose; palpi triarticulate..................................Ceratomyia Felt
    cc Flagellate antennal segments cylindric, subsessile; male with 12, female with 9 antennal segments; fourth vein rudimentary, obsolete distally....................................Mycophila Felt

bb Third vein rarely extending to the apex of the wing; flagellate antennal segments subsessile in the female, ornamented with crenulate whorls or other structures more complex than irregular whorls of simple hairs

c Antennae very short, the male with 10 to 11, the female with 6 to 8 subsessile segments, the second greatly enlarged................ Micromyia Rond.

cc Antennae not very short, the male with 14, the female with 11 to 22 antennal segments, the second not greatly enlarged.............. Campylomyza Meign.[1]

d Flagellate antennal segments with a more or less distinct collar subapically

e Claws denticulate, the pulvilli well developed..Prionellus Kieff.

ee Claws simple, the pulvilli short or rudimentary..Aprionus Kieff.

dd Flagellate antennal segments with a subapical whorl of stemmed disks; claws with a minute subapical tooth....Monardia Kieff.

ddd Flagellate antennal segments with reniform processes subapically, claws bent at right angles, dilated subapically............ Bryomyia Kieff.

dddd Flagellate antennal segments with subapical whorls of short, stout, usually recurved spines...............Cordylomyia Felt

ddddd Flagellate antennal segments with series of whorls of short, stout, curved spines........................Corinthomyia Felt

Strobliella Kieff.

1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 51
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 22, fig. 9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This genus, as characterized by Kieffer, has five simple long veins, the anterior border of the wing not being interrupted and passing gradually into the posterior margin. The palpi are quadriarticulate and the tarsal claws are provided at the basal half with long, parallel teeth; the pulvilli are very short. The illustration of the wing shows that this genus is closely allied to Campylomyza, the third vein uniting with costa at the apex, the fifth and sixth veins being simple; subcosta joins the anterior margin near the basal half, while the crossvein appears unusually long. Type S. intermedia Kieff.

Wasmanniella Kieff.

1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 49
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 11, 12
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

Members of this genus, according to Kieffer, may be recognized by the denticulate claws, the absence of pulvilli and by the subglobose, stemmed antennal segments. Each of the flagellate segments

[1] Owing to the unsatisfactory characterization of Campylomyza Meign., it is tentatively given rank as a supergenus. See above.

has a whorl of hairs and a subapical whorl of 4 hyaline, hooked appendages. The female is remarkable on account of the absence of wings. The larvae live under the leaf sheath of Scirpus silvaticus. It was impossible, from a study of the type kindly placed at my disposal by Professor Kieffer, to add to the above. Type and sole species W. aptera Kieff.

Joannisia Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., p. 175
1896 ———— Mis. Ent., 4:7
1897 ———— Syn. Cecid. Eur. & Alg., p. 48
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 312
1909 ———— Ent. Soc. Cent. 39th Rep't, p. 44
1911 ———— N. Y. Ent. Soc. Jour., 19:32

The antennae have 11 segments in the female and 14 in the male Joannisia, the flagellate segments with a subglobular enlargement ornamented only with irregular whorls of simple setae and a smooth, cylindric stem distally (figure 36). The venation is

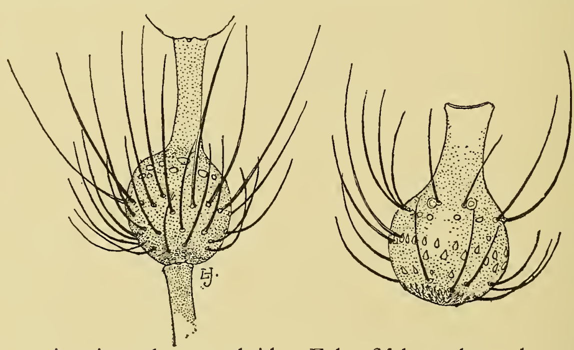

Fig. 36 Joanissia photophila Felt, fifth and tenth antennal segments of male, much enlarged. (Original)

very characteristic, since the third vein is well separated from costa, runs nearly parallel thereto and unites with the margin at or well beyond the apex; the fourth vein is simple, the fifth forked. The terminal clasp segment of the male is slender, curving and tapering to an acute apex in all species known to us, except in J. neomexicana.

One American species, J. pennsylvanica Felt, received through the courtesy of Prof. H. A. Surface, has been reared by Mr B. H. Farr of Reading, Pa., from decaying peony roots. Aside from this, nothing is known concerning the life history of our native forms. Kieffer has reared several European species from decaying wood, from tufts of moss and also from a mold covering a fungus. It is very probable that our American species live under similar conditions, particularly as they are most numerous in the vicinity of forests or where there is an abundance of decaying vegetable matter. The generic type is J. aurantiaca Kieff.

Key to species

a 11 antennal segments, females
  b Abdomen dark brown, unicolorous, palpi triarticulate............... flavopedalis Felt, C. 687
  bb Abdomen dark reddish brown, fuscous distally, palpi quadriarticulate.................................carolinae Felt, C. a1619
aa 14 antennal segments, males
  b Terminal clasp segment slender, tapering to an acute point
    c Legs thickly haired
      d Postscutellum reddish brown..............................
        e Terminal antennal segment reduced, oval.................... photophila Felt, C. 747, 748, 753, 472
        ee Terminal antennal segment produced, with a knob apically ... pennsylvanica Felt, Cecid. a1928
      dd Postscutellum fuscous yellowish......flavoscuta Felt, C. 653
    cc Legs sparsely haired.................carolinae Felt, C. a1619
  bb Terminal clasp segment stout, broadly rounded apically
    c Mesonotum dark brown, scutellum and abdomen a little lighter.... neomexicana n. sp., C. 891

Joannisia flavopedalis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313

This female was taken at Newport, N. Y., July 25, 1906.

Female. Length .5 mm. Antennae probably nearly as long as the body, sparsely haired, dark brown, 11 segments; fifth subglobose; terminal segment with the basal portion slightly produced, narrowly oval. Palpi; the first segment somewhat enlarged, subglobose, the second rather slender, one-half longer, the third somewhat irregular, nearly twice the length of the second. Eyes rather small, black; ocelli present. Head, thorax and abdomen apparently a nearly uniform dark brown, ovipositor pale yellowish. Wings hyaline, costa dark brown, subcosta joining the margin just before the basal half. Legs pale yellowish, the articulations variably tinged with dark carmine; distal tarsal segments reddish brown; metatarsus a little longer than the following segment; claws very long, slender, strongly curved, simple; pulvilli nearly as long. Ovipositor short, the terminal lobes triarticulate, the basal subquadrate, the second a little longer, dilated distally, the third narrowly oval, all sparsely setose; minor lobe long, slender, narrowly rounded. Type Cecid. 687.

Joannisia carolinae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 4 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 313

This species was taken on a window in a woodland hut at Davidson's River N. C., September 23, 1906.

Male. Length .4 mm. Antennae twice the length of the body, light brown; 14 segments, the fifth with a stem one-fourth longer than the subglobose enlargement; terminal segment suboval. Palpi; the first segment very broad, short, second broadly oval, the third narrowly oval and the fourth smaller. Mesonotum reddish brown. Scutellum, postscutellum and basal abdominal segments dark reddish brown, distal abdominal segments dull black. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal half; halteres yellowish basally, fuscous apically. Legs nearly uniform fuscous yellowish, sparsely haired, posterior metatarsus slender, more than twice the length of the following segment; claws strongly curved, almost at right angles, simple; pulvilli slender, nearly as long as the claws. Genitalia; basal clasp segment stout, broad, truncate, with an internal chitinous spine; terminal clasp segment broad at base, tapering. Dorsal plate rather broad, evenly rounded.

Female. Length .5 mm. Antennae a little longer than the body, light brown; 11 segments, the fifth with a stem two-thirds the length of the globular basal enlargement; terminal segment suboval. Palpi; the basal segment large, suboval, the others regularly decreasing in size. The colorational and structural characters of the thorax and its appendages practically as in the male. Ovipositor short, terminal lobes biarticulate, the basal subquadrate, the distal suboval. Type Cecid. a1619.

Joannisia photophila Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 313

This species is evidently one of our most common forms as it was taken on the office window at Albany during July and August, and also captured in a trap lantern at Poughkeepsie August 7, 1906.

Male. Length .5 mm. Antennae nearly as long as the body, thickly haired, dark brown; 14 segments, the fifth with a stem one-fourth longer than the globose enlargement, terminal segment ovate, thickly and irregularly clothed with long hairs. Palpi; the first segment quadrate, about one-half longer than broad, the second irregularly oval, broad, the third narrowly oval, as long as the second, the fourth one-half the length of the preceding, oval. Mesonotum dark reddish, submedian lines indistinct. Scutellum and postscutellum reddish brown. Abdomen dark brown, somewhat fuscous posteriorly. Wings hyaline, costa dark brown, halteres dark reddish. Legs fuscous yellowish, distal tarsal segments reddish brown; claws medium, strongly curved, simple; pulvilli nearly as long as the claws. Genitalia; basal clasp segments stout, broad, truncate and apparently with a large, curved, chitinous process extending behind the median plates and nearly touching a similar process arising from the opposite segment; terminal clasp segment swollen basally. Dorsal plate smooth, broadly rounded, short, ventral plate similar. Type Cecid. 747.

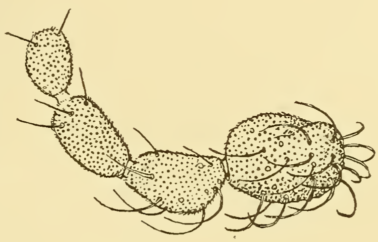

Fig. 37 Palpus of Joannisia photophila, enlarged. (Original)

Joannisia pennsylvanica Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:476

This species was submitted for study by Prof. H. A. Surface, who states that it was reared from decaying peony roots by Mr B. H. Farr of Reading, Pa.

Joannisia flavoscuta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313

This form was taken on a window at Nassau, N. Y., July 24, 1906.

Male. Length .5 mm. Antennae a little longer than the body, thickly haired, dark brown; 14 segments, 5th with stem one-fourth longer than the globose enlargement; terminal segment suboval. Palpi; the first segment broadly oval, the second nearly as long, narrowly oval, the third a little shorter, more slender, the fourth shorter and more slender. Mesonotum dark brown, submedian lines indistinct. Scutellum reddish brown, postscutellum dark fuscous yellowish. Abdomen nearly uniform dark brown. Wings hyaline, costa dark brown. Halteres yellowish transparent basally, fuscous apically. Legs mostly a fuscous yellowish, tarsi variably tinged with carmine; claws long, slender, strongly curved near the middle, simple. Genitalia; basal clasp segment short, stout, with a conspicuous chitinous tooth internally, obliquely truncate; terminal clasp segment short, stout, greatly swollen at the base. Dorsal plate short, broadly rounded, ventral plate a little wider, longer, broadly rounded. Type Cecid. 653.

Joannisia neomexicana n. sp.

This species was taken at Pecos, N. M., August 25th, by Prof. T. D. A. Cockerell.

Male. Length .75 mm. Antennae brown, about twice the length of the body, thickly haired; 14 segments, the fifth with a stem one-fourth longer than the globose enlargement; terminal segment dumbell-shaped, the basal swelling somewhat greater than the distal one, the two broadly united. Palpi apparently missing. Mesonotum dark brown. Scutellum and abdomen a little lighter. Wings hyaline, costa light brown. Legs a variable yellowish, the distal tarsal segments slightly fuscous; claws long, slender, strongly curved, minutely denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment stout, truncate; terminal clasp segment short, stout, slightly swollen near the middle. Type Cecid. 891.

Projoannisia Kieff.

1912 **Kieffer, J. J.** Neue Gallm.-Gatt. p. 2

This form is allied to Joannisia, has unusually broad wings and the third vein is nearer the rudimentary fourth than to costa. The antennal segments are 12, subsessile, the stem being about one-fourth the length of the pyriform basal enlargement, the latter with subapical, heavy, curved special sense organs not appearing in typical Joannisia. The simple claws are only slightly bent and about twice the length of the pulvilli. The ovipositor is very short. Type Joannisia latipennis Kieff.

Peromyia Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., p. 175
1896 ———— Mis. Ent., 4:7, 11
1897 ———— Syn. Cecid. Eur. & Alg., p. 48
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 22, fig. 12; pl. 24, fig. 1, 2
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

The antennal segments in this genus are subglobose, the segments (male 14, female 13) with long stems in both sexes. The palpi are biarticulate. The claws are bent at almost right angles and greatly swollen at the distal third. The anterior border of the wing extends a little beyond the third vein. The pulvilli are long. The third vein curves distally and joins the margin near the rudimentary fourth vein. The basal clasp segment of the male is stout, truncate, the terminal clasp segment short, stout, curved subapically, greatly swollen and obtusely rounded distally. Ovipositor quadriarticulate. Through the courtesy of the authorities we were allowed to study the excellent microscopic preparations of this genus in the Berlin Natural History Museum.

Neurolyga Rond., 1846, appears to be close to Peromyia Kieff, and the latter may prove to be identical therewith.

The pupa of the typical species is somewhat remarkable on account of its slender form and especially because of the 3 lateral triangular appendages arising from the first to third segments. The ventral abdominal surface is thickly studded with chitinous points, while the dorsum is ornamented with short, stout, chitinous spines. Type P. leveillei Kieff. No American forms have been recognized.

Trichopteromyia Will.

1896 **Williston, S. W.** Ent. Soc. London Trans., p. 255
1901 **Kieffer, J. J.** Suite Syn. Cecid. Eur. & Alg., p. 16–17
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

This West Indian genus is evidently allied to Campylomyza Meign. and may be distinguished therefrom, as indicated by the describer's illustration of the wing, by the absence of the rudimentary fourth vein; subcosta unites with the margin at the basal third, the third vein at the apex and the fifth just beyond the basal half, its branch near the basal third. The female antenna, as illustrated, presents much the same form as that of Joannisia with which this genus may be closely allied. Type T. modesta Will.

Mycophila Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

This genus is evidently related to Joannisia Kieff., though readily separable therefrom by the small number of antennal segments and by the rudimentary fourth vein being obsolete distally. Type M. fungicola Felt.

Mycophila fungicola Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

This species was reared from young mushrooms collected by H. Cecil Evans at San Rafael, Cal., September 7, 1897. Mr Pergande, of the Bureau of Entomology, Washington, D. C., states that the flies are red, the abdomen paler, marked with narrow, pale dusky bands, the thorax is dusky or blackish above, eyes black. Antennae and legs pale dusky and with a yellowish tinge.

Larvae. Length .75 mm., rather stout, broadly rounded posteriorly, nearly so anteriorly, pale orange. Head subrectangular with a diameter about one-half that of the body, antennae apparently uniarticulate, rather long, stout, with a length about five times the diameter, at the distal fifth tapering suddenly to an acute apex. No breast bone is apparent, the surface of the body is smooth.

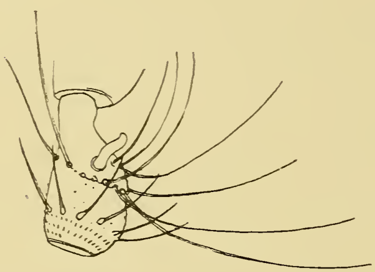

Fig. 38 Fifth antennal segment of male of Mycophila fungicola, enlarged. (Original)

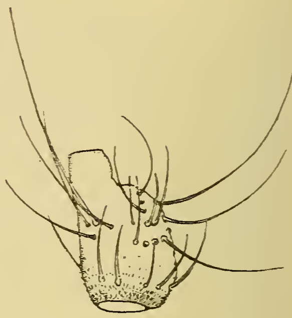

Fig. 39 Fifth antennal segment of male of Mycophila fungicola, other side, enlarged. (Original)

Female. Length .6 mm. Antennae extending to the second abdominal segment, sparsely haired, fuscous yellowish; 9 segments, the first broadly obconic, the second subglobose, the third produced, fusiform, free, the fifth with a length about twice its diameter, subcylindric, tapering; subbasal whorl of setae thick, long, curved; subapical band finer; distally there are apparently four broad, chitinous lobes; terminal segment produced, the basal portion broadly oval, the distal smaller, almost subglobose. Palpi indistinct. Ovipositor short, biarticulate, the basal sclerite long, broad, quadrate, tapering distally, the terminal sclerite broadly oval, both sparsely setose, minor lobe long, obliquely truncate, sparsely setose. Other characters as in the male, see citation.

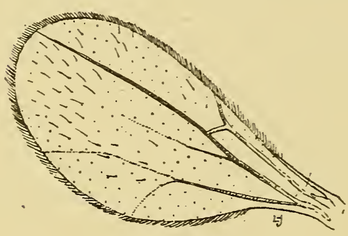

Fig. 40 Wing of Mycophila fungicola, enlarged. (Original)

Ceratomyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

Allied to Micromyia Rond. on account of the greatly enlarged second antennal segment, though easily separated therefrom by the absence of the fourth vein. The latter character indicates a relationship with Trichopteromyia Will. from which it may be separated by the greatly reduced antennal segments with only 6 short, sessile segments.

Ceratomyia johannseni Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33-4

This interesting species was received from Ocotlan, Mexico, through Dr O. A. Johannsen under date of December 12, 1910. See above citation for a detailed description.

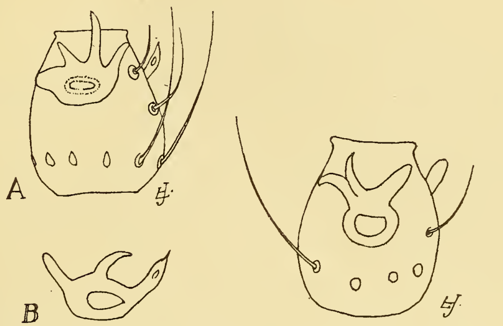

Fig. 41 Fifth antennal segment of female Mycophila fungicola; *b,* tridigitate process; *c,* fifth segment from other antennae, enlarged. (Original)

Micromyia Rond.

1840 **Rondani, Camillo.** Memoira II a per serv. alla Ditterolog. Ital. Parma, 23
1846 ———— Nouv. Ann. Sc. nat. Bologna, ser. 2, p. 369, 373
1864 **Schiner, J. R.** Fauna Austriaca Dipt., p. 411-12
1870 **Winnertz, J.** Vehr. z.-b.-Ges. Wien, 20:27
1876 **Bergenstamm, J. E. & Löw, Paul.** Syn. Cecidomyidarum, p. 18
1892 **Theobald, F. V.** Acct. Brit. Flies, p. 86
1896 **Kieffer, J. J.** Misc. Entomol., 4:24
1897 ———— Syn. Cecid. Eur. & Alg., p. 50
1900 ———— Soc. Ent. Fr. Ann., 69:441
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:34

This genus was erected by Rondani in 1840 for certain small forms presenting the general appearance of Campylomyza and easily distinguished therefrom by the 10 or 11 antennal segments of the male and the 8 of the female, they being sessile in both sexes; the second greatly enlarged, and having a diameter more than twice that of the third. The antennal setae of the male are unusually long, being three to four times as long as the segment. The palpi are quadriarticulate, the first segment rudimentary, the others nearly normal, the third in the female greatly expanded apically. Subcosta joins the anterior margin near the middle, the third vein before the apex and is united to subcosta by a distinct cross vein; the fourth vein is simple, indistinct and joins the posterior margin; the fifth at the distal third, its branch at the basal third. Terminal clasp segment long, stout, rounded apically.

The above is based on previous accounts and a study of specimens identified by Winnertz in the British Museum of Natural History and a good series in the Winnertz collection at the University of Bonn. Type M. l u c o r u m Rond. No American species are known.

Campylomyza Meign.

1818 **Meigen, J. W.** Syst. Beschr., 9:101, 1
1840 **Westwood, J. O.** Introduct. Class. Ins. Syn., p. 126
1846 **Rondani, Camillo.** Nouv. Ann. Sc. Nat. Bologna, S. 2; separate p. 13 (Neurolyga)
1864 **Schiner, J. R.** Fauna Austr. Dipt., 2:411
1870 **Winnertz, J.** Vehr. z.-b. Ges. Wien, 20:9–10
1876 **Bergenstamm, J. E., and Löw, Paul.** Syn. Cecidomyidarum, p. 17
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:133–34
1892 **Theobald, F. V.** Acct. Brit. Flies, 1:51, 86
1896 **Kieffer, J. J.** Misc. Entomol., 4:24
1897 ———— Syn. Cecid. Eur. & Alg., p. 50
1900 ———— Ent. Soc. Fr. Ann., 69:437, 442 (Neurolyga)
1908 **Meunier, F.** Soc. Sci. Brux. Ann., 28:8
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 312, 313
1911 ———— N. Y. Ent. Soc. Jour., 19:34

The unsatisfactory condition of this genus is briefly outlined in the above discussion of the tribe characteristics. We have provisionally given the genus supergeneric rank pending a satisfactory determination and description of the type species and have assigned thereto forms not readily grouped with more recently established genera, one or more of which may prove to be synonyms of Meigen's genus. Type C. f l a v i p e s Meign.

The first American species described is Say's C a m p y l o m y z a s c u t e l l a t a which was very briefly characterized in 1823.[1]

The types are not extant and it would be very difficult to establish the identity of this species though Mr Ainslee[2] records this species swarming on wooden uprights in a timothy and clover meadow.

Campylomyza

a 13 antennal segments
  b Length .75 mm; abdomen brown; fifth antennal segment with a stem one-third the length of the basal enlargement............. v i t i n e a Felt, C. 759

[1] 1823 Say, Thomas. Acad. Nat. Sci. Phila. Jour., 3:17; 1883 Say, Thomas. Compl. Writ., 2:44

[2] 1908 Ainslee, C. N. Ent. Soc. Wash. Proc., 10:16–17

aa 14 antennal segments

b Fifth antennal segment with a stem one-half the length of the basal enlargement

c Length 1 mm; abdomen fuscous yellowish; antennal segments asymmetrical, the middle claw denticulate........................ producta Felt, C. 726

cc Length 1.5 mm; abdomen yellowish brown; antennal segments symmetrical; middle claw not denticulate........................ pomifolia Felt, C. a379

bb Fifth antennal segment with a stem three-quarters the length of the basal enlargement

c Terminal clasp segment short, stout; pulvilli present

d Length .75 mm; abdomen dark brown; terminal clasp segment greatly swollen near the middle, the fourth palpal segment slender, twice as long as the preceding...................... pomiflorae Felt, C. 11, 12, 13, 15

cc Terminal clasp segment long, more or less flattened; pulvilli absent

d Length .75 mm; abdomen dark brown; basal enlargement of fifth antennal segment with a length fully twice its diameter, the fourth palpal segment twice the length of the third, the base of the terminal clasp segment not greatly flattened and dilated..................................cerasi Felt, C. 18

dd Length 1 mm; abdomen dark brown; basal enlargement of fifth antennal segment with a length about one-half greater than its diameter, the fourth palpal segment one-half longer than the third, the terminal clasp segment broad at base and strongly flattened.............................gibbosa Felt, C. 162

bbb Fifth antennal segment with a stem fully as long as the basal enlargement

c Length 1 mm; abdomen pale reddish brown; fifth antennal segment with a stem one-quarter longer than the basal enlargement; terminal clasp segment swollen, with a length five times its diameter........................flavoscuta Felt, C. 117

cc Length 1 mm; abdomen dark reddish brown, terminal clasp segment stout, roundly quadrate apically, palpi quadriarticulate... truncata Felt, C. 1404

ccc Length .4 mm; abdomen dark brown; fifth antennal segment with a stem as long as the basal enlargement; terminal clasp segment stout, elongate, ovoid, palpi quadriarticulate.................... modesta Felt, C. 147

cccc Length 1.25 mm; abdomen dark brown; fifth antennal segment with a length one-quarter greater than the basal enlargement; palpi triarticulate; terminal clasp segment stout, much produced, not dilated.............................texana Felt, C. 1258, 888

aaa 15 antennal segments, the fifth with a stem one-fourth longer than the basal enlargement

b Length 1 mm; abdomen dark brown; mesonotum black............. carpini Felt, C. 107

Campylomyza vitinea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul 110, p. 98; separate, p. 2
1908 ———— N. Y. State Mus. Bul. 124, p. 314

This species was taken about grape, Vitis, or ash, Fraxinus, August 14, 1906, at Albany, N. Y.

Male. Length .75 mm. Antennae shorter than the body, sparsely haired, brown; 13 segments, the fifth with a stem one-third the length of the pyriform basal enlargement, the terminal two segments

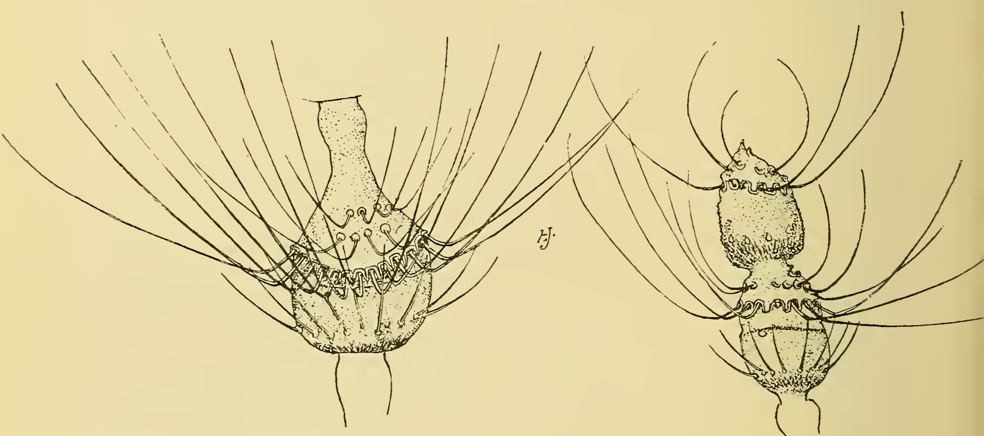

Fig. 42 Fifth and distal two antennal segments of male Campylomyza vitinea, enlarged. (Original)

partly fused. Palpi; the first segment long, swollen distally, the second slender, as long as the first, the third a little shorter. Mesonotum dark brown. Scutellum and abdomen brown, genitalia darker. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal third. Halteres, femora and tibiae pale, tarsi darker; claws medium, curved at nearly right angles, denticulate. Genitalia; basal clasp segment stout, subtruncate; terminal clasp segment stout, short, broadly rounded. Type Cecid. 759.

Campylomyza producta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315

This form was taken on a window at Nassau, N. Y., July 31, 1906.

Male. Length 1 mm. Antennae extending to the fourth abdominal segment, thickly haired, dark brown, 14 segments; the fifth with a stem one-half the length of the subcylindric enlargement, which latter tapers distally; terminal segment narrowly oval. Palpi;

the first segment somewhat elongate, enlarged, narrowly oval, the second more slender, longer, subrectangular, the third lanceolate and slightly shorter than the second, the fourth nearly twice the length of the third, more slender. Mesonotum dark brown, sub-

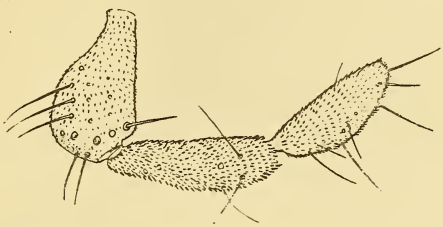

Fig. 43 Palpus of Campylomyza vitinea, enlarged. (Original)

median lines ornamented with short, yellowish setae; scutellum dark brown apically, postscutellum yellowish, dark brown laterally. Abdomen fuscous yellowish, genitalia brown, tipped with dull orange. Wings hyaline, costa dark brown. Halteres semitransparent basally, pale yellowish apically, coxae, femora and tibiae mostly pale semitransparent; femoro-tibio articulations and most of the tarsi pale orange; claws long, stout, the midpair minutely denticulate; pulvilli rudimentary. Genitalia: basal clasp segment short, broad, obliquely truncate; terminal clasp segment long, stout; irregular. Dorsal plate very broad, broadly rounded. Ventral plate broad at base, tapering, broadly rounded. Style long, slender. Type Cecid. 726.

Campylomyza pomifolia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315

A number of the small flies belonging to this species were taken on the under side of apple leaves, Pyrus malus at Nassau, N. Y., May 6, 1902.

Male. Length 1.5 mm. Antennae extending to the middle of the abdomen, sparsely haired, light brown, 14 segments; the fifth with a stem one-half the length of the subcylindric enlargement, which latter has a length nearly twice the diameter and tapers slightly, apically a pair of short stemmed disks; terminal segment somewhat reduced, narrowly ovate. Palpi; the first segment rather stout, subquadrate, the second one-half longer, more slender, the third reduced basally, as long and a little more slender than the second, the fourth one-half longer than the third, all rather thickly clothed with rather coarse setae. Halteres long, the distal portion prolonged. Legs probably a fuscous yellowish; claws long, strongly curved, simple; the pulvilli as long. Genitalia: basal clasp segment stout, obliquely truncate; terminal clasp segment long, stout, strongly constricted basally, broadly rounded. Dorsal plate long, broad, truncate. Ventral plate indistinct. Harpes short, stout, the ventral free portion broadly expanded, with irregular, angular projections anteriorly and posteriorly. Near the harpes are a pair of short, stout, strongly curved processes. Style short, narrowly rounded. Type Cecid. a379.

Campylomyza pomiflorae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3
1908 ———— N. Y. State Mus. Bul. 124, p. 315
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44

This species appears to be a very common, early spring form, since it was taken in numbers May 14, 1906, flying about the flowers of shadbush, Amelanchier canadensis, and also about the flowers of wild cherry, Prunus pennsylvanica, at Karner, N. Y.

Male. Length .75 mm. Antennae nearly as long as the body, thickly clothed with long hairs, dark brown; 14 segments, the fifth with a stem two-thirds the length of the subcylindric basal enlargement, apically a pair of oval, stemmed disks; terminal segment obconical, sometimes fused with the preceding, the apex scarcely produced. Palpi; the first segment rather long, broadly swollen distally and with a sensory organ on the internal distal surface, second more slender, as long as the first, the third a little longer than the second, slightly stouter, the fourth one-half longer than the third. Thorax and abdomen dark brown or black. Wings hyaline, iridescent, reddish at the insertion, anterior veins brown, subcosta uniting with the margin at the basal half; halteres whitish transparent. Legs brownish yellow, tarsi light yellow, tip of posterior tibiae, anterior tarsi and the terminal segments of the middle and posterior tarsi variably tinged with reddish; claws slender, simple. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment slender at base, broadly expanded distally, thickly setose apically. Dorsal plate broad, short, broadly rounded, ventral plate inconspicuous. Harpes with a convolute basal portion, a distal acute spine pointing in a latero-posterior direction and a submedian, recurved, fusiform, chitinous process extending anteriorly; style long, slender, irregularly curved. Type Cecid. 11.

Campylomyza cerasi Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 4
1908 ———— N. Y. State Mus. Bul. 124, p. 316

This species was taken May 15, 1906 in the vicinity of wild cherry, Prunus pennsylvanica, wild raspberry, Rubus sp., and various bushes at Nassau, N. Y.

Male. Length .75 mm. Antennae as long as the body, sparsely haired, dark brown, annulate with lighter; 14 segments, the fifth with a stem three-fourths the length of the irregular, subcylindric enlargement; terminal segment slender, subconical. Palpi; the first segment short, stout, broadly rounded, second more slender, one-half longer, the third subequal, the fourth one-half longer than the third. Head, thorax and abdomen dark brown. Wings subhyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs light brown with indistinct reddish markings at the articulations between the coxae and femora, the latter and tibiae, on the apex of the tibiae and with more or less suffused reddish tints on the tarsi; claws stout, slightly swollen near the middle, strongly curved, simple. Genitalia; basal clasp segment short, stout, ventral margin apparently produced as a recurved setose lobe; terminal clasp segment stout, curved. The dorsal plate apparently very broad, broadly and roundly excavated, the lobes widely separated, convolute laterally, irregularly and broadly rounded. Type Cecid. 18.

Campylomyza gibbosa Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 3
1908 ———— N. Y. State Mus. Bul. 124, p. 316

This species was taken June 7, 1906 on spruce, Picea canadensis, at Lake Clear, N. Y.

Male. Length 1 mm. Antennae longer than the body, dark brown, sparsely haired; probably 14 segments. Palpi; the first segment very much enlarged, broadly rounded, the second one-fourth longer than the first and slender, the third stouter, about two-thirds the length of the second and the fourth slender and a little longer than the second. Head, thorax and abdomen dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs pale straw, irregularly tinged with carmine, especially near the articulations; claws medium, strongly curved, pectinate. Genitalia; basal clasp segment very short, stout, truncate; terminal clasp segment longer than the basal clasp segment, greatly swollen basally, broadly rounded. Dorsal plate very broad, deeply emarginate, the lobes broadly rounded; ventral plate narrow, tapering, broadly rounded, sparsely haired. Harpes short, stout, irregularly convolute, with marginal conical projections; style short, stout, curved, narrowly rounded. Type Cecid. 162.

Campylomyza flavoscuta Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 97; separate, p. 1
1908 ———— N. Y. State Mus. Bul. 124, p. 313

This species was taken in general collecting at Albany, N. Y., June 4, 1906.

Male. Length 1 mm. Antennae about as long as the body, sparsely haired light brown, probably 14 segments, the fifth with a stem one-fourth longer than the enlargement, which latter has a length twice its diameter. Palpi missing. Mesonotum yellowish brown. Scutellum reddish brown, postscutellum yellowish. Abdomen pale reddish brown. Wings hyaline, costa brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs a nearly uniform pale fuscous yellow, first tarsal segment as long as the three following; claws slender, strongly curved, simple. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment small, swollen basally and tapering gradually to an obtuse point. Dorsal plate apparently very broad; ventral plate indistinct. Harpes apparently smooth, flattened, broadly rounded distally, the free ends approximate. Type Cecid. 117.

Campylomyza truncata Felt

1912 **Felt, E P.** N. Y. Ent. Soc. Jour., 20:102

Allied to the preceding and collected April 19, 1910 by Dr W. G. Dietz, Hazelton, Pa.

Campylomyza modesta Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3
1908 ———— N. Y. State Mus. Bul. 124, p. 316

This species was taken June 7, 1906 on balsam, A b i e s b a l s a m e a, at Lake Clear, N. Y.

Male. Length .4 mm. Antennae probably twice as long as the body, sparsely haired, light brown; probably 14 segments, the fifth with a stem about one-fourth longer than the subglobular basal enlargement. Palpi probably quadriarticulate. Mesonotum dark brown. Scutellum, postscutellum and abdomen nearly concolorous. Wings subhyaline, costa dark brown, subcosta uniting with the margin at the basal half, base of wing reddish; halteres fuscous basally, yellowish fuscous apically. Legs a nearly uniform yellowish straw, tarsi tinged with carmine; claws slender, strongly curved, simple; pulvilli a little shorter than the claws. Genitalia; basal clasp segment stout, broadly rounded, truncate; terminal clasp segment stout, nearly oval. Dorsal and ventral plates indistinct; style short, stout. Type Cecid. 147.

Campylomyza texana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316

This species was taken at Plano, Texas, in November 1907 by Mr E. S. Tucker and apparently the same form was captured October 22d by Prof. T. D. A. Cockerell at Boulder, Col.

Male. Length 1.25 mm. Antennae longer than the body, sparsely haired, dark brown; 14 segments, the fifth with a stem one-fourth longer than the subcylindric enlargement; terminal segment reduced, tapering to an acute apex. Palpi; the first segment short, stout, narrowly oval, with a large, irregularly oval sensory pit near the basal internal angle, second segment a little longer, more slender, the third longer and more slender than the second. The entire body a nearly uniform very dark brown. Wings hyaline, costa light brown, subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, light fuscous apically. Legs a light yellowish brown, the distal tarsal segments somewhat darker; claws long, slender, strongly curved, slightly denticulate, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment thickly haired, long, stout, slightly expanded and broadly rounded; dorsal plate short, stout, triangularly emarginate, lobes somewhat separated and broadly rounded, other organs apparently fused into an irregularly subquadrate process having conspicuous prolongations distally at the median and lateral angles. Type Cecid. 1258.

Campylomyza carpini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 4
1908 ———— N. Y. State Mus. Bul. 124, p. 314

This species was taken on ironwood, Carpinus caroliniana, at Albany, N. Y., June 1, 1906.

Male. Length 1 mm. Antennae as long as the body, thickly haired, dark brown; 15 segments, the fifth with a stem one-fourth longer than the pyriform enlargement; the terminal two segments much reduced, narrowly fused, the fifteenth ovoid. Palpi; the first segment suborbicular, broad, the second twice the length of the first, elliptical oval, the third more slender, a little longer. Mesonotum black with submedian lines of fine hairs. Scutellum dark brown with sparse apical setae. Abdomen dark brown. Wings hyaline, costa and subcosta reddish brown, the latter uniting with the anterior margin at the basal half; halteres yellowish transparent. Legs pale grayish, tarsi variably tinged with reddish; claws stout, strongly curved, simple. Genitalia; basal clasp segment long, relatively slender, obliquely truncate; terminal clasp segment stout, short, with a long, apical tooth. Dorsal and ventral plates not easily distinguished. There appear to be a pair of suboval appendages within, much resembling the terminal clasp segment, though these structures may be a convolute portion of the very broad dorsal plate; if so, the ventral plate is a narrow, subtriangular process narrowly rounded distally; style slender, projecting anteriorly. Type Cecid. 107.

Prionellus Kieff.

Prionota Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., p. 176
1895 ———— Soc. Ent. Fr. Bul., p. 318, 319
1896 ———— Mis. Ent., 4:7, 15
1897 ———— Syn. Cecid. Eur. & Alg., p. 49
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 3; pl. 22, fig. 10
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:34

This genus was originally defined by Kieffer as recognizable by the subconical, subsessile antennal segments of the female and with the tip of costa nearer the second than the third vein. The palpi are quadriarticulate, the claws denticulate and the pulvilli well developed. Later, Kieffer states that the claws are arched and not or hardly dilated, while the antennal segments of the male are eccentric, with a stem about three-fourths the length of the basal enlargement and with crenulate whorls as well as whorls of hairs, the third vein extending to the apex of the wing. The basal clasp segment is stout, lobed internally, while the terminal clasp segment is stout

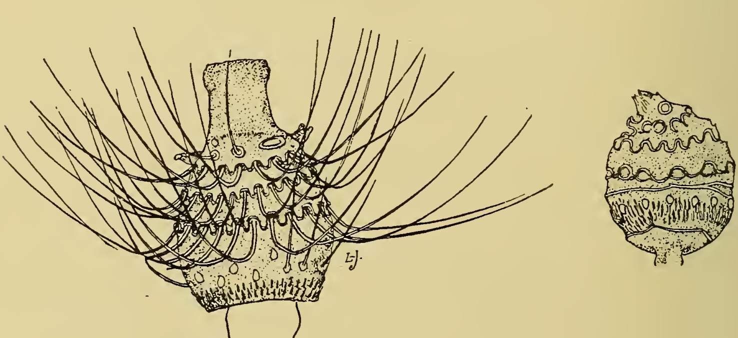

Fig. 44 Fifth and terminal antennal segments of Prionellus graminea, enlarged. (Original)

at the base, greatly expanded distally, swollen and broadly rounded apically. The female antennae are subconic or subovoid, with a very short stem and bearing subapically a broad, chitinous collar. The thickened anterior border of the wing extends almost to the fourth vein. Type Prionota pini Kieff. A number of American species have been provisionally referred to this genus.

Key to species

a 12 antennal segments, subsessile; females
  b Chitinous collar incised
    c Length 1 mm; abdomen dark yellow; fifth antennal segment with a length one-quarter greater than its diameter, the fourth palpal segment one-half longer than the third. . d e f e c t i v a Felt, C. 715
  bb Chitinous collar intact, not incised
    c Wings long, narrow
      d Length 1 mm; abdomen brownish yellow; fifth antennal segment with a length twice its diameter, the fourth palpal segment twice as long as the third..............s i l v a n a Felt, C. 883
      dd Length 1 mm; abdomen dark brown; fifth antennal segment with a length one-half greater than its diameter, the fourth palpal segment one-half longer than the third......................
m o n i l i s n. sp., C. 1296
    cc Wings medium or small
      d Length 1 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-third greater than its diameter, the fourth palpal segment one-half longer than the third..........
s i m u l a t o r Felt, C. 885
aa 13 antennal segments, sessile; females
  b Chitinous collar rudimentary; fifth antennal segment with a length one-quarter greater than its diameter
    c Length 1.5 mm; abdomen dark brown; fourth palpal segment one-quarter longer than the third......l o n g i p e n n i s Felt, C. 733w
  bb Chitinous collar well developed; fifth antennal segment with a length one-half greater than its diameter
    c Wings long, slender
      d Fifth tarsal segment of the posterior leg with a length one and one-half to twice its diameter
        e Length 1 mm; abdomen dark brown; fourth palpal segment one-half longer than the third; terminal lobe of the ovipositor broadly oval..........................t s u g a e Felt, C. 166
      dd Fifth tarsal segment of the posterior leg with a length 2 to 3 times its diameter
        e Length 1.5 mm; abdomen dark brown; fourth palpal segment one-half longer than the third, dilated; terminal lobe of the ovipositor orbicular ....
b o u l d e r e n s i s Felt, C. 886, c928, ? C. 1378
        ee Length 2 mm; abdomen fuscous yellowish; fourth palpal segment one-half longer than the third, slender; terminal lobe of the ovipositor broadly oval. ....d i l a t a t a Felt, C. 1109
    cc Wings broad
      d Length 2.5 mm; abdomen dark reddish brown; fourth palpal segment twice as long as the third.............................
l a t i p e n n i s Felt, C. a1457
aaa 14 antennal segments, stemmed; males
  b Fifth antennal segment with a stem one-third the length of the basal enlargement

c Langth 1.5 mm; abdomen dark brown; subcosta uniting with costa at the distal third; fourth palpal segment one-quarter longer than the third............................gramine a Felt, C. 5

cc Length .75 mm; abdomen dark brown; subcosta uniting with costa at the basal third; fourth palpal segment with a length twice the third.........................leguminicola Felt, C. 121

bb Fifth antennal segment with a stem three-quarters the length of the basal enlargement

c Length .75 mm; abdomen dark brown; wings narrow, the fourth palpal segment with a length twice the third.................... hesperia Felt, C. 714

cc Length 1 mm; abdomen black; wings broad; fourth palpal segment with a length twice that of the third...................... latipennis Felt, C. a1457

bbb Fifth antennal segment with a stem as long as the basal enlargement

c Length 1.5 mm; abdomen fuscous yellowish; fourth palpal segment with a length one-half greater than the third; basal clasp segment with an internal lobe.............dilatata Felt, C. 1109

cc Length 1.25 mm; abdomen fuscous; fourth palpal segment with a length one-half greater than the third; basal clasp segment without a lobe........................montana n. sp., C. a1951

Prionellus defectiva Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on hemlock, Tsuga canadensis, at Newport, N. Y., July 27, 1906.

Female. Length 1 mm. Antennae extending to the fourth abdominal segment, thickly haired, dark brown, 12 segments; fifth subglobose, terminal segment slightly prolonged, narrowly rounded distally. Palpi; the first segment somewhat enlarged, subglobose, the second short, stout, subquadrate, the third a little longer, the fourth one-half longer than the third. Mesonotum dark brown, submedian lines sparsely haired, indistinct. Scutellum dark brown, postscutellum and abdomen dark fuscous yellowish, distal segments dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin near the middle. Halteres yellowish transparent; legs mostly fuscous yellowish, the tarsal articulations variably tinged with deep carmine; distal tarsal segments brown; metatarsus more than twice the length of the following segment; claws stout, strongly curved, denticulate; pulvilli as long as the claws. Ovipositor short, the terminal lobes triarticulate, the distal segment broadly oval. Type Cecid. 715.

Prionellus silvana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken August 11, 1903 by Mr R. P. Currie at an altitude of 8000 feet on the Kokanee mountain, B. C.

Female. Length 1 mm. Antennae scarcely extending to the base of the abdomen, sparsely haired, reddish brown; 12 segments, the fifth obpyriform, with a length one-half greater than its diameter; terminal segment produced, slightly constricted near the distal third at the chitinous collar. Palpi; the first segment short, stout, irregularly ovoid, the second stout, with a length about one-half greater than its diameter, the third about one-half longer than the second, more slender, the fourth about twice as long as the third, greatly dilated. Mesonotum rather dark reddish brown. Scutellum and postscutellum lighter. Abdomen brownish yellow. Wings long, narrow, hyaline, costa a light brown, subcosta uniting with the anterior margin near the basal half. Legs a variable light yellowish; claws long, slender, strongly curved, with 4 or 5 long denticulations; pulvilli as long as the claws. Ovipositor short, the terminal lobes triarticulate, the third segment broadly oval. Type Cecid. 883.

Prionellus monilis n. sp.

This species was reared in November 1907 by Mr E. S. Tucker from a cage sown with oats.

Female. Length 1 mm. Antennae extending to the third abdominal segment, thickly haired, dark brown; 12 segments, the fifth with a length one-third greater than its diameter; terminal segment greatly produced, constricted and evidently composed of two closely fused. Palpi; first segment stout, broadly oval, the second narrowly oval, the third a little longer, more slender, the fourth one-half longer than the third. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum and postscutellum brown. Abdomen dark brown, the basal segments yellowish brown. Wings hyaline, costa light brown, subcosta joining the margin at the basal half, the third vein near the apex. Halteres yellowish transparent. Legs a variable fuscous yellowish, the distal tarsal segments brownish; claws strongly curved, denticulate, the pulvilli longer than the claws. Ovipositor short, the lobes triarticulate, the third segment broadly oval, all sparsely haired. Type Cecid. 1296.

Prionellus simulator Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken June 26, presumably 1903, by Mr R. P. Currie at Kaslo, B. C.

Female. Length 1 mm. Antennae hardly extending to the base of the abdomen, thickly haired, yellowish brown; 12 segments, the fifth subsessile, subcylindric, with a length about one-third greater than its diameter; terminal segment somewhat produced and tapering to a rounded apex. Palpi; the first segment greatly expanded distally, pyriform, the second a little longer, slender, narrowly rounded apically, the third a little longer and more slender than the second, the fourth one-half longer than the third, somewhat dilated. Mesonotum dark brown. Scutellum, postscutellum and abdomen fuscous yellowish, the latter dark brown distally. Wings hyaline, costa dark brown, subcosta uniting with the anterior margin near the basal half. Legs a fuscous yellowish; claws long, rather slender, strongly curved, finely denticulate, pulvilli longer than the claws. Ovipositor short, triarticulate; the third segment broadly oval. Type Cecid. 885.

Prionellus longipennis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on an office window August 2, 1906 at Albany, N. Y.

Female. Length 1.5 mm. Antennae extending to the base of the abdomen, thickly haired, brown, 13 segments; the fifth subsessile, pyriform; terminal segment somewhat reduced, nearly pyriform. Palpi; the first segment enlarged, subglobose, the second smaller, nearly oval, the third one-half shorter, broadly oval, the fourth a little longer, slender, elliptical. Mesonotum dark brown, submedian lines indistinct. Scutellum dark reddish brown, postscutellum light reddish brown. Abdomen dark brown, the distal segments darker, and with the incisures and pleurae pale orange, the sclerites not sharply defined. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal third. Halteres yellowish basally, fuscous apically, the legs a nearly uniform light brown, shaded with fuscous distally, tarsal segments dark brown; claws stout, curved, denticulate; pulvilli wanting. Ovipositor short, the lobes biarticulate, basal segment irregular, subquadrate, the distal one narrowly oval. Type Cecid. 733.

Prionellus tsugae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 5 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken June 7, 1906 on hemlock, T s u g a c a n a d e n s i s , at Lake Clear, N. Y.

Female. Length 1 mm. Antennae extending to the base of the abdomen, thickly haired, dark brown; 13 segments; fifth subcylindric, with a length one-half greater than its diameter, terminal segment subcylindric, tapering roundly to a slightly produced apex; Palpi; the first segment, pyriform, greatly enlarged distally, the second and third subequal, suboval, the fourth one-half longer than the third. Mesonotum dark brown, submedian lines with pale hairs. Scutellum yellowish brown. Abdomen dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal half; halteres probably whitish transparent. Legs a nearly uniform dark straw, terminal segments slightly darker; claws stout, strongly curved, serrate. Ovipositor short, the basal segment subquadrate, the second broadly oval. Type Cecid. 166.

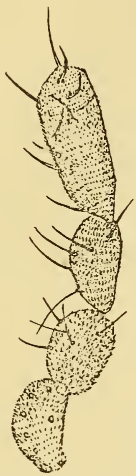

Fig. 45 Palpus of Prionellus tsugae, enlarged. (Original)

Fig. 46 Distal tarsal segments of Prinellus tsugae, enlarged. (Original)

Prionellus boulderensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken by Prof. T. D. A. Cockerell at Boulder, Col., October 15th. Apparently the same species was taken for the United States National Museum at Corvallis, Ore., May 18, 1896.

Female. Length 1.5 mm. Antennae extending to the second abdominal segment, thickly haired, reddish brown; 13 segments, the fifth with a length one-half greater than its diameter, the distal fourth, tapering; terminal segment somewhat reduced, tapering to a short, stout, rounded knob. Palpi; the first segment short, stout, broadly oval, with a conspicuous sensory organ on its internal face, the second about as long as the first, rather stout, rounded distally, the third a little longer and more slender than the second, the fourth about one-half longer than the third, somewhat dilated; body a nearly uniform dark brown. Wings hyaline, costa light brown; subcosta uniting with the margin just beyond the basal half. Legs dark fuscous yellowish, the tarsal segments somewhat lighter; claws long, strongly curved, denticulate, the pulvilli as long as the claws. Ovipositor short, triarticulate, the third segment broadly oval. Type Cecid. 886.

Prionellus dilatata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 149 (Campylomyza)
1908 ——— N. Y. State Mus. Bul. 124, p. 316 (Campylomyza)
1909 ——— Ent. Soc. Ont. 39th Rep't, p. 44 (Campylomyza)

This species was reared by the late Dr M. T. Thompson of Clark University, Worcester, Mass., from a vial containing decaying vegetable matter and seeds.

Male. Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, fuscous yellowish; 14 segments, the fifth with a stem as long as the subglobose basal enlargement; terminal segment reduced, pyriform. Palpi; the first segment short, stout, irregularly oval, the second a little longer, more slender, the third slightly longer than the preceding and the fourth one-half longer than the third, strongly flattened; face fuscous yellowish. Mesonotum dark

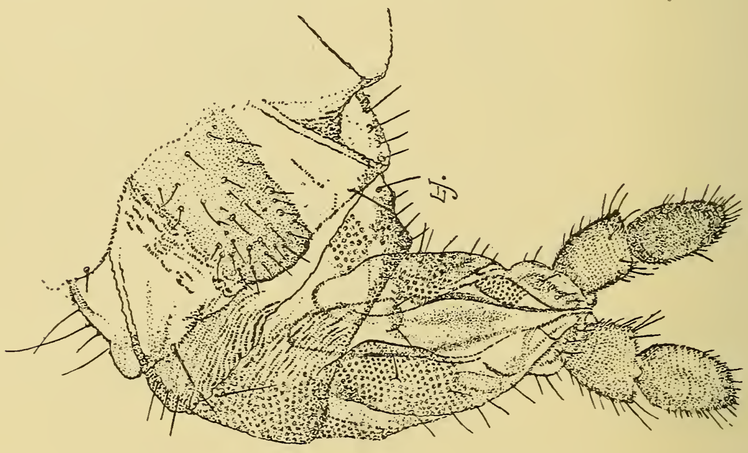

Fig. 47 Distal abdominal segments and ovipositor of Prionellus tsugae, enlarged. (Original)

brown. Scutellum yellowish, postscutellum fuscous yellowish. Abdomen a variable fuscous yellowish. Wings hyaline, costa light brown, subcosta uniting with the anterior margin near the middle. Halteres pale yellowish. Legs a nearly uniform light fuscous yellowish; claws long, strongly curved, denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment broad, truncate and with a long, roundly triangular lobe at the internal distal angle; terminal clasp segment short, stout, greatly dilated, subtriangular; dorsal plate narrow, tapering, narrowly rounded. Harpes stout, the distal margin bearing a pair of long, stout, recurved, teeth.

Female. Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, light fuscous yellowish; 13 segments, the fifth subsessile, subcylindric; with a length one-half greater than its diameter, the distal two segments closely fused, obtusely rounded apically. Palpi; the first segment short, stout, irregularly oval, the second a little longer, much more slender, the third longer and slightly stouter than the second, the fourth one-half longer and more slender than the third; face light fuscous yellowish. Mesonotum a fuscous yellowish. Scutellum a little lighter, postscutellum fuscous yellowish. Abdomen a light fuscous yellowish. Wings hyaline, costa pale straw, subcosta uniting with the margin near the basal half. Halteres yellowish transparent. Legs pale yellowish, the distal tarsal segments darker; claws long, strongly curved, denticulate, the pulvilli as long as the claws. Ovipositor short, triarticulate, the third segment broadly oval. Type Cecid. 1109.

Prionellus latipennis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

The male and female of this species were taken on a small pine, probably Pinus rigida, at Karner, N. Y., April 27, 1907. They were observed pairing, consequently there can hardly be any question as to their belonging to the same species.

Male. Length 1 mm. Antennae nearly as long as the body, thickly haired, dark brown; 14 segments, the fifth with a stem two-thirds the length of the subcylindric basal enlargement; terminal segment narrowly oval, subacute distally. Palpi; the first segment broadly oval, with a rather conspicuous sense organ internally, the second a little longer, narrow, subquadrate, the third a little shorter, more slender than the second, the fourth about twice the length of the preceding, more slender; face fuscous, eyes large, black. Mesonotum shining black, sparsely and irregularly clothed with short, yellowish hairs. Scutellum a dark reddish brown, postscutellum and abdomen nearly shining black, sparsely clothed with fine, yellowish hairs. Wings hyaline, costa reddish brown, subcosta uniting with the margin at the middle. Halteres nearly uniform fuscous yellowish. Legs fuscous yellowish, the incisures variably tinged with deep red, the distal tarsal segment reddish brown; claws long, strongly curved, denticulate, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout, tapering; terminal clasp segment rather long, almost pediceled, broadly rounded and with an enlargement near the distal third; dorsal plate broad, tapering, broadly rounded. Harpes short, stout, approximate, with an acute, chitinous spine posteriorly and a semicircular, dark, chitinous thickening dorsally.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, thickly haired, dark reddish brown; 13 segments, the fifth subsessile; terminal segment prolonged, subcylindric, tapering to an obtuse apex. Palpi; the first segment stout, broadly rectangular with a conspicuous sense organ internally, second a little longer, more slender, the third as long as the second, more slender, the fourth fully twice the length of the preceding, slightly enlarged at the distal third; face fuscous. Mesonotum black, sparsely and irregularly clothed with short, yellowish hairs. Scutellum reddish brown, postscutellum very dark brown. Abdomen sparsely clothed with fine, yellowish hairs, dark reddish brown, the incisures pale fuscous yellowish. Wings hyaline, costa light brown, subcosta uniting with the margin near the middle. Halteres pale orange basally, pale yellowish distally. Legs a nearly uniform dark brown; claws long, slender, strongly curved, denticulate, the pulvilli longer than the claws. Ovipositor short, triarticulate, the third segment suborbicular. Type Cecid. a1457.

Prionellus graminea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98; separate, p. 2 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This dark brown male was swept from grass etc. at Karner, N. Y., April 27, 1906.

Male. Length 1.5 mm. Antennae two-thirds the length of the body, sparsely haired, dark brown; 14 segments, fifth with a stem one-fourth the length of the subglobular enlargement; terminal segment subglobular, acute apically. Palpi; the first segment, sub-

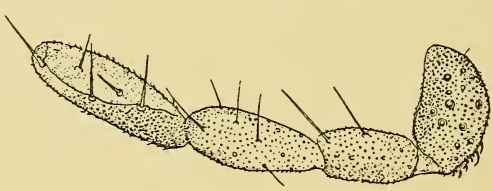

Fig. 48 Palpus of Prionellus graminea, enlarged. (Original)

quadrate, slightly enlarged distally, second and third subequal, the latter a trifle longer, the fourth one-half longer than the third. Head and thorax black or dark brown. Abdomen dark brown, pleurae and incisures yellowish brown. Wings hyaline, slightly fuscous, tinted with reddish basally, costa dark brown, subcosta uniting with the margin at the distal third; halteres semitransparent. Legs yellowish transparent or reddish; claws stout, strongly curved, pectinate. Genitalia; basal clasp segment short, stout, truncate; terminal clasp segment short, stout, broadly rounded. Dorsal and ventral plates indistinct. Harpes very broad, slightly expanded, deeply emarginate and with the internal angles produced. Style short, broad, tapering, narrowly rounded. Type Cecid. 5.

Prionellus leguminicola Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98; separate, p. 2 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was swept from red clover, Trifolium pratense, at Albany, N. Y., June 4, 1906.

Male. Length .75 mm. Antennae extending to the second abdominal segment, sparsely haired, reddish brown; 14 segments, the the fifth with a stem one-third the length of the subcylindric basal enlargement; terminal segment obtusely rounded apically. Palpi; the first segment large, subquadrate, slightly swollen distally, the second shorter, subglobular, the third a little longer, suboval, the fourth twice the length of the preceding, subrectangular; face dark brown. Mesonotum dark brown. Scutellum and postscutellum reddish brown. Abdomen dark brown or black. Wings hyaline, costa pale straw basally, dark brown apically, subcosta uniting with the margin at the basal third; halteres whitish transparent. Femora and tibiae brownish straw color, lighter ventrally, tarsi a pale straw color, terminal segment darker; claws stout, strongly curved, those on the second and third pairs of legs denticulate. Genitalia; basal clasp segment short, stout, truncate; terminal clasp segment short, greatly swollen at the distal third. Dorsal plate broad, broadly rounded. Harpes strongly chitinized, broad, tapering to a heavy, chitinized, apex with an acute prolongation laterally, one posteriorly on the median line and another internally and posteriorly; style slender, broadly rounded. Type Cecid. 121.

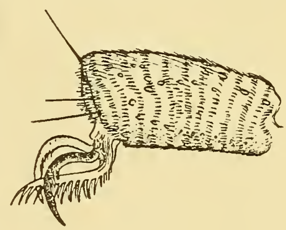

Fig. 49 Distal tarsal segment of Prionellus leguminicola, enlarged. (Original)

Prionellus hesperia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This form was taken on hemlock, Tsuga canadensis, at Newport, N. Y., July 27, 1906.

Male. Length .75 mm. Antennae nearly as long as the body, sparsely haired, dark brown, 14 segments; the fifth with a stem three-fourths the length of the pyriform basal enlargement, rather stout, bladelike chitinous processes arise from apical oval pits; terminal segment slightly reduced, the distal portion long, slender, fusiform. Palpi; the first segment slightly enlarged, subglobose, the second longer, irregularly rectangular, the third one-half longer than the second, broader, the fourth nearly twice as long as the third and broader. Head, thorax and abdomen a nearly uniform dark brown or black. Mesonotum shining. Wings hyaline, costa dark brown, subcosta uniting with the margin just before the basal half. Halteres pale yellowish; legs mostly pale yellowish transparent, the tarsal articulations variably tinged with carmine; the distal segments darker; metatarsus of the fore and middle legs scarcely twice the length of the following segment; claws rather slender, strongly curved, denticulate; the pulvilli as long as the claws. Genitalia: basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, stout, constricted at the base, narrowly rounded. Dorsal plate broad, broadly rounded. (Plate 12, figure 3.) Type Cecid. 714.

Prionellus montana n. sp.

This small form was taken by Prof. T. D. A. Cockerell at Boulder, Col., April 25, 1909.

Male. Length 1.25 mm. Antennae a little longer than the body, thickly haired, fuscous; 14 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length one-half greater than its diameter; terminal segment somewhat reduced, narrowly rounded. Palpi; first segment stout, subquadrate, the second a little longer, more slender, the third longer than the second, more slender, the fourth one-half longer than the third, slender. Thorax and abdomen a nearly uniform fuscous, the latter sparsely haired. Wings hyaline, costa fuscous, subcosta uniting therewith beyond the basal half, the third vein at or a little beyond the apex. Halteres yellowish. Legs a fuscous yellowish, the fourth and fifth tarsal segments a variable brown; claws long, stout, very strongly curved, minutely denticulate, the pulvilli longer than the claws. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment greatly dilated, subtriangular, the apex slightly recurved; dorsal plate broad, broadly rounded apically, ventral plate apparently slightly bilobed. Harpes conspicuous, dilated, heavily chitinized. Type Cecid. a1951.

Aprionus Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., 176
1895 ———— Soc. Ent. Fr. Bul., p. 318, 319
1896 ———— Mis. Ent., 4:7, 17
1897 ———— Syn. Cecid. Eur. & Alg., p. 49
1900 ———— Soc. Ent. Fr. Ann. v. 69, pl. 17, fig. 1, 2; pl. 23, fig. 15; pl. 24, fig. 5, 7, 12
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour. 19:34

This genus, as originally defined, has the antennal segments subconical, subsessile in the female, the thickened portion of costa approaching nearer the fourth than the third vein. Palpi quadriarticulate, claws simple, the pulvilli wanting. Later it was stated that the claws were arched and not or hardly dilated, while the palpi were tri- to quadriarticulate. The eccentric antennal segments are ornamented with hyaline lamellae in addition to crenulate whorls, while the third vein joins costa at the apex. The rudimentary pulvilli do not extend beyond the middle of the claws. The lobes of the ovipositor are triarticulate. Kieffer states that this genus differs from Prionellus by the simple character of the claws and the short or rudimentary pulvilli.

The nymph of A. miki Kieff., as illustrated by the author, is extremely interesting. There are the usual pair of slender, cephalic appendages, the smooth dorsum of the thorax is ornamented with two lines of stout setae arising from small tubercles, while the dorsum of the abdominal segments appears to be regularly marked with transverse rows of short, stout, chitinous points, the posterior margin being ornamented with a sparse row of short, stout, chitinous setae and the posterior angles of segments 2 to 8 bearing long, filiform appendages, each having a length about twice that of the segment. The terminal segment is produced as a pair of stout, subconic appendages, the lateral and internal angles of each bearing a short, stout spine. Type Apriona bidentata Kieff. No American species have been recognized.

Monardia Kieff.

1894 **Kieffer, J. J.** Mis. Ent., 4:7, 22
1895 ———— Soc. Ent. Fr. Bul., p. 318, 319
1897 ———— Syn. Cecid. Eur. & Alg., p. 50
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 4, 9; pl. 18, fig. 3; pl. 23, fig. 6; pl. 24, fig. 6
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

The North American members of this group are most easily recognized by the subapical whorls of mushroomlike appendages, termed stemmed disks, on the antennal segments. Kieffer states that members of this genus may be distinguished by the minute subapical tooth of the claws, a character which in our experience appears to be so insignificant or evanescent as to prove of comparatively slight service. The type of this genus is M. stirpium Kieff.

The members of this group present considerable variations in the number of antennal segments, especially in the female, they ranging from 11 in M. gilletti Felt to 22 in M. articulosa Felt. The known males have 14 or 16 stemmed antennal segments. The palpi may be either tri- or quadriarticulate. The wings present the typical venation of Campylomyza. The pulvilli may be as long as the claws or rudimentary. Near the posterior extremity of the abdomen the females have a pair of submedian, ventral, globular or trumpet-shaped glands. The ovipositor is short and indistinctly tri- or quadriarticulate. The male genitalia are stout with a short, swollen terminal clasp segment. The one reared American species, M. lignivora Felt, was obtained from the fungous affected heartwood of a pine, the larvae undoubtedly using the rather stout breast bone to erode irregular cavities in the affected wood.

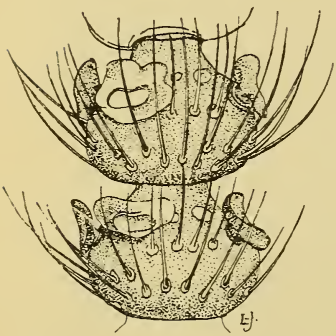

Fig. 50 Fifth and sixth antennal segments of female Monardia lignivora, enlarged. (Original)

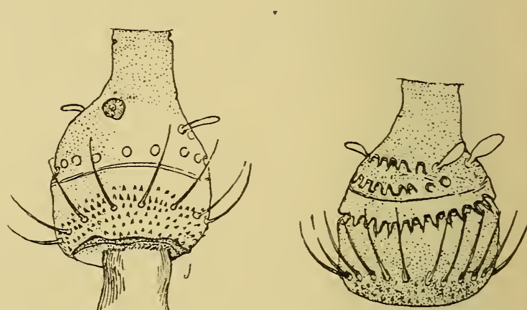

Fig. 51 Fifth antennal segment, views from opposite sides, of Monardia lignivora, male, enlarged. (Original)

Key to species

a 11 antennal segments, subsessile; females
- *b* Length 1.2 mm; abdomen fuscous yellowish; fifth antennal segment with a length equal to its diameter, the third palpal segment one-third longer than the second.......gilletti Felt, C. 1239a

aa 12 antennal segments, subsessile; females
- *b* Length 2 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-quarter greater than its diameter, the third palpal segment one-quarter longer than the second.............. toxicodendron Felt, C. 122
- *bb* Length .75 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-quarter greater than its diameter; fourth palpal segment with a length one-half greater than the third..... alexanderi n. sp., C. 1370

aaa 14 antennal segments
- *b* Antennal segments subsessile
  - *c* Length 2 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-half greater than its diameter, the fourth palpal segment as long as the third.................. pinicorticis Felt, C. 799
- *bb* Fifth antennal segment with a stem one-third the length of the basal enlargement; males; subcosta uniting with costa at the basal third
  - *c* Length 1.5 mm; abdomen reddish brown; terminal clasp segment plainly pyriform...........karnerensis Felt, C. 29

cc Length 1 mm; abdomen dark brown; terminal clasp segment only slightly enlarged apically..........populi Felt, C. 115

bbb Fifth antennal segment with a stem one-half the length of the basal enlargement; subcosta uniting with costa at the basal half

c Length .75 mm; abdomen dark brown; fourth palpal segment twice the length of the third....balsamicola Felt, C. 145

bbbb Fifth antennal segment with a stem three-quarters the length of the basal enlargement; male; subcosta uniting with costa just beyond the basal half

c Length 1.5 mm; abdomen reddish brown; fourth palpal segment with a length one-half greater than the third.................. barlowi Felt, C. 798

bbbbb Fifth antennal segment with a stem as long as the basal enlargement

c Length 1.25 mm; abdomen dark brown; fourth palpal segment with a length one-half greater than the third.................. tuckeri Felt, C. 1259

aaaa 16 antennal segments

b Length 1.3 mm; abdomen dark reddish; fifth antennal segment with a stem one-third the length of the basal enlargement, the third palpal segment only a little longer than the second; male.. lignivora Felt, C. a1614

aaaaa 21 antennal segments, subsessile; female

b Length 2.5 mm; abdomen dark red; fifth antennal segment with a length one-half greater than its diameter, the fourth palpal segment a little longer than the third......................... lignivora Felt, C. a1614

aaaaaa 22 antennal segments, subsessile; female

b Length 2.5 mm; abdomen light brown; fifth antennal segment with a length three-quarters its diameter; fourth palpal segment with a length one-half greater than the third...................... articulosa Felt, C. 884

Monardia gilletti Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on a window at Albany, N. Y., September 11, 1907.

Female. Length 1.2 mm. Antennae extending to the base of the abdomen, thickly haired, light brown; 11 segments, the fifth pyriform, with a length less than its diameter; terminal segment produced, broadly rounded. Palpi; the first segment short, stout, roundly subquadrate, the second a little longer and more slender, the third one-third longer than the second, more slender. Mesonotum dark brown. Thorax dark brown. Abdomen fuscous yellowish. Wings hyaline, costa yellowish brown, subcosta uniting with the anterior margin near the basal third. Halteres fuscous yellowish. Coxae and legs a variable fuscous yellowish; claws long, slender, strongly curved, simple, the pulvilli about as long as the claws. The venter of the seventh segment with submedian, subglobose organs, the ovipositor short, triarticulate; terminal segment narrowly oval. Type Cecid. 1239a.

Monardia toxicodendron Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98; separate, p. 1–2 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on poison ivy, Rhus toxicodendron, at Albany, N. Y., June 4, 1906.

Female. Length 2 mm. Antennae hardly extending to the base of the abdomen, thickly clothed with whitish hairs, dark brown;

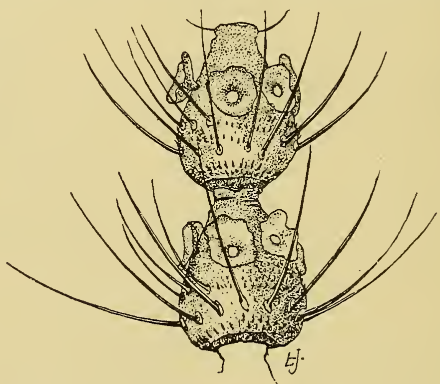

Fig. 52 Seventh and eighth antennal segments of Monardia toxicodendron, enlarged. (Original)

12 segments, the fifth pyriform; terminal segment much shortened, obliquely rounded distally. Palpi; the first segment subglobular, second one-half longer, lanceolate, the third one-quarter longer,

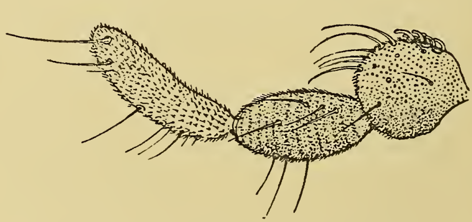

Fig. 53 Palpus of Monardia toxicodendron, enlarged. (Original)

more slender. Mesonotum dark brown, the posterior median area yellowish brown, submedian lines ornamented with pale hairs. Scutellum and postscutellum pale reddish yellow, the former with sparse yellowish hairs. Abdomen pale fuscous yellowish, terminal segment and ovipositor dark brown or black. Wings hyaline, costa pale straw, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs a nearly uniform pale straw

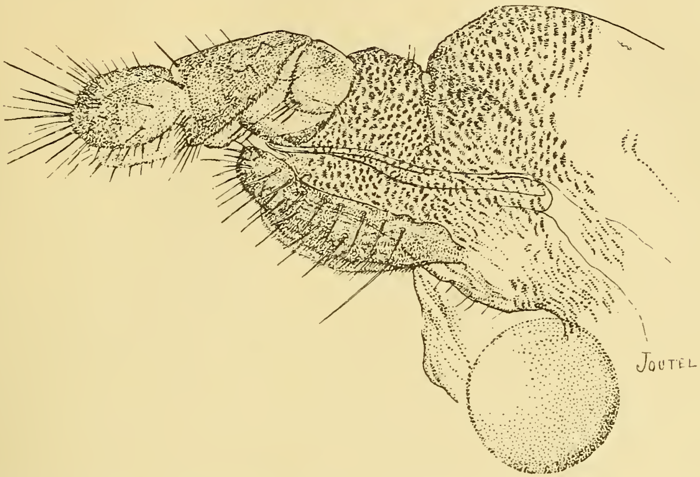

Fig. 54 Apex of abdomen showing ovipositor of Monardia toxicodendron, enlarged. (Original)

yellow; claws slender, strongly curved, simple. On the venter of the eighth abdominal segment, a pair of irregular, trumpet-shaped, fuscous organs. Ovipositor short, triarticulate, terminal lobe suboval. Type Cecid. 122.

Monardia alexanderi n. sp.

This species was taken by Mr C. P. Alexander on Sport island, Sacandaga river, N. Y., July 25, 1909.

Female. Length .75 mm. Antennae extending to the base of the abdomen, sparsely haired, deep red; 12 segments, the fifth with a length one-quarter greater than its diameter, the eleventh and twelfth segments narrowly fused, the latter somewhat reduced. Palpi probably quadriarticulate, the penultimate narrowly oval, with a length three times its width, the terminal segment one-half longer. Mesonotum dull black. Scutellum and postscutellum apparently concolorous. Abdomen fuscous yellowish. Costa pale straw, subcosta uniting therewith near the basal half. Halteres whitish transparent. Legs mostly pale straw, the tarsi variably tinged with reddish, the distal segments darker; claws strongly curved, slightly swollen subapically; pulvilli as long as the claws; ventral glands globose. Ovipositor short; terminal segment narrowly oval, with a length three times its width. Type Cecid. 1370.

Monardia pinicorticis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44 (Campylomyza)

This species was reared from the galleries of a Scolytid in pine, P i n u s sp., taken at Riverton, N. J., April 14, 1901 by Prof. C. W. Johnson.

Female. Length 2.5 mm. Antennae hardly extending to the base of the abdomen, sparsely clothed with fine hairs, light brown; 14 segments, the fifth pyriform, with a length one-half greater than its diameter; terminal segment reduced, acute apically. Palpi; the first segment rather long, broadly oval, the second a little shorter, narrow, the third considerably shorter and more slender than the preceding and the fourth more slender and nearly as long as the third. Mesonotum and scutellum reddish brown, the former sparsely and evenly clothed with fine, yellowish hairs, postscutellum dark brown. Abdomen fuscous yellowish, sparsely clothed with fine, yellowish hairs. Wings hyaline, costa light brown, subcosta uniting with the margin near the middle of the wing. Halteres and legs mostly fuscous yellowish, the distal tarsal segments somewhat darker. Metatarsus more than twice the length of the preceding segment. Claws short, stout, strongly denticulate, pulvilli rudimentary. Ovipositor short, triarticulate, the third segment short, broadly oval. Type Cecid. 799.

Monardia karnerensis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 5 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This reddish brown species was taken at Karner, N. Y., May 16, 1906.

Male. Length 1.5 mm. Antennae half the length of the body (probably broken) sparsely haired, dark brown; probably 14 segments, the fifth with a stem one-third the length of the subcylindric basal enlargement. Palpi; the first segment subquadrate, stout, the second as long, broadly oval, the third a little longer and the fourth one-half longer than the third. Mesonotum dark brown with submedian lines sparsely clothed with setae. Abdomen reddish brown. Wings subhyaline, the veins brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs semitransparent with irregular, reddish bands on the tarsi and at the tip of the tibiae, particularly on the mid and posterior legs; claws strongly curved, pectinate. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, greatly swollen distally. Dorsal plate broad, tapering, broadly rounded; ventral plate indistinct. Harpes broad at base, curving to a heavy, apical process with an acute, outward curved point distally and anteriorly a heavy, slender, chitinous spine, and slightly laterally a flattened, broadly rounded lobe parallel with the spine and nearly as long; style short, slender, the apex broadly rounded. (Plate 12, figure 1.) Type Cecid. 29.

Monardia populi Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98–99; separate, p. 2 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was taken on the large-toothed poplar, Populus grandidentata, at Albany, N. Y., June 4, 1906.

Male. Length 1 mm. Antennae extending to the second abdominal segment, dark brown, sparsely long haired; 14 segments, the fifth with a stem one-third the length of the subcylindric enlargement; terminal segment obconic, the apex slightly produced. Palpi; the first segment stout, broadly expanded distally, the second more slender, one-half longer, the third a little longer than the second, the fourth one-half longer than the third. Mesonotum dark brown. Scutellum and postscutellum a little lighter. Abdomen dark brown, very sparsely clothed with fine, yellowish hairs. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres whitish transparent. Legs a nearly uniform light slaty brown, claws stout, strongly curved, pectinate. Genitalia; basal clasp segment stout, obliquely truncate; terminal class segment stout, greatly expanded distally. Dorsal plate broad, broadly rounded. Harpes stout, expanded distally, the posterior margin slightly excavated, the internal angle produced as a short, acute spine; style stout, short, slightly expanded, broadly and roundly excavated. (Plate 13, figure 1.) Type Cecid. 115.

Monardia balsamicola Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was taken on balsam, Abies balsamea, at Lake Clear, N. Y., June 7, 1906.

Male. Length .75 mm. Antennae nearly as long as the body, dark brown, sparsely long haired; 14 segments, the fifth with a stem one-half the length of the subglobular basal enlargement; terminal segment subconical. Palpi; the first segment subglobular, second as long as the first, suboval, the third a little more slender, as long as the second, the fourth more than twice the length of the third. Mesonotum, scutellum, postscutellum and abdomen nearly uniform dark brown. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal half; halteres whitish transparent. Legs nearly uniform straw brown; claws stout, strongly curved, pectinate. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment greatly enlarged and broadly rounded. Dorsal plate about one-half the width of the entire segment, broadly rounded. Harpes stout, subtriangular basally, broadly and roundly excavated laterally at the posterior third, apically broadly rounded internally and with a conspicuous beak at the external posterior angle. (Plate 12, figure 2.) Type Cecid. 145.

Monardia barlowi Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316 (Campylomyza)

This species was taken May 2, 1904 by Prof. John Barlow at Kingston, R. I. Apparently the same species has been taken at Aweme, Manitoba, N. W. T., and at Hazleton, Pa.

Male. Length 1.5 mm. Antennae extending to the third abdominal segment, thickly long haired, dark brown; 14 segments, the fifth with a stem three-fourths the length of the subcylindric basal enlargement; terminal segment reduced, irregularly obtuse distally. Palpi: the first segment short, stout, irregularly oval, the second a little longer, subrectangular, the third a trifle longer, more slender, the fourth one-half longer than the third, more slender. Mesonotum dark brown, submedian lines sparsely clothed with fine, yellowish hairs. Scutellum dark brown. Abdomen reddish brown, rather thickly clothed with yellowish hairs. Wings hyaline, costa light brown, subcosta uniting with the margin just beyond the basal half. Halteres and legs a nearly uniform fuscous yellowish, the distal tarsal segments somewhat darker; claws short, stout, strongly curved, denticulate, the pulvilli as long as the claws. Genitalia: basal clasp segment short, stout, a conspicuous lobe at the internal distal angle, terminal clasp segment narrowed and prolonged at the base, swollen distally, broadly rounded; dorsal plate broad, broadly rounded. Harpes apparently consisting of two subrectangular, irregular plates with the internal and distal margins, the latter strongly excavated, heavily chitinized. Type Cecid. 798.

Monardia tuckeri Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316 (Campylomyza)

This species was taken in November 1907 at Plano, Texas, by Mr E. S. Tucker.

Male. Length 1.25 mm. Antennae longer than the body, sparsely haired, dark brown; 14 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length one-half greater than its diameter; terminal segment reduced, tapering, obtuse. Palpi; the first segment short, stout, irregularly oval, the second as long as the first, slender, the third a little longer and stouter than the second, the fourth one-half longer and more slender than the third. Entire body a nearly uniform dark brown. Wings hyaline, costa light brown; subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, light fuscous apically. Legs a light yellowish brown, the distal tarsal segments somewhat darker; claws long, slender, strongly curved, simple, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, the internal distal angle produced as a long, roundly tapering process; terminal clasp segment short, stout, greatly dilated near the basal third, broadly rounded. Dorsal plate long, stout, broadly rounded. Harpes short, broad, each with a pair of long retrorse spines; style long, slender, subacute. Type Cecid. 1259.

Monardia lignivora Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 4 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 314, 315 (Campylomyza)
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44 (Campylomyza)

Many larvae and a number of adults of this interesting form were taken September 21, 1906 in the fungus-affected heartwood of an 18 inch hard pine, Pinus rigida, at Davidson's River, N. C. The tree had been cut into the 20th of the preceding July for the purpose of observing the progress of a fungus affection. This undoubtedly gave the gnats an opportunity to enter and at the time of their discovery they had worked their way among the spongy tissues. The flies had probably oviposited in crevices and galleries a considerable distance from the cut surface. Larvae, pupae and adults were found in the affected wood at least three inches above the cut and fully two inches behind the deepest part. The affected wood, either as the result of fungous attack or because of the operations of the Cecid larvae, was quite spongy and contained numerous lenticular cavities. It was well charged with pitch. The Dipterous larvae appeared to erode the smooth surface of the wood, even that apparently hard and sound and, as a result, produced quantities of very fine, yellowish wood powder. Full-grown larvae to the number of fifteen to twenty were taken in a smooth channel about 6 mm in diameter and 5 cm long. Other larvae occurred singly and the same was true of pupae. Exuviae or pupal skins were so numerous on portions of the cut surface as to literally cover it, especially the more spongy portions.

Larva. Length 6 mm, slender, light salmon. Head small; antennae stout, apparently uniarticulate; breastbone stout, well developed, tridentate, the median tooth largest, the shaft slender, slightly expanded distally. Skin nearly smooth; the segments posteriorly with transverse rows of minute spines as in Miastor larvae. Terminal segment broadly rounded. (Plate 13, figure 4.)

Pupa. Length 5 mm. The head and thorax are reddish or dark brown, the abdomen a light salmon.

Exuviae. Length 3.5 mm, pale whitish; antennal cases short, stout; cephalic horns very slender; wing cases extending to the second abdominal segment; leg cases to the third and fourth abdominal segments. Abdomen dorsally, thickly ornamented with minute, chitinous points; posterior extremity reduced, narrowly rounded.

Male. Length 1.3 mm. Antennae extending to the fourth abdominal segment, sparsely long haired, light brown; 16 segments, the fifth pyriform, with a stem one-third the length of the enlargement; terminal segment reduced. Palpi yellowish, the first segment subglobular, second and third subequal, subquadrate, the fourth one-half longer than the preceding. Mesonotum black, sparsely clothed with short, fine, silvery hairs, laterally with a few long, black hairs, submedian lines indistinct. Scutellum and postscutellum dark brown. Abdomen dark red, the dorsal sclerites slightly ferruginous, sparsely clothed with short setae. Genitalia very dark brown. Wings subhyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres fuscous basally, yellowish apically. Legs a nearly uniform fuscous yellowish, claws heavy, slightly curved, simple. Genitalia; basal clasp segment broad, short; terminal clasp segment short, swollen at the middle. Dorsal plate large, triangular, tapering; ventral plate smaller, angulate, deeply emarginate, the lobes widely separated, acute and with conspicuous lateral prolongations at the basal half.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, densely yellow-haired, yellowish brown; 21 segments, the fifth subsessile, nearly disc-shaped. Palpi yellowish, the first seg-

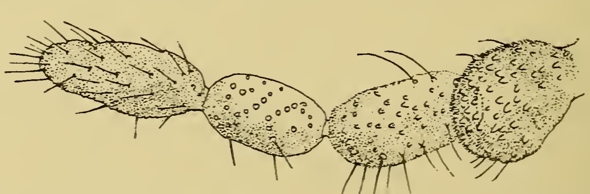

Fig. 55 Palpus of Monardia lignivora, enlarged. (Original)

ment short, subquadrate, second and third subequal, elongate oval, the fourth a little longer. Color practically as in the male. Ventrally near the middle of the eighth abdominal segment, there is a pair of submedian irregular, trumpet-shaped organs. Ovipositor triarticulate, terminal lobe orbicular. Type Cecid. a1614.

Monardia articulosa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This unique species from the United States National Museum, was taken in the White mountains by Morrison.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, thickly haired, reddish brown; 22 segments, the fifth subsessile, subglobose; terminal segment produced, a knob apically. Palpi; the first segment, somewhat produced, pyriform, the second

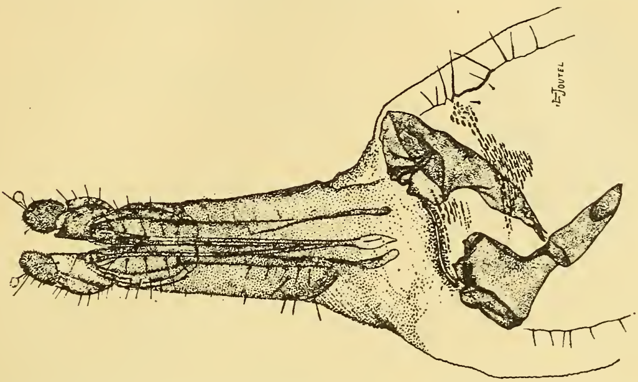

Fig. 56 Apex of abdomen, showing submedian ventral organs and ovipositor of Monardia lignivora, enlarged. (Original)

stout, narrowly oval, the third a little longer than the second, more slender, the fourth one-half longer than the third, more slender. Mesonotum dark brown. Abdomen light brown. Wings rather long, broad, hyaline, costa dark brown, subcosta uniting with the margin near the basal third. Coxae and femora fuscous yellowish, tarsi light yellowish; claws long, slender, strongly curved, simple, the pulvilli nearly as long as the claws. Ovipositor short, the venter of the seventh segment with a pair of submedian, subglobose organs; terminal lobes triarticulate; the third segment long, tapering to a narrowly rounded apex. Type Cecid. 884.

Bryomyia Kieff.

1896 **Kieffer, J. J.** Mis. Ent., 4:7, 15
1895 ———— Soc. Ent. Fr. Bul., p. 318
1897 ———— Syn. Cecid. Eur. & Alg., p. 49
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 6
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

Members of this genus have the claws bent at right angles and distinctly enlarged near the distal third. The pulvilli are very long, straight, and the flagellate antennal segments are each provided with a long stem in both sexes. The typical species has 10 segments in the female and 14 in the male, those of the latter eccentric and ornamented with crenulate whorls. The terminal antennal segments of the female, as illustrated by Kieffer, are subconical, with several irregular subbasal whorls of short, stout setae and subapically a pair of stout, chitinous, reniform appendages on either side of the segments. The palpi are quadriarticulate and the anterior border of the wing is continued to a point near the fourth vein. The terminal clasp segment of the male is short, swollen and obtuse apically. Type B. bergrothi Kieff. Representatives of this genus are not known to occur in America.

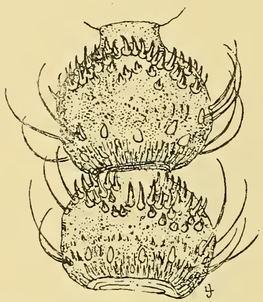

Fig. 57 Fourth and fifth antennal segments of Cordylomyia brevicornis, enlarged. (Original)

Cordylomyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

This genus is represented by a series of species with short antennae and is most easily recognized, especially in the female, by the subapical, frequently thick whorls of short, stout, occasionally recurved spines. These organs are less apparent in the male, though rudiments of a whorl may be seen in at least one species placed in this group. The type of this genus is C. coprophila Felt.

Key to species

a 11 subsessile antennal segments; females
- *b* Subcosta uniting with the margin at the distal third
  - c Length 2 mm; abdomen fuscous yellowish, unicolorus; fifth antennal segment subglobose, short haired..bryanti Felt, C. 796
  - *cc* Length 1 mm; abdomen fuscous yellowish, reddish basally; fifth antennal segment pyriform, rather slender, long haired.......... sylvestris Felt, C. a1620
  - *ccc* Length 1.5 mm; abdomen reddish brown; antennal segments stout luna Felt, C. 547
- *bb* Subcosta uniting with the margin at the basal half
  - *c* Fifth antennal segment cylindric, with a length three-fourths its diameter
    - *d* Length 2 mm; eleventh antennal segment about the same length as the tenth; fourth palpal segment slender.................. brevicornis Felt, C. 725, 756, 882, 889, 1229
    - *dd* Length 2.5 mm; eleventh antennal segment nearly twice the length of the tenth, strongly constricted near the middle; fourth palpal segment swollen apically...................... tumida n. sp., C. 1216
  - *cc* Length 1 mm; fifth antennal segment cylindric, with a length one-fourth greater than its diameter..coprophila Felt, C. 890
  - *ccc* Length 2 mm; fifth antennal segment cylindric, with a length twice its diameter........coloradensis n. sp., C. 1386, 1387

aa 12 antennal segments, subsessile; females

b Length 1 mm; scutellum reddish brown; abdomen fuscous yellowish
versicolor Felt, C. 617

bb Length 2 mm; scutellum dark brown; abdomen fuscous yellowish
americana n. sp., C. 887

bbb Length 1.25 mm; scutellum and abdomen dark brown............
kasloensis Felt, C. 881

aaa 14 antennal segments, male

b Fifth antennal segment with a stem three-fourths the length of the basal enlargement, length 1.25 mm; abdomen a variable brown..............................coprophila Felt, C. 890

bb Fifth antennal segment with a stem one-fourth longer than the basal enlargement; length 1.5 mm; abdomen dark brown........
coloradensis n. sp., C. 1386, 1387

Cordylomyia bryanti Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313 (Campylomyza)

This species was taken August 18, 1905, at Little River, Newfoundland, by Mr Owen Bryant.

Female. Length 2 mm. Antennae scarcely extending to the base of the abdomen, thickly fine haired, dark brown; 11 segments, the fifth subglobose, subsessile; terminal segment produced, constricted at the distal third, subacute apically. Mesonotum dark reddish brown, the submedian lines sparsely clothed with fine hairs. Scutellum apparently yellowish brown. Abdomen a fuscous yellowish, sparsely clothed with very fine, yellowish hairs. Wings hyaline, costa reddish brown, subcosta uniting with the margin at the distal third. Halteres yellowish basally, fuscous brown apically. Legs a nearly uniform fuscous yellowish, the distal tarsal segments darker; claws long, stout, strongly curved, minutely denticulate, the pulvilli longer than the claws; ovipositor short, the terminal lobes triarticulate, the third segment narrowly oval. (See plate 11, figure 5.) Type Cecid 796.

Cordylomyia sylvestris Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 97; separate, p. 1 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 313 (Campylomyza)

This species was taken on the window of a woodland hut at Davidson's River, N. C., September 23, 1906.

Female. Length 1 mm. Antennae extending to the base of the abdomen, sparsely haired, yellowish; 11 segments, the fifth pyriform; the last segment compound. Palpi; the basal segment subpyriform; the second and third subequal, the fourth as long as the two preceding. Face fuscous. Mesonotum reddish brown, submedian lines indistinct. Scutellum lighter, postscutellum dark brown. Abdomen dull yellowish with the basal segment reddish, the distal ones dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin at the apical third. Halteres yellowish basally, fuscous apically. Legs fuscous yellowish, first tarsal segment longer than the following two, others successively shorter; claws heavy, strongly curved, finely serrate. Ovipositor moderately long, terminal lobes consisting of a subquadrate basal segment and an orbicular distal one. Type Cecid. a1620.

Cordylomyia luna Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313 (Campylomyza)

This species was taken on a hotel window at Westfield, N. Y., July 11, 1906.

Female. Length 1.5 mm. Antennae very short, sparsely haired, dark brown, 11 segments; the fifth subsessile, subcylindric, with a length three-fourths its diameter; the eleventh segment constricted near the middle and with a broad, rounded process apically. Palpi; the first segment short, subglobose; the second narrowly lanceolate, the third a little stouter, subequal, the fourth nearly twice the length of the third, curved distally. Mesonotum dark brown, submedian lines lighter, sparsely haired. Scutellum and postscutellum dark brown. Abdomen a nearly uniform reddish brown, sparsely clothed with fine setae. Wings hyaline, costa dark brown, subcosta uniting with the margin near the middle. Halteres fuscous brown, legs a nearly uniform dark fuscous yellowish, the distal tarsal segments dark brown; metatarsus more than twice the length of the following segment; claws stout, strongly curved, simple; the pulvilli longer than the claws. Ovipositor short, triarticulate, the third segment nearly orbicular. Type Cecid. 547.

Cordylomyia brevicornis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 97; separate, p. 1 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species appears to be a very common and widely distributed form, since it was taken in July and August 1906 on a window at Nassau, N. Y., and appears to have been collected by H. G. Dyar at Kaslo, B. C. There are specimens in the National Museum from Jacksonville, Fla.

Female. Length 2 mm. Antennae one-fourth the length of the body, thickly haired, reddish brown; 11 segments, the fifth subcylindric, the length hardly equaling the diameter. Palpi; the first segment subglobular, second and third segments narrowly oval, subequal, fourth nearly twice the length of the third. Mesonotum dark brown, submedian lines indistinct. Scutellum and postscutellum dark reddish brown. Abdomen reddish brown, membrane and pleurae dark salmon, ovipositor dark brown. Wings hyaline, costa reddish brown, subcosta uniting with the margin at the basal half; halteres pale reddish brown. Legs dark reddish brown, tarsi

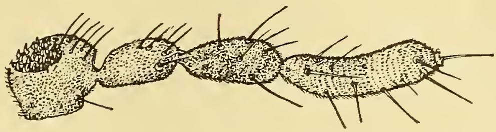

Fig. 58 Palpus of Cordylomyia brevicornis, enlarged. (Original)

lighter, distal segments dark brown; claws moderate, strongly curved, minutely denticulate. Ovipositor moderately long, terminal lobes triarticulate. Type Cecid. 756.

Cordylomyia tumida n. sp.

This species was taken on a window at Albany, N. Y., June 25, 1907.

Female. Length 2.5 mm. Antennae not extending to the base of the abdomen, thickly haired, dark brown; 11 segments, the fifth subsessile, subglobose, with a length three-fourths its diameter; terminal segment produced, slightly constricted near the middle, obtuse apically. Palpi; the first segment irregularly subglobose, second one-half longer than the first, much more slender, the third a little shorter and stouter than the second and the fourth fully twice as long as the third, strongly flattened and somewhat expanded distally. Mesonotum dark brown, the submedian lines indistinct. Scutellum reddish brown, postscutellum a little darker. Adbomen brown, the incisures and pleurae a variable orange or yellowish. Wings hyaline, costa light brown, subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, fuscous apically. Legs fuscous yellowish, the tarsi variably tinted with carmine; claws long, slender, strongly curved, finely denticulate, the pulvilli longer than the claws. Ovipositor short, triarticulate, the basal segment subquadrate, the second subtriangular, the third irregularly orbicular. Described from an alcoholic specimen. Type Cecid. 1216.

Cordylomyia coprophila Felt

1909 **Felt, E. P.** Ent. Soc. Ont. 39th Rep't, p. 44 (MS) (Campylomyza)
1911 ———— N. Y. Ent. Soc. Jour., 19:35

This small species was reared from manure at Washington, D. C., January 28, 1882.

Male. Length 1.25 mm. Antennae longer than the body, thickly haired, light brown; 14 segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length about three-fourths its diameter; a thick subbasal whorl of setae and on the apical half, 3 crenulate whorls, the distal 2 rudimentary; apically an irregular group of stout, curved, chitinous spines; terminal segment reduced, narrowly oval. Palpi; the first segment stout, with a length about twice its diameter, the second about three-fourths the length of the first, narrowly oval, the third a little longer and more slender and the fourth longer, strongly flattened, dilated. Mesonotum dark brown. Scutellum reddish brown. Abdomen a variable brown, the segments narrowly margined posteriorly with dark brown. Wings hyaline, costa light brown, subcosta joining costa near the basal half, the third vein just before the apex, the fourth just beyond the apex; the fifth unites with the posterior margin near the distal third, its branch at the basal third; crossvein at the distal third of subcosta. Legs fuscous yellowish; claws long, stout, strongly curved, simple, the pulvilli longer than the claws. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment stout, slightly swollen near the middle, very broadly rounded apically; dorsal plate short, broad, broadly rounded. Harpes with an apical group of 5 or 6 short, stout, recurved spines. (Plate 13, figure 3.)

Female. Length 1 mm. Antennae thickly haired, fuscous yellowish; 11 segments, the fifth subsessile, the enlargement cylindric, with a length one-fourth greater than its diameter; subbasal whorl sparse, the subapical band of setae short, scattering, covering the distal half; terminal segment produced, slightly constricted near the middle, broadly rounded apically. Mesonotum dark brown. Scutellum fuscous yellowish, postscutellum dark brown. Abdomen fuscous yellowish, dark brown distally. Legs light yellowish brown. Ovipositor short, the terminal lobes probably triarticulate. Type Cecid. 890.

Cordylomyia versicolor Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on tick trefoil, Desmodium grandiflorum, at Albany, N. Y., July 17, 1906.

Female. Length 1 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, fuscous basally; 11 segments, the fifth pyriform; the last two segments fused, the distal one subfusiform. Palpi; the first segment stout, rather long, swollen distally, the second a little longer, more slender, the third fusiform; face dark brown. Mesonotum dark brown, submedian lines indistinct. Scutellum reddish brown, postscutellum and abdomen fuscous yellow, the latter dark brown apically, sparsely clothed with pale yellowish hairs. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal third; halteres yellowish basally, fuscous apically. Legs a nearly uniform straw brown; claws long, strongly curved, apparently with a short, stout tooth basally. Ovipositor short, the terminal lobes with a stout basal subquadrate portion and a distal narrowly oval lobe. Type Cecid. 617.

Cordylomyia americana n. sp.

This species was taken at Boulder, Col., October 15th by Prof. T. D. A. Cockerell.

Female. Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, at least 9, probably 12 segments, the fifth subsessile, subcylindric, with a length one-half greater than its diameter. Palpi; the first segment greatly swollen, broadly rounded, the second a little shorter than the first, narrowly oval, the third a little longer than the second and the fourth nearly twice the length of the third, rather strongly flattened. Mesonotum dark brown. Abdomen a fuscous yellowish green, darker distally. Wings hyaline, costa light brown, subcosta uniting with the margin just before the middle. Legs a variable fuscous yellowish; claws long, slender, strongly curved, minutely denticulate, the pulvilli as long as the claws. Ovipositor short, the terminal lobe short, stout, triangular, narrowly rounded distally. Type Cecid. 887.

Cordylomyia kasloensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. p. 314 (Campylomyza)

This species was taken by Mr R. P. Currie June 11, presumably 1903, at Kaslo, B. C.

Female. Length 1.25 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown; 12 segments, the fifth pyriform, with a length three-fourths the diameter. Palpi; the first segment short, stout, greatly dilated apically, pyriform, the second one-half longer than the first, slender, the third a little longer and more slender than the second. Body a nearly uniform dark reddish brown. Wings hyaline, costa dark brown, subcosta uniting with the anterior margin near the basal half. Legs fuscous yellowish, tarsi darker; claws long, slender, strongly curved, simple, pulvilli as long as the claws. Ovipositor short, triarticulate, the basal segment irregularly ovoid, the second elongate, triangular, the third broadly oval. Type Cecid. 881.

Cordylomyia coloradensis n. sp.

This species was taken on a window in October 1910 by Prof. T. D. A. Cockerell at Boulder, Col.

Male. Length 1.5 mm. Antennae a little longer than the body, sparsely haired, dark brown; 14 segments, the fifth with a stem one-quarter longer than the pyriform enlargement, which latter has a length a little greater than its diameter; terminal segment conical, with a length twice its diameter, not fused with the preceding. Palpi; the third segment with a length about three times its width, the fourth one-half longer. Mesonotum, scutellum, postscutellum and abdomen a nearly uniform dark brown. Costa light brown, subcosta uniting therewith at the basal half. Halteres yellowish transparent. Coxae dark brown; femora, tibiae and tarsi mostly fuscous yellowish, the distal tarsal segment darker; claws stout, strongly curved, notched subapically, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment long, broadly rounded, dorsal plate short, broadly emarginate, the lobes subtruncate. Harpes stout, bidentate.

Female. Length 2 mm. Antennae extending to the second abdominal segment, rather thickly haired, reddish brown; 11 segments, the fifth subsessile, with a length about twice its diameter; eleventh segment distinctly constricted beyond the middle, evidently composed of two, the distal portion being narrowly oval. Palpi; first segment greatly swollen, irregularly oval, the second with a length over twice its width, the third as long as the second, subtruncate distally, the fourth one-half longer than the second. Mesonotum dark brown. Scutellum reddish brown, postscutellum concolorous. Abdomen sparsely haired, fuscous yellowish, the ovipositor slightly fuscous. Costa dark brown. Halteres yellowish transparent, slightly fuscous apically. Coxae dark brown; femora and tibiae fuscous straw, the second, third and fourth tarsal segments lighter, the fifth reddish brown, the eighth abdominal segment ventrally with a pair of submedian, subglobose bodies. Ovipositor short, triarticulate, the third segment orbicular. Type Cecid. 1386, 1387.

Corinthomyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

This group represents a form of specialization most easily recognized by the series of subequal whorls of stout, curved setae on the subsessile, flagellate segments, differing very greatly from the typical crenulate whorls so commonly present in Campylomyzine males. The venation is typical of Campylomyza. The pulvilli are as long as the claws. Males only are known. The type species is Campylomyza hirsuta Felt.

Key to species

a Fifth antennal segment with a length one-half greater than its diameter
- *b* Length 1.25 mm; abdomen reddish brown; 6 short, stout whorls — hirsuta Felt, C. 729
- *bb* Length 1.5 mm; abdomen reddish brown, 4 to 5 short, stout whorls — gracilis Felt, C. 1406
- *bbb* Length 2 mm; abdomen reddish brown; 7 short, stout whorls..... cincinna n. sp., C. 1220

aa Fifth antennal segment with a length three-fourths greater than its diameter
- *b* Length 1 mm; abdomen dark brown; 5 short, stout whorls....... currei Felt, C. 881a

Corinthomyia hirsuta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was taken on an office window at Albany, N. Y., August 1, 1906.

Fig. 59 Fourth antennal segment of Corinthomyia cincinna, enlarged. (Original)

Male. Length 1.25 mm. Antennae shorter than the body, sparsely haired, dark brown, 14 segments; the fifth with a stem one-fourth the length of the subglobose enlargement, subbasal whorl thick, 6 nearly equidistant whorls of stout, strongly curved setae; terminal segment reduced, pyriform. Palpi; the first segment subglobose with a conspicuous sense organ subbasally, the second a little longer, subrectangular, the third somewhat longer, slender at the base, the fourth one-half longer than the third. Mesonotum dark brown, submedian lines indistinct. Scutellum and postscutellum dark reddish brown. Abdomen dark brown. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal half. Halteres pale yellowish basally, fuscous apically; legs mostly a uniform light brown; claws long, slender, strongly curved; pulvilli a little longer. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment strongly constricted at the base, greatly enlarged and broadly oval distally. Dorsal plate apparently very long, broad, broadly and irregularly rounded. Type Cecid. 729.

Corinthomyia gracilis Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:102-3

This species was taken at Hazelton, Pa., May 18, 1910 by Dr W. G. Dietz. Type Cecid. 1405.

Corinthomyia gracilis Felt

This species was taken on an office window at Albany, N. Y., July 5, 1907.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, dark brown; 14 segments, the fifth subsessile, with a stem one-fifth the length of the subcylindric basal enlargement, which latter has a length one-half greater than the diameter; seven equidistant, thickly set, crenulate whorls; terminal segment prolonged, with a length fully twice its diameter. Palpi; the first segment short, stout, broadly oval, with a distinct sense organ internally, the second more slender, one-half longer, the third a little longer than the second and the fourth one-half longer than the third, dilated apically; face thickly clothed with grayish setae. Mesonotum dark brown, shining. Scutellum reddish brown, postscutellum a little darker. Abdomen brownish yellow, genitalia fuscous. Wings hyaline, costa light brown; subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, fuscous apically. Legs a fuscous straw; claws rather long, slender, strongly curved, the concavity finely denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, stout, greatly swollen near the distal fourth, obtusely rounded apically. Type Cecid. 1220.

Corinthomyia currei Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species, studied through the courtesy of the United States National Museum, was taken at Kaslo, B. C., by Mr R. P. Currie.

Male. Length 1 mm. Antennae extending to the fourth abdominal segment, thickly haired, dark brown; 14 segments, the fifth with a smooth stem one-fourth the length of the subcylindric basal enlargement, which latter has a length three-quarters greater than its diameter, 5 crenulate whorls; terminal segment slightly produced, narrowly rounded apically. Palpi; the first segment narrowly oval, the second stout, one-half longer, the third about as long as the second, more slender, the fourth one-half longer than the third, somewhat dilated. Body a nearly uniform dark brown. Wings hyaline, costa reddish brown, subcosta uniting with the anterior margin at the basal half. Legs fuscous yellowish; claws long, slender, strongly curved, finely denticulate, the pulvilli longer than the claws. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment with a short, narrow neck, greatly swollen apically, the inner face flattened, greatly dilated and produced basally to form a distinct angle; dorsal plate long, extremely broad, the posterior margin produced mesially. (Plate 13, figure 2.) Type Cecid. 881a.

HETEROPEZINAE

This subfamily comprises a number of exceedingly peculiar forms, some of them most remarkable on account of the great degree of specialization by reduction. Members of this heteromorphic group may be separated from the Itonididinae by the absence of circumfili, and from the Lestremiinae by the great reduction in venation, there being at most, four (rarely over three) long veins. The metatarsus may be longer than the following segment, while the number of tarsal segments may be reduced to two. Certain species have quinquearticulate tarsi and the wing membrane thickly clothed with rather broad, striate scales. Others have the wing membrane hyaline and clothed with short, erect hairs, quite distinct from the long, appressed ones found in the Itonididinae. The ocelli are wanting. The Heteropezinae, like the Lestremiinae, appear to depend to a considerable extent upon the olfactory organs.

Nothing was known concerning the life history of our American species till the writer studied several forms. Miastor americana Felt was reared from under bark, in an incipient stage of

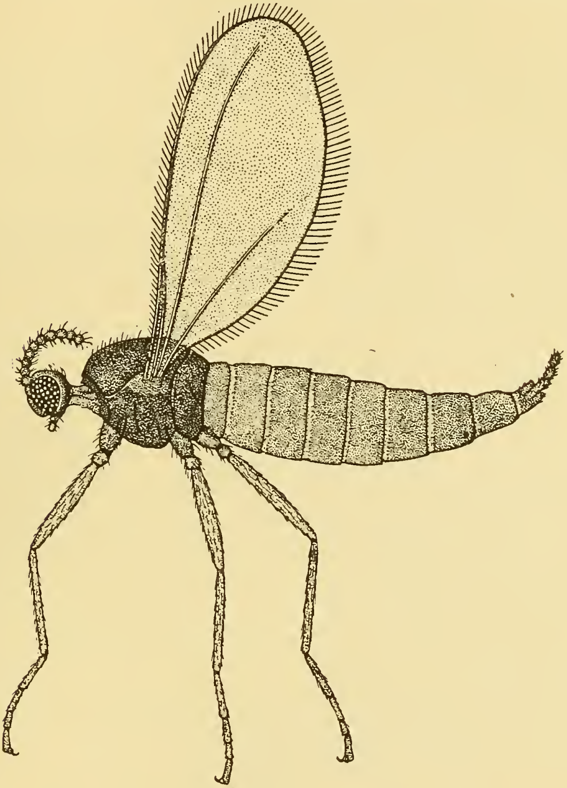

Fig. 60 Miastor americana, side view, enlarged. (Original)

decay from a variety of trees and proves to be rather common and widely distributed in New York State. The larvae of Oligarces ulmi Felt were found abundantly under the decaying bark of elm and numerous midges were reared. Leptosyna quercivora Felt was reared from partially rotten bark of red oak. Epimyia carolina Felt was taken in a woodland hut where there was an abundance of decaying vegetable matter in the vicinity. Two species of Brachyneura have been reared under conditions which lead us to believe that they may live in galls (possibly as inquilines). The larvae of certain species are extremely interesting biologically, since they reproduce by pedogenesis and are, moreover, very amenable to laboratory conditions.

Key to genera

a Metatarsus longer than the second segment
  b Tarsi quadriarticulate
    c Three long veins
      d Palpi quadriarticulate (amber)..............Meunieria Kieff.[1]
      dd Palpi triarticulate....................Palaeospaniocera Meun.
      ddd Palpi biarticulate............................Miastor Mein.
    cc One long vein, wings very narrow...........Neostenoptera Meun.
  bb Tarsi triarticulate, 2 long veins
    c Antennal segments cylindric....................Heteropeza Winn.[2]
    cc Antennal segments globose (amber).........Monodicrana H. Lw.[1]
aa Metatarsus shorter than the 2d segment
  b Tarsi quinquearticulate
    c Wing membrane finely haired
      d Third vein extending to the apex of the wing
        e Palpi biarticulate............................Frirenia Kieff.
          f Fifth vein forked..........................Haplusia Karsch
          ff Fifth vein simple.........................Johnsonomyia Felt[3]
        ee Palpi triarticulate, wings acuminate..........Meinertomyia Felt
        eee Palpi uniarticulate, wings acute apically...........Leptosyna Kieff.
      dd Third vein not extending to the apex of the wing
        e Palpi biarticulate............................Frirenia Kieff.
        ee Palpi triarticulate............................Epimyia Felt
    cc Wing membrane scaled
      d Fifth vein forked, palpi quadriarticulate (amber)............ Ledomyiella Meun.
      dd Fifth vein simple
        e Four simple long veins, palpi biarticulate, antennal segments stemmed in the female....................Kronomyia Felt
        ee Three simple long veins, palpi triarticulate................. Brachyneura Rond. (Spaniocera Winn.)
  bb Tarsi biarticulate.................................Oligarces Mein.

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[1] Location provisional.

[2] Messrs Kunstler and Chaine in Comptes Rendus Hebdomadaires des Séances et Mémoires de la Sociéte de Biologie, 1902, v. 54, p. 535, give the characters of a form reared from bananas as follows: Tarsi biarticulate, the first segment longer than the second; wings with two or three long veins, the two first branched; palpi quadriarticulate. It was referred to the Heteropezinae, though no name was proposed and is presumably related to Heteropeza Winn. and Monodicrana H. Lw.

[3] The Australian Necrophlebia Skuse and Chastomera Skuse are apparently closely related to this American genus and are provisionally associated therewith.

Meunieria Kieff.

1904 **Kieffer, J. J.** Soc. Sci. Brux. Ann., v. 28, pt. 2, separate, p. 42
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This genus was erected by Kieffer for a species from amber designated by Meunier as *Miastor du succin.* It is separated from Miastor by the quadriarticulate palpi. No American forms are known.

Palaeospaniocera Meun.

1901 **Meunier, Fernand.** Soc. Sci. Brux. Ann., pt. 2, 25:191–92
1904 ———— Soc. Sci. Brux. Ann., 28, pt. 2, separate, p. 37
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This genus was erected for an amber species, characterized by having 3 simple long veins, the tarsi quadriarticulate, the metatarsus being more than twice the length of the second segment, which latter is longer than the third and fourth combined. The antennae are composed of 13 cylindric segments, the thirteenth being plainly produced. The body is elongate, ovoid, the thorax slightly gibbous; palpi apparently composed of only 3 segments and the one lobe of the ovipositor plainly evident.

Miastor Mein.

1864 **Meinert, F. R.** Naturhist. Tidsskr., ser. 3, III, 42
1870 **Winnertz, Joh.** Vehr. z.-b. Ges. Wien, 20:5
1876 **Bergenstamm, J. E. & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 15
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:58
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:403
1894 **Kieffer, J. J.** Wien Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 54
1900 ———— Soc. Ent. Fr. Ann., 69:448
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316
1911 ———— N. Y. State Mus. Bul. 147, p. 84
1911 ———— N. Y. Ent. Soc. Jour., 19:36

Members of this genus have the wing membrane finely haired, the 3 long veins simple, the metatarsus quadriarticulate, the first segment being longer than the second. Palpi biarticulate. The generic type is M. m e t r a l o a s Mein. The genus is probably worldwide or nearly so in its distribution.

Miastor americana Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 5
1908 ———— N. Y. State Mus. Bul. 124, p. 286
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44
1911 ———— Science, 33:302–3

1911 ———— Can. Ent., 43:134–35; same in Science, 33:538; Econ. Ent. Jour., 3:296; Ent. News, 22:227; N. Y. Ent. Soc. Jour., 19:200–1
1911 ———— N. Y. State Mus. Bul. 147, p. 82–104
1911 ———— Econ. Ent. Jour., 4:414
1911 **Wheeler, W. M.** N. Y. Ent. Soc. Jour., 19:201

Prior to 1910 this species was known only through one female taken at Highland June 18, 1907. The interesting larvae of this remarkable form have subsequently been found in the decaying bark of maple, chestnut, oak, birch, beech and hickory at Highland, Tivoli, Nassau and Lake Placid, N. Y., indicating a considerable range for this species. The writer's experience justifies the belief that these insects are rather common under bark, in the incipient stages of decay. Miastor larvae have also been found in Connecticut and Indiana. A variable number of pedogenetic generations may occur in the fall and spring, the appearance of the adult midges being presaged by the development of a breastbone in the larvae, the formation of a prepupa and pupation. An extended discussion of pedogenesis as observed in this species, accompanied by descriptions of the larva and female, may be found in the writer's report for 1910. Stages not previously characterized are described below.

Prepupa. (Pl. 14, fig. 1) Length 1.75 mm. This stage is easily recognized by the apparent contraction and withdrawal of the body contents from the two extremities. The second to fifth segments become greatly enlarged, semitransparent, and on examination under a high power may be seen to contain the developing thoracic segments and their appendages. The head is much less prominent, being partially withdrawn into the anterior body segments. The well-developed breastbone is frequently visible, though occasionally obscured and is shed with the prepupal exuvium. The posterior extremity is also semitransparent and in the male distinctly bilobed.

Pupa. Length 1.5 mm; anterior extremity broadly rounded, semitransparent, the thoracic region somewhat larger, the thoracic horns long, slender, curved, the abdomen gradually tapering to a rather obtusely rounded, bilobed extremity. The posterior portion of the thoracic region and most of the abdomen whitish, the latter with a distinct orange tint in the subapical segment; terminal segment somewhat swollen, semitransparent, bilobed. Antennal, wing and leg cases semitransparent, the two latter extending to about the second abdominal segment and all, together with the eyes, gradually becoming infuscated till nearly black just prior to the appearance of the imago. The female pupa may have a length of 2 mm, the abdomen being longer, slender, and when viewed by transmitted light may show 4 or 5 large eggs.

Exuvia. Whitish transparent, the dorsum of the abdominal segments with minute, chitinous points, the structures otherwise practically as in the pupa.

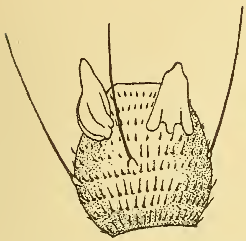


Fig. 61 Fifth antennal segment of Miastor americana, greatly enlarged. (Original)

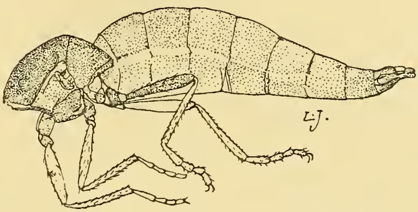


Fig. 62 Side view of thorax, legs and abdomen of Miastor americana. (Original)

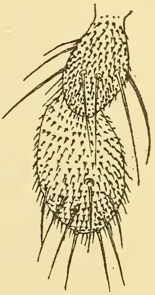


Fig. 63 Palpus of Miastor americana, greatly enlarged. (Original)

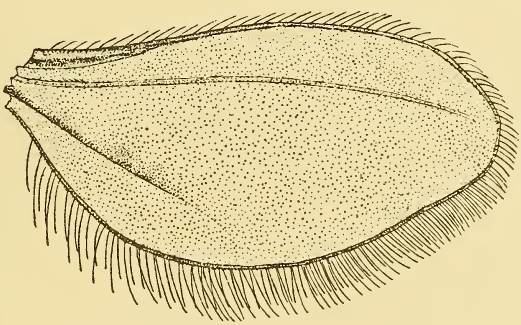


Fig. 64 Wing of Miastor americana, greatly enlarged. (Original)

Male. Length 1 mm. Antennae hardly extending to the base of the thorax, sparsely haired, yellowish or yellowish red; 11 segments, the fifth narrowly oval, with a length one-third greater than its diameter, a sparse whorl of stout setae near the middle and subapically a whorl of several irregular, narrowly triangular processes extending about to the basal fourth of the following segment; terminal segment oval, with a length one-third greater than its diameter. Palpi; first segment subquadrate, second segment oval, both sparsely setose. The vertex and eyes fuscous. Mesonotum yellowish brown. Scutellum brownish red, postscutellum reddish orange. Abdomen deep red; genitalia fuscous. Wings hyaline, costa yellowish basally, the distal half reddish; the feeble subcosta uniting with costa at the basal third, the third vein obsolescent distally, joining the margin at the apex of the wing; fifth vein simple, obsolete distally. Coxae, femora and tibiae fuscous yellowish, the tarsi tinged with red; claws rather long, evenly curved, simple, the pulvilli about half the length of the claws. Genitalia; basal clasp segment short, stout, obliquely truncate apically; terminal clasp segment short, stout, swollen subapically and with a heavy, chitinous spur at the internal distal angle; dorsal plate apparently short, triangularly emarginate, the lobes broadly rounded and sparsely setose; ventral plate apparently moderately long, stout, broadly rounded and sparsely setose apically; style short, stout, narrowly rounded distally.

Life history. Reproduction by pedogenesis occurs in the fall and early spring, and under certain conditions apparently throughout warm weather, though adults are usually produced from the latter part of May to August. Under favorable conditions it appears probable that pedogenesis may continue indefinitely. A larval generation occupies about 3 to 3½ weeks, much depending upon moisture, food and temperature. The transformations to the adult are preceded by the development of a distinct breastbone, this usually occurring in early May. The change is soon followed by the appearance of the prepupa, characterized by a marked swelling and transparent condition of the anterior body segments of the larva, and in 2 or 3 days by the development of the pupa, a stage lasting about 6 days. The small midges appear in immense numbers during the late morning hours, namely from about 9 a. m. until noon, swarming over the sides of the jar and behaving much like minute ants. There is comparatively little tendency to take wing. The development of adults may continue for several days and the midges may appear in smaller numbers for a period of several weeks. The large eggs, well formed in the abdomen of recently transformed females, are presumably deposited shortly and another succession of larval generations begun.

Natural enemies. Miastor is commonly preyed upon by the pinkish larvae of Lestodiplosis, and it is probable that Itonida pugionis Felt has similar habits. The larger predaceous maggots of Lonchaea polita Loew and a species of Medetrus were commonly found in the vicinity of Miastor colonies and were not infrequently the only available evidence of the earlier presence of midge larvae. Pseudotephritis vau Say was repeatedly reared from bark infested by Miastor larvae. In some instances the Pseudotephritis larvae occurred in clusters. These larvae may be predaceous enemies of the smaller Miastors.

Neostenoptera Meun.

1901 **Meunier, Fernand.** Soc. Sci. Brux. Ann., pt. 2, 25:201 (Stenoptera)
1904 ———— Soc. Sci. Brux. Ann. 28, pt. 2, separate, p. 5
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This genus was erected for a remarkable form found in copal from Africa. It is easily recognized by the extremely narrow, long-fringed wings having but one long vein, which latter unites with the anterior margin near the basal third. The tarsi are quadriarticulate, the metatarsus being nearly as long as the 3 following segments. The head is small, distinct, the palpi invisible. The antennae are apparently composed of 12 segments, the flagellate ones having an elongate, oval, basal enlargement ornamented near the middle with a closely set whorl of long, stout setae apparently resembling those of Johnsonomyia Felt. The stem of the fifth antennal segment is as long as the basal enlargement. Halteres very long. Type Stenoptera kiefferi Meun.

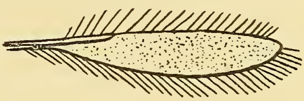


Fig. 65 Wing of Neostenoptera kiefferi, after Meunier

Heteropeza Winn.

1846 **Winnertz, J.** Stett. Ent. Zeit., 7:13–14
1870 ———— Vehr. z.-b. Ges. Wien, 20:4
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 16
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:57
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:401
1894 **Kieffer, J. J.** Wien Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 54
1900 ———— Soc. Ent. Fr. Ann., 69:444
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36
1911 ———— N. Y. State Mus. Bul. 147, p. 84

This genus may be recognized by the 2 simple long veins of the wings terminating at the basal third of the anterior and posterior margins respectively (the wing tip is narrowly rounded, hardly acute); the 3 tarsal segments, the first being the longest, and the 4 palpal segments. Antennal segments in the female 10, sessile, cylindric, and with a length three-fourths the diameter, thickly haired; in the male 11, stemmed; ocelli absent. Ovipositor one-fourth the length of the abdomen, somewhat thickened, the lobes slender, setose. Type H. pygmaea Winn.

Only two species are known, the European H. pygmaea having been reared from the bark of rotting trees, and H. transmarina Schin. recorded as bred from small excrescences on the leaves of Callistemon.

Monodicrana H. Lw.

1850 **Loew, H.** Dipt. Beitr., 4:11–12
1900 **Kieffer, J. J.** Ent. Soc. Fr. Ann., 69:444
1904 **Meunier, Fernand.** Soc. Sci. Brux. Ann., 28, separate, p. 9, 33
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This amber species has been doubtfully referred to the Itonididae, apparently being most closely allied to Heteropeza. Kieffer states that this species has a length of 1.1 mm, the borders of the wings being ciliate and the membrane not hairy; that the moniliform antennae have the funicle composed of 8 globose segments and an oval terminal segment. The tarsi are quadriarticulate. The type is M. terminalis H. Lw.

Haplusia Karsch

1877 **Karsch, F. A. F.** Revis. de Gallmucken, p. 15
1892 **Rubsaamen, E. H.** Berl. Ent. Zeitschr., 37:328, 368–69
1896 **Kieffer, J. J.** Wien. Ent. Zeit., 15:91
1900 ———— Soc. Ent. Fr. Ann., 69:448
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 84

This genus was erected for a unique female having at least 11 and possibly 14 antennal segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length three times its diameter and has a short, rather thick basal, and a thick extended distal whorl of long, curved setae; circumfili absent. The palpi are quadriarticulate. The wings have 3 long veins; subcosta with a rudimentary vein at the basal fourth somewhat as in Diallactes. A rudimentary crossvein appears to unite its distal third to the third vein, the latter joining the wing margin probably well beyond the apex. The fifth unites with the margin at the distal third, its branch apparently at the basal half. The fork is therefore very short. The first tarsal segment is short, while the fifth tapers to the small, simple claws with rudimentary pulvilli. The ovipositor is rather short, triarticulate, the terminal segment slender, tapering and sparsely setose.

The above characters are drafted from the type species, H. plumipes Karsch, now in the Berlin Museum of Natural History and very nicely mounted in balsam, thanks to the skill of Professor Rubsaamen. We agree with him in referring this form to the Heteropezinae.

Tetradiplosis Kieff. & Jörg.

1910 **Kieffer, J. J. & Jörgensen, P.** Centrbl. Bakt. Parsit. Insektk., 27:421–23
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37

This Argentine genus is tentatively referred to the Heteropezinae because of the total absence of circumfili. It appears to be allied to the South American Haplusia Karsch from which it is easily separated by the unidentate claws.

Antennae with 14 segments, the cylindric fifth with a length about twice its diameter and a stem not longer than wide. Palpi quadriarticulate, the segments short. Wings long; the supernumerary vein extends beyond the middle of subcosta, which latter unites with costa at the middle of the wing. There appears to be a distinct crossvein, the third vein joining the margin beyond the apex of the wing. Tarsi quinquearticulate; claws fuscous, toothed, the two portions nearly equal and strongly bent; pulvilli wanting. Ovipositor not produced, with 2 gradually tapering lamellae, each about three times as long as broad. The larva is remarkable because of the 6 small, triangular teeth internally on the diverging subtriangular major lobes of the breastbone; shaft well developed. Reared from a stem gall on Prosopis alpataco. Type T. sexdentatus Kieff. & Jörg.

Johnsonomyia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417
1911 ———— N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 84

This genus was erected for several small forms apparently allied to Colpodia Winn. A closer study of the species, however, shows that circumfili are absent and compels us to refer this genus to the Heteropezinae. The short first tarsal segment, the antennal and alar structures indicate a relationship to Haplusia Karsch, from which it is easily separated by the simple fifth vein. This is a remarkable synthetic form, since the arrangement of the long setae on the antennal segments closely approximate that of the peculiar crenulate whorls in Campylomyza, while the venation alone would lead one to refer it at once to the Epidosariae. Type J. rubra Felt.

This genus appears to be related to the Australian Chastomera Skuse, though the latter is remarkable because of the third vein being widely distant from subcosta.

Key to species

a Abdomen reddish brown, length 4 mm, the fifth antennal segment with a stem one-half longer than the basal enlargement........... rubra Felt, C. 826

aa Abdomen dark brown and yellowish, length 4 mm, the fifth antennal segment with a stem as long as the basal enlargement........... fusca Felt, C. 1237

aaa Abdomen reddish yellow, wings indistinctly banded, length 5 mm, the fifth antennal segment with a length three-fourths the basal enlargement...cincta Felt

Johnsonomyia rubra Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417

This interesting form and type of the genus was taken at Montpelier, Vt., June 26, 1906 by Prof. C. W. Johnson.

Male. Length 4 mm. Antennae as long as the body, thickly long haired, dark brown; 16 segments, the fifth with a stem one-half longer than the subcylindric basal enlargement, which latter has a length twice its diameter, a subbasal whorl of short, stout, slightly curved setae, near the basal third a thick whorl of closely set, long, strongly curved setae arising from conspicuous tubercles; subapically there is a scattering whorl of similar long setae; terminal segment with the basal portion slightly produced, the stem much reduced, rudimentary. Palpi; the first segment short, stout, subquadrate, the second fully twice the length of the first, expanding distally, the third a little stouter, about as long as the second, the fourth shorter and more slender than the third, the fifth nearly twice the length of the fourth, all sparsely clothed with coarse setae; face fuscous yellowish, eyes rather large, black. Mesonotum dark reddish brown. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen rather thickly clothed with yellowish hairs, reddish brown. Genitalia fuscous yellowish. Wings hyaline, costa reddish brown. Halteres yellowish basally, fuscous apically. Legs a fuscous yellowish, the distal three tarsal segments yellowish white; claws probably simple. Genitalia; basal clasp segment short, stout, slightly rounded externally, somewhat excavated internally, nearly truncate distally; terminal clasp segment very short, stout, greatly swollen basally and tapering distally to a conspicuous, prolonged, denticulate, chitinous process. (See plate 11, figure 6.) Type Cecid. 826.

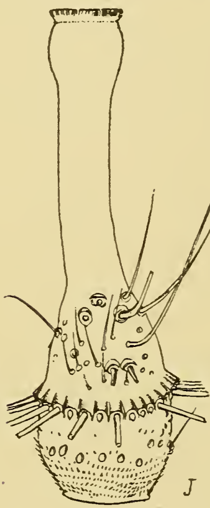


Fig. 66 Fifth antennal segment of Johnsonomyia rubra, enlarged. (Original)

Johnsonomyia fusca Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417

This species was taken at Albany, N. Y., August 9, 1907.

Male. Length 4 mm. Antennae nearly as long as the body, sparsely haired, fuscous yellowish; 16 segments, the fifth with a stem as long as the suboval basal enlargement, which latter has a length about twice its diameter, with a conspicuous whorl of long, stout setae near the middle and numerous setae of variable length clothing the face of the enlargement; terminal segment produced, with a length about five times its diameter and at the distal fourth

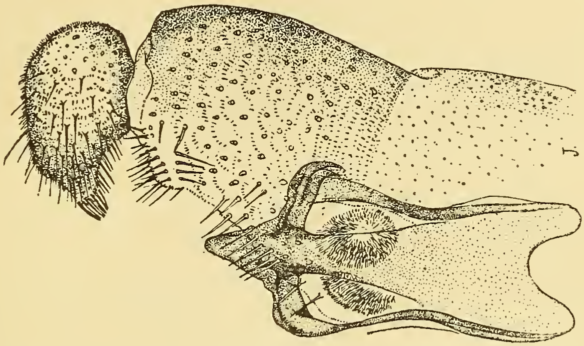


Fig. 67 Portion of male genitalia of Johnsonomyia rubra, enlarged. (Original)

a distinct constriction. Palpi; first segment stout, incrassate, with a length three times its diameter, the second as long as the first, rectangular, the third a little shorter than the second, the fourth slender, with a length more than twice the third. Mesonotum shining brown, the submedian lines rather thickly haired. Scutellum dark brown, postscutellum yellowish brown. Abdomen a variable dark brown and yellowish brown, the dorsum of the first segment and that of the fourth to eighth fuscous yellowish; genitalia fuscous. Wings hyaline, costa dark brown, venation practically as in J. rubra, though the wing is markedly smaller. Halteres yellowish, fuscous subapically; pleurae and coxae a variable fuscous yellowish; femora, tibiae and the 2 basal tarsal segments a dark fuscous yellowish, almost black, the tip of the second tarsal segment, the third and fourth white, the fifth yellow tinted apically; claws rather long, stout, slightly curved, simple, pulvilli rudimentary. Genitalia; basal clasp segment short, stout; terminal clasp segment very short, greatly swollen and with a long, chitinous tooth apically. (Plate 11, figure 7.) Type Cecid. 1237.

Johnsonomyia cincta Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:103

A large, strikingly colored midge taken on the Polochic river, Guatemala, February 22, 1912, by Messrs Barber and Schwarz.

Chastomera Skuse

1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:112
1892 **Rubsaamen, E. H.** Berl. Ent. Zeitschr., 37:333
1900 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 69:448
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37

This Australian genus was erected for the reception of a female having 16 stemmed antennal segments and 4 palpal segments. Like Haplusia, the third vein unites with the margin well beyond the apex and is joined to subcosta by a long distinct crossvein; the fifth vein is simple, uniting with the posterior margin near the basal half. The type species, C. bella Skuse, is characterized as having almost pyriform flagellar segments, the stem being nearly as long as the basal enlargement, the latter with numerous whorls of hairs, the basal whorl much longer than the rest.

Necrophlebia Skuse

1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc. S. 2, 3:111, pl. 2, fig. 10

1892 **Rubsaamen, E. H.** Berl. Ent. Zeitschr., 37:332 (quotes Skuse)

1900 **Kieffer, J. J.** Ent. Soc. Fr. Ann., 69:449 (quotes Skuse)

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37

The female of this Australian genus has the antennae about half the length of the body. There are 14 segments, each with a stem one-half the length of the subcylindric basal enlargement, which latter has 2 sparse whorls of hairs. Palpi quadriarticulate. The illustration shows the wing to be rather broad, subcosta uniting with costa well before the basal half, a distinct, somewhat oblique crossvein, the third a little beyond the apex, while the simple fifth joins the posterior margin near the basal half. This genus appears to be closely related to Johnsonomyia Felt. The 2 genera agree in major characters and it is possible that further study may prove our American forms cogeneric with this Australian species. Type N. volitans Skuse.

Meinertomyia Felt

1870 **Meinert, F. R.** Naturhist. Tidsskr., ser. 3., 6:463 (Pero)

1876 **Bergenstamm, J. E. & Löw, Paul.** Syn. Cecidomyidarum, p. 24 (Pero)

1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 15 (Pero)

1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:328, 369 (Pero)

1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201 (Pero)

1898 ———— Synop. Cecid. Eur. & Alg., p. 54 (Pero)

1900 ———— Soc. Ent. Fr. Ann., 69:448 (Pero)

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37

1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus may be recognized by the 3 long veins and the finely haired membrane of the acuminate wings, in connection with the 5 tarsal segments, the metatarsus being shorter than the preceding. It is separated from Leptosyna Kieff. by the triarticulate palpi. Pero Mein. is preoccupied by Pero H. Schf.

Type and sole species Pero fasciata Mein., the larvae of which occur under the bark of hornbeam and reproduce by pedogenesis. European.

Leptosyna Kieff.

1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201, 209–11
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus has 3 simple long veins, the third attaining the tip of the wing, the wing membrane finely haired, tarsi, quinquearticulate, the metatarsus shorter than the second segment. It may be separated from Meinertomyia Felt by the uniarticulate palpi. Antennal segments in the female 12, in the male 13. Type L. acutipennis Kieff.

Leptosyna quercivora Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:546 (L. quercus)
1912 ———— N. Y. State Mus. Bul. 155, p. 123 (new name)
1913 **Kieffer, J. J.** Marcellia, 11:235 (L. quercicola)

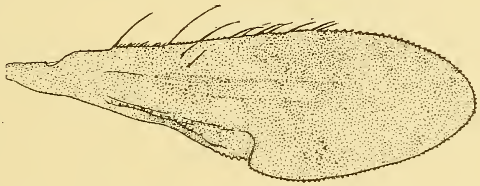


Fig. 68 Wing of Leptosyna quercivora, enlarged. (Original)

This slender, yellowish midge was reared April 20, 1911 from partially rotten bark of red oak, Quercus rubra, collected at Nassau, N. Y., the preceding fall on account of its being infested

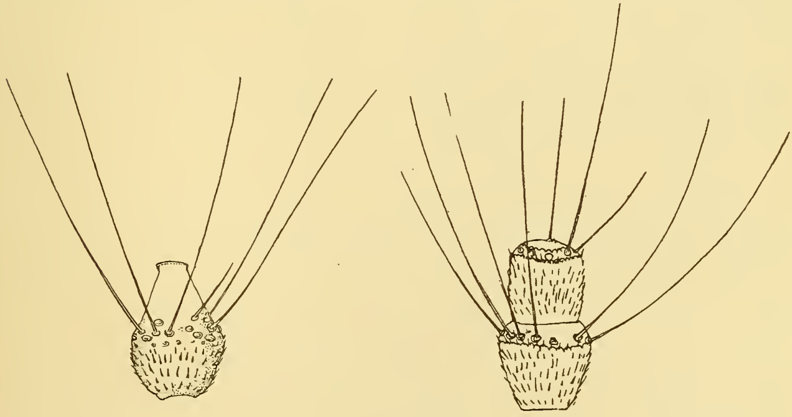


Fig. 69 Seventh and distal two antennal segments of Leptosyna quercivora, enlarged. (Original)

with yellowish Sciara larvae. The larva of this midge was not seen. This species is closely allied to L. americana from which it is most easily separated by the relatively longer twelfth and thirteenth antennal segments, these latter having a length two and one-half times the diameter, the distal being knobbed. See the above citation for a description of the male.

Leptosyna americana n. sp.

The specimen referred to this genus was captured in a trap lantern at Nassau, N. Y., May 27, 1908.

Male. Length .75 mm. Antennae extending to the second abdominal segment, sparsely haired, fuscous yellowish; 13 segments, the first somewhat produced, obconic, the second short, subglobose, the third and fourth distinct, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length one-half greater than its diameter and is adorned subapically with a thick whorl of long, stout setae, the twelfth and thirteenth segments are rather closely fused, the latter truncate apically. Palpi apparently uniarticulate. Mesonotum dark reddish brown. Scutellum, postscutellum and abdomen fuscous yellowish or yellowish orange. Wings hyaline, subcosta uniting with costa at the basal third, the third vein at the apex and the simple fifth at the distal third. Halteres yellowish transparent. Legs light fuscous yellowish; tarsi slightly darker, presumably five-segmented. Genitalia; basal clasp segment stout, truncate; terminal clasp segment stout, strongly curved, apically with a heavy, recurved, process; dorsal plate long, broad, deeply and triangularly emarginate, the lobes roundly truncate; ventral plate long, nearly divided, the lobes long, slender, tapering, narrowly rounded. (Plate 13, figure 5.) Type Cecid. 1341.

Frirenia Kieff.

1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:204, 206–9
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37
1911 ——— N. Y. State Mus. Bul. 147, p. 85

Members of this genus may be recognized by the 3 simple long veins, the third disappearing before the tip of the wing, the membrane sparsely clothed with fine hairs, and the 5 tarsal segments, the first being shorter than the second, in connection with the biarticulate palpi. Antennal segments 13, subcylindric and with short stems in both sexes. Male genitalia; basal clasp segment stout, subtriangular; terminal clasp segment rather long, stout, with a distinct, chitinous process at the internal distal angle; dorsal plate short, broad, deeply and roundly emarginate, the lobes roundly triangular; ventral plate rather long, broad, truncate apically; ovipositor short, the lobes consisting of three subequal segments. Type F. tenella Kieff. No American species are known.

Epimyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38
1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus is erected for a remarkable species evidently somewhat allied to Frirenia Kieff. The third vein unites with the anterior margin near the distal fourth, while the simple fifth joins the posterior margin at the basal half. Palpi triarticulate, the claws simple

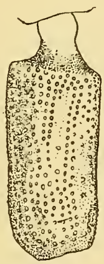


Fig. 70 Fifth antennal segment of Epimyia carolina, enlarged. (Original)

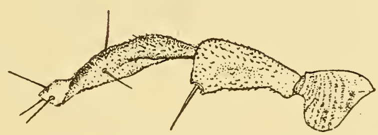


Fig. 71 Palpus of Epimyia carolina, enlarged. (Original)

and the genitalia of the male remarkably complex. The abundant vestiture and neuration of the wing indicate a relationship to Brachyneura Rond. though the absence of the characteristic scales on the membrane and the peculiar genitalia show that it has little in common with Brachyneura vitis Felt. The female is unknown. Type and sole species Epimyia carolina Felt.

Epimyia carolina Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38

The single specimen known was taken on the window of a woodland hut at Davidson's River, N. C., September 23, 1906.

Ledomyiella Meun.

1904 **Meunier, Fernand.** Soc. Sci. Brux. Ann., v. 28, pt. 2, p. 33
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38

This genus appears to be a rather common form in amber. It may be separated from Brachyneura Rond. by the metatarsus being shorter than the second segment and by the fork of the fifth long vein. Tarsal segments five. Antennal segments 14, cylindric, sessile in the female, stemmed in the male; palpi quadriarticulate, the venation about as in Brachyneura aside from the forked fifth vein noted above. Type L. succini Meun. No American species are known.

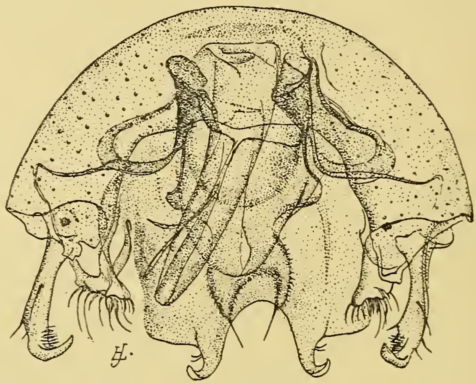


Fig. 72 Male genitalia of Epimyia carolina, enlarged. (Original)

Kronomyia Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:476

The unique form noticed below is evidently allied to Brachyneura Rond., though readily separated therefrom by the 4 long veins, the fifth and sixth being simple, and the totally different an-

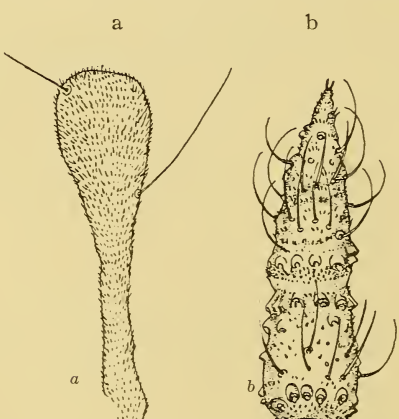


Fig. 73 *a* Palpus; *b* distal antennal segment of Kronomyia populi, enlarged. (Original)

Fig 74 Claw of Kronomyia populi, enlarged. (Original)

tennal structure. The antennae in the female of this species have but 12 segments, the apical evidently composed of 2 closely fused reduced segments, the other flagellate ones with a short stem and a short, stout basal enlargement ornamented with a basal whorl of long, stout setae and a thick band of short, curved setae. The biarticulate palpi with the greatly produced, capitate terminal segment and the peculiar ovipositor, all serve to differentiate this species from allied genera. Type K. populi n. sp.

Kronomyia populi Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:476–77

This peculiar form was reared May 5, 1911 from a whitish larva found in punky poplar wood at Nassau, N. Y., April 12, 1911. Only one larva was observed and this presented the general appearance of a small Oligarces larva just after it had escaped from the mother larva in early spring. See the above citation for a description of the female; also plate 13, figure 6.

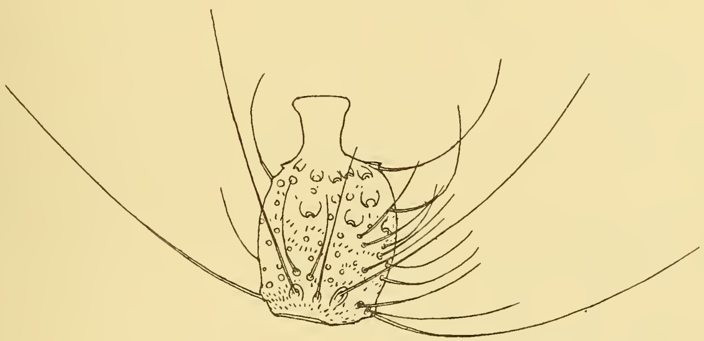


Fig. 75 Fifth antennal segment of Kronomyia populi, enlarged. (Original)

Brachyneura Rond.

1846 **Rondani, Camillo.** Nouvi Ann. Sc. Nat. Bolog., ser. 2, VI; separate, p. 13
1853 **Winnertz, J.** Linn. Ent., 8:190 (Spaniocera)
1862 **Osten Sacken, C. R.** Dipt. N. Am., 1:175
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, A. F. A.** Revis. der Gallmucken, p. 15
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:42, 146
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:401–?366?
1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 55
1900 ———— Soc. Ent. Fr. Ann., 69:439, 447
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316, 317
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38
1911 ———— N. Y. State Mus. Bul. 147, p. 85

Members of this genus are easily recognized by their general resemblance to Lasioptera in connection with the densely scaled, usually fuscous wing membrane. The two are readily separated by the fact that the antennal segments in Brachyneura are much longer than in Lasioptera and, moreover, never possess the characteristic circumfili almost invariably found in the Itonididinae. The antennae are composed of 12 segments. There are 3 simple long veins. The tarsi are quinqearticulate. Type B. fusco-grisea Rond.

Two American species of this genus have been reared, one B. eupatorii was bred presumably from an oval swelling on thoroughwort, Eupatorium perfoliatum, the other species, B. vitis, was reared from a jar containing the familiar Lasioptera vitis gall on grape, Vitis sp., and presumably came from this plant.

Key to species

a Fifth antennal segment with a length twice its diameter; scutellum yellowish

b Antennae with 11 segments, femora and tibiae dark brown. Bred ? from Lasioptera vitis gall........vitis Felt, C. a1165d

bb Antennae with 12 segments; femora and tibiae silvery grey. Bred from thoroughwort, Eupatorium perfoliatum......... eupatorii Felt, C. a1349

aa Fifth antennal segment with a length three times its diameter, scutellum black, legs uniform fuscous or black..americana Felt, C. 734

Brachyneura vitis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 317
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44

This species was reared July 13, 1907 from a jar containing the familiar Lasioptera vitis galls on grape, Vitis sp., and presumably came from this plant.

Male. Length .5 mm. Antennae nearly as long as the body, sparsely haired, dark brown; 11 segments, fifth subcylindric, with a stem one-fourth the basal enlargement, which latter has a length about twice its diameter, and is thickly clothed with short, narrow, appressed scales; terminal segment produced, tapering to a narrowly rounded apex. Palpi; the first segment short, stout, subquadrate, the second and third apparently stout, each with a length about three times its diameter. Mesonotum black. Scutellum, postscutellum and basal abdominal segment apparently fuscous yellowish, the remainder of the abdomen dark brown, sparsely haired. Wings hyaline, costa dark brown; membrane thickly clothed with fine hairs. Halteres yellowish transparent. Legs a variable dark brown; claws unidentate, pulvilli shorter than the claws. Genitalia;

basal clasp segment long, slender, roundly truncate; terminal clasp segment short, swollen basally; dorsal plate long, broad, deeply and triangularly emarginate; ventral plate long, narrow, deeply and broadly emarginate; style stout, nearly uniform. Type Cecid. a1165d.

Fig 76 Fifth antennal segment of Brachyneura vitis, enlarged. (Original)

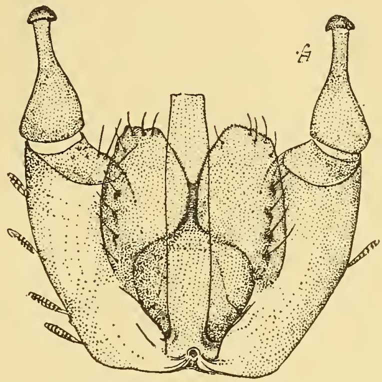


Fig. 77 Male genitalia of Brachyneura vitis, enlarged. (Original)

Brachyneura eupatorii Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 317
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44

The female was reared September 14, 1907, possibly from a gall on thoroughwort, Eupatorium perfoliatum, taken at Poughkeepsie, N. Y. The swelling on the stem was about 6 mm in diameter and contained 6 yellow larvae occupying cocoons massed in the center of the cell.

Female. Length 1.2 mm. Antennae shorter than the body, densely clothed with scales, presumably dark brown, the basal segments creamy white; 12 segments, the fifth with a length about twice its diameter; terminal segment slightly produced, with a length three times its diameter and apically with a short, stout, knoblike appendage. Palpi; the first segment short, stout, irregular, the second subrectangular, with a length about three times its diameter, slightly expanded distally, the third as long as the second, slender, tapering at both extremities. Face creamy white, eyes large, black, with fine, white points. Mesonotum dark fuscous, the submedian lines narrowly whitish. Scutellum yellowish, clothed with silvery hairs. Abdomen black, except where the whitish ground color appears; membrane and pleurae pale yellowish, ovipositor whitish apically. Wings black, costa black, thickly clothed with scales. Halteres black, whitish at the base, the pedicel unusually short and curved. Coxae pale yellowish; femora and tibiae silvery gray, the posterior tarsi silvery gray, the 2 distal segments black, the anterior and mid tarsi darker; claws unidentate, pulvilli shorter than the claws. Ovipositor short, the terminal lobes broadly oval. Type Cecid. a1349.

Brachyneura americana Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 5
1908 ———— N. Y. State Mus. Bul. 124, p. 286

The single female representing this species was taken August 2, 1906 on the office window in Albany, N. Y., and was presumably reared from material brought into the office.

Female. Length 1 mm. Antennae extending to the base of the abdomen, thickly clothed with narrow scales, black; 12 segments, the fifth subcylindric, the enlargement, with a length nearly three times its diameter; terminal segment produced, slender, distally tapering to a narrowly rounded apex. Palpi; the first segment short, stout, somewhat rounded, the second more than twice the length of the first, more slender, the third a little longer and more slender than the second. Mesonotum very dark brown, sparsely ornamented with yellowish hairs. Scutellum black with yellowish hairs basally, postscutellum and abdomen dark brownish black. Wings subhyaline, the membrane thickly clothed with narrow fuscous scales, costa black. Halteres fuscous yellowish basally, black apically. Legs mostly a uniform fuscous or black, the second and third segments of the posterior tarsi fuscous yellowish; claws long, unidentate, the pulvilli as long as the claws. Ovipositor short, the lobes short, narrowly rounded. Type Cecid. 734.

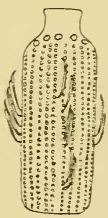


Fig. 78 Fifth antennal segment of Brachyneura americana, enlarged. (Original)

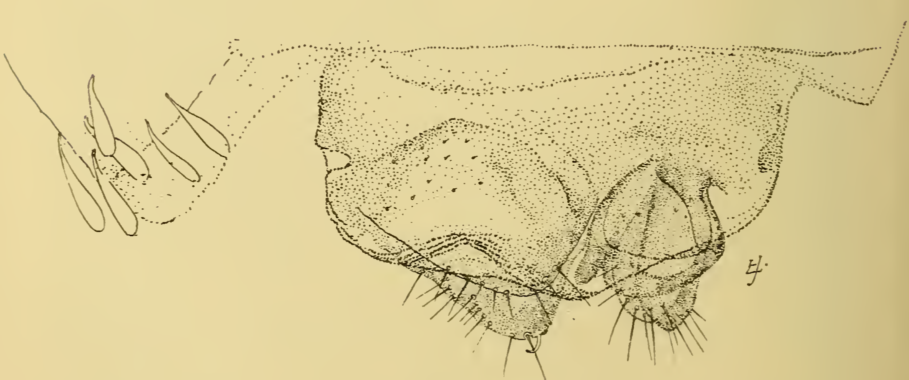


Fig. 79 Ovipositor of Brachyneura americana, enlarged. (Original)

Oligarces Mein.

1865 **Meinert, F. R.** Naturhist, Tidsskr., ser. 3, III, 238
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 16
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:401.
1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 53
1900 ———— Soc. Ent. Fr. Ann., 69:448
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 317
1911 ———— N. Y. Ent. Soc. Jour., 19:38
1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus was erected by Meinert in 1865 with O. paradoxus as the type and sole species. Members of this genus may be recognized by the finely haired wing membrane and the 2 or 3 simple veins in connection with the biarticulate tarsi, the first segment being shorter than the second. The mouth parts are rudimentary or wanting.

Oligarces noveboracensis Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 5
1908 ———— N. Y. State Mus. Bul. 124, p. 286

This species was taken on a window at Albany, N. Y., July 15, 1907 and was presumably reared from material brought into the office.

Female. Length 1 mm. Antennae extending to the second abdominal segment, pale yellowish; 13 segments, the fifth and following sessile, cylindric, with a length about one-fourth greater than the diameter; terminal segment reduced, narrowly rounded apically and irregularly clothed with long, chitinous spines. Palpi apparently wanting, eyes small, brown, ocelli absent; face yellowish. Mesonotum light brown, pleurae pale orange. Scutellum and postscutellum light fuscous yellowish. Abdomen pale yellowish, the basal and distal segments pale orange, the ovipositor pale white. Wings long, narrow, hyaline, costa pale yellowish, subcosta uniting with the anterior margin at the basal third, the third vein near the basal half, the fifth indistinct distally, joining the posterior margin at the basal half, its branch at the basal fourth, entire margin thickly clothed with long, rather stout hairs. Halteres yellowish transparent. Legs pale yellowish white. Coxae short, irregular; femora long, stout, fusiform, tibiae a little longer, with weak spines apically, tarsi biarticulate, the first segment about three-fourths the length of the slender second. Claws short, stout, slightly curved; pulvilli rudimentary; venter of eighth abdominal segment with submedian, subquadrate appendages. Ovipositor short, indistinctly triarticulate, the third segment long, narrowly oval. Type Cecid. 1226.

Oligarces ulmi Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:477–78

The larvae of this species were found at Nassau, N. Y., March 18, 1911 in the thick, partly decaying bark of an old elm, Ulmus, cut some two or three years ago. They were so inconspicuous and concealed in the tissues that there was some doubt for a time as to there being anything living in the bark, though one or two exuviae led us to believe that larvae might be present. The infested bark was brought into a warm room March 20th and on the 22d a number of whitish transparent young appeared. By the 27th there were literally thousands upon the inside of the breeding jars, crawling freely upon the glass. Many perished while others doubtless reestablished themselves in the bark. These larvae do not appear very amenable to laboratory methods, since we were unable to obtain adults from a small piece of bark containing hundreds of larvae clamped to a microscopic slide and kept in a small box. The few placed in water under a cover-glass soon escaped.

The first pupa was observed April 18. When discovered it was standing at an oblique angle, being supported by the presumably glutinous posterior extremity, since at this stage there are no clasping organs. The pupa soon turned and twisted, released its hold and was shortly lying at a totally different angle upon the moist surface of the wood. The pupal period probably extends over two or three days. The pupae evidently work themselves partly out of the wood before disclosing the adult. The first imagoes were found April 24th, females occurring in increasing numbers until about the 26th, at which time males became very numerous and continued so to the 29th. The adult flies emerge almost entirely between 10 a. m. and noon. They display a marked preference for the light, crawl freely, and when abundant run about in much the same manner as a swarm of winged ants. They crawl easily upon the surface of a glass cage though they frequently drop. Very little can be seen of the midges except at the hours above named, even when they are allowed to remain in the cage from day to day. It is probable that the eggs are deposited shortly after the females emerge. An individual may contain one to four ova, each with a length about three-fourths that of the abdomen. One female dropped in alcohol extruded two eggs which remained attached to the extremity of the abdomen (plate 14, figure 4).

The colony we discovered was practically free from natural enemies, since only one Lestodiplosis larva was observed in the material collected and no adults reared.

Egg. Length .4 mm, diameter .08 mm, extremities rounded. The egg is white and granular.

Mother larva. Length 2.5 mm, moderately stout, tapering toward each extremity, a dull yellowish white, the color harmonizing so closely with the decaying inner bark of elm as to be detected with difficulty. Head rather short, broad; the antennae short, stout, uniarticulate; transverse bands of spines on the distinct body segments rudimentary or wanting, the margins of the incisures of both extremities frequently rather strongly chitinized; the posterior extremity is rather stout, bilobed, the lobes rather broadly and irregularly rounded and with minute tubercles; the skin is nearly smooth. An overwintering mother larva may contain 8 or 10 practically fully developed young.

Young larva. Length 1.5 mm, moderately stout, white or whitish transparent, the posterior extremity sometimes with a darker reflection, due possibly to the black bark upon which the specimen was resting. Head long, triangular, the anterior third rather heavily chitinized, except the extreme apex; antennae moderately long, tapering, biarticulate; skin nearly smooth, transverse bands of spines, rudimentary or wanting; posterior extremity obtuse, bilobed, the lobes irregularly rounded and minutely tuberculate.

Pupa. Length 1 mm, moderately stout, eyes reddish brown, the thorax pale yellowish; abdomen yellowish orange; thoracic horns long, slender; antennal cases stout, extending to the base of the wing pads, the wing and leg cases extending to about the third abdominal segment; abdomen smooth, the fourth to ninth segments free and successively tapering, flexible; the posterior extremity broadly rounded and in the male, slightly bilobed. At the humeral angles there is a pair of irregularly oval, fuscous or reddish brown spots.

Exuviae. Whitish transparent, the dorsum of the abdominal segments with irregular rows of minute, chitinous points.

Female. Length 1.2 mm. Antennae short, very sparsely haired, brownish yellow; 10–12 subsessile segments, the fifth with a length about one-fourth greater than its diameter, broadly pyriform, with a few long, stout setae subbasally and an irregular whorl of long, chitinous spines subapically; terminal segment reduced, narrowly oval. Palpi apparently wanting. Face fuscous yellowish; eyes light brown. Mesonotum dark brown, the submedian lines fuscous yellowish. Scutellum reddish brown, postscutellum and abdomen pale yellowish or reddish orange, frequently slightly fuscous apically, the ovipositor fuscous yellowish. Wings long, narrow; fringe long. Halteres yellowish transparent. Legs a somewhat variable reddish yellow, the tarsi somewhat darker; first tarsal segment with a length about one-third that of tibia, the second tarsal segment with a length one-fourth greater than the first; claws stout, slightly curved, the pulvilli rudimentary. Abdomen slender and containing one to three large eggs, each with a length about three-fourths that of the abdomen; the eighth segment ventrally with submedian, irregularly pyriform appendages. Ovipositor short, indistinctly triarticulate, the third segment with a length two and one-half times its diameter. For a description of the male, see the above citation. Type Cecid. a2136.

EXPLANATION OF PLATES

PLATE 1

Pear thrips

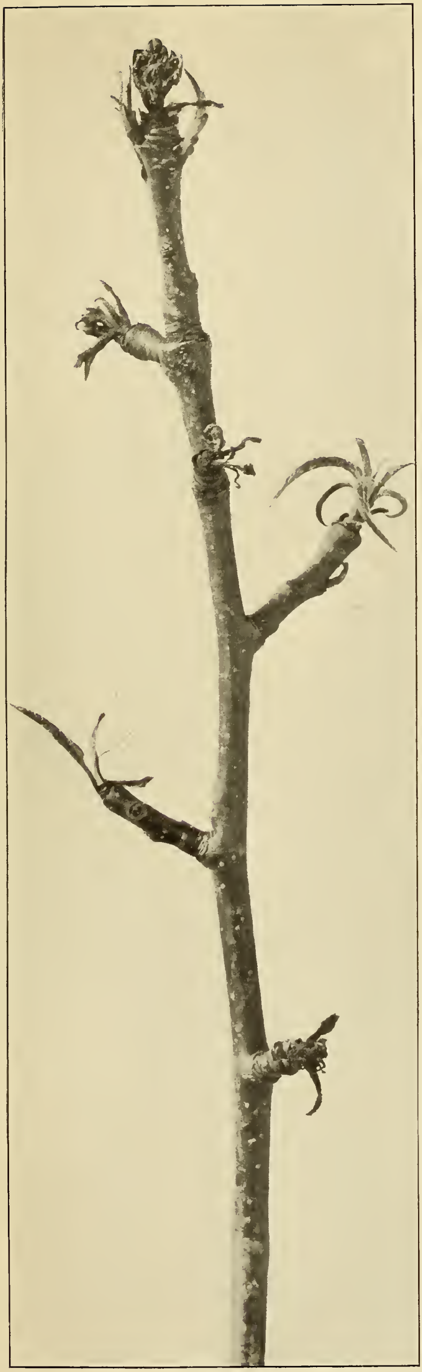
Euthrips pyri Daniel

1 Twig showing nearly total destruction of blossom buds and rudimentary leaves

2 A similar branch with the leaves partly unfolded

Plate I

1



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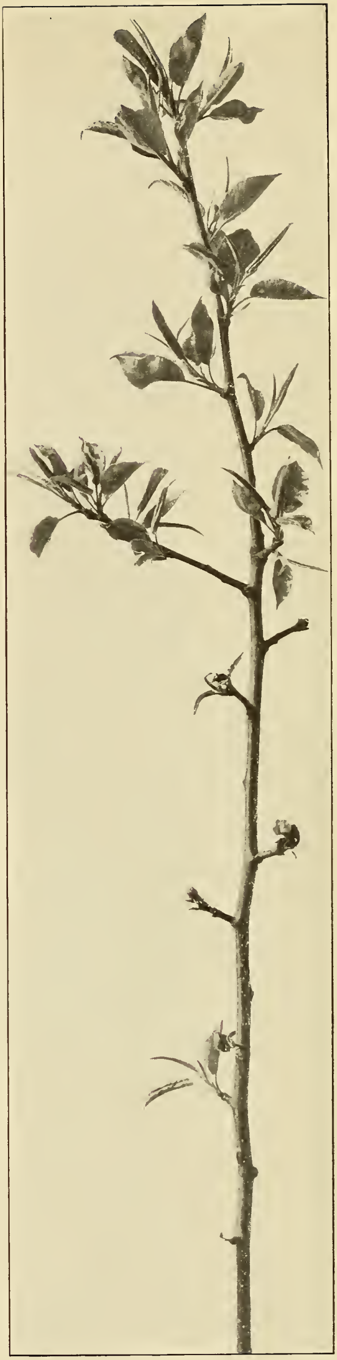


Pear thrips work

PLATE 2

Pear thrips

Euthrips pyri Daniel

1 Cluster of buds in a condition favorable to attack by pear thrips

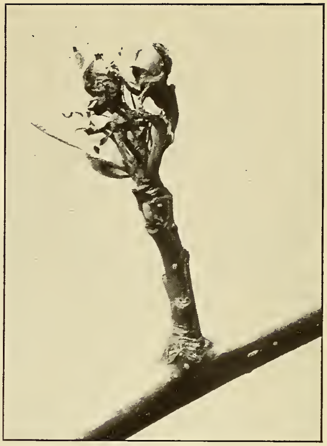
2 Fruit stem with buds seriously affected

3 A twig showing one cluster of buds somewhat enlarged by the thrips and several clusters of leaves illustrating the rolling and spoon-shaped deformity produced by this insect

Plate 2

1

2



3

Pear thrips work

PLATE 3

Pear thrips

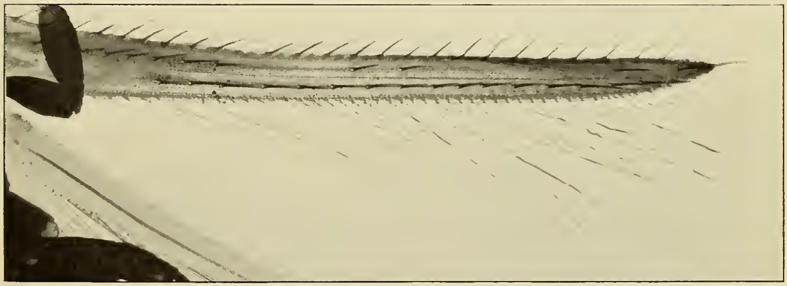
Euthrips pyri Daniel

1 Female thrips, greatly enlarged (x 40)
2 Wing of female (x 80)

Plate 3

1

2



Pear thrips

PLATE 4

Queen blow fly

Phormia regina Meig.

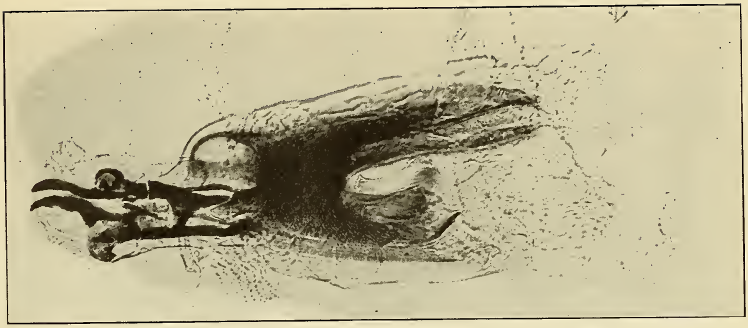
1 Anterior extremity of first stage maggot, showing the cephalo-pharyngeal skeleton and the transverse bands of chitinous points (x 100)

2 Anterior portion of second stage maggot, showing cephalo-pharyngeal skeleton (x 100)

3 Cephalo-pharyngeal skeleton of third stage maggot (x 66)

Plate 4

1



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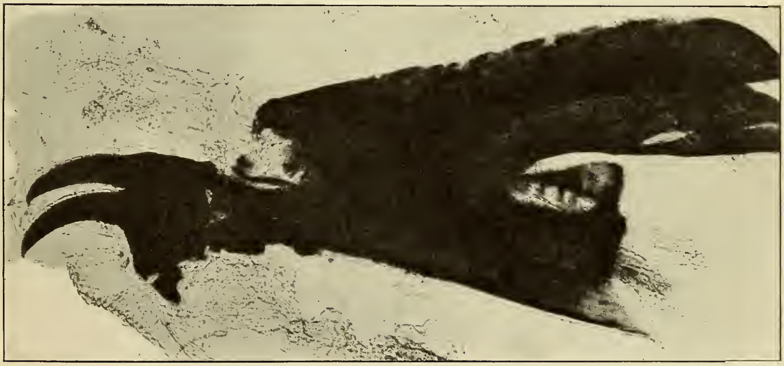


Queen blowfly larvae

PLATE 5

Queen blow fly

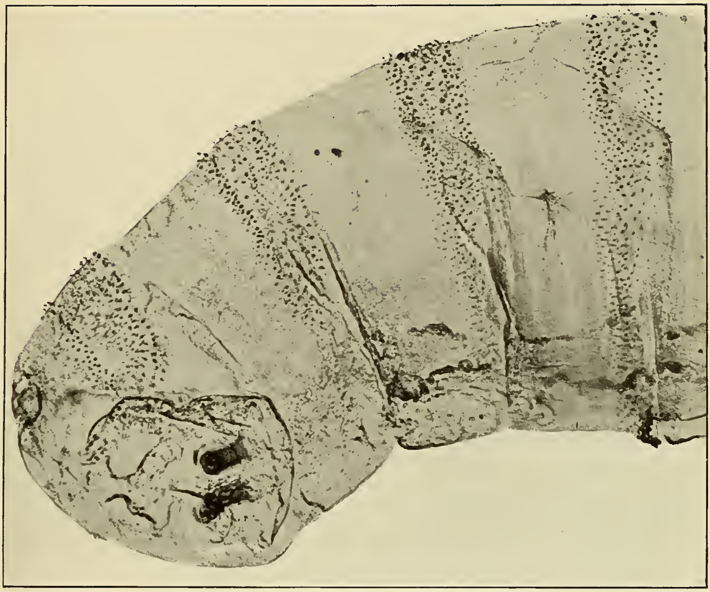
P h o r m i a   r e g i n a   Meig.

1 Posterior extremity of first stage maggot, showing the posterior pair of spiracles and the transverse bands of chitinous points (x 100)

2 Posterior spiracles of second stage maggot (x 200)

Plate 5

1



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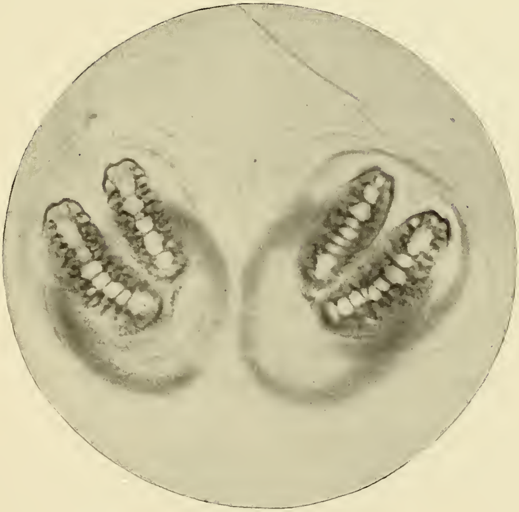


Queen blowfly larvae

PLATE 6

Queen blow fly

Phormia regina Meig.

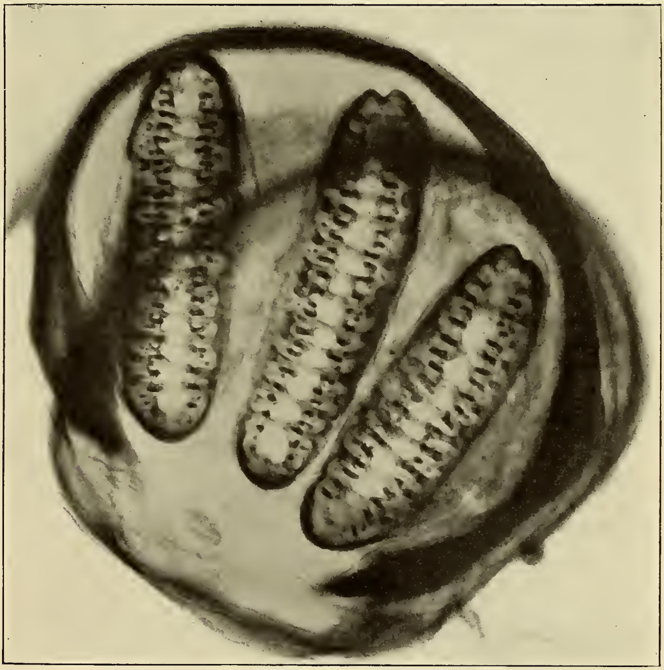
1 Portion of transverse band of chitinous points, greatly enlarged (x 200)

2 One posterior spiracle showing three orifices, each with a series of mostly transverse bars (x 200)

Plate 6

1

2



Queen blowfly larvae

PLATE 7

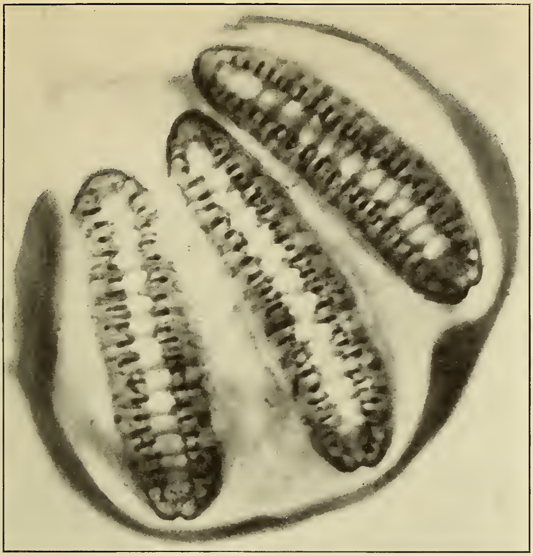
Georgian flesh fly

Sarcophaga georgina Wied.

1 Posterior spiracle showing three orifices and numerous anastomosing, oblique, chitinous bars (x 200)
2 Anterior spiracle showing the radially arranged orifices (x 100)
3 Cephalo-pharyngeal skeleton (x 80)
4 Portion of male genitalia (x 50)

Plate 7

1



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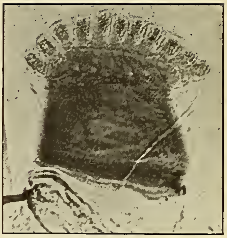

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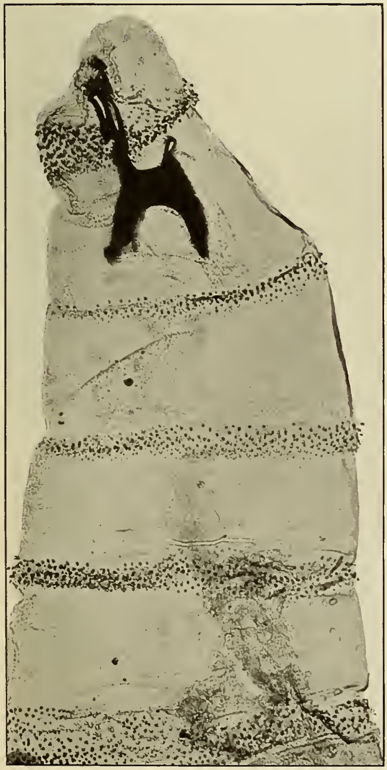

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Georgian flesh fly

PLATE 8

Effects following the application of a miscible oil

1 View in Baldwin orchard set 19 years. Over 100 trees were in a dying condition following spraying the preceding fall. Photographed June 10, 1912

2 View in orchard of peach and apple trees set 12 years. Many of the apple trees are in a dying condition and were sprayed the preceding fall with a miscible oil. Photographed June 10, 1912

Plate 8

1

2

Effects following the application of miscible oil

PLATE 9

Effects following the application of a miscible oil

1 King tree sprayed in November 1911 with a miscible oil. One-half of this tree is dead. Photographed June 10, 1912

2 A view of the base of the same tree, more enlarged. Note the darker spots on the portion of the large limb from which the outer bark had been cut away, they being especially marked at the second fork on the base of a limb which was entirely dead. Photographed June 10, 1912

Plate 9

1

2

Effects following the application of miscible oil

PLATE 10

Pear midge

Contarinia pyrivora Riley

1 Cluster of pears showing four upright ones, three at least being abnormally swollen and globular, as a result of infestation by maggots

2 Similar pears opened to show the condition of the infested fruit

[246]

Plate 10

1

2

Pear midge work

PLATE 11

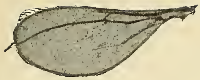
[247]

Gall midge structures

1 Joannisia carolinae Felt (x 20)
2 Campylomyza vitinea Felt (x 20)
3 Campylomyza producta Felt (x 20)
4 Prionellus longipennis Felt (x 20)
5 Cordylomyia bryanti Felt (x 20)
6 Johnsonomyia rubra Felt (x 15)
7 Johnsonomyia fusca Felt, male genitalia (x 18c)

Plate 11

1



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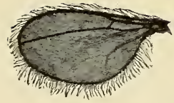

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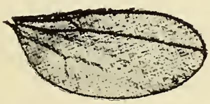

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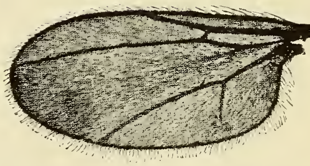

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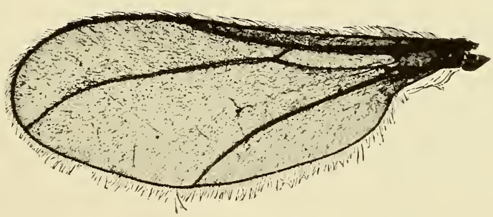

7

Gall midge structures

PLATE 12

Gall midge genitalia

1 Monardia karnerensis Felt, male (x 260)
2 Monardia balsamicola Felt, male (x 260)
3 Prionellus hesperia Felt, male (x 260)
4 Campylomyza producta Felt, male (x 260)
5 Campylomyza pomifolia Felt, male (x 260)
6 Campylomyza pomiflorae Felt, male (x 260)

Plate 12

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2

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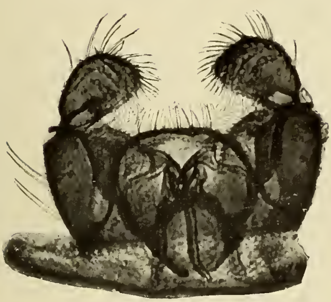

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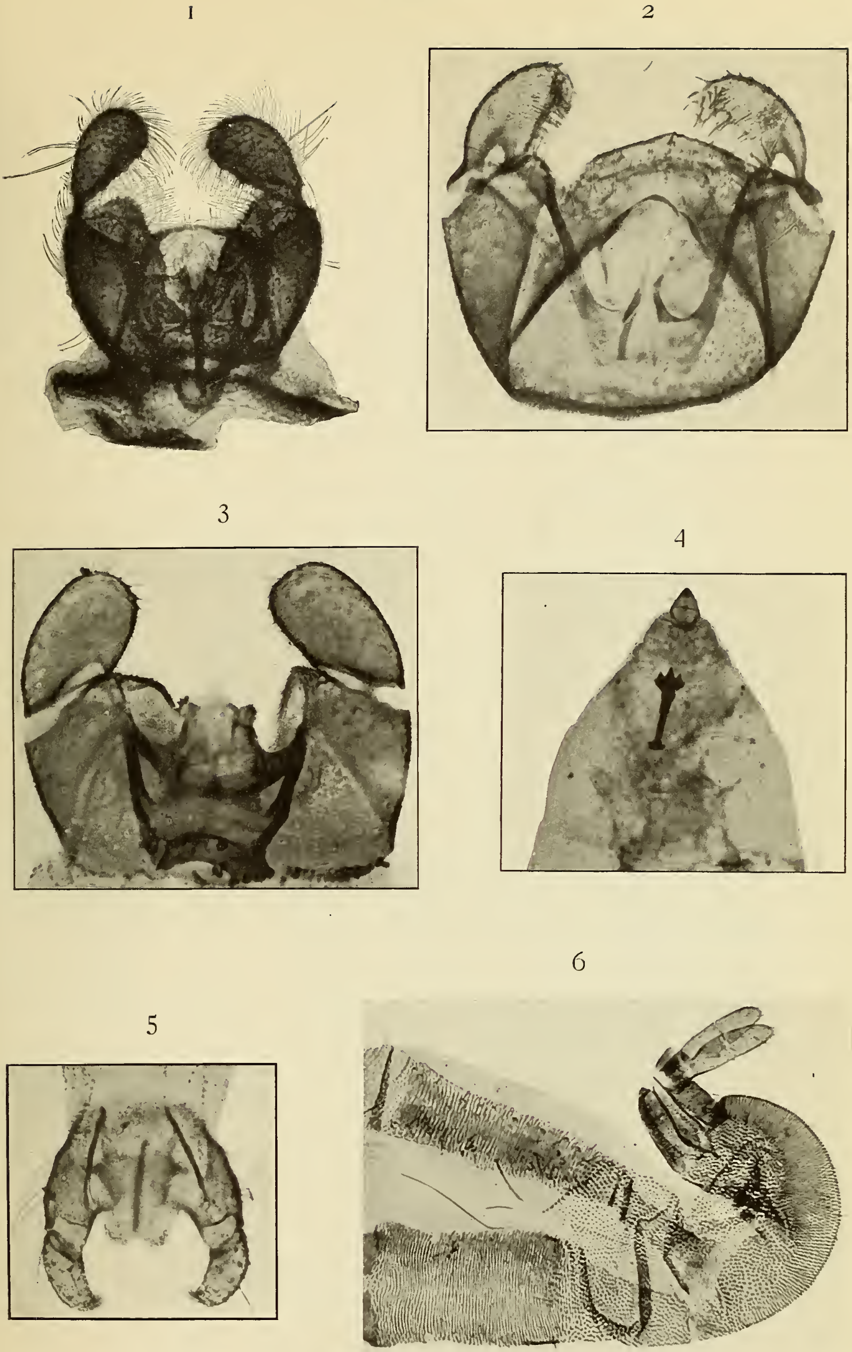
Gall midge genitalia

PLATE 13

Gall midge anatomy

1 Monardia populi Felt, male genitalia (x 260)
2 Corinthomyia currei Felt, male genitalia (x 260)
3 Cordylomyia coprophila Felt, male genitalia (x 195)
4 Monardia lignivora Felt, anterior portion of larva, showing the tridentate breastbone (x 50)
5 Leptosyna americana Felt, male genitalia (x 260)
6 Kronomyia populi Felt, posterior extremity of female (x 125)

Plate 13



Gall midge anatomy

PLATE 14

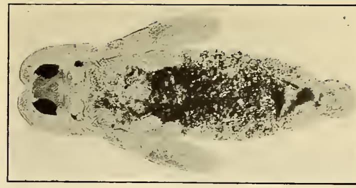
Miastor and Oligarces

1 Prepupa of Miastor
2 Pupa of Oligarces
3 Oligarces ulmi Felt, male
4 Oligarces ulmi Felt, female, showing eggs protruding from abdomen

Plate 14

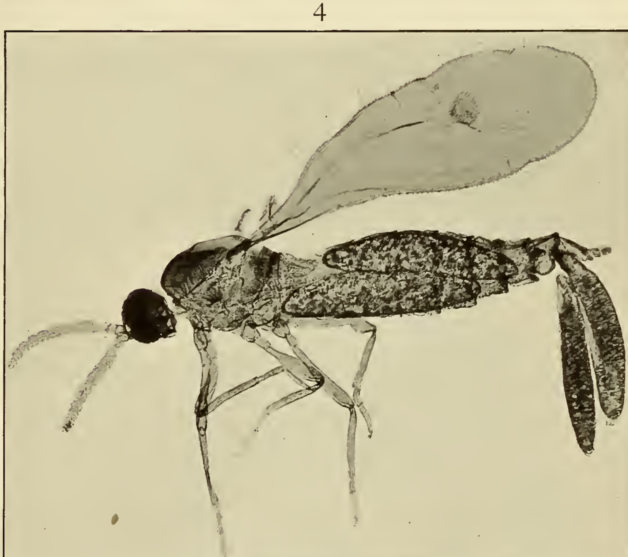
1

2



3

4



Miastor and Oligarces

INDEX

ERRATA

Page 119, line 7 from the bottom, for *arancosa* read *araneosa*

Page 208, line 7 from the bottom, for *Lonchae* read *Lonchaea*

Appendix 4

Botany

Museum Bulletin 167

167 Report of the State Botanist 1912

University of the State of New York Bulletin

Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 24, 1912

Published fortnightly

No. 550 ALBANY, N. Y. September 1, 1913

New York State Museum

John M. Clarke, Director
Charles H. Peck, State Botanist

Museum Bulletin 167

REPORT OF THE STATE BOTANIST 1912

New York State Education Department
Science Division, February 14, 1913

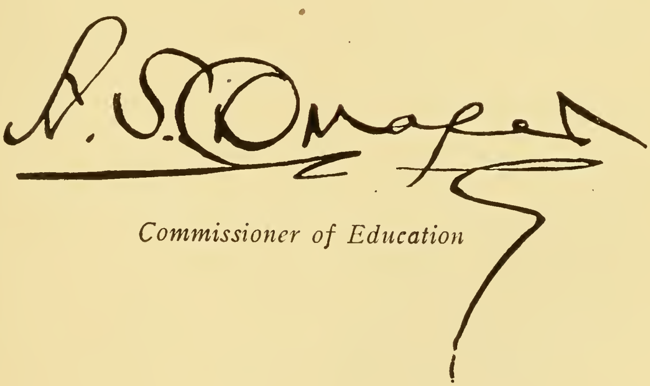
Hon. Andrew S. Draper LL.D.
Commissioner of Education

SIR: I have the honor to transmit herewith the manuscript and accompanying illustrations of the annual report of the State Botanist, for the fiscal year ending September 30, 1912, and I recommend the same for publication as a bulletin of the State Museum.

Very respectfully
JOHN M. CLARKE
Director

STATE OF NEW YORK
EDUCATION DEPARTMENT
COMMISSIONER'S ROOM

Approved for publication this 19th day of February, 1913



Commissioner of Education

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New York State Museum

JOHN M. CLARKE, Director

CHARLES H. PECK, State Botanist

Museum Bulletin 167

REPORT OF THE STATE BOTANIST 1912

Dr John M. Clarke, Director of the State Museum:

I have the honor of submitting the following report of work done in the botanical section of the State Museum since the date of my last report.

The collections of the season of 1911 have been mounted on herbarium sheets or placed in pasteboard boxes suitable for their reception and arranged in their proper places in the herbarium. Additional specimens of plants either native or naturalized have been collected in the counties of Albany, Essex, Lewis, Livingston, Monroe, Steuben and Sullivan.

Specimens have been contributed that were collected in the counties of Albany, Chautauqua, Cattaraugus, Clinton, Columbia, Fulton, Hamilton, Herkimer, Monroe, New York, Oneida, Ontario, Onondaga, Orleans, Oswego, Rensselaer, Richmond, Schoharie, Suffolk, Tompkins, Ulster, Warren and Washington.

Correspondents have contributed extralimital specimens that were collected in Canada, California, Colorado, Connecticut, Cuba, District of Columbia, Indiana, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, North Carolina, Ohio, Pennsylvania, Utah and Vermont.

The number of species of which specimens have been added to the herbarium is 278, of which 72 were not before represented therein. Of these, 11 are considered new or hitherto undescribed species.

A list of the names of the added species is marked "Plants added to the herbarium." These are divided into two groups respectively designated plants "New to the herbarium" and plants "Not new to the herbarium."

The number of those who have contributed specimens of plants is 70. This list includes the names of those who sent specimens for identification only, if the specimens were of such character and condition as to make them desirable additions to the herbarium.

The number of identifications made is 1859; the number of those for whom they were made 136.

A list of the names of the contributors and their respective contributions is marked "Contributors and their contributions."

The names of species new to our flora with their respective localities, times of collection and remarks concerning them will be found under the title "Species not before reported." This may include such plants as have previously been considered forms or varieties of other species, but which are now considered worthy of specific distinction.

New localities of rare species, new varieties and any facts of interest that may have been observed will be mentioned under the title "Remarks and observations."

Species sent for identification, if collected outside the limits of our State, have been described under the heading "New species of extralimital fungi," when no description could be found to match them.

Two species of mushrooms have been tried for their edible qualities, and though neither can be considered first class in all respects, both have been found to be harmless and palatable and have been approved as edible. Colored figures of them have been prepared and descriptions will be given in a chapter on "Edible fungi." These make the whole number of New York species and varieties of mushrooms now known to be edible 215.

A small but attractive looking mushroom was discovered growing among decaying pine leaves in Richmond county by Mr W. H. Ballou. He found it to be very poisonous. It is therefore figured and described as a poisonous fungus.

Specimens of seven species of Crataegus or thorn bushes have been added to the herbarium. Of this genus of trees and shrubs 218 New York species are now recognized. Prof. C. S. Sargent, the eminent expert crataegologist, has kindly prepared a synoptical key to our New York species. This was a most difficult and intricate piece of work which none but an expert in this peculiar branch of botany could well do. In this work he has laid an excellent foundation for the study of these interesting though often considered nearly worthless and annoying shrubs and trees. He has also added to this, descriptions of 25 new species of this genus.

In places where the chestnut bark disease, Diaporthe parasitica Murrill, has obtained a foothold it still continues its destructive work. The chestnut tree is common in the central and eastern parts of Rensselaer county. Its bark disease has been reported from both the northern and southern borders of the county. Two visits have been made the past season to the town of Sand Lake in the central part of the county to look for the disease, but hitherto no evidence of its presence there has been found. It seems remarkable that the disease should occur in the northern and southern borders only, unless its approach has been made from two different points of infection situated in nearly opposite directions from the center of the county. With the disease both in the northern and in the southern borders it is perhaps too much to expect that the intervening space can long escape attack. It would be well for the owners of chestnut timber land to keep a sharp lookout for it and promptly remove any affected trees that may be discovered, strip off the bark and burn it at once, that the disease may be kept in check as much as possible.

A small rocky knob at the north end of Lake Placid in Essex county is locally known by the name Eagles eyrie. It is covered with woods, the prevailing trees being red spruce and paper or canoe birch. These vie with each other in the size and length of their trunks. I have seen no more stately and no finer specimens of them in any other part of the Adirondacks. The trail leading from the shore of Lake Placid to the top of this mountain is about half a mile long and neither very rough nor very steep. At three stations on this trail the leaves of the striped maple, Acer pennsylvanicum L., were wilted and drooping. An examination of the base of the trunk revealed a mass of white mycelioid filaments infesting it and the roots. The fungus was not in fruiting condition and its systematic location could not be ascertained. The attack was apparently so severe that it doubtless will eventually destroy the lives of the diseased trees.

Near the red schoolhouse in the town of North Elba, Essex county, there is a patch of shrubs of wicopy or leatherwood, Dirca palustris L. It occupies about half an acre of wooded hillside. The trunks range in diameter from one-fifth cm at or near the base, and are often free from branches for one or two feet (30–60 cm). In this case the shrubs assume a treelike aspect. In these shrubs the medullary rays are quite as conspicuous as the annular rings. They are zigzag in direction and anastomose. Thin cross sections of the trunk may easily be crumbled between the thumb and fingers into small angular fragments, the cleavage following the medullary rays as well as the annular rings. These thin cross sections, even of trunks an inch or an inch and a half in diameter, may easily be made with an ordinary pocket knife without splitting or laceration by using a little pressure on the standing trunk in the direction of the cut at the time of cutting. The largest shrub of this kind that has come under my notice is one transplanted into a dooryard many years ago. Its trunk at the base is now about 9 inches or 22.5 cm in diameter. The root of this shrub is yellow and much branched. On sloping ground it is often slightly bent or somewhat decumbent in the upper part and tapers downward like a tap root, but it is much branched. Although the name " leatherwood " is often applied to this shrub the wood itself is quite soft and brittle. It is the bark that is really the tough and leathery part of the plant. Therefore " leatherbark " would be a more appropriate name. It is probable that an exceedingly strong kind of rope or cordage could be made of this bark. The Indians are said to have used the branches for cords but it is evident that the bark was the valuable factor in their material. It might be worth while to experiment a little with the fiber of the bark to see if it could not be used in making a coarse strong canvas suitable for sacks, bags, tents or sails.

The prevailing weather in the spring of 1912 was, in the eastern part of the State, unusually cool and vegetation in consequence was late and backward. On the night of June 14th a frost occurred in the vicinity of Albany sufficiently severe to kill young foliage on many small shrubs and herbs and the tender marginal cells of the younger leaves of others and on some trees. The rainfall for this month was below the mean, and the early outlook for vegetation was not encouraging; but later, conditions became more favorable, vegetation revived and rarely have we had a more fruitful and productive season.

One of our thorn bushes, Crataegus helderbergensis Sarg., the Helderberg thorn, failed entirely to bear fruit this season, probably because its blossoms were in the right condition to be frozen on the night of June 14th or possibly because it was an "off year." Sometimes thorn trees, like apple trees, appear to have "off years"; that is, a year in which a thorn tree bears an abundant crop of fruit is likely to be followed by one in which it bears no fruit, as if the production of the abundant crop had so weakened its vigor as to render it incapable of bearing two abundant crops in two successive years. The fruitless year is called an "off year."

It is interesting to note the correspondence between the favorable influences of a season on the common products of the garden and field and on the mycological crop of the woods, pastures and waste places. A productive season in one case is usually a productive season in the other. The very fruitful season of 1912 was ushered in by an unusually abundant crop of morels as the following quotations from communications of correspondents will show. "We had a very fair morel season this year and I found about 300." "Mushrooms are very early and very plentiful here this season." "We never had so many or such large morels before." My own experience here in the vicinity of Albany corroborates the above statements. I found morels larger and more plentiful than usual. They seemed to presage an abundantly fruitful season. This prophetic indication has been very satisfactorily fulfilled by an unusually good crop of wild mushroom growths in general; and in August and September the common mushroom, Agaricus campestris L., was very plentiful in pastures in the vicinity of Albany.

Much time has been required and devoted to the necessary preparation for the removal of the herbarium and duplicate specimens from Geological Hall to their new location in the Education Building. The specimens have been securely tied in bundles or, if kept in small boxes, safely packed in larger boxes to facilitate their handling and secure transportation. The contents of the table cases of the anteroom, in anticipation of removal, have for several weeks been packed in boxes and been ready for transportation.

Respectfully submitted

CHARLES H. PECK

State Botanist

Albany, December 31, 1912

PLANTS ADDED TO THE HERBARIUM

New to the herbarium

Achillea ptarmica *L.*
Amanita ovoidea *Bull.*
Anellaria separata (*L.*) *Karst.*
Aposphaeria fibriseda (*C. & E.*)
Artemisia carruthii *Wood*
A. dracunculoides *Pursh*
A. glauca *Poll.*
Arthonia quintaria *Nyl.*
A. radiata (*Pers.*) *Th. Fr.*
Betula alba *L.*
Bolbitius vitellinus (*Pers.*) *Fr.*
Boletus retipes *B. & C.*
Calosphaeria myricae (*C. & E.*)
Calvatia rubroflava (*Cragin*) *Morg.*
Chrysothamnus pinifolius *Greene*
Clavaria grandis *Pk.*
C. vermicularis *Scop.*
Cladochytrium alismatis *Büsgen*
Collema crispum *Borr.*
Collybia murina *Batsch*
Coronopus procumbens *Gilibert*
Crataegus gracilis *S.*
C. harryi *S.*
C. leptopoda *S.*
C. livingstoniana *S.*
C. macera *S.*
C. procera *S.*
Creonectria ochroleuca (*Schw.*)
Diaporthe castaneti *Nits.*
Diatrypella favacea (*Fr.*) *C. & D.*
Didymella asterinoides (*E. & E.*)
Dothidea baccharidis *Cke.*
Escholtzia californica *Cham.*
Flammula graveolens *Pk.*
Helicopsis punctata *Pk.*
Heliomyces pruinosipes *Pk.*
Helminthosporium fuscum *Fckl.*
Hydnum laevigatum *Sw.*
H. subcrinale *Pk.*
Hygrophorus ruber *Pk.*
Inocybe radiata *Pk.*
Lenzites trabea (*Pers.*) *Fr.*
Leptonia euchlora (*Lasch.*) *Fr.*
Macrophoma juniperina *Pk.*
Malus glaucescens *S.*
Mycena flavifolia *Pk.*
M. splendidipes *Pk.*
Opegrapha herpetica *Ach.*
Penicillium hypomycetes *Sacc.*
Pestalozzia truncata *Lev.*
Phialea anomala *Pk.*
Phoma asclepiadea *E. & E.*
P. semiimmersa *Sacc.*
Phyllosticta mahoniaecola *Pass.*
P. rhoicola *E. & E.*
Placodium camptidium *Tuck.*
Pleurotus tessulatus (*Bull.*) *Fr.*
Polyporus dryadeus (*Pers.*) *Fr.*
Puccinia urticae (*Schum.*) *Lagerh.*
Riccardia sinuata (*Dicks.*) *Limpr.*
Russula ballouii *Pk.*
Septoria margaritaceae *Pk.*
Silene dichotoma *Ehrh.*
Tricholoma latum *Pk.*
T. piperatum *Pk.*
T. subpulverulentum (*Pers.*)
Urophlyctis major *Schroet.*
Vermicularia hysteriiformis *Pk.*
Verrucaria muralis *Ach.*
V. papularis *Fr.*
Vicia hirsuta (*L.*) *S. F. Gray*
Zygodesmus avellanus *Sacc.*

Not new to the herbarium

Acetabula vulgaris *Fckl.*
Adiantum pedatum *L.*
Aecidium hydnoideum *B. & C.*
Agaricus abruptibulbus *Pk.*
A. micromegethus *Pk.*
Agrostis borealis *Hart.*
Ajuga reptans *L.*
Aleurodiscus oakesii (*B. & C.*) *Cke.*
Alnus rugosa (*DuRoi*) *Spreng.*
Alopecurus genic. aristulatus *Torr.*

Amanita formosa *G. & R.*
A. frostiana *Pk.*
Amaranthus graecizans *L.*
A. retroflexus *L.*
Ambrosia artemisiifolia *L.*
Andromeda glaucophylla *Link*
Anthemis cotula *L.*
A. tinctoria *L.*
Arenaria stricta *Mx.*
Aristida purpurascens *Poir*
Artemisia biennis *Willd.*
A. frigida *Willd.*
A. gnaphaloides *Nutt.*
A. vulgaris *L.*
Aspidium boottii *Tuck.*
A. cristatum (*L.*) *Sw.*
A. goldianum *Hook.*
A. marginale (*L.*) *Sw.*
A. noveboracensis (*L.*) *Sw.*
A. spinulosum (*O. F. Muell.*)
A. spin. dilatatum (*Hoffm.*)
A. spin. intermedium (*Muhl.*)
A. thelypteris (*L.*) *Sw.*
Asplenium acrostichoides *Sw.*
A. filix-foemina (*L.*)
A. platyneuron (*L.*) *Oakes*
A. trichomanes *L.*
Barbarea vulgaris *R. Br.*
Boletinus grisellus *Pk.*
Boletus brevipes *Pk.*
B. scaber *Fr.*
B. subaur. rubroscriptus *Pk.*
B. subtomentosus *L.*
Botrychium lanceolatum (*S.G.Gmel.*)
B. obliquum *Muhl.*
B. obliq. dissectum (*Spreng.*)
B. ramosum (*Roth*) *Aschers*
B. simplex *E. Hitchc.*
B. tern. intermedium *Eaton*
B. virginianum (*L.*) *Sw.*
Camelina microcarpa *Andrz.*
Camptosorus rhizophyllus (*L.*) *Link*
Cantharellus cibarius *Fr.*
C. floccosus *Schw.*
Carex aestivalis *M. A. Curtis*
C. muhlenbergii *Schkr.*
C. trib. reducta *Bailey*
Carya glabra villosa (*Sarg.*)
C. ovata (*Mill.*) *K. Koch*
Cercospora symplocarpi *Pk.*
Cephalozia lunulaefolia *Dum.*
Chlorosplenium aeruginascens (*Nyl.*)
Cladonia crist. vestita *Tuck.*
C. grac. dilatata (*Hoffm.*)
Clavaria cristata *Holmsk.*
C. fastigiata *L.*
C. kunzei *Fr.*
C. obtusissima minor *Pk.*
C. pinophila *Pk.*
C. stricta *Pers.*
C. tsugina *Pk.*
Clitocybe adirondackensis *Pk.*
C. cerussata *Fr.*
C. maxima *G. & M.*
Clitopilus noveboracensis *Pk.*
Convolvulus sepium pubescens (*Gray*)
Corallorhiza odontorhiza *Nutt.*
Cortinarius uliginosus *Berk.*
C. vernalis *Pk.*
C. variicolor (*Pers.*)
Crucibulum vulgare *Tul.*
Cynanchium nigrum (*L.*) *Pers.*
Cyperus dentatus *Torr.*
C. ferax *Rich.*
Cystopteris bulbifera (*L.*) *Bernh.*
C. fragilis (*L.*) *Bernh.*
Cytospora chrysosperma (*Pers.*) *Fr.*
Daedalea unicolor (*Bull.*) *Fr.*
Dicksonia punctilobula (*Mx.*) *Gray*
Diaporthe parasitica *Murrill*
Doassansia alismatis (*Fr.*) *Cornu*
Elymus canadensis *L.*
Entoloma sericeum (*Bull.*) *Fr.*
E. sinuatum *Fr.*
Epilobium molle *Torr.*
Epipactus repens ophioides (*Fern.*)
E. tesellata (*Lodd.*)
Erigeron annuus (*L.*) *Pers.*
E. canadensis *L.*
Eupatorium pur. maculatum (*L.*)
Equisetum hyemale *L.*
E. scirpoides *Mx.*
E. varieg. nelsonii *Eaton*
Fagus grandiflora *Ehrh.*
Fistulina hepatica *Fr.*
Flammula spum. unicolor *Pk.*
F. sulphurea *Pk.*
Fomes igniarius (*L.*) *Fr.*
F. pinicola (*Sw.*) *Fr.*
Fomitiporia prun. betulicola *Pk.*

Geoglossum microsporum *C. & P.*
Geum canadense *Jacq.*
G. flavum (*Porter*) *Britton*
G. strictum *Ait.*
Grimaldia fragrans (*Balb.*) *Cd.*
Gutierrezia sarothrae (*Pursh*)
Gymnolomia multiflora (*Nutt.*)
Habenaria fimbriata (*Ait.*) *R. Br.*
H. microphylla *Goldie*
Haplosporella ailanthi *E. & E.*
Hebeloma fastibile *Fr.*
Hedeoma pulegioides (*L.*) *Pers.*
Helianthemum majus *BSP.*
Heliopsis scabra *Dunal.*
Helvella capucinoides *Pk.*
Hierochloe odorata (*L.*) *Wahl.*
Humaria leucoloma (*Hedw.*) *Fr.*
H. granulata *Bull.*
Hydnum caput-ursi *Fr.*
Hygrophorus nitidus *B. & C.*
Hypericum perforatum *L.*
Hypholoma incertum *Pk.*
Ilex monticola *Gray*
Inocybe eutheloides *Pk.*
I. geophylla violacea *Pat.*
I. subochracea (*Pk.*) *Mass.*
Jeffersonia diphylla (*L.*) *Pers.*
Jungermannia lanceolata *L.*
Lactarius glyciosmus *Fr.*
L. vellereus *Fr.*
Lamium amplexicaule *L.*
Lecanora subfusca allophana *Ach.*
Lejeunea cavifolia (*Ehrh.*) *Lindb.*
Lenzites sepiaria *Fr.*
Leonorus cardiaca *L.*
Lepiota americana *Pk.*
L. cepaestipes *Sow.*
L. farinosa *Pk.*
L. procera *Scop.*
Liparis loeselii (*L.*) *Rich.*
Listera australis *Lindl.*
Lonicera hirsuta *Eaton*
Lycopodium annotinum *L.*
L. annot. pungens *Desv.*
L. comp. flabelliforme *Fern.*
L. clavatum *L.*
L. inundatum *L.*
L. lucidulum *Mx.*
L. obscurum *L.*
Lycopodium obsc. dendroideum (*Mx.*)
L. tristachyum *Pursh*
Machaeranthera pulverulenta (*Nutt.*)
Malva moschata *L.*
Marasmius elongatipes *Pk.*
M. scorodonius *Fr.*
M. semihirtipes *Pk.*
Marrubium vulgare *L.*
Marsupella emarginata (*Ehrh.*)
Microstylis unifolia (*Mx.*) *BSP.*
Monarda didyma *L.*
Mutinus elegans (*Mont.*) *E. Fisch.*
Myosotis virginica (*L.*) *BSP.*
Nepeta cataria *L.*
Odontoschisma prostratum (*Wahl.*)
Onoclea sensibilis *L.*
Onopordum acanthium *L.*
Origanum vulgare *L.*
Osmunda cinnamomea *L.*
O. claytoniana *L.*
Oxalis filipes *Small*
O. stricta *L.*
Pallavicinia lyellii (*Hook.*)
Panaeolus papilionaceus *Fr.*
Panax quinquefolia *L.*
Panicum boscii *Poir*
P. dichotomum *L.*
P. latifolium *L.*
P. oricola *H. & C.*
P. spretum *Schultes*
P. xanthophysum *Gray*
Panus torulosus *Fr.*
Peridermium pyriforme *Pk.*
P. strobi *Kleb.*
Pertusaria leioplaca (*Ach.*) *Schaer.*
Phallus ravenellii *B. & C.*
Phegopteris dryopteris (*L.*) *Fee*
P. polypodioides *Fee*
Pholiota adiposa *Fr.*
P. autumnalis *Pk.*
P. cerasina *Pk.*
P. duroides *Pk.*
P. squarrosa *Muell.*
Phoma lineolata *Desm.*
Phylloporus rhodoxanthus (*Schw.*)
Physalis virginiana *Mill.*
Picea canadensis (*Mill.*) *BSP.*
Pleurotus ost. magnificus *Pk.*
P. septicus *Fr.*

Pleurotus sulfuroides *Pk.*
Poa debilis *Torr.*
Polygonum acre *HBK.*
P. aviculare *L.*
P. maritimum *L.*
P. pennsylvanicum *L.*
P. persicaria *L.*
Polypodium vulgare *L.*
Polyporus betulinus *Fr.*
P. curtisii *Berk.*
P. distortus *Schw.*
P. frondosus *Fr.*
P. radicatus *Schw.*
P. squamosus (*Huds.*) *Fr.*
P. volvatus *Pk.*
Polystichum acrostichoides (*Mx.*)
P. braunii (*Spenner*) *Fee*
Poria inermis *E. & E.*
Potentilla recta *L.*
Prunella vulgaris *L.*
Psathyrella disseminata *Pers.*
Psilocybe atomatoides *Pk.*
Pteris aquilina *L.*
Ribes triste albinervium (*Mx.*)
Roestelia aurantiaca *Pk.*
Rubus odoratus *L.*
R. triflorus *Richards.*
Russula nigricans (*Bull.*) *Fr.*
R. sanguinea (*Bull.*) *Fr.*
Rynchospora capillacea *Torr.*
Salsola kali tenuifolia *G. F. W. Mey.*
Saponaria officinalis *L.*
Satureja vulgaris (*L.*) *Fritsch*
Scapania undulata (*L.*) *Dum.*
Schistostega osmundacea (*Dicks.*)
Scirpus caespitosus *L.*
S. planifolius *Muhl.*
Scleroderma vulgare *Hornem.*
Seligeria pusilla *B. & S.*
Serapias helleborine *L.*
Sesuvium maritimum (*Walt.*) *BSP.*
Setaria glauca (*L.*) *Bv.*
S. viridis (*L.*) *Bv.*
Shepherdia canadensis (*L.*) *Nutt.*
Sisymbrium offic. leiocarpum *DC.*
Sparganium diver. acaule (*Beebe*)
Spherobolus stellatus *Tode*
Spathularia clavata (*Schaeff.*)
Sphenolobus exsectaeformis (*Briedl.*)
Spiranthes praecox (*Walt.*) *BSP.*
Symphoricarpos orbiculatus *Moench.*
Thlaspi arvense *L.*
Tremella vesicaria *Bull.*
Tricholoma chrysenteroides *Pk.*
Trillium grandiflorum (*Mx.*)
Typhula phacorrhiza *Fr.*
Urnula craterium (*Schw.*) *Fr.*
Valsa pini (*A. & S.*) *Fr.*
Verbascum thapsus *L.*
Verbena hastata *L.*
V. urticaefolia *L.*
Veronica peregrina *L.*
V. tournefortii *C. C. Gmel.*
Vicia angustifolia *Roth*
V. tetrasperma (*L.*) *Moench.*
Viola cucullata *Ait.*
V. septentrionalis *Greene*
Volvaria bombycina (*Pers.*) *Fr.*
Xanthium commune *Britton*
Xyris montana *H. Reis*

CONTRIBUTORS AND THEIR CONTRIBUTIONS

Miss L. C. Allen, Newtonville, Mass.

Clavaria fumigata *Pers.*
Lepiota alleniae *Pk.*

Miss F. Beckwith, Rochester

Artemisia dracunculoides *Pursh*

Mrs N. L. Britton, New York

Schistostega osmundacea (*Dicks.*)
Seligeria pusilla *B. & S.*

Mrs J. C. Cahn, Detroit, Mich.

Clavaria platyclada *Pk.*

Miss V. K. Charles, Washington, D. C.

Agaricus subrufescens *Pk.*

Mrs E. P. Gardner, Canandaigua

Ajuga reptans *L.*
Convolvulus sepium pubescens (*Gray*)
Corallorhiza odontorhiza *Nutt.*
Geum flavum (*Porter*) *Britton*
Heliopsis scabra *Dunal.*
Panicum boscii *Poir*
P. spretum *Schultes*
Physalis virginiana *Mill.*
Veronica peregrina *L.*
V. tournefortii *C. C. Gmel.*

Mrs L. L. Goodrich, Syracuse

Crucibulum vulgare *Tul.*

Miss C. C. Haynes, New York

Bazzania tricrenata (*Wahl.*) *Trev.*
B. trilobata (*L.*) *S. F. Gray*
Blepharostoma trichophyllum (*L.*)
Calypogeia trichomanis (*L.*) *Cd.*
Cephalozia bicuspidata (*L.*) *Dum.*
C. connivens (*Dicks.*)
C. fluitans (*Nees*) *Spruce*
C. lunulaefolia *Dum.*
Chiloscyphus polyanthus (*L.*) *Cd.*
Conocephalum conicum *L.*
Diplophylleia taxifolia (*Wahl.*)
Frullania eboracensis *Gottsche*
Geocalyx graveolens (*Schrad.*)
Jungermannia lanceolata *L.*
Lejeunea cavifolia (*Ehrh.*) *Lindb.*
Lepidozia setacea (*Web.*) *Mitt.*
Lophocolea heterophylla (*Schrad.*)
Lophozia alpestris (*Schleich.*)
Lophozia attenuata (*Mart.*) *Dum.*
L. barbata (*Schreb.*) *Dum.*
L. mildeana (*Gottsche*)
Marchantia polymorpha *L.*
Marsupella emarginata (*Ehrh.*)
Mylia anomala (*Hook.*) *S. F. Gray*
M. taylori (*Hook.*) *S. F. Gray*
Nardia crenulata (*Smith*) *Lindb.*
Notothylas orbicularis (*Schw.*)
Odontoschisma denudatum (*Mart.*)
O. prostratum (*Sw.*)
Pallavicinia lyellii (*Hook.*)
Pellia epiphylla (*L.*) *Cd.*
Plagiochila asplenioides (*L.*) *Dum.*
Radula tenax *Lindb.*
Reboulia hemisphaerica (*L.*) *Raddi*
Riccardia sinuata (*Dicks.*) *Limpr.*
Ricciella sullivantii (*Aust.*)

Scapania apiculata *Spruce*
S. nemorosa (*L.*) *Dum.*
S. undulata (*L.*) *Dum.*
Sphenolobus exsectaeformis (*Briedl.*)
S. exsectus (*Schmid.*)
Temnoma setiforme (*Ehrh.*)
Trichocolea tomentella (*Ehrh.*) *Dum.*

Miss A. Hibbard, West Roxbury, Mass.

Clavaria obtusissima *Pk.*
Clavaria subcaespitosa *Pk.*
Tricholoma piperatum *Pk.*

Mrs M. W. Hill, St Paul, Minn.

Lentinus tigrinus (*Bull.*) *Fr.*

Miss M. F. Miller, Washington, D. C.

Adiantum pedatum *L.*
Aspidium boottii *Tuck.*
A. cristatum (*L.*) *Sw.*
A. goldianum *Hook.*
A. marginale (*L.*) *Sw.*
A. noveboracense (*L.*) *Sw.*
A. spinulosum (*O. F. Muell.*)
A. spin. dilatatum (*Hoffm.*)
A. spin. intermedium (*Muhl.*)
A. thelypteris (*L.*) *Sw.*
Asplenium acrostichoides *Sw.*
A. filix-foemina (*L.*)
A. platyneuron (*L.*) *Oakes*
A. trichomanes *L.*
Botrychium lanceolatum (*S. G. Gmel.*)
B. obliquum *Muhl.*
B. obliq. dissectum (*Spreng.*)
B. ramosum (*Roth*)
B. simplex *E. Hitckc.*
tern. intermedium *Eaton*
B. virginianum (*L.*) *Sw.*
Camptosorus rhizophyllus (*L.*) *Link*
Cystopteris bulbifera (*L.*) *Bernh.*
C. fragilis (*L.*) *Bernh.*
Dicksonia punctilobula (*Mx.*) *Gray*
Equisetum hyemale *L.*
Geum canadense *Jacq.*
Lycopodium annotinum *L.*
L. annot. pungens *Desv.*
L. clavatum *L.*
L. comp. flabelliforme *Fern.*
L. lucidulum *Mx.*
L. obscurum *L.*
L. obsc. dendroideum (*Mx.*)
L. tristachyum *Pursh*
Microstylis unifolia (*Mx.*) *BSP.*
Monarda didyma *L.*
Onoclea sensibilis *L.*
Osmunda cinnamomea *L.*
O. claytoniana *L.*
Panax quinquefolia *L.*
Phegopteris dryopteris (*L.*) *Fee*
P. polypodioides *Fee*
Polypodium vulgare *L.*
Polystichum acrostochoides (*Mx.*)
P. braunii (*Spenner*) *Fee*
Potentilla recta *L.*
Pteris aquilina *L.*

Mrs E. Watrous, Hague

Arenaria stricta *Mx.*

Miss E. C. Webster, Canandaigua

Camelina microcarpa *Andrz.*
Cortinarius variicolor (*Pers.*)
Lamium amplexicaule *L.*
Lepiota farinosa *Pk.*
Thlaspi arvense *L.*

Mrs M. S. Whetstone, Minneapolis, Minn.

Boletus sphaerosporus *Pk.*
Entoloma helodes *Fr.*
Guepinia elegans *B. & C.*
Guepiniopsis fissus *Berk.*
Inocybe fibrillosa *Pk.*
Marasmius trullisatipes *Pk.*
Pholiota autumnalis *Pk.*
Psilocybe cystidiosa *Pk.*
Stropharia umbilicata *Pk.*
Volvaria perplexa *Pk.*

W. E. Abbs, Rochester

Boletus subaur. rubroscriptus *Pk.*
Phylloporus rhodoxanthus (*Schw.*)
Tricholoma subpulverulentum (*Pers.*) *Fr.*

C. P. Alexander, Gloversville

Achillea ptarmica *L.*
Andromeda glaucophylla *Link*
Carex aestivalis *M. A. Curtis*
C. muhlenbergii *Schkr.*
C. tribul. reducta *Bailey*
Cyperus dentatus *Torr.*
Epilobium molle *Torr.*
Epipactis repens ophioides (*Fern.*)
E. tesellata (*Lodd.*)
Equisetum scirpoides *Mx.*
E. varieg. nelsonii *Eaton*
Habenaria fimbriata (*Ait.*) *R.Br.*
Habenaria microphylla *Goldie*
Helianthemum majus *BSP.*
Ilex monticola *Gray*
Liparis loeselii (*L.*) *Rich.*
Listera australis *Lindl.*
Lycopodium inundatum *L.*
Microstylis uniflora (*Mx.*) *BSP.*
Panicum oricola *H. & C.*
P. xanthophysum *Gray*
Shepherdia canadensis (*L.*) *Nutt.*
Sparganium diver. acaule (*Beebe*)
Xyris montana *H. Reis*

F. H. Ames, Brooklyn

Boletus scaber *Fr.*
Polyporus curtisii *Berk.*

G. F. Atkinson, Ithaca

Cladochytrium alismatis *Büsgen*
Clavaria tetragona *Schw.*
Doassansia alismatis (*Fr.*) *Cornu*
Heliomyces pruinosipes *Pk.*
Lepiota cepaestipes *Sow.*
Marasmius semihirtipes *Pk.*
Tremellodendron aurantium *Atk.*
Urophlyctis major *Schroet.*

G. G. Atwood, Albany

Diaporthe parasitica *Murrill*
Peridermium strobi *Kleb.*

W. H. Ballou, New York

Lactarius volem. subrugosus *Pk.*
Lenzites trabea (*Pers.*) *Fr.*
Mycena splendidipes *Pk.*
Phallus ravenellii *B. & C.*
Psilocybe graveolens *Pk.*
Russula ballouii *Pk.*

H. J. Banker, Greencastle, Ind.

Helvella capucinoides *Pk.*
Polyporus distortus *Schw.*
Volvaria bombycina (*Pers.*) *Fr.*

E. Bartholomew, Stockton, Kan.

Asteromella asteris *Pk.*
Coryneum effusum *Pk.*
Cylindrosporium crescentum *Barth.*
Diatrype albopruinosa (*Schw.*) *Cke.*

Fusicladium depressum (*B. & Br.*)
Herpotrichia diffusa (*Schw.*) *Sacc.*
Hysteriographium acerinum *Pk.*
Irpex cinnamomeus *Fr.*
Ramularia anomala *Pk.*
Valsa translucens (*DeNot.*)
Valsa truncata *C. & P.*

M. S. Baxter, Rochester

Alopecurus genic. aristulatus *Torr.*
Artemisia biennis *Willd.*
A. carruthii *Wood*
A. dracunculoides *Pursh*
A. frigida *Willd.*
A. glauca *Pall.*
A. gnaphalodes *Nutt.*
A. vulgaris *L.*
Carex brunnescens *Poir*
C. flava *L.*
C. lanuginosa *Mx.*
C. leptalea *Wahl.*
Chrysothamnus pinifolius *Greene*
Cynosurus cristatus *L.*
Eleocharis rostellata *Torr.*
Elymus canadensis *L.*
Grindelia squarrosa (*Pursh*) *Dunal.*
Gutierrezia sarothrae (*Pursh*)
Gymnolomia multiflora (*Nutt.*)
Hierochloe odorata (*L.*) *Wahl.*
Jeffersonia diphylla (*L.*) *Pers.*
Machaeranthera pulverulenta (*Nutt.*)
Marrubium vulgare *L.*
Panicum dichotomum *L.*
P. latifolium *L.*
P. spretum *Schultes*
Poa debilis *Torr.*
Rynchospora capillacea *Torr.*
Scirpus caespitosus *L.*
S. planifolius *Muhl.*
Serapias helleborine *L.*

F. S. Boughton, Pittsford

Acetabula vulgaris *Fckl.*
Boletinus grisellus *Pk.*
Clavaria fastigiata *L.*
C. pinophila *Pk.*
C. stricta *Pers.*
C. vermicularis *Scop.*
Inocybe geophylla violacea *Pat.*
Panus torulosus *Fr.*
Pleurotus tessulatus (*Bull.*) *Fr.*
Psilocybe atomatoides *Pk.*
Russula sanguinea (*Bull.*) *Fr.*
Urnula craterium (*Schw.*) *Fr.*

F. J. Braendle, Washington, D. C.

Hydnum fasciatum *Pk.*
Hygrophorus nemoreus *Fr.*
Polystictus perg. revolutus *Pk.*
Polystictus pseudopergamenus (*Thuem.*)
Pterula densissima *B. & C.*
Tricholoma tumulosum *Kalchb.*

C. K. Brain, Columbus, Ohio

Collybia delicatula *Pk.*
Collybia murina *Batsch*
Russula xerampelina *Fr.*

S. H. Burnham, Hudson Falls

Aleurodiscus oakesii (*B. & C.*)
Amaranthus retroflexus *L.*
Ambrosia artemisiifolia *L.*
Anthemis cotula *L.*
Barbarea vulgaris *R. Br.*
Boletus retipes *B. & C.*
Cantharellus cibarius *Fr.*
Cercospora symplocarpi *Pk.*
Clavaria cristata *Holmsk.*
C. grandis *Pk.*
C. kunzei *Fr.*
C. tsugina *Pk.*
C. vermicularis *Scop.*
Clitocybe adirondackensis *Pk.*
C. cerussata *Fr.*
C. maxima *G. & M.*

Clitopilus noveboracensis *Pk.*
Collema crispum *Borr.*
Collybia murina *Batsch*
Cortinarius vernalis *Pk.*
Daedalea unicolor (*Bull.*) *Fr.*
Diatrypella favacea (*Fr.*)
Entoloma sericeum (*Bull.*) *Fr.*
E. sinuatum *Fr.*
Erigeron annuus (*L.*) *Pers.*
E. canadensis *L.*
Fagus grandiflora *Ehrh.*
Flammula graveolens *Pk.*
Fomes igniarius (*L.*) *Fr.*
Geoglossum microsporum *C. & P.*
Geum strictum *Ait.*
Grimaldia fragrans (*Balb.*) *Cd.*
Haplosporella ailanthi *E. & E.*
Hedeoma pulegioides (*L.*) *Pers.*
Heliomyces pruinosipes *Pk.*
Hydnum laevigatum *Sw.*
Hygrophorus nitidus *B. & C.*
H. ruber *Pk.*
Hypericum perforatum *L.*
Inocybe eutheloides *Pk.*
I. radiata *Pk.*
I. subochracea (*Pk.*) *Mass.*
Lactarius vellereus *Fr.*
Leonurus cardiaca *L.*
Malva moschata *L.*
Marasmius elongatipes *Pk.*
M. scorodonius *Fr.*
Mutinus elegans (*Mont.*) *E. Fisch.*
Myosotis virginica (*L.*) *BSP.*
Nepeta cataria *L.*
Origanum vulgare *L.*
Oxalis filipes *Small*
O. stricta *L.*
Pestalozzia truncata *Lev.*
Pholiota autumnalis *Pk.*
P. squarrosa *Muell.*
Phoma lineolata *Desm.*
Pleurotus ost. magnificus *Pk.*
Pleurotus sulfuroides *Pk.*
Polygonum acre *HBK.*
P. aviculare *L.*
P. pennsylvanicum *L.*
P. persicaria *L.*
Polyporus frondosus *Fr.*
P. radicatus *Schw.*
Prunella vulgaris *L.*
Psathyrella disseminata *Pers.*
Ribes triste albinervium (*Mx.*)
Rubus odoratus *L.*
Salsola kali tenuifolia *G. F. W. Mey.*
Saponaria officinalis *L.*
Satureja vulgaris (*L.*) *Fritsch*
Setaria glauca (*L.*) *Bv.*
S. viridis (*L.*) *Bv.*
Sisymbrium offic. leiocarpum *DC.*
Spathularia clavata (*Schaeff.*)
Sphaerobolus stellatus *Tode*
Symphoricarpos orbiculatus *Moench*
Tremella vesicaria *Bull.*
Tricholoma chrysenteroides *Pk.*
T. latum *Pk.*
Typhula phacorrhiza *Fr.*
Verbascum thapsus *L.*
Verbena hastata *L.*
V. urticaefolia *L.*
Verrucaria muralis *Ach.*
V. papularis *Fr.*
Viola cucullata *Ait.*
V. septentrionalis *Greene*
Xanthium commune *Britton*

M. T. Cook, New Brunswick, N. J.
Polycephalum subauranticum *Pk.*

S. Davis, Brookline, Mass.

Bulgaria rufa *Schw.*
Clavaria kromholzii *Fr.*
Clitopilus leptonia *Pk.*
Entoloma flavifolium *Pk.*
E. fumosonigrum *Pk.*
E. minus *Pk.*
E. modestum *Pk.*
Inocybe asterospora *Quel.*
I. castaneoides *Pk.*
Inocybe decipientoides *Pk*
I. diminuta *Pk.*
I. longispora *Pk.*
I. teichospora *Berk.*
Lepiota cristatella *Pk.*
Morchella conica *Pers.*
M. esculenta (*L.*) *Pers.*
Nolanea delicatula *Pk.*
N. multiformis *Pk.*
Ombrophila clavus (*A. & S.*) *Cke.*

J. Dearness, London, Ont.

Aecidium magnatum *Arth.*
A. monoicum *Pk.*
Diplodia exocarpi *Dearness*
Pestalozzia fun. multiseta *Sacc.*
Ramularia pruni *Pk.*
Septogloeum salicinum (*Pk.*) *Sacc.*
Uromyces trifolii (*Hedw.*) *Lev.*

C. C. DeRouville, Albany

Agaricus micromegathus *Pk.*
Amanita formosa *G. & R.*

F. Dobbin, Shushan

Phialea subcarnea (*C. & P.*)
Picea canadensis (*Mill.*) *BSP.*
Ptilidium ciliare (*L.*) *Nees*
Vicia angustifolia *Roth*
Vicia tetrasperma (*L.*) *Moench*

J. Dunbar, Rochester

Malus glaucescens *S.*

D. L. Dutton, Brandon, Vt.

Physcia ciliaris (*L.*) *Ach.*
Stereocaulon coralloides *Fr.*

C. E. Fairman, Lyndonville

Aposphaeria fibriseda (*C. & E.*)
Didymella asterinoides (*E. & E.*)
Helicopsis punctata *Pk.*
Helminthosporium fuscum *Fckl.*
Humaria leucoloma (*Hedw.*) *Fr.*
Hydnum subcrinale *Pk.*
Pholiota duroides *Pk.*
Phyllosticta mahoniaecola *Pass.*
Zygodesmus avellaneus *Sacc.*

W. G. Farlow, Cambridge, Mass.

Puccinia physostegiae *Pk. & Clint.*

J. C. Fisher, Baltimore, Md.

Claviceps purpurea (*Fr.*) *Tul.*

W. P. Fraser, Quebec, Que.

Diatrype tumidella *Pk.*

H. Garman, Lexington, Ky.

Aspergillus clavellus *Pk.*
Sporotrichum atropurpureum *Pk.*

A. O. Garrett, Salt Lake City, Utah

Albugo bliti (*Biv.*) *Ktze.*
A. candida (*Pers.*) *Ktze.*
A. tragopoginis (*DC.*) *Gray*
Cercosporella fraserae (*E. & E.*)
Claviceps setulosa (*Oud.*) *Sacc.*
Clavaria contorta *Holmsk.*
Cylindrosporium padi *Karst.*
Erysiphe polygoni *DC.*
Lophiostoma sieversiae *Pk.*
Microsphaera alni ludens *Salm.*
Monilia sidalceae *Pk.*
Ramularia sambucina *Sacc.*
Rhysotheca halstedii (*Farl.*)
Septoria polemonioides *Pk.*
Tuberculina persicina (*Ditm.*) *Sacc.*

W. E. Geiser, Albany
Amanita ovoidea *Bull.*

H. T. Güssow, Ottawa, Que.
Pleurotus petaloides (*Bull.*) *Fr.*

M. E. Hard, Kirkwood, Mo.
Collybia atrata *Fr.*

L. R. Hesler, Ithaca
Sphaerella saccharoides *Pk.*
Valsa pini (*A. & S.*) *Fr.*

G. H. Hudson, Plattsburg
Chlorosplenium aeruginascens (*Nyl.*) *Karst.*

F. W. Kelley, Albany
Trillium grandiflorum (*Mx.*) *Salisb.*

G. L. Kirk, Rutland, Vt.
Endocarpiscum guepini (*Delis*) *Nyl.*

R. H. Kirtland, Albany
Lactarius glyciosmus *Fr.*
Russula nigricans (*Bull.*) *Fr.*

L. C. C. Krieger, Chico, Cal.
Bolbitius vitellinus (*Pers.*) *Fr.*
Lysurus borealis (*Burt*) *C. G. Lloyd*

R. Latham, Orient Point
Anthemis tinctoria *L.*
Aristida purpurascens *Poir*
Arthonia quintaria *Ach.*
Calosphaeria myricae (*C. & E.*)
Calvatia rubroflava (*Cragin*)
Cladonia crist. vestita *Tuck.*
C. grac. dilitata (*Hoffm.*)
Cyperus ferax *Rich.*
Dothidea baccharidis *Cke.*
Humaria granulata *Bull.*
Lecanora subfusca allophana *Ach.*
Lenzites sepiaria *Fr.*
L. trabea (*Pers.*) *Fr.*
Macrophoma juniperina *Pk.*
Odontoschisma prostratum (*Wahl.*)
Onopordum acanthium *L.*
Opegrapha herpetica *Ach.*
Pertusaria leioplaca (*Ach.*) *Schaer.*
Phoma asclepiadea *E. & E.*
P. semiimmersa *Sacc.*
Phyllosticta rhoicola *E. & E.*
Placodium camptidium *Tuck.*
Pleurotus septicus *Fr.*
Polygonum maritimum *L.*
Poria inermis *E. & E.*
Scleroderma vulgare *Hornem.*
Sesuvium maritimum (*Walt.*) *BSP.*
Spiranthes praecox (*Walt.*) *W. & C.*
Tricholoma piperatum *Pk.*

C. G. Lloyd, Cincinnati, Ohio
Polyporus dryadeus (*Pers.*) *Fr.*

C. A. Mabie, Holley
Hydnum caput-ursi *Fr.*
Lepiota americana *Pk.*

R. B. Mackintosh, Peabody, Mass.
Hypholoma velutinum leucocephalum *B. & Br.*

G. E. Morris, Waltham, Mass.
Boletinus glandulosus *Pk.*
B. solidipes *Pk.*
Boletus rubinellus *Pk.*
B. satanus *Lenz*
Clavaria ligula *Fr.*
Eccilia regularis *Pk.*
Flammula brunneodisca *Pk.*
F. sphagnicola *Pk.*
Hydnum geogenium *Fr.*
Lenzites sepiaria *Fr.*
Leptonia euchlora (*Lasch.*) *Fr.*

W. A. Murrill, New York
Hypholoma ambiguum *Pk.*

H. S. Paine, Glens Falls
Amanita frostiana *Pk.*
Cantharellus floccosus *Schw.*

F. T. Pember, Granville
Prunella vulgaris *L.*

A. J. Perkins, Santa Ana, Cal.
Gyrophragmium decipiens *Pk.*

C. R. Pettis, Albany
Peridermium pyriforme *Pk.*

F. J. Seaver, New York
Creonectria ochroleuca (*Schw.*) *Seaver*

W. L. Sherwood, New York
Selaginella sherwoodii *Underw.*

F. C. Stewart, Geneva
Flammula sulphurea *Pk.*
Fomes pinicola (*Sw.*) *Fr.*
Hebeloma fastibile *Fr.*
Panaeolus papilionaceus *Fr.*
Pholiota adiposa *Fr.*
P. cerasina *Pk.*

D. R. Sumstine, Wilkinsburg, Pa.
Diaporthe castaneti *Nits.*
Diaporthe parasitica *Murrill*

D. B. Swingle, Bozeman, Mont.
Trametes malicola *B. & C.*

W. H. VanGasbeck, Albany
Carya ovata (*Mill.*) *K. Koch*

J. M. VanHook, Bloomington, Ind.
Rosellinia mammiformis (*Pers.*) *Ces. & DeNot.*

H. L. Wells, New Haven, Conn.

Boletus edulis clavipes *Pk.*

Boletus gertrudiae *Pk.*

M. S. Wheeler, Berlin, Mass.

Diaporthe parasitica *Murrill*

T. E. Wilcox, Washington, D. C.

Armillaria nardosmia *Ellis*

Boletus auriporus *Pk.*

Boletus subluteus *Pk.*

Calvatia craniiformis (*Schw.*)

Tricholoma equestre (*L.*) *Fr.*

F. A. Wolf, Auburn, Ala.

Pestalozzia rostrata *Zab.*

D. B. Young, Albany

Crucibulum vulgare *Tul.*

Lepiota farinosa *Pk.*

Penicillium hypomycetis *Sacc.*

Polyporus squamosus (*Huds.*) *Fr.*

P. volvatus *Pk.*

Roestelia aurantiaca *Pk.*

SPECIES NOT BEFORE REPORTED

Achillea ptarmica L.

Near Gloversville, Fulton co. C. P. Alexander. Introduced and probably escaped from cultivation.

Amanita ovoidea Bull.

Ground in woods. Near Hurstville, Albany co. September. W. B. Geiser. The description of this species will be found in the chapter on Edible fungi in this report.

Anellaria separata (L.) Karst.

On manure in groves. North Elba, Essex co. July.

Aposphaeria fibriseda (C. & E.) Sacc.

Decorticated wood of sumac. Lyndonville, Orleans co. May. C. E. Fairman.

Artemisia carruthii Wood

Cobbs Hill reservoir. Rochester. September. M. S. Baxter.

Artemisia dracunculoides Pursh

Cobbs Hill reservoir. Rochester. October. Miss Florence Beckwith. M. S. Baxter. Introduced but apparently well established.

Artemisia glauca Pall.

Cobbs Hill reservoir. Rochester. September. M. S. Baxter.

Arthonia quintaria Nyl.

On bark of Ailanthus, Ailanthus glandulosa Desf. and butternut, Juglans cinerea L. Orient Point, Suffolk co. June. R. Latham. Shushan, Washington co. August. F. Dobbin.

Arthonia radiata (Pers.) Th. Fr.

On bark of shag-bark hickory, Carya ovata (Mill.) K. Koch and basswood, Tilia americana L. Shushan. August. F. Dobbin. Determined by G. K. Merrill.

Betula alba L.

The European white birch is often planted for ornament in parks and lawns. Near Rochester it has escaped from cultivation and is apparently permanently established in a wild locality not far from the city.

Bolbitius vitellinus (Pers.) Fr.

Manure in groves. North Elba. July.

Boletus retipes B. & C.

Woods. Vaughns, Washington co. September. S. H. Burnham. This is a southern species and the locality here given is probably near the northern limit of its range.

Calosphaeria myricae (C. & E.) E. & E.

Dead stems and branches of bayberry, Myrica carolinensis Mill. Orient point. December and January. R. Latham.

Calvatia rubroflava (Cragin) Morg.

Sandy soil. Orient Point. November. R. Latham.

Chrysothamnus pinifolius Greene

Cobbs Hill reservoir. Rochester. September. M. S. Baxter. Determined by P. A. Rydberg.

Clavaria grandis Pk.

Woods. Vaughns. October. S. H. Burnham. This is a small slender form with few short branches supported by a long slender stem.

Clavaria vermicularis Scop.

Ray Brook, Essex co. C. H. Peck. Vaughns. October. S. H. Burnham. Pittsford, Monroe co. September. F. S. Boughton.

Cladochytrium alismatis Büsgen

Living and languishing leaves of water plantain, Alisma plantagoaquatica L. Ithaca flats. July. B. B. Higgins. Communicated by G. F. Atkinson.

Collema crispum Borr.

On mosses. Vaughns. April. S. H. Burnham.

Collybia murina Batsch

Among fallen leaves in woods. North Elba. July. C. H. Peck. Vaughns. August. S. H. Burnham.

Coronopus procumbens Gilibert

Near Chenango lake, Chenango co. F. V. Coville. Introduced. The specimens are apparently a dwarf form without fruit.

Crataegus gracilipes S.

East side of Hemlock lake, Ontario co. September.

Crataegus harryi S.

Wetstone brook near Honeoye state road, Richmond, Ontario co. September.

Crataegus leptopoda S.

East side of Hemlock lake. September.

Crataegus livingstoniana S.

East side of Hemlock lake near the north end. September.

Crataegus macera S.

East side of Hemlock lake near the north end. September.

Crataegus procera S.

East side of Hemlock lake near the north end. September.

Creonectria ochroleuca (Schw.) Seaver

On white birch. Autumn. New York City. F. J. Seaver. Sphaeria ochroleuca Schw., Nectria ochroleuca Berk., Nectria aureofulva C. & E., Nectria pallida E. & E. and Nectria depauperata Cke. are regarded as synonyms of this species by Mr Seaver.

Diaporthe castaneti Nits.

Dead branches of chestnut, Castanea dentata (Marsh.) Borkh. Bemus Point, Chautauqua co. May. D. R. Sumstine.

Diatrypella favacea (Fr.) Ces. & DeNot.

Dead branches of European white birch, Betula alba L. Albany. April. S. H. Burnham.

Didymella asterinoides (E. & E.) Rehm

Dead stems of wild teasel, *Dipsacus sylvestris* Huds. Lyndonville. May. C. E. Fairman. This is *Sphaerella asterinoides* E. & E.

Dothidea baccharidis Cke.

Dead branches of groundsel bush, *Baccharis halimifolia* L. Orient Point. April. R. Latham.

Escholtzia californica Cham.

Cobbs Hill reservoir. Rochester. September. This is commonly called California poppy. It is abundant on the steep banks of the reservoir and is apparently well and permanently established.

Flammula graveolens Pk.

Forbes Manor grounds in old sawdust. Rensselaer. November. S. H. Burnham.

Helicopsis punctata n. sp.

Cespitose; tufts gregarious, minute, .25–.5 mm broad, brown; hyphae very short or obsolete, irregular, slender, hyaline; spores convolute, forming a spiral, 6–8-septate, usually with a nucleus in each cell, colored, persistent, 4–5 μ broad.

Inside of bark scales of some species of Prunus. April. Lyndonville. C. E. Fairman.

Caespites gregarii, minuti, .25–.5 mm lati, brunnei; hyphae brevissimae vel obsoletae, irregulares, graciles, hyalinae; sporae convolutae, spiram 6–8-septatem, 4–5 μ latam, coloratam, persistentem, cellis uninucleatis, formantes.

Heliomyces pruinosipes n. sp.

Pileus tremelloid, thin, submembranaceous, broadly convex or depressed by the upcurving of the margin, glabrous, hygrophanous, bright orange red when moist, reddish brown when dry, odor strong, disagreeable; lamellae thin, narrow, close, adnate, pallid; stems slender, hollow, dark reddish brown, usually pruinose or slightly pubescent above, whitish tomentose at the base and there fasciculately united; spores not seen.

Pileus 1–2 cm broad; stem 2–3 cm long, 1.2–2.5 mm thick.

Around old stumps of coniferous trees. Vaughns. August and September. S. H. Burnham. On bark. Ithaca. September. G. F. Atkinson.

Pileus tremelloideus, tenuis, submembranaceous, late convexus vel depressus, margine recurvo, glaber, hygrophanous, humidus laete aurantiaco-ruber, siccus, rubescente brunneus, odore graveolente, ingrato; lamellae tenues, angustae, confertae, adnatae, pallidae; stipites graciles, cavi, rufescente brunnei, vulgo pruinosi vel leviter apice pubescentes, basi albescente tomentosi, fasciculati; sporae ignotae.

Helminthosporium fuscum Fckl.

Dead herbaceous stems. Lyndonville. April. C. E. Fairman.

Hydnum laevigatum Sw.

Near Tripoli, Washington co. October. S. H. Burnham.

Hydnum subcrinale n. sp.

Subiculum effused, composed of a whitish tomentum; aculei very slender, close, equal or slightly tapering upward, flexuous, subglabrous, acute, pallid or subincarnate; spores minute, subglobose, 1.5–2 μ broad.

Decayed wood. Blue Mountain lake, Hamilton co. August. C. E. Fairman. This resembles Hydnum crinale Fr. in structure but is very unlike it in color.

Subiculum effusum, tomento albido compositum; aculei gracillimi, conferti, aequales vel sursum leviter attenuati, flexuosi, subglabri, acuti, pallidi vel subincarnati; sporae minutae, subglobose, 1.5–2 μ latae.

Hygrophorus ruber Pk.

Woods. Vaughns. Fine large bright colored specimens were collected in September by S. H. Burnham.

Inocybe radiata Pk.

Under pine trees. Vaughns. October. S. H. Burnham. The epidermis of this species sometimes excoriates as in Inocybe excoriata Pk. The specimens referred to this species in New York State Museum Bulletin 105, page 24, as a small form belong to I. asterospora Quel.

Lenzites trabea (Pers.) Fr.

On pine wood. Richmond co. November. W. H. Ballou. Orient Point. R. Latham.

Leptonia euchlora (Lasch.) Fr.

Orville, Onondaga co. August. G. E. Morris.

Macrophoma juniperina n. sp.

Perithecia gregarious, .3–.5 mm broad, thin, slightly prominent, at first covered by the epidermis, then erumpent, black, white within; spores elliptic, oblong or obovate, hyaline, granulose within, 25–40 x 12–18 μ, sporophores mostly shorter than the spores.

Dead branchlets of red cedar, Juniperus virginiana L. Orient Point. December. R. Latham.

The spores are similar in size to those of Macrophoma cavarae Poll., but they are more variable in shape and are not nucleate.

Perithecia gregaria, .3–.5 mm lata, tenua, leviter prominentia, primum epidermide tecta, demum erumpentia, atra, intra alba; sporae ellipsoideae, oblongae vel obovatae, hyalinae, intra granulosae, 25–40 x 12–18 μ, sporophores vulgo sporis breviores.

Malus glaucescens S.

Near Charlotte, Monroe co. September. J. Dunbar.

Mycena flavifolia n. sp.

Pileus thin, slightly submembranaceous, conic or convex, sulcate striate, somewhat plicate-crenate on the margin, glabrous, pale smoky yellow, becoming pale pinkish brown or subalutaceous in drying, sometimes slightly umbonate; lamellae thin, close, broad at the outer extremity, narrowed toward the stem, pale yellow, becoming pallid in drying; stem slender, equal, glabrous, hollow, chestnut colored; spores ellipsoid or subovoid, 6–8 x 4–5 μ.

Gregarious. Under balsam fir trees. North Elba. September. The center of the pileus is often more highly colored than the rest.

Pileus tenuis, submembranaceous, sublentus, conicus vel convexus, sulcato–striatus, interdum margine plicato–crenatus, glaber, subumbonatus, pallide fumoso-luteus, in siccitate incarnato-brunnescens vel subalutaceus; lamellae tenues, confertae, anteriore latae, posteriore angustatae, pallido luteae, pallescentes; stipes gracilis, aequalis, glaber, cavus, castaneus; sporae ellipsoideae vel subovoideae 6–8 x 4–5 μ.

Mycena splendidipes n. sp.

Plate X

Pileus thin, submembranaceous, oval when young, brown above and yellow below, becoming grayish green, greenish brown or brown and subcampanulate or convex with age, striate, glabrous, odor strong, flavor disagreeable, properties poisonous; lamellae subdistant, rather narrow, adnate, white or whitish; stem long or short, straight or flexuous, hollow, glabrous, bright lemon yellow; spores broadly ellipsoid or subglobose, 6–8 x 4–6 μ.

Pileus 10–20 mm broad; stem 5–30 cm long, 1–2 mm thick.

Decaying pine leaves. Richmond co. November. W. H. Ballou.

This is a dangerous or poisonous species. A single plant chewed and possibly a little of it swallowed caused sickness for some time.

Pileus tenuis, submembraneus, primum ovalis superiore brunneus, inferiore luteus, demum griseo-viridis, straitus, convexus subcampanulatusve, glaber, graveolens, flavor ingratus, venenus; lamellae subdistantes, angustae adnatae, albae albidaeve; stipes longus brevisve, rectus flexuosuve, cavus, glaber, luteus; sporae late ellipsoideae vel subglobosae, 6–8 x 4–6 μ.

Opegrapha herpetica Ach.

On basswood, T i l i a a m e r i c a n a L. Orient Point. June. R. Latham. Determined by G. K. Merrill who says of it, " the first American specimen I have seen."

Penicillium hypomycetes Sacc.

On the inner bark of an unknown tree. Albany. March. D. B. Young.

Pestalozzia truncata Lev.

On cone scales of Norway spruce, P i c e a e x c e l s a Link. Albany. April. S. H. Burnham. The name of this species is suggested by the fact that in old spores the terminal hyaline cells fall away leaving the colored central part with truncate ends.

Phialea anomala n. sp.

Receptacle thin, broadly cupulate or disciform, 1.5–3 mm broad, externally clothed with small, tawny, radiating fibrils, the margin incurved, entire; stem slender, firm, flexuous, .5–1.5 cm long, tawny, fibrillose, tomentose, fulvous; hymenium greenish black; asci cylindric or subclavate, eight-spored, spores ellipsoid or somewhat narrowed toward the base, continuous, hyaline, 10–12 x 4–5 μ, paraphyses filiform.

On dead herbaceous stems or twigs in wet places. Remsen, Oneida co. August.

The anomalous character of this species is in its tawny, fibrillose stem and the exterior surface of the receptacle. The peculiar color of the hymenium is also unusual in this genus.

Receptaculum tenue, late cupulatum vel disciforme, 1.5–3 mm latum, fibris parvis fulvis radiantibus externe investum, margine incurvo, integrum; stipes gracilis, fulvus, fibrilloso-tomentosus, firmus, flexuosus, .5–1.5 cm longus; hymenium viride atrum; asci cylindracei subclavative, 8-sporae ellipsoideae vel basi leviter attenuatae, continuae, hyalinae, 10–12 x 4–5 μ, paraphyses filiformes.

Phoma asclepiadea E. & E.

Dead stems of common milkweed, Asclepias syriaca L. Orient Point. January. R. Latham.

Phoma semiimmersa Sacc.

Dead branches of thorn bushes. Orient Point. January. R. Latham.

Phyllosticta mahoniaecola Pass.

Leaves of the so-called cultivated "American holly," a species of Mahonia. Lyndonville. September. C. E. Fairman.

Phyllosticta rhoicola E. & E.

Living leaves of poison ivy, Rhus toxicodendron L. Orient Point. August. R. Latham.

Placodium camptidium Tuck.

Oak bark. Orient Point. November. R. Latham. Determined by L. W. Riddle.

Pleurotus tessulatus (Bull.) Fr.

Camp Monroe, Fourth lake, Herkimer co. August. F. S. Boughton.

Polyporus dryadeus (Pers.) Fr.

Base of oak trees. Near Kenwood, Albany co. August.

Puccinia urticae (Schum.) Lagerh.

On leaves of some species of Carex. West Albany. Formerly confused with Puccinia angustata Pk.

Riccardia sinuata (Dicks.) Limpr.

Damp decaying prostrate trunks of trees. Little Moose lake, Herkimer co. September. Miss C. C. Haynes.

Russula ballouii n. sp.

Plate IX, figures 1–4

Pileus thin, broadly convex, nearly plane or slightly depressed in the center, yellow when moist, grayish yellow when the moisture has escaped, the pale brick-red cuticle cracking into minute scales everywhere except in the center; lamellae thin, narrow, close, adnate or subdecurrent, pale yellow, becoming pruinose or dusted by the white spores; stem firm, equal or slightly tapering downward, the surface colored and adorned like the pileus; spores subglobose, 8–10 μ.

Pileus 2–3 cm broad; stem 2–3 cm long, 8–10 mm thick.

Woods, specially under poplar trees. Near Bullshead, Richmond co. October. W. H. Ballou.

Pileus tenuis, late convexus, subplanus vel in centro leviter depressus, humidus luteus, siccus griseo-luteus, ubique, disco excepto, squamis minutis lateritiis ornatus; lamellae tenues, angustae, confertae, adnatae vel subdecurrentes, pallidae vel pruinosae; stipes firmus, aequalis vel leviter sursum crassus, pileo similis ornatus et coloratus; sporae subglobosae, 8–10 μ.

Septoria margaritaceae n. sp.

Spots mostly large, .5–2 cm long, commonly one on a leaf, brown; perithecia epiphyllous, minute, about .25 mm wide, black; spores filiform, curved or flexuous, 40–80 x 1–2 μ, commonly attenuated toward the apex, oozing out and forming a whitish or yellowish white mass on the apex of the perithecium.

On languishing leaves of pearly everlasting, Anaphalis margaritacea (L.) B. & H. White Lake, Oneida co. August.

Usually there is a single large spot on a leaf but occasionally there are several smaller spots occupying the whole leaf.

Maculae vulgo magnae, .5–2 cm longae, vulgo solitariae, brunneae; perithecia epiphylla, minuta, circiter, .25 mm lata, atra; sporae filiformes, curvae vel flexuosae, 40–80 x 1–2 μ, vulgo ad apicem attenuatae, exudantes et globulum albidum formantes.

Silene dichotoma Ehrh.

Marietta, Onondaga co. S. N. Cowles. An introduced species.

Tricholoma latum Pk.

Plate IX, figures 5–8

Pileus fleshy, firm but flexible, broadly convex or nearly plane, moist, glabrous, white or whitish, flesh white, taste disagreeable;

lamellae plane or slightly arcuate in mass, narrow, close, rounded behind, adnexed, white or whitish, becoming dingy or tinged with reddish brown when old; stem short, nearly equal, solid or stuffed, slightly pruinose at the top, more or less white tomentose at the base, colored like the pileus; spores oblong or subfusiform, 10–12 x 3.5–4 μ.

Pileus 5–10 cm broad; stem 2.5–5 cm long, 1.5–2 cm thick. Gregarious. Woods, Vaughns. September. S. H. Burnham.

Pileus carneus, firmus, flexuosus, late convexus vel subplanus, humidus, glaber, albus albidusve, carne albus, sapor ungratus; lamellae planae vel leviter arcuatae; confertae, angustae, adnexae, albae albidaeve, in senectute sordidae; stipes brevis, subaequalis, solidus vel farctus, ad apicem subpruinosus, basi albotomentosus, pileo similis coloratus; sporae oblongae vel subfusiformes, 10–12 x 3.5–4 μ.

Tricholoma piperatum Pk.

Orient Point. November. R. Latham.

Tricholoma subpulverulentum (Pers.) Fr.

Near Rochester. October. W. E. Abbs. Only two specimens were received. The species has been regarded as edible, but it was not possible to obtain enough fairly to try its edible quality.

Urophlyctis major Schroet.

Living or languishing leaves of water plantain, Alisma plantago-aquatica L. Ithaca flats. July. B. B. Higgins. Communicated by G. F. Atkinson.

Vermicularia hysteriiformis n. sp.

Perithecia thin, oval or oblong, .4–.8 mm long, shining, black, covered by the epidermis and at length adorned with numerous subulate divergent black or brown setae; spores narrowly fusiform, acute at each end, slightly curved, hyaline, 20–30 x 3–4 μ.

Dead stems of blue cohosh, Caulophyllum thalictroides (L.) Mx. Troupsburg, Steuben co. May.

A species very distinct from all others by the shape of the perithecia which appear longer than broad through the epidermis, resembling in this respect some species of Hysterium.

Perithecia tenua, ovalia oblongave, .4–.8 mm longa, nitida, atra, primum epidermide tecta, demum setis numeris subulatis, divergentibus atris vel fuscis ornata; sporae anguste fusiformes, utrinque acutae, leviter curvae, hyalinae, 20–30 x 3–4 μ.

Verrucaria muralis Ach.

Limestone rocks. Vaughns. April. S. H. Burnham.

Verrucaria papularis Fr.

Limestone rocks. Indian ladder, Helderberg mountains, Albany co. April. S. H. Burnham. Determined by G. K. Merrill.

Vicia hirsuta (L.) S. F. Gray

Richmond co. June. N. L. Britton. An introduced species.

Zygodesmus avellanus Sacc.

On wood of wild cherry. Lyndonville. April. C. E. Fairman.

REMARKS AND OBSERVATIONS

Aecidium hydnoideum B. & C.

This parasitic leaf fungus attacks living leaves of the leatherwood, Dirca palustris L. It usually forms a single large yellowish or reddish yellow spot on a leaf. A single cluster of cups commonly occupies each spot.

Agrostis borealis Hartm.

Along McIntyre brook, Adirondack mountains. July. This is an unusual form having the awn of the spikelet short and not exserted.

Boletus scaber Fr.

In this species the hymenium or mass of tubes is usually more or less depressed around the stem. In three specimens collected in Rosedale, Long Island, by F. H. Ames the tubes are adnate at first and then in drying separate from the stem carrying with them a thin layer of the external coating, thereby forming a cuplike depression about its insertion.

Boletus subaureus rubroscriptus n. var.

Pileus variously marked with red lines. Rochester. September. W. E. Abbs.

Pileus lineis rubris variis notatus.

Cladonia cristatella vestita Tuck.

Sandy soil. Orient Point. November. R. Latham.

Clavaria obtusissima minor n. var.

Plant smaller than the type, with more numerous and more slender branches and branchlets, the ultimate ones not so distinctly consolidated nor umbilicate, but obtuse or obtusely dentate.

Bolton, Warren co. September. For the description of the species see chapter on "New species of extralimital fungi."

Minor, rami ramulique numerosiores et graciliores, ultimati non distincte consolidati ne umbilicati, sed obtusi vel obtuse dentati.

Cynanchum nigrum (L.) Pers.

The black swallowwort is abundant near Rochester not far from Cobbs Hill reservoir. It usually grows in small patches of six to ten feet in diameter. The pods often divaricate in such a way as to give a somewhat stellate appearance to their arrangement.

Cytospora chrysosperma (Pers.) Fr.

Bark of glaucous willow, Salix discolor Muhl. Alder creek, Oneida co. In this form the spore tendrils assume an orange color instead of golden yellow as in the type.

Flammula spumosa unicolor n. var.

Pileus uniformly yellow; otherwise as in the type. In marshy woods. Karner, Albany co. July.

Fomitiporia prunicola Murr.

A form of this species which usually grows on trunks of wild bird cherry or pin cherry, Prunus pennsylvanica L., was found growing on a trunk of the canoe birch, Betula alba papyrifera (Marsh.) Spach, in the Adirondack mountains. The form growing on canoe birch was not distinguishable in any way from that on cherry. It might be called Fomitiporia prunicola f. betuli cola.

Habenaria fimbriata (Ait.) R. Br.

This large and fine purple-fringed orchis is remarkable for the durability of its flowers. A vase of the cut flowers has been known to remain perfectly fresh in appearance, at least ten days, with no other care than an occasional supply of fresh water. This is remarkable since its natural habitat is in wet marshy ground and often in the shade of trees. It is not rare in wooded marshes at North Elba. If a suitable habitat could be furnished it would make a fine addition to the ornamental plants of parks and gardens.

Ilex monticola Gray

Woodsworth lake, Fulton county. June. C. P. Alexander. This is an outlying station about seventy-five miles north and west of its nearest previously recorded localities, Taconic, Shawangunk and Catskill mountains, Gray's new Manual mentions Cattaraugus county also as a station for it, but this is apparently a far western outlying station.

Jeffersonia diphylla (L.) Pers.

Moist woods. Pittsford. Fine flowering specimens of this rare plant were collected April 15th and contributed by M. S. Baxter. He also contributed a fine fruiting specimen from High island, Potomac river, Maryland.

Lonicera hirsuta Eaton

This pretty, climbing shrub sometimes attains a comparatively large size. An example was observed in North Elba with the shrub approximately 2 cm in diameter and 3 or 4 m tall.

Pholiota cerasina Pk.

Specimens of this rare species were collected in Inlet, Hamilton co. and contributed by F. C. Stewart. It is peculiar in its cherry-like odor by which it is easily recognized.

Picea canadensis (Mill.) BSP.

Cambridge water works swamp, Washington co. July. F. Dobbin and S. H. Burnham. This swamp is a large one, covering an area of approximately one square mile and the stream flowing through it is fed by cold springs which probably aid in making it a suitable habitat for this northern cold-loving spruce. This is doubtless the southern limit for it in our State and an outlying station in which it has been able to maintain itself by reason of the cold character of the soil. Nevertheless the shortness of the leaves of these specimens indicate that its environment here is not favorable to its most vigorous development. Still it bears cones though not of large size.

Pleurotus ostreatus magnificus n. var.

Pileus very large, 12–30 cm broad, glabrous, often pitted toward the margin, pallid or subalutaceous; lamellae whitish, anastomosing at the base; stem 5 to 10 cm long, eccentric, strigose, variable, whitish; spores 10–14 x 4–5 μ.

On an old log near the ground. Shakers, Albany co. November. S. H. Burnham.

Pileus maximus, 12–30 cm latae, glaber, saepe margine lacunosus, pallidus subalutaceusve; stipes 5 to 10 cm longus, eccentricus, strigosus, variabilis, albidus; sporae 10–14 x 4–5 μ.

Polystichum braunii (Spenner) Fee

A new station for this rare fern has been discovered in our State by Edgar Tweedy, a lover of both plants and birds. It is in North Elba and is at present its most northern New York station known to me. It had previously been found in several places in the Catskill mountains, also near Summit, Schoharie co., and Hague, Warren co. It is limited in quantity in the North Elba locality and it is hoped that any one finding it will be careful not to exhaust the locality.

Seligeria pusilla B. & S.

Limestone rocks. Chilson lake, Essex co. Mrs N. L. Britton. This is the second New York locality for this very rare little moss.

Senecio robbinsii Oakes

The Robbins' ragwort has become very abundant in some of the low wet meadows in North Elba and constitutes a large percentage of the hay cut from them. It is uniformly spread over the meadows and when in flower gives to them a more subdued yellow hue than the common buttercup gives to drier meadows earlier in the season.

Serapias helleborine L.

This rare and somewhat local plant occurs in many places in deep woods in Monroe county. The suggestion that it may have been introduced for medicinal purposes does not seem to be well sustained, since inquiry by a resident of the locality among some of the oldest inhabitants there failed to elicit any evidence to substantiate such a supposition. A fine, unusually heavy, fruited form of the species was found growing in dense woods along the banks of the Genesee river below Rochester by M. S. Baxter.

Trillium grandiflorum (Mx.) Salisb.

A "double flowered" form of this beautiful trillium has appeared several years near Howes Cave and is apparently permanently established. It has three whorls of petals beside the calyx lobes, but no stamens or pistils. It is needless to say that it bears no fruit, as all the essential organs of the flower are transformed into petals. It was discovered there in May by F. W. Kelley of Albany who has kindly contributed a specimen to the herbarium.

NEW SPECIES OF EXTRALIMITAL FUNGI

Asteromella asteris

Perithecia superficial, epiphyllous, densely cespitose, seated on an obscure thin brown crust, globose, about .25 mm broad, black, the tufts about 1 mm broad; spores minute, oblong or subcylindric, continuous, hyaline, 6–8 x 2–2.5 μ, sporophores minute or obsolete.

Upper surface of living or languishing leaves of the panicled aster, Aster paniculatus Lam. Louisville, Kan. October. E. Bartholomew.

Perithecia superficialia, epiphylla, dense aggregata, crusta tenue obscura brunnea insidentia, globosa, atra, caespites 1 mm lati; sporae minutae, oblongae vel subcylindraceae, continuae, hyalinae, 6–8 x 2–2.5 μ, sporophores minuti vel obsoleti.

Boletinus solidipes

Pileus fleshy, convex becoming broadly convex or nearly plane, squamose with radiately arranged closely appressed brown or purplish brown hairs, sometimes purplish brown or yellowish brown in the center, flesh whitish; tubes small, angular, radiately arranged, grayish becoming brown, adnate or decurrent; stem equal, solid, slightly annulate, yellowish below the annulus, grayish above, often stained with darker spots or marks, white or yellowish within, veil grayish, adhering partly to the margin of the pileus, partly to the stem; spore print ochraceous, spores 8–10 x 4–5 μ.

Pileus 5 to 10 cm broad; stem 5–8 cm long, 8–10 mm thick. Friendship, Me. August. G. E. Morris.

This species resembles in some respects Boletinus cavipes Opat. but it is somewhat darker in color and differs specially in its solid stem.

Pileus carnosus, convexus, demum late convexus vel subplanus, pilis purpureo-brunneus radiantibus appressis squamosus, interdum in centro lutescente brunneus, carne albido; tubuli parvi, angulares, radiantes, adnati vel decurrentes, grisei, deinde brunnei; stipes aequalis, solidus, leviter annulatus, infra annulum luteolus, supra annulum griseus, saepe maculis brunneis inquinatus, intra albidus, velo griseo, margini partim pilei et partim stipiti adherente; sporae subochraceae, oblongae, 8–10 x 4–5 μ.

Clavaria obtusissima

Much branching from a short thick whitish stem, the branches curving, dividing irregularly, enlarged above and divided into several blunt, wrinkled ends, longitudinally wrinkled, ochraceous, flesh white, taste mild; spores ochraceous in mass, oblong or subcylindric, 12–16 x 5–6 μ.

Plant 10–12 cm tall, 6–10 cm broad.

Woods of deciduous trees. West Roxbury, Mass. September. Miss Ann Hibbard.

Stipes crassus, brevis, ramosissimus, ramosi ramulosique curvati, supra sulcati et incrassata, ochracei, caro albus, sapor mitis; sporae ochroceae, oblongae vel subcylindraceae, 12–16 x 5–6 μ.

Clavaria subcaespitosa

Forming dense tufts 7.5–12.5 cm tall, fragile, white or whitish, the stems united at the base, three to five times dichotomously divided, the terminal branchlets obtuse or subacute, both stems and branches solid, soft, becoming thinner and flattened or angular in drying, flesh white, taste mild; spores broadly ellipsoid or subglobose, 4–5 x 3–4 μ.

Ground. Ellis, Mass. September. Mrs E. B. Blackford and G. E. Morris. Communicated by Miss Ann Hibbard.

This species may be separated from Clavaria densa Pk. by its greater fragility, whiter color, softer texture and smaller spores. In the dried specimens the stems and branches are much more slender and of a purer white color than in C. densa.

Stipes brevis, crassus, dichotome ramosissimus, caespites densus 7.5–12.5 cm longos fragiles formans; rami ramulique obtusi vel subacuti, solidi, molles, in siccitate tenuiores et deplanati vel angulares, carno albo, sapore mite; sporae late ellipsoideae vel subglobosae, 4–5 x 3–4 μ.

Clitopilus leptonia

Pileus thin, conic or convex, umbilicate, hygrophanous, squamulose in and near the broad umbilicus, chestnut color and striatulate on the margin when moist, black in the umbilicus; lamellae broad, broadly simuate adnate or decurrent, distant, white becoming pink, sometimes transversely venose; stem slender, equal or slightly narrowed upward, fibrillose, straight, stuffed or hollow, brown becoming darker with age, with a copious white myceliod tomentum at the base; spores subglobose, angular, uninucleate, 10–12 x 8–10 μ.

Pileus 2.5–3.5 cm broad; stem 5–8 cm long, 1–3 mm thick.

Gregarious. Low ground under trees. Stow, Mass. September. S. Davis.

This slender species closely approaches some species of Leptonia in general appearance. This character has suggested the specific name. The more or less decurrent lamellae throw the species into the genus Clitopilus. It differs from Clitopilus vilis Fr. by the color of the pileus and by its larger spores, and from C. subvilis Pk. by the color of the pileus and its squamulose center. In the dried state the pileus and stem are black and the margin of the pileus is sulcate striate.

Pileus tenuis, conicus vel convexus, umbilicatus hygrophanus, centro umbilicoque squamulosus alibi glaber, udus, castaneus, margine striatulatus, in umbilico ater; lamellae latae, late adnatae vel decurrentes, distantes, albae, demum incarnatae, interdum transverse venosae; stipes gracilis, aequalis, vel leviter seorsum attenuatus, fibrillosus, rectus farctus cavusve, brunneus, basi abundante albo tomentoso; sporae subglobosae, angulares, uninucleatae, 10–12 x 8–10 μ.

Pileus 2.5–3.5 cm latus; stipes 5–8 cm longus; 1–3 mm crassus.

Coryneum effusum

Forming thinly effused indefinite black patches on wood, mycelium subhyaline, sporophores slender, often flexuous and tapering downward, subhyaline, 12–30 μ long; spores oblong or subfusiform, straight or slightly curved 2-septate when mature, the central cell black, the terminal cells subhyaline, one or both finally subtruncate, 20–28 x 10–12 μ, the central cell 10–12 μ long.

Wood of western cottonwood, Populus occidentalis Rydb. Stockton, Kan. March. E. Bartholomew.

Differs from typical species of Coryneum in forming no definite acervuli or subcutaneous erumpent heaps but in developing in effused patches on decorticated wood.

Coryneum tenuiter effusum, in ligni superficiei areas atras indefinitas formans; sporae oblongae vel subfusiformae, rectae vel leviter curvae, in maturitate biseptatae, loculo centrale atro, terminalibus subhyalinis, saepe truncates, 20–28 x 10–12 μ, loculus centralis 10–12 μ longus.

Diatrype tumidella

Stroma orbicular, plane or convex, 1–2 mm broad, surrounded by a black line which penetrates to the wood, erumpent and surrounded by the ruptured fragments of the epidermis, the surface at first pallid or brownish and dotted by the black sulcate ostiola, becoming blackish with age, whitish within; perithecia monostichous, black within, 4–12 in a stroma; asci subclavate or cylindric, the sporiferous part 35–50 x 8–10 μ; spores crowded or subbiseriate, straight or slightly curved, obtuse at each end, fuscous, 10–20 x 4–5 μ.

Dead branches of pin cherry, Prunus pennsylvanica L. Ste. Anne de Bellevue. Quebec, Canada. W. P. Fraser.

Closely related to Diatrype tumida E. & E., from which it differs in its smaller stroma, its broader asci and specially in its broader and darker spores.

Stroma orbiculare, disciforme vel convexum, 1–2 mm latum linea atra ad lignum penetrante cinctum, epidermidis ruptae fragmentis cinctum primum pallide brunneum, demum nigrum, ostiolis sulcatis punctatum intra albidum; perithecia monosticha, intra atra, in stromate 4–12; asci subclavati vel cylindracei, 35–50 x 8–10 μ; sporae confertae vel subbiseriatae, rectae vel leviter curvae, putrinque obtusae, fuscae, 10–20 x 4–5 μ.

Eccilia regularis

Pileus thin, submembranaceous, convex, finely striate to the center, distinctly umbilicate, bright buff or pinkish buff, sometimes with an orange spot in the center when moist, becoming silky in drying; lamellae close, arcuate, decurrent, soon pink; stem colored like or a little paler than the pileus; spores angular, uninucleate, 8–10 x 7–8 μ.

Pileus 2–3 cm broad; stem 4–6 cm long, 2–3 mm thick.

Ground in woods. Friendship, Me. August. G. E. Morris.

This is a small but beautiful and very regular or symmetrical species. It is nearly uniformly colored throughout, being a yellowish or pinkish buff. The dried specimens are tawny ochraceous. Under a lens they appear to have the pileus minutely striate.

Pileus tenuis, submembranaceous, convexus, minute striatus, umbilicatus, late luteolus vel incarnate luteolus, interdum udus in centro aurantiacus, siccus sericeus; lamellae confertae, arcuatae, decurrentes, mox incarnatae; stipes gracilis, aequalis, farctus, rectus, glaber, pileo in colore similis vel pallidior; sporae angulares, uninucleatae, 8–10 x 7–8 μ.

Pileus 2–3 cm latus; stipes 4–6 cm longus, 2–3 mm crassus.

Entoloma fumosonigrum

Pileus fleshy, thin, convex or nearly plane, involute on the margin, dry, subglabrous, smoky black, flesh white, taste disagreeable; lamellae moderately close, sinuate adnate, eroded on the edge, at first white, then pale pink; stem slender, equal or slightly tapering upward, stuffed, glabrous or fibrillose, pruinose at the top, colored like or a little paler than the pileus, with a white mycelioid tomentum at the base, sometimes wholly white; spores subglobose, slightly angular, uninucleate, often with an oblique apiculus at one end, 8–10 μ long.

Pileus 2–5 cm broad; stem 4–5 cm long, 2–4 mm thick.

Under trees in swamps. Stow, Mass. September. S. Davis.

Apparently related to Entoloma melaniceps C. & M. from which it is separated by its stuffed stem and smaller spores. From E. fuliginarium Karst. by the even margin of the pileus and the paler color of the lamellae.

Pileus carnosus, tenuis, convexus vel subplanus, margine involutus, siccus, subglaber, fumoso niger, carne alba, sapore ingrato; lamellae subconfertae, sinuatae, adnatae, acie erosae, primum albae, demum pallide incarnatae; stipes gracilis, aequalis vel leviter sursum attenuatus farctus, glaber vel leviter fibrillosus, ad apicem pruinosus, pileo in colore similis vel pallidior basi tomento albo ornatus, interdum omnino albidus; sporae subglobosae, leviter angulares uninucleatae, saepe oblique apiculatae, 8–10 μ longae.

Pileus 2–5 cm latus; stipes 4–5 cm longus, 2–4 mm crassus.

Flammula brunneodisca

Pileus fleshy, thin, broadly convex or nearly plane, umbonate, slightly viscid with a separable pellicle, slightly innately fibrillose, ochraceous yellow with a brown center, flesh white; lamellae thin, close, adnate with a decurrent tooth, pale yellow becoming rusty brown; stem slender, equal, solid, glabrous, pale yellow without and within, paler at the top; spores ellipsoid, 6–8 x 4–5 μ.

Pileus 2.5–6 cm broad; stem 2–3 cm long, 4–6 mm thick.

Cespitose. "On ground at the edge of a stone but probably growing from a buried root." Waltham, Mass. October. G. E. Morris.

Pileus carnosus, tenuis, late convexus vel subplanus, umbonatus, leviter viscidus, obscure et innate fibrillosus, pallide ochraceo-luteus, in centro brunneus, carne alba; lamellae tenues, confertae, adnatae, dente decurrentes, pallide luteae ferrugineo-brunnescentes; stipes aequalis, gracilis, solidus, glaber, pallide luteus, ad apicem pallidior; sporae ellipsoideae, 6–8 x 4–5 μ.

Pileus 2.5–6 cm latus; stipes 2–3 cm longus, 4–6 mm crassus.

Flammula sphagnicola

Pileus fleshy, thin, convex or nearly plane, obtuse or umbonate, viscid, glabrous, yellowish with reddish or reddish brown often spotted center, flesh white; lamellae thin, narrow, close, adnate or with a decurrent tooth, whitish becoming cinnamon color; stem slender, equal or slightly enlarged at the base, hollow, whitish, slightly white fibrillose at the top, with a white tomentum at the base; spores ellipsoid, uninucleate, 8–10 x 4–6 μ.

Pileus 1–2.5 cm broad; stem 2.5–3.5 cm long, 1–3 mm thick.

Among sphagnum in swamps. Amesbury, Mass. September. G. E. Morris.

Pileus carneus, tenuis vel subplanus, obtusus vel umbonatus, viscidus, glaber, lutescens rufescens vel rufo-brunneus, in centro saepe maculatus, carno albo; lamellae tenues, angustae, confertae, adnatae, interdum dente decurrentes, albidae demum cinnamomeae; stipes gracilis aequalis vel basi crassus, cavus, albidus, ad apicem leviter fibrillosus, basi tomento albo; sporae ellipsoideae, uninucleatae, 8–10 x 4–6 μ.

Pileus 1–2.5 cm latus; stipes 2.5–3.5 cm longus, 1–3 mm crassus.

Hysteriographium acerinum

Perithecia subsuperficial, subseriate broadly elliptic or oblong, even, black, 1–3 mm long, .5–1 mm broad; asci subcylindric, 120–170 μ long; spores crowded, oblong or subfusiform, 7–10-septate, muriform, 35–50 x 12–16 μ.

Decorticated wood of Rocky mountain maple, Acer glabrum Torr. Boulder, Col. August. E. Bartholomew.

Perithecia superficialia, subseriatim disposita, late ellipsoidea vel oblonga, levia, atra, 1–3 mm longa, .5–1 mm lata; asci subcylindracei, 120–170 μ longi; sporae confertae, oblongae vel subfusiformes, 7–10-septatae, muriformes, 35–50 x 12–16 μ.

Inocybe castaneoides

Pileus thin, conic or convex becoming nearly plane, broadly umbonate, fibrillose, squamulose on the umbo, striatulate on the margin, rimulose, chestnut color when young, becoming reddish brown; lamellae thin, close, sinuate, adnexed, whitish becoming ferruginous, whitish on the edge; stem brittle, flexuous, fibrillose, solid or stuffed, white becoming reddish brown, a slight white veil is sometimes seen in the very young plant; spores 8–10 x 6–8 μ, cystidia rare, 40–50 x 15–20 μ.

Pileus 1.5–2.5 cm broad; stem 2–4 cm long, 1–2 mm thick.

Gregarious. Roadsides under grass and ferns. Stow, Mass. September. S. Davis.

This species belongs to the section Rimosi. It is allied to Inocybe castanea Pk. from which it differs in its squamulose umbo, sinuately adnexed lamellae, its stem white when young, the presence of an evanescent veil, its more distinctly nodulose spores and its broader, shorter cystidia.

Pileus tenuis, conicus vel convexus, deinde subplanus late umbonatus, fibrillosus, in umbone squamulosus, in margine striatulatus, in juventate castaneus, demum fuscus; lamellae tenues, confertae, sinuatae, adnexae, albidae, deinde ferrugineae, acie albidae; stipes fragilis, flexuosus, fibrillosus, farctus vel solidus, albus demum fuscus, velo albo evenescente; sporae subglobosae, irregulare nodolosae, uninucleatae, 8–10 x 6–8 μ, cystidia sparsa, 40–50 x 15–20 μ.

Lophiostoma sieversiae

Perithecia minute, about .25 mm broad, erumpent, black; asci oblong, 150–280 x 50–70 μ, usually 8-spored; spores oblong or subfusiform, 3-septate, at first involved in mucus, 50–75 x 20–25 μ.

Dead stems of Sieversia turbinata (Rydb.) Greene. Big Cottonwood canyon, Utah. July. A. O. Garrett.

Perithecia minuta, .25 mm lata, erumpentia, atra; asci oblongi, 150–280 x 50–70 μ, vulgo 8-sporis; sporae oblongae vel subfusiformes, 3-septatae, primum in muco involutae, 50–75 x 20–25 μ.

Marasmius trullisatipes

Pileus thin, campanulate or convex, acutely umbonate, glabrous, isabelline or subrufescent; lamellae thin, subclose, broad anteriorly, adnate, whitish tinged with pink; stem tough, solid, white within, pruinose above, tomentose below, externally cartilaginous; spores 6 x 4 μ.

Pileus 1.2–2 cm broad; stem 3–5 cm long, 2–3 mm thick.

Ground. Near Minneapolis, Minn. May. Mrs M. S. Whetstone. Also Cedar Point, Ohio. July. C. K. Brain.

The umbo in the dried specimens sometimes appears blackish. The tomentum of the lower part of the stem binds together particles of earth and causes the stem to appear thickened at the base or deeply rooted in the ground.

Pileus tenuis, campanulatus vel convexus, acute umbonatus, glaber, isabellinus vel subrufescens; lamellae tenues, subconfertae, anteriore latae, adnatae, incarnato-albidae; stipes tenax, solidus, intus albus, ad apicem pruinosus, basi tomentosus, extus cartilaginous; sporae 6 x 4 μ.

Pileus 1.2–3 cm latus; stipes 3–5 cm longus, 2–3 mm crassus.

Monilia sidalceae

Widely effused on the lower surface of the leaf, tufts at first white, then brownish; hyphae very short; spores oblong elliptic or globose, hyaline, 16–20 x 12–14 μ or 12–14 μ broad.

Living leaves of S i d a l c e a n e r v a t a A. Nels. Red Butte canyon, Utah. July. A. O. Garrett.

Caespites late effusi, hypophylli, albi, brunnescentes; hyphae brevissimae; sporae oblongae ellipsoideae vel globosae, hyalinae, 16–20 x 12–14 μ vel 12–14 μ latae.

Nolanea multiformis

Pileus fleshy, thin, convex nearly plane or centrally depressed, fragile, glabrous or slightly fibrillose, brown or blackish brown, striatulate on the margin which becomes wavy split or irregular when old; lamellae thin, subdistant, broad, adnate, white becoming pink; stem equal, fragile, flexuous, glabrous or fibrillose, solid or hollow, white or brown; spores subglobose, angular, uninucleate, 10–12 x 8–10 μ.

Pileus 1–3 cm broad; stem 1–2 cm long, 1–2 mm thick.

Gregarious. Grassy ground. Brookline, Mass. September. S. Davis.

This species is apparently allied to N o l a n e a a e t h i o p s Fr. from which it may be separated by the striatulate margin of the pileus, the absence of black dots or points from the top of the stem and by its more globose spores. In the dried specimens the pileus is often plicate. When fresh the stem is sometimes white both at the top and bottom but brown in the middle.

Pileus carnosus, tenuis, convexus subplanus vel in centro depressus, fragilis, glaber vel leviter fibrillosus, brunneus vel nigresco-brunneus, in margine striatulatus, demum undatus rimosus vel irregularis; lamellae tenues, subdistantes, latae, adnatae, albae incarnatescentes; stipes aequalis, fragilis, flexuosus, glaber vel fibrillosus, solidus vel cavus, albus brunneusve; sporae subglobosae, angulares, uninucleatae, 10–12 x 8–10 μ.

Pileus 1–3 cm latus; stipes 1–2 cm longus, 1–2 mm crassus.

Polycephalum subaurantiacum

Stem slender, 1–3 mm long, slightly attenuated upward, thickened or bulbous at the base, clothed with ascending mostly whitish hairs, simple or slightly branched above, composed of united hyphae, orange colored below, white above, the fertile ones bearing 1–4 globose or subglobose minute whitish heads of spores; spores ellipsoid or subglobose, hyaline, 4–6 x 3–4 μ.

Gregarious on branchlets of avocado or alligator pear, Persea gratissima Gaertn. f. Cuba. September. Communicated by M. T. Cook.

Sometimes two or three stems start from the same hairy bulb. The species is apparently closely related to Polycephalum aurantiacum K. & C. and may be a variety of it but from which it may be separated because of its slender generally tapering or subulate stem which is white above and because of its larger spores. The hairs of the bulb are usually concolorous with it, those of the stem are white or whitish. They are apparently the diverging tips of some of the component hyphae of the stem.

Stipes gracilis, 1–3 mm longus, sursum leviter attenuatus, basi crassus vel bulbosus, vulgo pilis ascendentibus albidis hirtus, simplex vel leviter supra ramosus, hyphis coalitis compositus, infra aurantiacus, supra albus, fertilibus sporarum capita 1–4 minuta globosa vel subglobosa albida producentibus; sporae ellipsoideae vel subglobosae, 4–6 x 3–4 μ.

Psilocybe cystidiosa

Pileus thin, convex or subconic, glabrous, hygrophanous, pale brown when moist, yellowish drab with a brownish center and sometimes obscurely striate on the margin when dry, sometimes becoming lacerated when expanded, flesh white, taste nutty; lamellae thin, close, adnate, whitish becoming purplish brown, stem equal or slightly tapering upward, hollow, pruinose at the top, white, often with a subglobose mass of earth adhering to the base; spores purplish brown, ellipsoid, 8–10 x 5–6 μ, cystidia 60–80 x 12–20 μ.

Pileus 2–4 cm broad; stem 4–5 cm long, 2–4 mm thick.

Solitary or clustered. Minneapolis, Minn. August. Mrs M. S. Whetstone.

Pileus tenuis, convexus vel subconicus, glaber, hygrophanous, pallide brunneus humidus, luteolus siccus, mox in centro brunneus et obscure in margine striatus, mox expansus laceratescens, carne alba, sapore nucino; lamellae tenues, confertae, adnatae, albidae, purpureo-brunnescentes; stipes aequalis vel leviter deorsum attenuatus cavus, ad apicem pruinosus, albus, basi conglobatus; sporae purpuroe-brunneae, ellipsoidae, 8–10 x 5–6 μ, cystidia 60–80 x 12–20 μ.

Pileus 2–4 cm latus; stipes 4–5 cm longus, 2–4 mm crassus.

Psilocybe graveolens

Cespitose, strongly odorous; pileus hemispheric or convex, glabrous, varying in color from creamy white to subalutaceous, flesh pallid; lamellae close, subventricose, rounded behind, adnexed, brown when mature; stem equal, silky fibrillose, stuffed or hollow, white; spores subelliptic, 8–10 x 5–6 μ.

Hackensack marshes, New Jersey. November. W. H. Ballou.

This species is remarkable for its strong, persistent odor.

Plantae caespitosae, graveolentes; pileus hemisphaericus vel conconvexus, glaber, cremeo subalutaceus, carne pallido; lamellae confertae, subventricosae, adnexae, in maturitate brunneae; stipes aequalis, sericeo-fibrillosus, confertus vel cavus, albus; sporae subellipticae, 8–10 x 5–6 μ.

Ramularia anomala

Tufts forming indefinite whitish patches on the lower surface of the leaves with no discolored spot and scarcely visible to the naked eye; hyphae very minute, densely crowded about 20 μ long; spores oblong or cylindric, continuous, hyaline, subacute, 12–20 x 3–4 μ.

Living leaves of climbing false buckwheat, Polygonum scandens L. Red Cloud, Neb. J. M. Bates. Communicated by E. Bartholomew.

Unlike most species of Ramularia, this has no discolored spots on the leaves of the host plant.

Caespites areas indefinitas albidas obscuras in superficiei foliorum inferiore formantes, macula nulla discolorata, fungoque oculo inermi vix visible; hyphae minutissimae dense confertae circiter 20 μ longae; sporae oblongae vel cylindraceae, continueae, hyalinae utrinque, subacutae, 12–20 x 3–4 μ.

Septoria polemonioides

Spots suborbicular, brown or brown with a whitish center, perithecia epiphyllous, black; spores slender, straight or curved, pointed at each end, continuous, hyaline, 30–60 x 1–1.5 μ.

Living or languishing leaves of some species of Polemonum. Utah. A. O. Garrett.

This species differs from Septoria polemonii Thuem, in its longer continuous and sharp pointed spores and in the color of the spots.

Maculae suborbiculares, brunneae, interdum centro albidae; perithecia epiphylla, atra; sporae graciles, rectae vel curvae, utrinque acutae, continuae, hyalinae, 30–60 x 11.5 μ.

Sphaerella saccharoides

Spots definite, oblong, .5–1 cm long, brownish on the margin; perithecia epiphyllous, minute, black; asci subcylindric, 70–80 x 12–14 μ; spores biseriate, oblong or subfusiform, constricted at the septum, each cell binucleate, hyaline, 25–30 x 5–6 μ.

Leaves of sugar cane, Saccharum officinarum L. Cuba. T. E. Thurston. Communicated by L. R. Hesler.

This species appears to be closely related to Sphaerella sacchari Speg. from which according to the description it differs in its definite whitish spots, in the longer asci and spores and in the latter being quadri-nucleate.

Maculae definitae, oblongae, .5–1 cm longae, margine brunescetes; perithecia epiphyllae, minutae, nigrae; asci subcylindracei, 70–80 x 12–14 μ; sporae in asco biseriatae, oblongae vel subfusiformes, ad septum constrictae, quadri-nucleatae, hyalinae, 25–30 x 5–6 μ.

Sporotrichum atropurpureum

Hyphae widely effused, forming a soft tomentose covering on the matrix, at first white, gradually becoming red, dark purple or violaceous, sparsely and irregularly branched, septate, often granular within, 2–5 μ broad, sterile branches or mycelium gradually or sometimes abruptly tapering to a long slender point, the fertile often fasciculately combined; spores oblong or subcylindric, frequently narrowed toward one end, very variable, 6–16 x 2–4 μ.

On kernels of Indian corn, Zea mays L. Lexington, Ky. H. Garman.

This is a remarkable species by reason of the peculiar color of the mature fungus.

Mycelium late effusum; hyphae in matrice stratum molle tomentosum formantes, primum album, deinde rubrum vel atropurpureum, ramulis paucis irregularibusque, 2–5 μ latis, saepe intra granularibus, septatis, sterilibus praelonge attenuatis, fertilibus in maturitate frequenter et fasciatim combinatis; sporae oblongae vel subcylindaceae, saepe infra attenuatae, variabiles, 6–16 x 2–4 μ.

Stropharia umbilicata

Pileus fleshy, convex, deeply umbilicate, shining, squamose with scattered appressed brownish scales, umber brown, tinged with olive green when dry, the margin sometimes adorned with fragments of the veil, flesh yellowish; lamellae close, adnexed or almost free, sinuate, 2–3 mm broad, becoming sooty brown with a white edge; stem subequal, slightly broader at the top, stuffed or hollow, fibrillosely scaly, whitish above, rusty brown below, annulus superior, membranaceous; spores ellipsoid, 7–8 x 4–5 μ.

Pileus 4–5 cm broad; stem 2.5–4 cm long, 4–6 mm thick.

Cespitose. Chips and sawdust. Minnesota. September. Doctor Munger. Communicated by Mrs M. S. Whetstone.

Pileus carnosus, convexus, profunde umbilicatus, nitidus, squamulis sparsis appressis, brunneis ornatus, umbrinus, demum olivaceo-viride tinctus, interdum margine fragmentis veli triangularibus ornatus, carne lutescente; lamellae confertae, adnexae vel subliberae, sinuatae, 2–4 mm latae, demum fuliginosae, acie albidae; stipes subaequalis, farctus vel cavus, fibrilloso-squamulosus, supra albidus, infra ferrugineo-brunneus, annulo superiore, membranaceo; sporae ellipsoideae, 7–8 x 4–5 μ.

Pileus 4–5 cm latus; stem 2.5–4 cm longus, 4–6 mm crassus.

Volvaria perplexa

Pileus thin, convex or nearly plane, umbonate, slightly depressed around the umbo, dry, adorned with minute erect hairy squamules, fimbriate on the even margin, white; lamellae close, free, about 2 mm broad in the widest part, pale pink; stem long, slender, glabrous, shining, solid or stuffed, slightly pruinose at the top, thickened at the base, white, brownish where bruised, volva closely sheathing, elongated; spores ellipsoid, 6–8 x 4–5 μ.

Pileus 12–20 mm broad; stem 5–7 cm long, 2–3 mm thick.

Solitary. Among fallen leaves in woods. Minnesota. November. Mrs M. S. Whetstone.

This species seems to be closely allied to Volvaria parvula Weinm. from which it is separated by its squamulose pileus with fimbriate margin, its much longer stuffed or solid stem and longer sheathing volva, its larger spores and by the absence of cystidia.

Pileus tenuis, convexus vel subplanus, umbonatus, circa umbonem leviter depressus, siccus, squamulis erectis hirtis minutis ornatus, margine leve fimbriatus, albus; lamellae confertae, liberae, circiter 2 mm latae, pallide incarnatae; stipes longus, gracilis, nitidus, glaber, solidus vel farctus, ad apicem leviter pruinosus, basi crassus, albus, ubi contusus brunnescens, volva elongata vaginata; sporae ellipsoideae 6–8 x 4–5 μ.

Pileus 12–20 mm latus; stem 5–7 cm longus, 2–3 mm crassus.

EDIBLE FUNGI

Amanita ovoidea Bull.

OVOID AMANITA

Plate 131

Pileus fleshy, hemispheric or expanded, glabrous, inflexed on the margin, pure white, flesh white, taste insipid; lamellae rather broad, subclose, ventricose, free or nearly so, white; stem equal or tapering upward, squamulose farinaceous, solid, firm, white without and within, bulbous at the base, annulate above; spores globose or subglobose, 10–12 x 9–11 μ or about 10 μ broad.

The ovoid amanita is a large, attractive and noble looking species. It is pure white throughout with the exception of the volva that envelops the bulbous base of the stem. This is slightly tinged with pink. The cap may range from 4 to 8 inches broad, the stem from 4 to 6 inches long and 6 to 12 lines thick. The cap is very smooth, almost glossy, and white as snow. The flesh also is white but its taste is insipid, and in cooking it is necessary to season it well with butter and salt to make it satisfactorily palatable. The stem is firm, solid, more or less mealy externally and pure white. The species is very rare having not before been found in our State so far as I know. In Sylloge, volume V, page 9, Professor Saccardo remarks that he has never seen its spores nor has anyone else so far as he knows. This remark no longer holds good. The New York specimens yielded spores. Since the species is cogeneric with some of our most poisonous species of mushrooms, we advise no one to try its edibility unless perfectly sure of its identity.

Tricholoma chrysenteroides Pk.

GOLDEN-FLESH TRICHOLOMA

Plate 132

Pileus fleshy, convex or nearly plane, glabrous, or slightly silky, firm, pale yellow or at length rufescent, the margin sometimes reflexed, flesh pale yellow, taste and odor farinaceous; lamellae close, adnexed, often with venose interspaces, yellowish, sometimes becoming dingy with age; stem equal, firm, glabrous, solid or stuffed, rarely hollow, yellowish without and within; spores ellipsoid, 8–10 x 5–6 μ.

The golden-flesh tricholoma is easily known by its pale yellow color and its farinaceous odor and taste. It is similar in color to Tricholoma sulphureum Bull. Its cap is one to two or sometimes two and a half inches broad, convex or nearly flat above or occasionally with the margin curved upward. It is smooth or slightly silky and its flesh is colored like the cap. Indeed the plant is nearly uniform in color throughout, except in old specimens in which the upper surface of the cap becomes reddish. The lamellae are rather close, adnexed, usually veiny in the interspaces and are apt to become dingy with age. The stem is equal in diameter throughout, firm, smooth or somewhat silky fibrillose, solid or rarely stuffed or slightly hollow when large or old and colored like the pileus. It was found growing under poplar trees among fallen leaves at Vaughns in September. When cooked it has an agreeable flavor but old specimens are liable to be somewhat tough, though still very palatable.

POISONOUS FUNGI

Mycena splendidipes Pk.

POISON MYCENA

Plate X

Pileus at first ellipsoid, even, the upper half brown, the lower half yellow, at length hemispheric or convex, submembranous, widely striate on the margin, glabrous, greenish gray; lamellae ascending, subdistant, white; stem slender, hollow, glabrous, bright shining lemon yellow; spores broadly ellipsoid or subglobose, 6–8 x 4–6 μ.

Pileus 6–10 lines broad; stem 2–6 inches long, .5–1 line thick.

Woods. Among fallen pine leaves. Richmond co. November. W. H. Ballou.

This is a beautiful little Mycena, very attractive in appearance by reason of its bright shining yellow stems and very interesting on account of the great change in appearance caused by its transformation from the young to the mature state. This is best expressed by the figures given in the plate. It is a veritable little siren. Its discoverer, venturing to eat a single sample of it was made sick by the experiment, and has furnished a warning to all future generations against its dangerous qualities.

CRATAEGUS IN NEW YORK

So much has been learned of the characters and distribution of the different species of Crataegus in New York during the last three or four years through the collections and observations of a number of students of these plants that it now seems desirable to join in a brief summary this information with that contained in the various publications on the subject which have appeared in the last ten years.

In western New York Crataegus has been more systematically and carefully collected and studied than in any other part of North America, but there is still much field work to be done before the species of the eastern, southern and central parts of the State are equally well known, and it is hoped that the publication of this synopsis of the work already accomplished may lead to further investigations and collections.

C. S. Sargent

Arnold Arboretum
Jamaica Plain, Mass.
December 1912

KEY TO THE SPECIES

Synopsis of the groups

A Nutlets without ventral cavities........................... (Groups Crus-galli-Anomalae)

B Nutlets with longitudinal cavities on their ventral faces..... (Group Tomentosae)

Crus-galli

Leaves subcoriaceous to coriaceous, obovate to oblong-obovate, usually rounded, or acute or acuminate at the apex, mostly serrate only above the middle, without lobes except on vigorous shoots, their veins thin and sometimes within the parenchyma, petioles short, usually eglandular; flowers in many-flowered corymbs; fruit subglobose to short-oblong, flesh thin, usually green.

* Veins of the leaves within the parenchyma; stamens 10

Anthers rose color ....C. crus-galli

Anthers white ....C. arduennae

** Veins of the leaves prominent

†Glabrous with the exception of occasional hairs on the young leaves; anthers pale pink

Stamens 9–10....................C. geneseensis

Stamens 10–20

Flowers at least 1.8 cm in diameter, in broad many-flowered corymbs; leaves broadly ovate; fruit crimson, spines stout ....C. robusta

Flowers not more than 1.2 cm in diameter, in few-flowered corymbs; leaves narrowly obovate; fruit bright cherry red; spines slender..C. cerasina

†† Corymbs more or less villose

Mature leaves glabrate; corymbs slightly villose; stamens 10–20, anthers dark rose color; fruit short-oblong to subglobose........................C. persimilis

Mature leaves pubescent below; corymbs densely villose; stamens 10–14, anthers white sometimes faintly tinged with pink; fruit short-oblong to obovoid..............
C. helderbergensis

Punctatae

Leaves thin, mostly acute or acuminate, usually more or less lobed above the middle, their veins prominent, petioles short; flowers in many-flowered corymbs; anthers rose color or pink (pale yellow in one variety of no. 1); fruit subglobose to ellipsoidal or obovoid, usually more or less flattened at the ends, punctate, flesh dry and mealy, nutlets 2–5, prominently ridged on the back.

* Stamens 20

Leaves more or less villose at maturity; anthers rose color, or yellow (in var. aurea); leaves obovate, often acutely lobed above the middle on vigorous shoots; fruit flattened at the ends, marked by large dots, dull red, or yellow (in var. aurea)...............C. punctata

Leaves glabrous at maturity

† Anthers dark rose color

Pedicels stout, villose; calyx thickly coated with white hairs; fruit subglobose, crimson, lustrous
C. celsa

Pedicels slender, glabrous; calyx glabrous; fruit short-oblong to slightly obovoid

Flowers not more than 1.2 cm in diameter; fruit orange-red, lustrous; leaves cuneate at the base
C. notabilis

Flowers at least 2.5 cm in diameter; fruit dark crimson, pruinose; leaves cuneate or broad and rounded at the base.....C. eastmaniana

†† Anthers pink; corymbs glabrous

Flowers 1.8–2 cm in diameter; leaves ovate, oval or orbicular; fruit short-oblong, crimson, pruinose.... C. dewingii

Flowers not more than 1.5 cm in diameter; fruit not pruinose

Leaves ovate or obovate; fruit short-oblong to depressed-globose, bright cherry-red........... C. eatoniana

Leaves oblong-obovate; fruit oblong-obovoid, scarlet.........................C. barbara

** Stamens 15–20, anthers rose color; leaves oblong-obovate to oval, rounded or acute at the apex; corymbs slightly villose; fruit short-oblong to slightly obovoid, dull brick-red ....C. pausiaca

*** Stamens 10; anthers rose color or pink corymbs slightly villose

Leaves rhombic or obovate, acuminate and long-pointed, glabrous; fruit short-oblong.............. C. desueta

Leaves obovate to ovate, acute, villose while young; anthers pink; fruit subglobose to slightly obovoid.. C. brownietta

Pruinosae

Leaves thick, usually broad at the base, smooth or scabrate above; petioles long and slender; flowers in glabrous or hairy corymbs; stamens usually 10 or 20, anthers rose color, pink or white; fruit subglobose, often broader than high, short-oblong or obovoid, sometimes angled, green or red, generally pruinose, ripening late, flesh dry and hard, the mature calyx prominent, raised on a tube; nutlets 3–5.

*Stamens 20

† Mature leaves smooth and glabrous on the upper surface

‡ Fruit on slender drooping pedicels

Anthers rose color, red or maroon

Tube of the calyx of the fruit elongated; anthers dark rose color; leaves blue-green; fruit pruinose

Leaves elliptical; fruit subglobose, becoming dark red and very lustrous when fully ripe........ C. pruinosa

Leaves oblong-ovate; fruit obovoid, crimson.... C. oblita

Tube of the calyx of the fruit short

Upper surface of the young leaves glabrous

Fruit obovoid, slightly pruinose

Fruit conspicuously mammillate below the middle; leaves ovate to rhombic; anthers rose color..................C. arcana

Fruit not mammillate; leaves rhombic; anthers maroon..............C. obstipa

Fruit short-oblong to slightly obovoid, densely pruinose; leaves oblong-ovate; anthers maroon ....C. beata

Upper surface of the young leaves covered with soft hairs

Leaves broadly ovate; anthers red; flowers 2.5 cm in diameter in 10–15-flowered corymbs; fruit short-oblong; cavity of the calyx pointed in the bottom.....C. pallescens

Leaves ovate; anthers rose color; flowers not more than 2 cm in diameter, in 5- or 6-flowered corymbs; fruit subglobose to obovoid; cavity of the calyx wide in the bottom...... C. pelacris

Anthers pink

Tube of the calyx of the fruit elongated; fruit pruinose

Leaves ovate; anthers creamy white, slightly tinged with pink; fruit subglobose to short-oblong, dark red................C. amoena

Leaves ovate to oval, long-pointed; fruit subglobose, slightly 5-angled, bright red.......... C. aristata

Leaves ovate; fruit broad-obovoid to short-oblong, green with a purple cheek.............. C. prominens

Tube of the calyx of the fruit short; fruit pruinose

Leaves ovate

Fruit depressed-globose, green tinged with red or orange color..............C. gracilis

Fruit globose to depressed-globose, angular, becoming scarlet and lustrous. C. howeana

Fruit short-oblong, vermillion..C. latiflora

Fruit short-oblong to subglobose, often broader than high, dark red; anthers faintly tinged with pink ....C. pellecta

Leaves oblong-ovate; fruit short-oblong to oval, red ....C. ramosa

Leaves obovate; fruit subglobose, crimson...... C. scitula

Anthers yellow

Tube of the calyx of the fruit elongated

Leaves broadly ovate; fruit subglobose to short-oblong, crimson, lustrous.....C. conspecta

Leaves ovate to obovate; fruit obovoid, pale red, pruinose ....C. russata

Tube of the calyx of the fruit short

Leaves ovate; fruit pruinose

Fruit short-oblong to slightly obovoid, scarlet. C. formosa

Fruit obovoid, pruinose, green becoming dull crimson at maturity..........C. cognata

Leaves ovate to oval; fruit subglobose, often broader than high, to obovoid, orange-red, lustrous, flesh orange-red....C. rubro-lutea

‡‡ Fruit on stout erect pedicels; tube of the calyx of the fruit short

Anthers faintly tinged with pink; fruit obovoid

Leaves ovate to oval; fruit bright cherry-red, pruinose ....C. casta

Leaves broadly ovate; fruit dark green, becoming bright red and lustrous at maturity............. C. leiophylla

Anthers pale rose color; leaves ovate; fruit short-oblong, slightly angled, red, pruinose; calyx much enlarged ....C. macrocalyx

Anthers bright red; leaves ovate, acuminate; fruit subglobose, often broader than high, distinctly angled, orange-red, lustrous....C. clintoniana

Anthers yellow or white
Leaves ovate to oval; fruit subglobose, usually broader than high, conspicuously angled while young, pruinose, dull orange-red blotched with green at maturity..............C. conjuncta
Leaves oblong-ovate; fruit obovoid, gradually narrowed to the base, dark green tinged with red... C. longipedunculata
†† Mature leaves scabrate on the upper surface
Leaves ovate to rhombic; anthers red; fruit ovoid to short-oblong, slightly pruinose, crimson; tube of the calyx of the fruit elongated.....C. lennoniana
Leaves ovate; anthers pink; fruit subglobose, often broader than high, bright apple green, slightly pruinose; tube of the calyx of the fruit short.......... C. bronxensis
** Stamens 10 or less
† Mature leaves smooth and glabrous on the upper surface
‡ Fruit on slender drooping pedicels, anthers rose color, red or maroon; tube of the calyx of the fruit short
Leaves ovate
Anthers slightly tinged with rose; fruit depressed-globose, broader than high, red, lustrous........ C. uncta
Anthers dark red; fruit short-oblong, crimson, lustrous.............................C. radiata
Anthers purplish red; fruit short-oblong to obovoid, bright orange-red, pruinose.........C. placiva
Leaves ovate to oval; anthers maroon; fruit short-oblong, cherry-red, pruinose..........C. pulchra
‡‡ Fruit on erect pedicels
Anthers rose color
Tube of the calyx of the fruit elongated; leaves ovate, acuminate; fruit obovoid, dark red, pruinose, hard and dry at maturity.....C. aridula
Tube of the calyx of the fruit short; leaves ovate; fruit depressed-globose, rather broader than high, dull red, slightly pruinose, becoming lustrous... C. robbinsiana

Anthers pink

Leaves ovate to broadly ovate; fruit globose to depressed-globose, angular, scarcely pruinose, dull red, often blotched with red......C. brevipes

Leaves oblong-obovate; fruit short-oblong, pruinose, light green, becoming crimson at maturity. C. plana

†† Mature leaves scabrate on the upper surface

‡ Fruit on slender drooping pedicels, pruinose

Leaves ovate; anthers rose color; fruit obovoid, scarlet ....C. ovatifolia

Leaves broadly ovate; anthers yellow; fruit short-oblong, dull greenish red..........C. inusitula

‡‡ Fruit on erect pedicels; leaves ovate; anthers dark rose color; fruit subglobose, often broader than high, scarlet, pruinose ....C. exornata

Medioximae

Leaves hairy on the upper surface early in the season, glabrous and smooth or scabrate at maturity; petioles long and slender; flowers in few-or many-flowered glabrous corymbs; stamens 10 or less, anthers rose color or pink; fruit globose, short-oblong or obovoid, rarely slightly angled, scarlet, crimson, maroon or orange-red, more or less pruinose, ripening late in September or in October, flesh hard and solid, mature calyx sessile, nutlets 2–5, usually 3 or 4.

* Fruit subglobose to globose

† Mature leaves smooth on the upper surface

‡ Leaves yellow-green

Leaves ovate to rhombic, acute or acuminate; fruit rather broader than high, crimson, blotched with green ....C. dissona

Leaves ovate to oval, acuminate and short-pointed; fruit subglobose to ovoid, crimson, pruinose............. C. implicata

Leaves broadly ovate

Calyx-lobes foliaceous, coarsely serrate; fruit obovoid at first, when fully grown becoming depressed-globose, bright red; leaves often truncate at the base ....C. deltoides

Calyx-lobes small, finely serrate; fruit subglobose, orange-red; leaves not truncate at the base......... C. seclusa

‡‡ Leaves blue-green

Leaves ovate to deltoid; fruit globose, dark scarlet, lustrous .... C. maineana

Leaves oblong-ovate to oval; fruit rather broader than high to short-obovoid, obscurely angled, crimson, lustrous................ C. opulens

Leaves ovate-acuminate; fruit subglobose to short-oblong, truncate at the apex, rounded at the base, maroon, lustrous .... C. perspicabilis

†† Mature leaves scabrate on the upper surface

Leaves yellow-green, ovate; fruit subglobose to short-oblong, scarlet, lustrous.............. C. macera

Leaves blue-green, ovate-acuminate; fruit subglobose to short-oblong, flattened at the ends, scarlet, lustrous, slightly pruinose .... C. diffusa

** Fruit short-oblong

† Mature leaves smooth on the upper surface

Leaves broadly ovate; calyx-lobes short and broad; anthers red; fruit orange-red, slightly pruinose.... C. xanthophylla

Leaves ovate; calyx-lobes long and slender; anthers bright rose color; fruit red and lustrous.......... C. livingstoniana

†† Mature leaves scabrate on the upper surface, ovate, long-pointed; fruit scarlet, lustrous........... C. strigosa

*** Fruit obovoid

† Mature leaves glabrous on the upper surface

‡ Leaves blue-green above

Leaves subcoriaceous, oblong-ovate

Fruit oblong-obovoid or rarely short-oblong, light cherry red, pruinose .... C. compta

Fruit full and rounded at the apex, abruptly narrowed at the base, bright orange-red, pruinose............. C. tortuosa

Leaves thin

Leaves oblong-ovate, acuminate; flowers in broad lax many-flowered corymbs; fruit oblong-obovoid, gradually tapering to the long base, crimson, lustrous.... C. promissa

Leaves ovate; flowers in compact 4–6-flowered corymbs; fruit only slightly narrowed at the base and sometimes decurrent on the pedicel..... C. congestiflora

‡‡ Leaves yellow-green above, thin
Anthers dark rose color
Calyx-lobes short and broad
Leaves oblong-ovate, long-pointed; flowers in 5–8-flowered corymbs; fruit abruptly narrowed and often mammillate at the base, scarlet, pruinose.. C. numerosa
Leaves oblong-ovate, acuminate; flowers in 8–12-flowered corymbs; fruit crimson, lustrous...... C. foliata
Calyx-lobes long and slender; leaves oblong-ovate, deeply tinged with red when they unfold; fruit crimson, lustrous ....C. colorata
Anthers pale pink; calyx-lobes long and narrow; leaves ovate; fruit scarlet, lustrous............C. cruda
†† Mature leaves scabrate on the upper surface
‡ Leaves blue-green on the upper surface, ovate to rhombic; fruit crimson, pruinose, remaining hard at maturity.... C. acerba
‡‡ Leaves yellow-green on the upper surface
Leaves broadly ovate to triangular; anthers pale rose color; fruit on long slender drooping pedicels, light cherry-red, pruinose................. C. dissociabilis
Leaves broadly ovate; anthers purple; fruit on stout erect or spreading pedicels, crimson, pruinose ....C. barryana

Tenuifoliae

Leaves thin, hairy on the upper surface early in the season, becoming smooth or scabrate; petioles long and slender; flowers in glabrous or slightly villose corymbs; stamens 10 or less, or rarely 20, anthers rose color or pink; fruit short-oblong, subglobose or obovoid, red, lustrous, ripening in August or September, the flesh soft and succulent, mature calyx small and sessile.

* Stamens 10 or less
† Fruit longer than broad
‡ Fruit usually short-oblong
Leaves yellow-green above
Upper surface of mature leaves glabrous
Leaves ovate, acuminate

Calyx-lobes villose on the inner surface.
Leaves oblong-ovate; flowers in 6–12-flowered corymbs; pedicels and calyx-tube glabrous.. C. ignea
Leaves broadly ovate; flowers in 15–18-flowered corymbs; pedicels and calyx-tube slightly villose ....C. hadleyana
Calyx-lobes glabrous on the inner surface
Fruit bright orange-red
Anthers dark rose color; cavity of the fruit deep and narrow............C. suavis
Anthers pink
Flowers not more than 1.2 cm in diameter, in narrow compact corymbs; cavity of the fruit broad and shallow........... C. boothiana
Flowers 1.5–1.6 cm in diameter, in broad lax corymbs; fruit sometimes slightly obovoid, the cavity deep and narrow.. C. slavînii
Fruit dark crimson, lustrous, oblong-obovoid early in the season, becoming short-oblong; anthers pink ....C. ascendens
Fruit crimson, sometimes subglobose; anthers dark red; leaves long-pointed............. C. acuminata
Fruit sometimes slightly obovoid
Flowers in wide lax many-flowered corymbs
Anthers dark rose color; fruit bright scarlet, its cavity small and shallow...... C. tenella
Anthers pale rose color; fruit crimson, its cavity deep and narrow............... C. spathifolia
Flowers in small compact corymbs; anthers pink; fruit scarlet, lustrous...C. nescia
Leaves ovate, acute; fruit rarely subglobose, the flesh red; anthers purple..C. rubrocarnea
Leaves broadly ovate, acute, glaucescent early in the season; anthers dark rose colored; fruit scarlet, lustrous...............C. glaucophylla

Leaves ovate to deltoid, acute; anthers rose colored; fruit sometimes slightly obovoid................ C. demissa

Leaves ovate to broadly oval, acute; anthers light red; fruit scarlet, lustrous......C. delucida

Leaves ovate to rhombic or ovate-oblong; anthers red; fruit dark purple-red, ripening and falling in August ....C. matura

Upper surface of the mature leaves scabrate

Leaves ovate, acuminate

Calyx-lobes slightly villose on the inner surface; fruit scarlet, lustrous

Calyx and pedicels glabrous; leaves dark green; flesh of the fruit dry and yellow..................C. streeterae

Calyx and pedicels slightly hairy; leaves light green; flesh of the fruit juicy and red..................C. rubicunda

Calyx-lobes glabrous on the inner surface

Anthers light rose color

Fruit scarlet, lustrous; flowers up to 1.8 cm in diameter......C. recta

Fruit dull red; flowers about 1.5 cm in diameter ....C. insignata

Anthers dark rose color; fruit crimson.... C. fucata

Leaves oval to ovate, acute; fruit dark crimson, lustrous; stamens rarely more than five...... C. pentandra

Leaves blue-green above, glabrous at maturity

Leaves ovate, acuminate; fruit scarlet, lustrous; anthers rose color

Cavity of the fruit broad and deep; flesh of the fruit thick, sweet and juicy........C. bella

Cavity of the fruit narrow and shallow; flesh of the fruit thin, dry and mealy....C. ornata

Leaves oval, acute or acuminate; anthers rose color; fruit crimson, lustrous.............C. genialis

‡‡ Fruit obovoid

Leaves yellow-green

Upper surface of the mature leaves glabrous

Leaves oblong-ovate, long-pointed, narrowed at the base; anthers dark red; fruit cherry-red, 1–1.2 cm long..............C. leptopoda

Leaves ovate, acuminate, often broad at the base; anthers rose color; fruit scarlet, 2.5 cm long.. C. paineana

Upper surface of the mature leaves scabrate

Leaves ovate, acuminate; fruit scarlet, the calyx little enlarged; anthers light red............ C. gracilipes

Leaves ovate, acute; fruit crimson, the calyx much enlarged and prominent; anthers dark rose color ....C. habereri

Leaves blue-green above, glabrous at maturity

Leaves oblong-ovate to oval, acuminate, thick; flowers not more than 1 cm in diameter, in wide many-flowered corymbs; stamens usually 5, anthers pink; fruit crimson, lustrous............ C. parviflora

Leaves broadly ovate, acuminate, thin; flowers 1.5 cm in diameter, in narrow usually 4–6-flowered corymbs; stamens 10, anthers dark rose color; fruit scarlet, lustrous..........C. tenuiloba

†† Fruit subglobase; leaves yellow-green

Leaves scabrate on the upper surface, deeply lobed...... C. claytoniana

Leaves glabrous on the upper surface, slightly lobed.... C. stolonifera

** Stamens 20

† Fruit usually short-oblong

Leaves yellow-green and glabrous on the upper surface at maturity

Leaves oblong-ovate to oval, acuminate; flowers in compact 7–8-flowered corymbs; anthers pink; fruit on drooping pedicels, occasionally obovoid, bright cherry-red, lustrous................C. edsonii

Leaves broadly ovate, acuminate; anthers rose color; fruit on erect pedicels, orange-red, lustrous...... C. conferta

Leaves blue-green and scabrate on the upper surface at maturity, ovate, acuminate

Flowers in wide lax many-flowered corymbs; anthers red; fruit on long drooping pedicels, dull scarlet, its cavity shallow and narrow......C. benigna

Flowers in compact 6–12–flowered corymbs; anthers light red; fruit sometimes slightly obovoid, on short erect pedicels, its cavity deep and narrow...... C. mellita

†† Fruit obovoid, dark crimson, lustrous; leaves oblong-ovate, acuminate, yellow-green, flabrous at maturity; anthers dark red..................C. luminosa

Coccineae

Leaves large, thin, oblong, acutely and more or less deeply lobed; petioles long; flowers in usually wide many-flowered corymbs; stamens 10 or less, or 20; anthers rose color, pink or rarely white; fruit short-oblong to obovoid, up to 2 cm in length, flesh succulent, nutlets 3–5, grooved and usually ridged on the back (*Flabellatae* Sargent in Rhodora 111.22 [1901]).

* Anthers rose color or pink

† Stamens 10 or less

‡ Fruit short-oblong

Leaves glabrous on the upper surface at maturity

Stamens usually 5; fruit on long slender pedicels

Calyx-tube glabrous; leaves ovate to oval, acute; anthers dark red...........C. holmesiana

Calyx-tube villose

Leaves oblong-ovate, acuminate; calyx-tube densely covered with matted hairs, the lobes long and slender, villose on the inner surface; anthers pink.................C. acclivis

Leaves ovate, acute or acuminate; calyx-tube slightly hairy, the lobes short and broad, glabrous; anthers rose color....C. uticaënsis

Stamens usually 10; fruit on short stout pedicels

Leaves ovate, acute, drooping, conspicuously concave; fruit dark dull red, villose at the ends..... C. pringlei

Leaves oval to oblong-ovate; fruit crimson, lustrous, glabrous ....C. lobulata

Leaves scabrate on the upper surface at maturity

Leaves broadly ovate to oval, acute or acuminate; stamens usually 10; anthers rose color; fruit rounded and symmetrical at the base............ C. pedicellata

Leaves ovate, acuminate; stamens 8–10; anthers pale pink; fruit usually unsymmetrical at the base by a mammillate process adnate to the pedicel........ C. gloriosa

‡‡ Fruit obovoid

Leaves glabrous on the upper surface at maturity, ovate, acute or acuminate; stamens 10, anthers pink...... C. letchworthiana

Leaves scabrate on the upper surface at maturity

Leaves oblong-ovate, acuminate; stamens 10, anthers pale pink ....C. vivida

Leaves oval to oblong-ovate, short-pointed and acute at the apex; stamens 5–8, anthers dark rose color.. C. tardipes

‡‡‡ Fruit subglobose to short-oblong or rarely obovoid, on erect pedicels; leaves glabrous on the upper surface at maturity, ovate to oval, acute or acuminate; stamens usually 5, anthers rose purple..C. polita

‡‡‡‡ Fruit subglobose to oval; leaves scabrate on the upper surface at maturity, ovate, acuminate; stamens 7–10, anthers rose color..C. sejuncta

†† Stamens 20

‡ Leaves glabrous on the upper surface at maturity.

Leaves broadly ovate, acuminate; fruit gradually narrowed to the base and often slightly decurrent on the pedicel.

Leaves yellow-green; calyx-tube glabrous; anthers pink ....C. dayana

Leaves blue-green; calyx villose; anthers red..... C. gilbertiana

Leaves ovate, long-pointed, deeply lobed; corymbs densely villose; anthers pink....C. flabellata

‡‡ Leaves scabrate on the upper surface at maturity.

Leaves ovate, long-pointed and acuminate; anthers pale rose color; fruit abruptly narrowed at the base. C steubenensis

Leaves oblong-ovate, acuminate, slightly lobed; corymbs only sparingly villose; anthers red...... C. limosa

** Anthers white

Stamens 20; calyx and pedicels densely villose..C. irrasa

Stamens 5–8; calyx and pedicels slightly villose.......... C. perrara

Molles

Leaves thin, broad, cuneate or rounded at the base, petioles long; flowers large, in many-flowered corymbs; stamens 10 or less, or 15–20, anthers yellow, rose color or pink; fruit up to 2.5 cm in diameter, subglobose or obovoid, scarlet, more or less pubescent at the ends; nutlets 3–5, narrow at the ends, only slightly ridged.

* Stamens 10 or less

† Anthers yellow

Fruit obovoid to short-oblong, on erect pedicels; leaves blue-green and glabrous on the upper surface at maturity......................C. champlainensis

Fruit subglobose to short-oblong, on drooping pedicels; leaves yellow-green and scabrate on the upper surface at maturity, their margin more or less contorted...... C. contortifolia

†† Anthers rose color; leaves yellow-green at maturity

Leaves scabrate on the upper surface at maturity

Flowers in wide many-flowered corymbs; leaves oval; fruit short-oblong, crimson..C. ellwangeriana

Flowers in very compact few-flowered corymbs; leaves oblong-ovate; fruit short-oblong to oblong-obovoid, scarlet.......................C. robesoniana

Leaves glabrous on the upper surface at maturity

Flowers in wide corymbs; leaves ovate; fruit short-oblong to obovoid, bright cherry-red..C. exclusa

Flowers in compact corymbs; leaves oblong-ovoid; fruit subglobose to short-oblong, dark crimson........... C. urbica

Flowers in broad loose many-flowered villose corymbs; leaves ovate; fruit obovoid to short-oblong, crimson.. C. anomala

††† Anthers pink; leaves blue-green and glabrous on the upper surface at maturity; fruit obovoid, bright scarlet.... C. huntiana

** Stamens 15–20; anthers rose color; leaves oval to ovate, yellow-green and scabrate above at maturity; fruit short-oblong, crimson ....C. radians

*** Stamens 20; anthers rose color; leaves ovate to oval, yellow-green and usually scabrate above at maturity; fruit short-oblong ....C. fulleriana

Dilatatae

Leaves thin, wide, often broader than long on vigorous shoots, petioles long and slender; flowers large, in broad 6–12-flowered corymbs; stamens 20, anthers rose color; fruit subglobose, the calyx enlarged and prominent; nutlets 5, ridged on the back.

* Leaves truncate or cordate at the wide base, broadly ovate; fruit bright scarlet..................C. dilatata

** Leaves cuneate at the base; fruit crimson

Leaves ovate to slightly obovate; fruit ripening early in September and soon falling, its cavity deep........ C. hudsoniana

Leaves ovate; fruit ripening late in October and persistent until midwinter, its cavity shallow........... C. durobrivensis

Intricatae

Leaves thin, usually cuneate at the base, petioles short, glandular; flowers large, opening late, in small few-flowered glandular corymbs, with large conspicuous bracts and bractlets; stamens 10 or less in the New York species, anthers yellow, pink or rose color; fruit late ripening, usually short-oblong or obovoid, red or yellow, flesh hard; nutlets 3–5, rounded at the ends.

* Anthers yellow

Fruit obovoid; mature leaves glabrous above

Leaves oblong-ovate, acuminate; fruit dark orange-red..............................C. intricata

Leaves oval — acuminate to ovate — acute; fruit pale orange-yellow ....C. cornellii

Fruit short-oblong to obovoid, crimson; leaves oblong to obovate, scabrate on the upper surface at maturity. C. verecunda

Fruit subglobose to short-oblong or obovoid, green, yellow or orange, villose at the ends; leaves ovate, scabrate on the upper surface at maturity........... C. modesta

Fruit subglobose, orange-red; leaves oblong-ovate to oval, glabrous on the upper surface at maturity..... C. foetida

** Anthers pink or pale rose color

Fruit obovoid, dull orange-red tinged with green, on drooping pedicels; leaves oval to ovate, glabrous.... C. bissellii

Fruit subglobose to short-oblong or ovoid, yellow-green, tinged with red, villose at the ends, on erect pedicels; leaves oblong-ovate, scabrate on the upper surface at maturity ....C. peckii

Rotundifoliae

Leaves subcoriaceous or thin, obovate to ovate, elliptical or rhombic, cuneate at the base, petioles usually short; flowers in many- or few-flowered corymbs; stamens 10 or less, or 15–20, anthers yellow, white, rose color or pink; fruit subglobose to short-oblong or obovoid, red, generally ripening late, mostly 1–1.5 cm in diameter; nutlets usually 3 or 4 (*Coccineae* Sargent in Rhodora 3:26 (not Loudon) (1901).

* Anthers yellow or white

† Stamens 10 or less

Leaves subcoriaceous; flowers in glabrous or in villose corymbs (var. pubera); fruit short-oblong, up to 1.5 cm in diameter................C. rotundifolia

Leaves thin

Leaves smooth and glabrous; corymbs glabrous; fruit short-oblong, usually less than 1 cm in diameter... C. dodgei

Young leaves roughened above by short hairs; corymbs villose, fruit obovoid....C. caesariata

†† Stamens 10–18; leaves thin; flowers in compact villose corymbs; fruit short-oblong to subglobose, scarlet.... C. divergens

††† Stamens usually 20

‡ Upper surface of the mature leaves smooth

Flowers in villose corymbs; anthers white; fruit ellipsoidal to subglobose, bright cherry-red............ C. illuminata

Flowers in glabrous corymbs; fruit short-oblong, crimson

Leaves thick, elliptical to obovate or ovate, roughened above while young by short hairs; flowers in wide many-flowered corymbs; anthers white.. C. maribella

Leaves thin, rhombic to obovate, glabrous above; flowers in narrow few-flowered corymbs; anthers yellow . . ..C. macauleyae

‡‡ Upper surface of the mature leaves scabrate; flowers in villose corymbs; stamens 15–20; leaves broadly ovate, deeply lobed; fruit short-oblong to subglobose, crimson ....C. noveboracensis

** Anthers rose color, red or pink

† Stamens 10 or less

‡ Corymbs villose; leaves roughened above while young by short hairs

Flowers in small compact 4–10-flowered corymbs; fruit subglobose to short-oblong

Stamens 5–10, anthers red; fruit scarlet; leaves ovoid to obovoid.............C. verrucalis

Stamens 5–7, anthers dark rose color; fruit short-oblong, orange-red; leaves rhombic to obovate... C. puberis

Stamens 10, anthers pale pink; fruit crimson; leaves ovate ....C. proctoriana

Flowers in wide many-flowered corymbs; stamens 5–10, anthers pink

Fruit short-oblong, ripening at the end of September, its cavity deep, pointed in the bottom; leaves elliptical to slightly obovate......C. maligna

Fruit subglobose, ripening in August, its cavity shallow, broad in the bottom; leaves rhombic... C. praecoqua

‡‡ Corymbs usually glabrous

Leaves roughened above by short white hairs; fruit subglobose to ellipsoidal, scarlet

Flowers in small very compact 5–10-flowered corymbs; stamens 10, anthers pink........ C. spissa

Flowers in wide mostly 10–15-flowered corymbs; stamens 5, anthers dark rose color .... C. chateaugayensis

Young leaves covered above by soft hairs; flowers in wide 7–15-flowered corymbs; stamens 5 or 6; anthers pink; fruit short-oblong to slightly obovoid, cherry-red .... C. harryi

†† Stamens 20, anthers pink; leaves thin, glabrous; flowers in wide 7–10-flowered glabrous corymbs; fruit short-oblong, dark red .... C. neo-baxteri

Anomalae

Leaves thick to subcoriaceous, usually cuneate or on vigorous shoots narrowed and rounded or rarely cuneate or subcordate at the base, scabrate above while young; petioles long and slender; flowers in many-flowered glabrous or villose corymbs; stamens 10 or 20, anthers rose color or pink; fruit subglobose to short-oblong or rarely obovoid, nutlets furnished with obscure ventral depressions.

* Stamens 20

† Flowers on villose pedicels; leaves ovate to oval or obovate, villose on midribs and veins below; anthers rose color; fruit short-oblong to ovoid or depressed-globose, orange-red, cavity of the fruit broad .... C. saundersiana

†† Flowers on glabrous pedicels; leaves glabrous below; cavity of the fruit narrow

Leaves ovate to oval; calyx-lobes glabrous on the inner surface; anthers pink; fruit short-oblong to obovoid, orange-red .... C. brachyloba

Leaves obovate to ovate; calyx-lobes villose on the inner surface; anthers rose color; fruit subglobose, scarlet .... C. fallsiana

** Stamens 10 or less

† Leaves scabrate on the upper surface at maturity

‡ Fruit subglobose; pedicels and inner surface of the calyx-lobes villose

Leaves broadly ovate to oval or suborbicular, acute; fruit often broader than high, crimson .... C. dunbarii

Leaves oblong-ovate, acuminate; fruit dark red ...... C. inopinata

‡‡ Fruit short-oblong
Pedicels and inner surface of the calyx-lobes glabrous; leaves oblong-obovate, acuminate. C. scabrida
Pedicels and inner surface of the calyx-lobes villose
Leaves rhombic to broadly obovate, short-acuminate .... C. affinis
Leaves rhombic to obovate, acuminate.......... C. misella
Leaves oblong-ovate, acuminate................ C. asperifolia
‡‡‡ Fruit short-oblong to obovoid, bright red; pedicels and inner surface of the calyx-lobes villose.......... C. repulsans
†† Leaves glabrous on the upper surface at maturity; pedicels glabrous; inner surface of the calyx-lobes villose
Leaves oblong-ovate, long-pointed, finely serrate, on vigorous shoots gradually narrowed and cuneate at the base; anthers dark red or purple; fruit narrow-obovoid .... C. floridula
Leaves ovate, acuminate, coarsely serrate, on vigorous shoots broad, rounded, subcordate or rarely cuneate at the base; anthers rose color; fruit short-oblong.... C. knieskerniana

Tomentosae

Leaves thin or subcoriaceous; flowers small, opening late, in many-flowered tomentose, villose or rarely glabrous corymbs; stamens usually 10 or 20; fruit obovoid to subglobose or short-oblong, becoming soft and succulent at maturity; nutlets 2 or 3, obtuse at the ends, penetrated on their inner faces by longitudinal cavities
* Leaves thin
† Stamens usually 20
‡ Anthers rose color or pink
Fruit obovoid, orange-red; leaves oval to ovate-oblong; anthers pale rose color.. C. tomentosa
Fruit usually subglobose
Mature leaves more or less villose below
Anthers rose color
Leaves oblong-ovate to rhombic, smooth above while young; corymbs and calyx nearly glabrous; fruit scarlet........... C. efferta

Leaves oblong-obovate, scabrate above while young; fruit sometimes slightly obovoid, crimson ....C. diversa

Anthers pink

Leaves rhombic to oblong-ovate; fruit short-oblong to subglobose, orange-red........... C. finitima

Leaves ovate to obovate; fruit sometimes slightly obovoid, scarlet....C. spinifera

Mature leaves glabrous, elliptic to rhombic or rarely obovate; fruit scarlet; anthers red.............. C. menandiana

‡‡ Anthers pale yellow

Mature leaves more or less villose below

Fruit short-oblong to obovoid, orange-scarlet; leaves oblong-ovate to oval or obovate..C. structilis

Fruit short-oblong to subglobose, orange-red, covered with short pale hairs; leaves ovate to rhombic.... C. comans

Fruit subglobose, dark red; leaves obovate........ C. truculenta

Mature leaves glabrous, ovate to elliptic or subrhombic; fruit short-oblong, crimson.........C. ambrosia

†† Stamens 10 or less

‡ Anthers rose color or pink; fruit subglobose to short-oblong

Mature leaves villose below, rhombic to obovate, acute or acuminate; fruit on erect pedicels, bright red; anthers purple ....C. rhombifolia

Mature leaves glabrous below

Fruit on drooping pedicels, scarlet

Leaves ovate, long-pointed; anthers dark rose color; cavity of the fruit deep and narrow..... C. deweyana

Leaves obovate to rhombic; anthers pink; cavity of the fruit broad and shallow................ C. cupulifera

Fruit on erect pedicels, orange-red; leaves obovate to rhombic; anthers pink......C. balkwillii

‡‡ Anthers pale yellow; fruit subglobose

Fruit on drooping pedicels
Leaves obovate to ovate or oval; fruit crimson; flowers up to 1.5 cm in diameter, on slightly hairy pedicels ....C. microsperma
Leaves oblong-ovate to oval; fruit dark crimson; flowers not more than 1.2 cm in diameter, on densely villose pedicels..........C. flagrans
Fruit on erect pedicels
Leaves oblong-ovate; fruit crimson; flowers on glabrous pedicels ....C. venustula
Leaves oval to oblong-obovate; fruit dark orange-red; flowers on densely villose pedicels.........
C. laneyi

** Leaves thick
† Stamens usually 20
‡ Anthers pale rose color or pink
Fruit on long drooping pedicels, scarlet
Leaves elliptical, acute at the ends; fruit subglobose ....C. succulenta
Leaves broadly oval to obovate, acute or rounded at the apex; fruit subglobose to short-oblong......
C. gemmosa
Leaves rhombic to oval or ovate, acute or acuminate; fruit ovoid to oval..........C. calvinii
Leaves obovate, acute; fruit short-oblong to subglobose; anthers pink. C. sonnenbergensis
Fruit on erect pedicels
Corymbs and under surface of the leaves villose
Fruit scarlet
Leaves obovate; fruit short-oblong...........
C. frutescens
Leaves oval to ovate or obovate; fruit short-oblong to ovate........C. honeoyensis
Fruit bright cherry-red, subglobose to short-oblong or ovate ....C. admiranda
Corymbs and under surface of the leaves glabrous; leaves rhombic; fruit short-oblong to subglobose.
C. spinea
‡‡ Anthers pale yellow; leaves oblong-obovate to oval; fruit on drooping pedicels, subglobose, crimson......
C. halliana

†† Stamens 10–20; anthers pink; leaves oblong-obovate; tomentose below at maturity; fruit on drooping pedicels, subglobose to short-oblong, crimson. . C. conspicua

††† Stamens 10 or less

‡ Anthers rose color or pink; leaves ovate to obovate; fruit on drooping pedicels, crimson

Young leaves glabrous above; anthers rose color; fruit subglobose to obovoid, cavity of the calyx deep . . . . C. beckiana

Young leaves covered above by short white hairs; anthers pale pink; fruit subglobose, cavity of the calyx shallow . . . . C. ogdensburgensis

‡‡ Anthers pale yellow

Fruit on drooping pedicels, subglobose to short-oblong; spines stout

Leaves rhombic or oval or obovate, short-pointed or rounded at the apex . . . . C. ferentaria

Leaves broadly ovate to slightly obovate, acute. . . . C. hystricina

Fruit on erect pedicels, subglobose, crimson, not more than 1 cm in diameter; spines long and slender; leaves broadly obovate to elliptic or oval . . . . C. macracantha

List of species

CRUS-GALLI

Crataegus crus-galli Linnaeus

Spec. 476 (1753). Sargent, Silva N. Am. IV. 91, t. 178

Near Albany and Hemlock lake region; not common.

Var. pyracanthifolia Aiton, Hort. Kew. II. 170 (1788)

Rochester, Niagara Falls and La Salle; not common.

Var. rubens n. var.

Anthers white faintly tinged with pink; flesh of the fruit red, otherwise as in the species.

On the rich bottom lands bordering the outlet of Canandaigua lake east of the railroad station at Chapin, Ontario county; very common.

B. H. Slavin (no. 3, type), September 24, 1908, June 14, 1909; (no. 54), September 24, 1908; June 14, 1909.

Crataegus arduennae Sargent

Bot. Gazette XXXV. 377 (1903); N. Y. State Mus. Bul. 122. 27 (1908)

South Buffalo; not common; also eastern Pennsylvania and Ontario to Illinois and Missouri.

Crataegus geneseensis Sargent

N. Y. State Mus. Bul. 122. 27 (1908)

Valley of the Genesee river.

Crataegus robusta Sargent

N. Y. State Mus. Bul. 122. 28 (1908)

Niagara Falls.

Crataegus cerasina Sargent

N. Y. State Mus. Bul. 122. 29 (1908)

Niagara Falls.

Crataegus persimilis Sargent

Proc. Rochester Acad. Sci. IV. 94. (1903)

Near Rochester and Syracuse.

Crataegus helderbergensis Sargent

N. Y. State Mus. Bul. 105. 49 (1906)

Thompson lake, near Albany.

PUNCTATAE

Crataegus punctata Jacquin

Hort. vind. I. 10, t. 28 (1770). Sargent, Silva N. Am. IV. 103, t. 184

Very common.

Var. aurea Aiton, Hort. Kew. II. 170 (1780).

Common.

Var. canescens Britton, Bul. Torrey Bot. Club XXI. 231 (1894).— Sargent, N. Y. State Mus. Bul. 105. 50 (1906).

North Greenbush; rare.

Crataegus celsa Sargent

N. Y. State Mus. Bul. 122. 31 (1908)

Niagara Falls.

Crataegus notabilis Sargent

N. Y. State Mus. Bul. 122. 32 (1908)

Buffalo.

Crataegus eastmaniana n. sp.

Glabrous. Leaves obovate and cuneate at the base to ovate and rounded at the base, sharply serrate and slightly divided above the middle into small acuminate lobes; nearly fully grown when the flowers open during the first week of June and then thin, yellow-green above and glaucescent below, and at maturity thin, dark blue-green and lustrous on the upper surface and paler on the lower surface, 4.5 to 5 cm long and 3 to 4 cm wide, with prominent mid-ribs and primary veins; turning orange and red in October; petioles slender, slightly wing-margined at the apex, 1.5–2.5 cm in length; leaves on vigorous shoots broadly ovate, rounded or cuneate at the base, more coarsely serrate and more deeply lobed, and often 6 to 7 cm long and 5 to 6 cm wide. Flowers 2.5 cm in diameter on slender pedicels, in small compact five- to ten-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes separated by wide sinuses, slender, acuminate, nearly entire, occasionally glandular-serrate near the middle, reflexed after anthesis; stamens twenty; anthers dark rose color, soon fading to light green; styles three to five, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening early in October on slender drooping pedicels, short-oblong to slightly obovoid, dark crimson, slightly pruinose, marked by numerous small pale dots, about 1.5 cm long and 1.2 cm in diameter; calyx little enlarged, with a deep narrow cavity pointed and densely tomentose in the bottom, and spreading usually incurved persistent lobes; flesh thin, dry and mealy; nutlets three to five, rounded at the base, narrowed and rounded at the apex, ridged on the back with a broad high ridge, 9 to 10 mm long and 5 to 6 mm wide, the narrow hypostyle extending nearly to the middle of the nutlet.

An arborescent shrub 5 to 7 m high, with a short main stem sometimes 3 cm in diameter, smooth pale gray branches, and slender nearly straight branchlets dark yellow-green when they first appear, light orange-brown at the end of their first season, and gray-brown the following year, and armed with numerous slender straight or slightly curved chestnut-brown shining spines 2.5 to 3.5 cm long.

Low rich ground on the border of Durand-Eastman park, Rochester, Henry T. Brown (no. 1, type), October 6, 1908; June 7, 1909.

Crataegus dewingii Sargent

N. Y. State Mus. Bul. 122. 34 (1908).

Buffalo, Belfast.

Crataegus eatoniana Sargent

N. Y. State Mus. Bul. 105. 51 (1906).

Menands near Albany.

Crataegus barbara Sargent

N. Y. State Mus. Bul. 122. 33 (1908).

Brighton near Rochester.

Crataegus pausiaca Ashe

Ann. Carnegie Mus. 1. 390 (1902). Sargent, Trees and Shrubs 1. 105. t. 53.

Chapin; also in eastern Pennsylvania.

Crataegus desueta Sargent

N. Y. State Mus. Bul. 122. 84 (1908).

Coopers Plains and Olean.

Crataegus brownietta n. sp.

Leaves obovate to ovate, acute, cuneate or rounded at the base, finely and often doubly serrate with straight glandular teeth, and slightly divided above the middle into short acuminate spreading lobes; nearly fully grown when the flowers open in the last week of May and then yellow-green, roughened above by short white hairs and sparingly villose on the midribs and veins below, and at maturity thin, dark yellow-green and glabrous on the upper surface, still slightly villose on the lower surface, 4 to 4.5 cm long and 2.5 to 3 cm wide, with slender midribs and four or five pairs of thin primary veins; petioles slender, slightly wing-margined at the apex, sparingly villose early in the season, becoming glabrous, and more or less tinged with red in the autumn, 1 to 1.5 cm in length; leaves on vigorous shoots broadly ovate, acuminate, rounded at the wide base, subcoriaceous, coarsely serrate, deeply lobed, often 7 to 8 cm long and wide, with stout winged petioles. Flowers on slender slightly hairy pedicels, in wide lax many-flowered sparingly villose corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes long, slender, acuminate, usually glandular-serrate below the middle, glabrous on the outer, slightly villose on the inner surface, reflexed after anthesis; stamens ten; anthers bright pink; styles three or four, surrounded at the base by a broad ring of long white hairs. Fruit ripening the end of

September on glabrous drooping red pedicels, subglobose to slightly obovoid, crimson, lustrous, marked by numerous small pale dots, 1.5 cm in diameter; calyx prominent with a broad shallow cavity pointed and tomentose in the bottom, and spreading and incurved lobes; flesh thin, yellow, dry and mealy; nutlets three or four, rounded and broadest at the apex, gradually narrowed and rounded at the base, prominently ridged on the back with a broad high ridge, 8 to 9 mm long and about 5 mm wide, the narrow chestnut-brown hypostyle extending to below the middle of the nutlet.

A tree or arborescent shrub 6 to 7 m high, with a stem covered with yellowish brown bark, upright branches, and slender nearly straight branchlets dark orange-green marked by pale lenticels and slightly villose when they first appear, glabrous, lustrous and light gray-green at the end of their first season and dull gray-brown the following year, and armed with stout straight chestnut-brown shining spines 3 to 5 cm long.

Helmlock lake region, Livingston county, Henry T. Brown (no. 31, type), May 28, 1906; September 20, 1907.

This species is named for its discoverer, Henry T. Brown, the engineer of the park department of the city of Rochester who has paid particular attention to the Thorns which grow in great abundance and variety near Hemlock lake.

PRUINOSAE

Crataegus pruinosa K. Koch

Verhandl. Preuss. Gart. Verein. neue Reihe 1. 346 (1854). Sargent, Silva N. Am. XIII. 61, t.648; N. Y. State Mus. Bul. 122. 37 (1908).

Crown Point, Lansingburg, Chapin, Buffalo, Belfast, Salamanca; also western Vermont, Massachusetts, eastern Pennsylvania, and southern Ontario to Ohio and Illinois.

Crataegus oblita Sargent

N. Y. State Mus. Bul. 122. 40 (1908).

Buffalo.

Crataegus arcana Beadle

Biltmore Bot. Studies 1. 122 (1902). Sargent, Bot. Gazette XXXV. 101; N. Y. State Mus. Bul. 122. 35 (1908).

Syracuse, Niagara Falls, Coopers Plains; also eastern Pennsylvania to western North Carolina.

Crataegus obstipa n. sp.

Glabrous. Leaves rhombic, acute at the ends, finely serrate with straight glandular teeth and slightly divided above the middle into two or three pairs of short, broad lobes; about one-half grown when the flowers open early in June and then yellow-green and paler below than above, and at maturity thin, yellow-green, smooth and lustrous on the upper surface, pale on the lower surface, 4 to 4.5 cm long and 2.5 to 3 cm wide, with thin midribs and primary veins; petioles slender, narrowly wing-margined to the middle, 4.5 to 6 cm in length; stipules linear, glandular, bright red, deciduous before the flowers open; leaves on vigorous shoots thicker, more coarsely serrate and more deeply lobed, and sometimes 5 cm long and 4 cm wide. Flowers on slender pedicels, in five- or six-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes separated by wide sinuses, gradually narrowed from the base, slender, acuminate, entire or minutely glandular-dentate near the middle; stamens twenty; anthers maroon; styles three to five. Fruit ripening early in October on slender drooping pedicels, obconic, rounded at the apex and at the narrow base, crimson, marked by large pale dots, pruinose, 1.3–1.5 cm long and 1 to 1.2 cm in diameter; calyx prominent, with a short tube, a deep narrow cavity pointed in the bottom, and spreading erect lobes; flesh thin, hard and dry; nutlets three to five, thin and rounded at the ends, broader at the apex than at the base, ridged on the back, with a broad, grooved ridge, 6 to 7.5 mm long and 5 mm wide, the narrow hypostyle extending to just below the middle of the nutlet.

A shrub 3 or 4 m high, with ascending stems and branches covered with dark gray bark, and thin zigzag contorted branchlets dark green and marked by pale lenticels when they first appear, orange-brown at the end of their first season and dull gray-brown the following year, and armed with very numerous straight chestnut-brown shining spines 1.5 to 3 cm long, persistent and compound on old stems and branches.

Open pastures in heavy soil, near Chapin, Ontario county, B. H. Slavin (no. 21, type), October 3, 1908; May 29, 1909.

Crataegus beata Sargent

Proc. Rochester Acad. Sci. IV. 97 (1903); N. Y. State Mus. Bull. 122. 85 (1908).

Ithaca, Chapin, near Rochester, Hemlock lake, Canadice lake, Belfast, Portage, Castile, Coopers Plains; common.

Crataegus pallescens n. sp.

Glabrous with the exception of the hairs on the young leaves and calyx-lobes. Leaves ovate, acuminate, rounded or abruptly cuneate at the broad base, sharply and often doubly serrate with straight glandular teeth, and divided into five or six pairs of short acuminate spreading lobes; more than half-grown when the flowers open the middle of June and then thin, yellow-green, and covered above by short white hairs and glabrous and glaucescent below, and at maturity thin, glabrous, dark yellow-green on the upper surface and pale on the lower surface, 6.5 to 8.5 cm long and 6 to 8 cm wide, with thick midribs and thin primary veins arching obliquely to the points of the lobes; petioles slender, broadly wing-margined at the apex, glandular with conspicuous occasionally persistent glands, 2.5 to 3.5 cm in length; stipules strap-shaped, acute, bright rose color, conspicuously glandular, often persistent until the flowers open; leaves on vigorous shoots abruptly cuneate at the base, more coarsely serrate and more deeply lobed, and sometimes 9 to 10 cm long and broad. Flowers 2.5 cm in diameter on long slender pedicels, in compact mostly ten- to fifteen-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes separated by wide sinuses, long, wide, acuminate, conspicuously glandular-serrate, slightly villose on the inner surface, reflexed after anthesis; stamens ten; anthers deep red; styles four or five. Fruit ripening early in October on drooping red pedicels, short-oblong, rounded at the ends, cardinal-red, marked by occasional large pale dots, pruinose, 1 to 1.2 cm in diameter; calyx prominent, with a short tube, a wide, deep cavity pointed in the bottom, and spreading prominent lobes; flesh thin, yellow, dry and mealy; nutlets four or five, gradually narrowed to the ends, rather broader at the apex than at the base, irregularly ridged on the back with a high narrow ridge, 7 to 8 mm long and 4 to 4.5 mm wide, the broad hypostyle extending one-third the length of the nutlet.

An arborescent shrub 6 to 7 m tall, with stems sometimes 3 cm in diameter at the base, covered with dull ashy gray bark, ascending and spreading branches forming a thin open head, and stout slightly zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, becoming pale chestnut-brown and lustrous at the end of their first season and armed with occasional stout slightly curved chestnut-brown shining spines 4 to 5 cm long and sometimes persistent and compound on old stems and branches.

Open damp woods near Ogdensburg, John Dunbar (no. 45, type), June 12 and September 28, 1907; June 5, 1908.

Crataegus pelacris n. sp.

Glabrous with the exception of the hairs on the young leaves. Leaves ovate, acuminate, abruptly cuneate or rounded at the wide base, sharply often doubly serrate with straight or incurved glandular teeth, and divided usually above the middle into four or five pairs of small acuminate recurved lobes; tinged with red when they unfold, and at the end of May when the flowers open, thin, yellow-green, and covered above by short white hairs and glabrous below, and at maturity thick, glabrous, dark blue-green on the upper surface, pale blue-green on the lower surface, 4 to 5 cm long and 3 to 4.5 cm wide; petioles slender, sparingly glandular, 2 to 2.5 cm in length; leaves on vigorous shoots cuneate at the base, more coarsely serrate, more deeply lobed, and often 6 to 7 cm long and broad. Flowers 1.8 to 2 cm in diameter on slender pedicels, in small compact mostly five- or six-flowered corymbs, the much elongated lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes separated by wide sinuses, gradually narrowed from the broad base, acuminate, entire or minutely glandular-dentate near the middle, reflexed after anthesis; stamens twenty; anthers large, bright rose color; styles five, surrounded at the base by a ring of white hairs. Fruit ripening in October on drooping pedicels, subglobose to obovoid, rounded at the ends, green and pruinose, becoming red when fully ripe, 1 to 1.2 cm in diameter; calyx prominent, with a short tube, a broad deep cavity wide in the bottom, and spreading lobes; flesh thin, hard and dry; nutlets five, thin and rounded at base, rounded and grooved on the back, 6 to 6.5 mm long and 4 mm wide, the broad conspicuous hypostyle extending to below the middle of the nutlet

A shrub 3 to 4 m high, with ascending stems and branches covered with dark gray bark near the ground, and stout, slightly zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, dull chestnut-brown at the end of their first season and red-brown the following year, and armed with numerous stout straight or curved bright chestnut-brown shining spines 3 to 4.5 cm long.

Pastures near Olean, B. H. Slavin (no. 51, type), May 25 and September 19, 1908; pastures near Salamanca, B. H. Slavin (no. 18), June 6 and September 24, 1907.

Crataegus amoena Sargent

N. Y. State Mus. Bul. 122. 38, 86 (1908).

Niagara Falls and Coopers Plains.

Crataegus aristata Sargent

N. Y. State Mus. Bul. 150. 27 (1911).

Rossie.

Crataegus prominens Sargent

Ontario Nat. Sci. Bul. 4. 23 (1908).

Hemlock lake; also near Toronto, Canada.

Crataegus gracilis Sargent

N. Y. State Mus. Bul. 122. 37 (1908).

Niagara Falls and Coopers Plains.

Crataegus howeana Sargent

N. Y. State Mus. Bul. 105. 52 (1906).

Menands near Albany.

Crataegus latiflora n. sp.

Glabrous. Leaves broadly ovate, acute or acuminate, abruptly cuneate or rounded at the base, sharply doubly serrate with straight glandular teeth, and divided into four or five pairs of small acuminate lobes; more than half-grown when the flowers open in the first week of June and then thin, yellow-green, smooth and lustrous on the upper surface, pale on the lower surface, and at maturity 6 to 7 cm long and wide, with thin midribs and primary veins; petioles slender, narrowly wing-margined nearly to the middle, rose colored in the autumn, 1.5 to 2 cm in length; leaves on vigorous shoots sometimes rounded at the broad base, more coarsely serrate and more deeply lobed, often 8 cm long and wide, their petioles stout, glandular with persistent glands, 2 to 2.5 cm in length. Flowers 2.5 to 2.8 cm in diameter, on slender pedicels, in usually six- to eight-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes separated by wide sinuses, broad, acuminate, coarsely glandular-serrate, reflexed after anthesis; stamens twenty; anthers pale pink; styles four or five. Fruit ripening in October on drooping pedicels, short-oblong, rounded at the ends, vermilion, marked by occasional large pale dots, 1 cm long and 8 to 9 mm in diameter; calyx prominent with a short tube, a broad deep cavity wide in the bottom, and spreading and appressed lobes mostly deciduous from the ripe fruit; nutlets four or five, acute at the ends, rather broader at the apex than at the base, ridged on the back with a high, grooved ridge, 6 to 7 mm long and 4 to 4.5 mm wide, the broad hypostyle extending nearly to the middle of the nutlet.

An arborescent shrub 3 to 4 m high, with stems covered with brown scaly bark, and slender, slightly zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, light chestnut-brown and lustrous at the end of their first season, and armed with occasional nearly straight chestnut-brown shining spines 4 to 5 cm long, persistent and compound on old stems and branches.

In heavy clay soil on the Miller farm in the town of Richmond, Livingston county, H. T. Brown (no. 64, type), June 4, 1906; October 1, 1909.

Crataegus pellecta Sargent

N. Y. State Mus. Bul. 122. 85 (1908).

Coopers Plains.

Crataegus ramosa Sargent

N. Y. State Mus. Bul. 122. 86 (1908).

Coopers Plains.

Crataegus scitula n. sp.

Glabrous. Leaves obovate, acuminate, gradually narrowed and cuneate at the entire base, finely doubly serrate with straight glandular teeth, and slightly divided above the middle into three or four pairs of narrow acuminate lobes; more than half-grown when the flowers open in the first week of June and then yellow-green and slightly tinged with red above and lustrous on the upper surface, pale on the lower surface, 5 to 6 cm long and 3 to 4 cm wide, with thin prominent midribs and primary veins; pedicels slender, wing-margined at the apex, glandular early in the season, 2 to 2.5 cm in length. Flowers on slender pedicels, in mostly twelve- to fifteen-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube broadly obconic, the lobes gradually narrowed from the base, slender, acuminate, glandular-serrate; stamens twenty; anthers pink; styles three to five. Fruit ripening in October, on drooping red pedicels, subglobose or sometimes rather longer than broad, crimson, marked by small pale dots, very pruinose, 9 to 11 mm in diameter; calyx prominent, with a short tube, a narrow deep cavity pointed in the bottom, and spreading appressed lobes dark red on the upper side below the middle, flesh thin, dry and mealy; nutlets three to five, broad and rounded at the apex, narrowed at the base, ridged on the back with a broad high ridge, 6 to 7 mm long and 4 to 5 mm wide, the broad hypostyle extending to the middle of the nutlet.

A shrub 2 to 3 m high, with ascending stems and branches covered with ashy gray bark, and slender nearly straight branchlets dark orange-green and marked by pale lenticels when they first appear, becoming light chestnut-brown and lustrous at the end of their first season, and armed with numerous slender straight or slightly curved chestnut-brown shining spines 3 to 4 cm long.

Open pastures in heavy soil near Chapin, Ontario county, B. H. Slavin (no. 7, type), September 24, 1908 and May 29, 1909.

Crataegus conspecta Sargent

Ontario Nat. Sci. Bul. 4. 28 (1908).

Salamanca; also Chippewa and Niagara-on-the-Lake, Ontario.

Crataegus russata n. sp.

Glabrous. Leaves ovate to obovate, acuminate and long-pointed at the apex, abruptly or gradually narrowed and cuneate at the base, finely doubly serrate with straight glandular teeth, and slightly divided usually above the middle into short broad, acuminate lobes; nearly fully grown when the flowers open the end of May and then thin, smooth and lustrous above and paler below, and at maturity thick, dark yellow-green on the upper surface, pale on the lower surface, 4 to 4.5 cm long and 2.5 to 4.5 cm wide; petioles slender, narrowly wing-margined at the apex, glandular with occasional persistent glands, 1.5 to 2 cm in length; leaves on vigorous shoots broadly ovate, acuminate, rounded or truncate at the wide base, more coarsely serrate and more deeply lobed, and often 7 cm long and broad, their petioles stout, wing-margined nearly to the base, more or less glandular. Flowers 2 to 2.3 cm in diameter, on slender pedicels, in small compact 5–8-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes separated by wide sinuses, slender, elongated, acuminate, entire, minutely dentate near the middle, reflexed after anthesis; stamens twenty; anthers pale yellow or white; styles four or five, surrounded at the base by a ring of pale tomentum. Fruit on slender drooping pedicels, ripening in October and persistent on the branches for several weeks, obovoid, rounded at the apex, gradually narrowed at the base, pale red, pruinose, 1.3 to 1.5 cm long and 1 cm in diameter; calyx prominent with a long tube, a wide deep cavity pointed in the bottom, and spreading lobes mostly deciduous from the ripe fruit; flesh hard and dry, tinged with red; nutlets four or five, rounded at the ends, rather broader at the apex than at the base, rounded and slightly grooved on the back, 6 mm long and 3.4 mm wide, the narrow hypostyle extending one-third the length of the nutlet.

A shrub 3 to 4 m high, with stout stems covered near the base with gray-brown scaly bark, ascending branches, and slender nearly straight zigzag branchlets dark orange-brown and marked by pale lenticels when they first appear, becoming bright chestnut-brown and lustrous at the end of their first season and dull gray-brown the following year, and armed with numerous slender straight dark chestnut-brown shining spines 3 to 5 cm long.

Hillsides, near Painted Post, Steuben county, common; G. D. Cornell (no. 132, type), October 1907; May 26, 1908.

Crataegus formosa Sargent

Proc. Rochester Acad. Sci. IV. 101 (1903).

Near Rochester, Coopers Plains, Murray, Niagara Falls, Buffalo and Salamanca.

Crataegus cognata Sargent

Rhodora V. 58 (1903); N. Y. State Mus. Bul. 122. 41 (1908).

Dykemans, Castile, Coopers Plains, Tuscarora, Hemlock lake, Niagara Falls, Buffalo, Chapin; also southern New England and southern Ontario.

Crataegus rubro-lutea Sargent

N. Y. State Mus. Bul. 122. 88 (1908).

Coopers Plains.

Crataegus casta Sargent

N. Y. State Mus. Bul. 105. 53 (1906).

Coopers Plains.

Crataegus leiophylla Sargent

Proc. Rochester Acad. Sci. IV. 99 (1903); N. Y. State Mus. Bul. 122. 41 (1908).

Ithaca, Coopers Plains, Belfast, Tuscarora, near Rochester, and Buffalo.

Crataegus macrocalyx Sargent

N. Y. State Mus. Bul. 122. 89 (1908).

Coopers Plains.

Crataegus clintoniana Sargent

N. Y. State Mus. Bul. 122. 39 (1908).

Buffalo.

Crataegus conjuncta Sargent

Rhodora V. 57 (1903); N. Y. State Mus. Bul. 105. 54 (1906).

Near Albany, common; also southern New England, eastern Pennsylvania, northern Illinois and Wisconsin.

Crataegus longipedunculata Sargent

Ontario Nat. Sci. Bul. 4. 26 (1908); Peck in N. Y. State Mus. Bul. 150. 28 (1911).

Near Canandaigua; also in southern Ontario.

Crataegus lennoniana Sargent

Proc. Rochester Acad. Sci. IV. 98 (1903).

Rochester, Murray, Adams Basin and Syracuse.

Crataegus bronxensis Sargent

N. Y. State Mus. Bul. 122. 115 (1908).

Bronx Park, New York City.

Crataegus uncta Sargent

N. Y. State Mus. Bul. 122. 91 (1908).

Coopers Plains.

Crataegus radiata Sargent

N. Y. State Mus. Bul. 122. 42 (1908).

Buffalo.

Crataegus placiva n. nom. Sargent

N. Y. State Mus. Bul. 122. 46 (1908) (not Sargent in Ontario Nat. Sci. Bul. (1908)).

Ithaca, Belfast and Buffalo.

Crataegus pulchra Sargent

N. Y. State Mus. Bul. 122. 42 (1908).

Ithaca, Chapin, Niagara Falls and Buffalo.

Crataegus aridula Sargent

N. Y. State Mus. Bul. 122. 43 (1908).

Niagara Falls.

Crataegus robbinsiana Sargent

Rhodora VII. 197 (1905); N. Y. State Mus. Bul. 105. 55 (1906).

Near Albany; also in western and southern Vermont and western New Hampshire.

Crataegus brevipes Peck

N. Y. State Mus. Bul. 139. 20 (1910).

Corning.

Crataegus plana Sargent

N. Y. State Mus. Bul. 122. 45 (1908).

Coopers Plains, Belfast, Castile, Almond, Hemlock lake and Buffalo.

Crataegus ovatifolia Sargent

N. Y. State Mus. Bul. 122. 92 (1908).

Coopers Plains.

Crataegus inusitula Sargent

N. Y. State Mus. Bul. 122. 55 (1908).

Chapin and Coopers Plains.

Crataegus exornata Sargent

Ontario Nat. Sci. Bul. 4. 31 (1908).

Salamanca; also southern Ontario.

MEDIOXIMAE

Crataegus dissona Sargent

Rhodora V. 60 (1903); N. Y. State Mus. Bul. 105. 54 (1906).

Moores Mills, Colemans Station, Dykemans, Albany, Coopers Plains; also western and southern New England, eastern Pennsylvania and southern Illinois.

Crataegus implicata Sargent

N. Y. State Mus. Bul. 122. 49 (1908).

Buffalo.

Crataegus deltoides Ashe

Jour. Elisha Mitchell Sci. Soc. XVII, pt. II, 19 (1901). Sargent, Proc. Acad. Nat. Sci. Phila. 603 (1905). Peck, N. Y. State Mus. Bul. 116. 21 (1907).

Moores Mills; also in eastern Pennsylvania.

Crataegus seclusa n. sp.

Glabrous with the exception of the hairs on the young leaves and calyx-lobes. Leaves broadly ovate, rounded or occasionally abruptly cuneate at the wide base, sharply doubly serrate with straight glandular teeth, and slightly divided into broad acuminate lobes; more than half-grown when the flowers open in the last week of May and then thin, yellow-green, smooth and slightly hairy above and glabrous and glaucescent below, and at maturity thin, dark yellow-green and glabrous on the upper surface, pale on the lower surface, 5 to 7 cm long and wide, with stout midribs, and prominent primary veins extending obliquely to the points of the lobes; petioles slender, narrowly wing-margined at the apex, slightly hairy on the upper side early in the season, soon becoming glabrous, occasionally glandular, 2 to 2.5 cm in length. Flowers 1.5 cm in diameter, on long slender pedicels, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, short-acuminate, glandular-serrate, villose on the lower surface, reflexed after anthesis; stamens six to ten; anthers dark red; styles three or four, surrounded at the base by a ring of white tomentum. Fruit ripening at the end of September, on drooping red pedicels, subglobose, orange-red, marked by small pale dots, slightly pruinose, becoming lustrous, 1 cm in diameter; calyx little enlarged, with a broad, shallow cavity pointed in the bottom, and spreading closely appressed persistent lobes; flesh thin, dry and mealy; nutlets three or four, rounded at the ends, rather broader at the apex than at the base, ridged on the back with a broad grooved ridge, 1.6 to 1.7 cm long and 3 to 4 mm wide, the narrow hypostyle extending nearly to the base of the nutlet.

A shrub 5 to 6 m high, with stout stems covered with rough dark brown bark, ascending branches, and slender glabrous, zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, becoming light chestnut-brown and lustrous at the end of their first season and dull gray-brown the following year, and armed with stout slightly curved chestnut-brown shining spines 3.5 to 4 cm long.

On clay soil north of Hemlock lake in the town of Richmond, Livingston county, Henry T. Brown (no. 136, type), September 27, 1907; May 30, 1908.

Crataegus maineana Sargent

Proc. Rochester Acad. Sci. 4. 106 (1903); N. Y. State Mus. Bul. 122 46 (1908).

Hemlock lake, Rochester, Belfast and Buffalo.

Crataegus opulens Sargent

Proc. Rochester Acad. Sci. IV. 104 (1903).

Near Herkimer, Coopers Plains, Belfast, Hemlock lake, Rochester, Brighton, Buffalo; also in southeastern Michigan.

Crataegus perspicabilis n. sp.

Glabrous with the exception of the hairs on the young leaves and calyx-lobes. Leaves ovate, acuminate, rounded or abruptly cuneate at the broad base, coarsely doubly serrate with straight glandular teeth, and slightly divided into four or five pairs of short, broad, lateral lobes; more than half-grown when the flowers open from the 20th to the end of May, and then thin, yellow-green and sparingly furnished above with short white hairs and paler below, and at maturity thin but firm in texture, blue-green on the upper surface, pale blue-green on the lower surface, 5–7 cm long and 5–6 cm wide, with slender midribs and primary veins; petioles slender, slightly hairy on the upper side while young, soon becoming glabrous, glandular with occasional minute persistent glands, 3 to 3.5 cm in length; leaves on vigorous shoots ovate, acuminate, rounded, truncate or slightly obcordate at the wide base, thicker, more deeply lobed, coarsely serrate, often 10 to 11 cm long and broad, their petioles stout, glandular with prominent stipitate persistent glands. Flowers on long slender pedicels, in narrow mostly 4–10-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from wide bases, long, slender, acuminate, ciliate or obscurely toothed on the margins, slightly hairy on the inner surface below the middle, reflexed after anthesis; stamens 10; anthers light rose color; styles three. Fruit ripening in October, on slender pedicels, subglobose to short-oblong, truncate at the apex, rounded at the base, maroon, lustrous, marked by numerous pale dots, 1 to $1\frac{1}{4}$ cm in diameter; calyx little enlarged, with a wide shallow cavity tomentose in the bottom, and spreading persistent lobes; flesh thick, dry and mealy; nutlets three, rounded at the ends, rather broader at the apex than at the base, rounded and ridged on the back with a broad irregularly grooved ridge, 6 to 7 mm long and about 4 mm wide.

An arborescent shrub sometimes 4 m high, with stout stems covered with ashy gray bark, becoming dark and scaly near their base, ascending branches forming an open irregular head, and stout, zigzag branchlets dark orange-green and marked by pale lenticels when they first appear, chestnut or orange-brown at the end of their first season and dull red-brown the following year, and armed with numerous stout straight chestnut-brown spines 4.5 to 5 cm long.

Salamanca, B. H. Slavin (no. 43, type), October 6, 1907; May 26, 1908.

Crataegus macera Sargent

N. Y. State Mus. Bul. 122. 117 (1908).

Hemlock lake.

Crataegus diffusa Sargent

Proc. Rochester Acad. Sci. IV. 103 (1903).

Ithaca, Hemlock lake and Rochester.

Crataegus beckwithae Sargent

Proc. Rochester Acad. Sci. IV. 124 (1903).

Ithaca, Hemlock lake and Rochester.

Crataegus xanthophylla Sargent

N. Y. State Mus. Bul. 122. 48 (1908).

Buffalo.

Crataegus livingstoniana Sargent

N. Y. State Mus. Bul. 122. 116 (1908).

Hemlock lake.

Crataegus strigosa Sargent

N. Y. State Mus. Bul. 122. 51 (1908).

Buffalo and near Herkimer.

Crataegus compta Sargent

Proc. Rochester Acad. Sci. IV. 102 (1903).

Near Utica, Rochester and Buffalo.

Crataegus tortuosa Sargent

N. Y. State Mus. Bul. 122. 47 (1908).

Utica, Ithaca and Buffalo.

Crataegus promissa Sargent

N. Y. State Mus. Bul. 122. 50 (1908).

Filmore, Hemlock lake, Niagara Falls; also in southern Ontario.

Crataegus congestiflora Sargent

N. Y. State Mus. Bul. 122. 44 (1908).

Near Herkimer, Castile, Belfast, Olean, Palmyra, Buffalo and Salamanca.

Crataegus numerosa Sargent

N. Y. State Mus. Bul. 122. 90 (1908).

Coopers Plains.

Crataegus foliata Sargent

N. Y. State Mus. Bul. 122. 53 (1908).

Niagara Falls.

Crataegus colorata Sargent

Proc. Rochester Acad. Sci. IV. 123 (1903); N. Y. State Mus. Bul. 122. 60 (1908).

Dykemans, near Herkimer, Ithaca, Chapinville, Rochester, Hemlock lake, Belfast, Coopers Plains, Murray, Buffalo, Salamanca; also in southern Ontario and Michigan.

Crataegus cruda Sargent

N. Y. State Mus. Bul. 122. 54 (1908).

Hemlock lake, Niagara Falls and Salamanca.

Crataegus acerba Sargent

N. Y. State Mus. Bul. 122. 93 (1908).

Coopers Plains and Olean.

Crataegus dissociabilis Sargent

N. Y. State Mus. Bul. 122. 95 (1908).

Coopers Plains.

Crataegus barryana Sargent

N. Y. State Mus. Bul. 122. 52, 93 (1908).

Corning, Rochester, Hemlock lake and Coopers Plains.

TENUIFOLIAE

Crataegus ignea Sargent

N. Y. State Mus. Bul. 122. 96 (1908).

Coopers Plains and Little Falls.

Crataegus hadleyana n. sp.

Leaves broadly ovate, acuminate, rounded or cuneate at the base, finely often doubly serrate with straight glandular teeth, and slightly divided into four or five pairs of short acuminate lateral lobes; nearly fully grown when the flowers open at the end of May and then thin, light yellow-green and roughened above by short white hairs and paler and glabrous below, and at maturity firm in texture, glabrous, dark yellow-green and lustrous on the upper surface, pale on the lower surface, 6 to 8 cm long and 5 to 6.5 cm wide, with stout midribs, and slender primary veins arching obliquely to the points of the lobes; petioles stout, wing-margined at the apex, sparingly villose on the upper side while young, becoming glabrous, glandular with occasional minute deciduous glands, 1.5 to 2.5 cm in length. Flowers 1.5 to 1.7 cm in diameter, on long slender slightly villose pedicels, in wide mostly 15–18-flowered corymbs, the much elongated slender nearly glabrous lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, slightly villose, the lobes long, slender, acuminate, conspicuously glandular-serrate, glabrous on the outer surface, sparingly villose on the inner surface, reflexed after anthesis; stamens six to ten, usually six; anthers rose color; styles two to five, surrounded at the base by a broad ring of white hairs. Fruit ripening early in October, on glabrous pedicels, in wide, drooping clusters, short-oblong, rounded at the ends, scarlet, lustrous, marked by large pale dots, 1 to 1.2 cm long and 9 to 10 cm in diameter; calyx little enlarged, with a deep, narrow cavity pointed in the bottom, and spreading lobes dark red on the upper side below the middle, their tips mostly deciduous from the ripe fruit; flesh thin, tinged with red, soft and succulent; nutlets usually two or three, rounded and broadest at the apex, gradually narrowed and rounded at the base, ridged on the back with a broad grooved ridge, 7 to 8 mm long and 4 to 5 mm wide, the narrow hypostyle extending nearly to the base of the nutlet.

A shrub with stout, slightly zigzag glabrous branchlets light orange-green and marked by numerous orange colored lenticels when they first appear, becoming light chestnut-brown and lustrous at the end of their first season and dull red-brown the following year, and armed with stout curved chestnut-brown shining spines 3 to 3.5 cm long.

Rocky hilltops north of the Mohawk river, Beaver brook valley, three miles east of Herkimer, J. V. Haberer (no. 2444, type), October 1907, May 28 and October 1, 1912.

This handsome and distinct plant is named in memory of James Hadley M.D. (1785–1869), professor of chemistry and natural sciences in the Fairfield Medical College of Physicians and Surgeons at Fairfield, Herkimer county, and later professor of chemistry and natural sciences in Hamilton College, an active and successful student of the plants of central New York and at Fairfield instructor in botany of Asa Gray.

Crataegus suavis Sargent

N. Y. State Mus. Bul. 122. 59 (1908).

Clayton, Ithaca, Frankfort, East Aurora, Buffalo, Niagara Falls, Hemlock lake, Coopers Plains, Salamanca, Cattaraugus creek.

Crataegus boothiana Sargent

N. Y. State Mus. Bul. 122. 58 (1908).

Rochester, Monroe, Fillmore, Tuscarora, Almond.

Crataegus slavinii Sargent

N. Y. State Mus. Bul. 122. 57 (1908).

Brighton, Hemlock lake, Almond and Salamanca.

Crataegus ascendens Sargent

Rhodora V. 141 (1903); N. Y. State Mus. Bul. 105. 57 (1906).

Thompsons lake near Albany; also in western Vermont.

Crataegus acuminata Sargent

N. Y. State Mus. Bul. 105. 56 (1906).

Near Albany and Herkimer.

Crataegus tenella Ashe

Ann. Carnegie Mus. I, pt III. 338 (1902). Sargent, Bot. Gazette XXXV. 108. Peck, N. Y. State Mus. Bul. 116. 23 (1907).

Colemans Station, Moores Mills, Dykemans; also in eastern Pennsylvania and Delaware.

Crataegus spatifolia Sargent

N. Y. State Mus. Bul. 122. 98 (1908).

Coopers Plains.

Crataegus nescia Sargent

N. Y. State Mus. Bul. 122. 100 (1908).

Coopers Plains.

Crataegus rubrocarnea Sargent

N. Y. State Mus. Bul. 105. 55 (1906).

Albany.

Crataegus glaucophylla Sargent

Rhodora V. 140 (1903); Proc. Rochester Acad. Sci. IV. 12; N. Y. State Mus. Bul. 122. 102 (1908).

Westport, near Herkimer, Chapin, Rochester, Hemlock lake, Portage, Castile, Belfast, East Aurora, Coopers Plains; also western Pennsylvania, southern Ontario and Michigan.

Crataegus demissa Sargent

Rhodora V. 139 (1903); N. Y. State Mus. Bul. 105. 55 (1906).

Near Albany, Gansevoort, Ithaca, Chapin and Tuscarora.

Crataegus delucida Sargent

Rhodora V. 139 (1903); N. Y. State Mus. Bul. 105. 55 (1906).

Near Albany; also in western Vermont.

Crataegus matura Sargent

Rhodora III. 24 (in part) (1901); Rhodora v. III (1903); Proc. Rochester Acad. Sci. IV. 126.

Moores Mills, Dykemans, Lewis Point, Oneida lake, Chapin, Hemlock lake, Belfast, Coopers Plains, Olean; also in western New England and southern Ontario.

Crataegus streeterae Sargent

Proc. Rochester Acad. Sci. IV. 119 (1903); N. Y. State Mus. Bul. 122. 62 (1908).

Ithaca, Frankfort, near Utica, Chapin, Rochester, Belfast, Coopers Plains, Buffalo, Niagara Falls; also in southern Michigan.

Crataegus rubicunda Sargent

Proc. Rochester Acad. Sci. IV. 121 (1903); N. Y. State Mus. Bul. 122. 60 (1908).

Chapin, Rochester, Belfast, Hermitage; also in southern Ontario.

Crataegus recta Sargent

N. Y. State Mus. Bul. 122. 97 (1908).

Coopers Plains.

Crataegus insignata Sargent

N. Y. State Mus. Bul. 122. 101 (1908).

Coopers Plains.

Crataegus fucata Sargent

N. Y. State Mus. Bul. 122. 99 (1908).

Coopers Plains.

Crataegus pentandra Sargent

Rhodora III. 25 (1901); Silva N. Am. XIII. 129, t. 681; N. Y. State Mus. Bul. 105. 35 (1906).

Moores Mills, Pawling and near Albany, west of Whetstone; also in western New England.

Crataegus bella Sargent

N. Y. State Mus. Bul. 122. 61 (1908).

Ithaca, Chapin, Hemlock lake, Coopers Plains, Belfast, Buffalo, Buffalo, Salamanca, Cattaraugus creek; also in southern Ontario.

Crataegus ornata Sargent

Proc. Rochester Acad. Sci. IV. 120 (1903); N. Y. State Mus. Bul. 122. 60 (1908).

Lenox, Madison City, near Utica, Rochester, Coopers Plains, Buffalo and LaSalle.

Crataegus genialis Sargent

Rhodora V. 148 (1908); N. Y. State Mus. Bul. 105. 55 (1906).

Near Albany, Little Falls, Belfast, Coopers Plains and Buffalo; also in southern Ontario.

Crataegus leptopoda Sargent

N. Y. State Mus. Bul. 122. 118 (1908).

Hemlock lake, Canadice lake and Almond.

Crataegus paineana n. sp.

Glabrous with the exception of the hairs on the young leaves. Leaves ovate, acuminate, rounded or cuneate at the base, finely serrate with straight slender teeth and divided usually only above the middle into short broad acute lobes; more than half grown when the flowers open about the first of June and then yellow-green and slightly roughened above by short white hairs, and at maturity thin, dull yellow-green on the upper surface, paler on the lower surface, 4 to 5 cm long and 3 to 3.5 cm. wide, with slender midribs and primary veins; petioles slender, slightly wing-margined at the apex, 2 to 3 cm in length; leaves on vigorous shoots ovate. abruptly acuminate, broad and rounded or cuneate at the base, coarsely serrate, often deeply lobed, 1.7 to 1.8 cm long and 6 to 7 cm wide, their petioles stout, wing-margined to the middle, rose-colored and often glandular in the autumn. Flowers on long slender pedicels, in many-flowered corymbs, the much elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, tne lobes gradually narrowed from the base, long and slender, entire, reflexed after anthesis; stamens five to nine; anthers rose color; styles two to four. Fruit ripening at the end of September, on elongated pedicels, in many-fruited drooping clusters, long-obovoid, rounded at the apex, gradually narrowed to the base, scarlet, lustrous, marked by small pale dots, 2 to 5 cm long and 1 cm in diameter; calyx little enlarged, with a very narrow and deep cavity, the lobes appressed and mostly deciduous from the ripe fruit; flesh thick, orange-colored, sweet and of good flavor; nutlets two to four, usually three, narrowed and rounded at the ends, rather broader at the apex than at the base, ridged on the back with a narrow grooved ridge, 7 to 8 mm long and about 4 mm wide, the narrow hypostyle extending to below the middle of the nutlet.

A shrub 3 to 4 m high, with numerous erect stems and branches forming an open round-topped head, and stout, slightly zigzag branchlets tinged with red when they first appear, becoming dull reddish or orange-brown at the end of their first season, and armed with numerous stout or slender incurved chestnut-brown spines 2 to 4 cm long.

Rocky upland pastures, Beaver brook valley north of the Mohawk river and two or three miles east of Herkimer, very common, J. V. Haberer (no. 2518, type), June 10 (the petals fallen) and September 30, 1907; Haberer, Dunbar and Sargent, September 26, 1912.

This species, which, in autumn when it is covered with its innumerable drooping clusters of brilliant fruit, is one of the most beautiful of all the Tenuifoliae, is named in memory of John A. Paine, jr (1840–1912), author of "A Catalogue of Plants of Oneida County and Vicinity."

Crataegus gracilipes Sargent

N. Y. State Mus. Bul. 122. 119 (1908).

Near Herkimer and Hemlock lake.

Crataegus habereri Sargent

N. Y. State Mus. Bul. 116. 21 (1907).

Near Utica.

Crataegus parviflora Sargent

Proc. Rochester Acad. Sci. IV. 117 (1903).

Ithaca, Chapin, Penfield, Rochester, Hemlock lake, Cattaraugus creek.

Crataegus tenuiloba Sargent

Proc. Rochester Acad. Sci. IV. 122 (1903).

Lenox, Rochester, Penfield, Hemlock lake and Buffalo.

Crataegus claytoniana Sargent

N. Y. State Mus. Bul. 122. 120 (1908).

Clayton.

Crataegus stolonifera Sargent

Bot. Gazette XXXV. 109 (1903).

Tuscarora; also in Delaware, eastern and western Pennsylvania and southern Michigan.

Crataegus edsonii Sargent

Rhodora VII. 205 (1905); N. Y. State Mus. Bul. 105. 57 (1906).

Lansingburg; also in western New England.

Crataegus conferta Sargent

N. Y. State Mus. Bul. 122. 62 (1908).

Ithaca, near Rochester, Buffalo and Salamanca.

Crataegus benigna Sargent

Proc. Rochester Acad. Sci. IV. 127 (1903).

Rochester, Silver Springs and Belfast.

Crataegus mellita Sargent

N. Y. State Mus. Bul. 105. 58 (1906).

Sand Lake, near Albany.

Crataegus luminosa Sargent

N. Y. State Mus. Bul. 122. 63 (1908).

Buffalo.

COCCINEAE

Crataegus holmesiana Ashe

Jour. Elisha Mitchell Sci. Soc. XVI, pt II. 78 (1900). Sargent Silva N. Am. XIII. 119, t. 676; Proc. Rochester Acad. Sci. IV. 114 (1903).

Phoenicia, Albany, Ogdensburg, Little Falls, near Utica, Oriskany, Elmira, Ithaca, Syracuse, Rochester, Hemlock lake, Belfast, Castile, Buffalo; also in Quebec and Ontario, New England and Pennsylvania.

Crataegus acclivis Sargent

Proc. Rochester Acad. Sci. IV. 115 (1903); N. Y. State Mus.. Bul. 122. 71 (1908).

Albany, near Utica, Ithaca, Chapin, Rochester, Hemlock lake, Belfast, Niagara Falls and Buffalo.

Crataegus uticaensis n. sp.

Leaves ovate, acute or acuminate, abruptly cuneate or gradually narrowed and rounded or broad and rounded at the base, coarsely serrate with straight glandular teeth, and divided above the middle into four or five pairs of short acuminate lobes; more than half grown when the flowers open about the 20th of May and then ellow-green, roughened above by short white hairs and paler and glabrous below, and at maturity yellow-green, smooth and glabrous on the upper surface, 6 to 7 cm long and 5 to 5.5 cm wide, with thin midribs and primary veins; petioles slender, sparingly villose when they first appear, soon becoming glabrous, glandular with occasional small deciduous glands, 1.5 to 2.5 cm in length; stipules linear, acuminate, conspicuously glandular, caducous; leaves on vigorous shoots cuneate, rounded or slightly cordate at the wide base, more coarsely serrate and more deeply lobed, often 8 cm long and wide. Flowers 2 to 2.2 cm in diameter, on slender sparingly villose pedicels, in compact slightly hairy mostly 8–14-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, hairy with occasional white hairs or nearly glabrous, the lobes separated by broad sinuses, short, broad, entire or occasionally glandular-dentate near the middle, glabrous, reflexed after anthesis; stamens five or six; anthers rose color; styles three or four. Fruit ripening and falling in September, on slender drooping pedicels, short-oblong, rounded at the ends, scarlet, marked by large pale dots, about 1.5 cm long and 1.2 to 1.3 cm in diameter; calyx little enlarged with a wide deep cavity pointed in the bottom, and spreading lobes dark red on the upper side below the middle; flesh thick, orange color; nutlets three or four, narrowed and rounded at the ends, ridged on the back with a low rounded ridge, 7 to 8 mm long and 4 to 5 mm wide, the broad conspicuous hypostyle extending to below the middle of the nutlet.

An arborescent shrub 5 to 7 m high, growing singly or in clumps, with ascending stems and branches covered with ashy gray bark and forming a pyramidal head, stout glabrous branchlets tinged with red when they first appear, becoming light orange-brown, lustrous and marked by pale lenticels during their first season and ashy gray the following year, and armed with slender nearly straight dark brown shining spines 4.5 to 5 cm long.

Hills south of Utica, common; J. V. Haberer (no. 2441, type, 2441A, 2441B), May 24 and September 19, 1912. Rocky banks north of the Mohawk river at Little Falls, J. V. Haberer (no. 2439), May 6, 1907; Haberer and Dunbar, September 27, 1912.

Crataegus pringlei Sargent

Rhodora III. 21 (1901); Silva N. Am. XIII. 111, t. 672; Proc. Rochester Acad. Sci. IV. 112 (1903).

Crown Point, Colemans Station, Fort Ann, Oriskany, near Little Falls, near Herkimer, Marcy, Chapin, Rochester, Hemlock lake; also in western New England, southern Ontario, Michigan and Illinois.

Crataegus lobulata Sargent

Rhodora III. 22 (1901); Silva N. Am. XIII. 117, t. 675; N. Y. State Mus. Bul. 105. 63 (1906).

Sand Lake, near Albany, Crown Point; also in western and southern New England.

Crataegus pedicellata Sargent

Bot. Gazette XXXI. 226 (1901); Silva N. Am. XIII. 121, t. 677; N. Y. State Mus. Bul. 122. 69 (1908).

New Hartford, Little Falls, Chapin, Syracuse, Rochester, Hemlock lake, East Aurora, Buffalo, Salamanca; also in southern Ontario and western Pennsylvania.

Crataegus gloriosa Sargent

N. Y State Mus. Bul. 122. 70 (1908).

Rochester.

Crataegus letchworthiana Sargent

N. Y. State Mus. Bul. 122. 69 (1908).

Near Portage.

Crataegus vivida Sargent

Ontario Nat. Sci. Bul. 4. 47 (1908).

Ithaca, Chapin, Cattaraugus creek; also in southern Ontario.

Crataegus tardipes Sargent

Ontario Nat. Sci. Bul. 4. 51 (1908).

Utica, Salamanca; also in southern Ontario.

Crataegus polita Sargent

Rhodora V. 112 (1903); N. Y. State Mus. Bul. 105. 63 (1906).

Sand Lake, near Albany, Little Falls, near Herkimer and Utica.

Crataegus sejuncta Sargent

N. Y. State Mus. Bul. 105. 62 (1906).

Albany, Buffalo; also in western New England.

Crataegus dayana Sargent

N. Y. State Mus. Bul. 122. 66 (1908).

Hemlock lake, Buffalo and Cattaraugus creek.

Crataegus gilbertiana n. sp.

Leaves ovate, acute, cuneate or rounded at the broad base, sharply often doubly serrate with straight glandular teeth, and slightly divided into four or five pairs of short acuminate lateral lobes; about one-third grown when the flowers open the middle of June and then thin, yellow-green, roughened above by short white hairs and slightly hairy below along the midribs and veins, and at maturity thin, dark blue-green and glabrous on the upper surface, paler on the lower surface, still slightly hairy on the thin midribs and primary veins, 7 to 8 cm long and 5.5 to 6.5 cm wide; petioles slender, slightly wing-margined at the apex, glabrous, 2.5 to 3 cm in length; leaves on vigorous shoots acuminate, abruptly cuneate at the base, more coarsely serrate, often deeply lobed, 10 to 12 cm long and 9 to 10 cm wide, with stout glandular winged petioles. Flowers about 2 cm in diameter, on slender slightly villose pedicels, in erect sparingly hairy mostly 10–12-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, thickly covered with long white hairs, the lobes separated by wide sinuses, slender, acuminate, entire, glabrous on the upper surface, slightly villose on the lower surface, reflexed after anthesis; stamens twenty; anthers red; styles three or five. Fruit ripening in October, on long drooping nearly glabrous pedicels, obovoid, rounded at the apex, gradually and abruptly narrowed at the base, crimson, lustrous, marked by small pale dots, 1.5 to 1.8 cm long and 1.3 to 1.5 cm in diameter; calyx with a short neck, a broad deep cavity pointed in the bottom, and spreading mostly deciduous lobes; flesh very thin, orange-colored, dry and mealy; nutlets gradually narrowed and rounded at the ends, slightly ridged on the back, 8 to 9 mm wide, the narrow hypostyle extending to just below the middle of the nutlet.

An arborescent shrub 6 to 7 m high, with ascending stems sometimes 3 dm in diameter at the base, and covered with ashy gray scaly bark, and stout nearly straight glabrous branchlets dark orange-green and marked by pale lenticels when they first appear, becoming bright chestnut-brown and very lustrous at the end of their first season and pale gray the following year, and armed with stout nearly straight chestnut-brown spines 3 to 4 cm long.

Pastures and meadows on the borders of Mud lake in Warren, Herkimer county, common; J. V. Haberer (no. 2414), June 16 and October 9, 1907; Haberer, Dunbar and Sargent, September 28, 1912.

The blue color of the leaves of this species is unusual in plants of the Coccineae group. It is named in memory of Benjamin Davis Gilbert (1835–1907), a native of Clayville, New York, and for many years a resident of Utica where he was a successful bookseller and the agricultural editor of the Utica Morning Herald, secretary of the New York Dairymen's Association, and secretary and treasurer of the Central New York Farmers Club. Mr Gilbert, who early became interested in ferns, was the author of many papers on these plants and an industrious and careful student of the flora of central New York.

Crataegus steubenensis Sargent

N. Y. State Mus. Bul. 122. 103 (1908).

Coopers Plains.

Crataegus irrasa Sargent

Rhodora V. 116 (1903).

Keene, Essex co.; also in the Province of Quebec.

Crataegus perrara n. sp.

Leaves ovate to broadly oval, acute at the apex, rounded or sharply cuneate at the broad base, finely often doubly serrate with straight glandular teeth, and divided above the middle into four or five pairs of short broad acuminate lobes; nearly fully grown when the flowers open at the end of May and then thin, yellow-green, roughened above by short white hairs and glabrous below, and at maturity thin, yellow-green, scabrate on the upper surface, pale on the lower surface, more or less contorted, 4.5 to 5.5 cm long and 3.5 to 4.5 cm wide, with thin midribs and primary veins; petioles slender, glabrous, 2 to 3 cm in length; leaves on vigorous shoots rounded, truncate or abruptly cuneate at the broad base, coarsely serrate, deeply divided into broad lateral lobes and often 8 to 9 cm long and 7 to 8 cm wide. Flowers 2 cm in diameter, on stout slightly hairy pedicels, in compact many-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, sparingly villose with long white hairs, the lobes slender, acuminate, coarsely glandular-serrate, slightly hairy on the outer surface, glabrous on the inner surface, reflexed after anthesis; stamens five to eight; anthers white; styles three to five. Fruit ripening the middle of September on drooping red pedicels, short-oblong to slightly obovoid, rounded at the ends, crimson, lustrous, marked by small pale dots, 1.5 to 1.8 cm long and 1 to 1.2 cm in diameter; calyx little enlarged with a deep narrow cavity, and erect often incurved lobes; flesh thin, yellow, dry and mealy; nutlets near the apex of the fruit, three to five, broadest and rounded at the apex, gradually narrowed to the base, slightly and irregularly ridged on the back, 6 to 7 mm long and 4 to 5 mm wide.

A shrub 5 to 6 m high with ascending branches, dark brown scaly bark, and stout zigzag branchlets dark orange-green and slightly villose when they first appear, becoming light chestnut-brown, lustrous and marked by small pale lenticels at the end of their first season and light red-brown the following year, and unarmed or armed with occasional chestnut-brown spines 5 to 6 cm long.

Meadows in rich moist soil, near Chapinville, Ontario county, B. H. Slavin (no. 35, type), May 29 and September 17, 1909; Honeoye lake region, Ontario county, Henry T. Brown (no. 76). June 7 and September 19, 1907.

Crataegus limosa Sargent

N. Y. State Mus. Bul. 122. 67 (1908).

Near Rochester.

Crataegus flabellata (Spach) Sargent

Rhodora III. 75 (1901); Rhodora V. 114 (1903).

Mespilus flabellata Bosc, ex Spach Hist. Vég. II. 63 (1834).

Crown Point and Rossie; also in western Vermont, New Hampshire, Province of Quebec, Massachusetts and Connecticut.

MOLLES

Crataegus champlainensis Sargent

Rhodora III. 20 (1901); Silva N. Am. XIII, 105, t. 667; N. Y. State Mus. Bul. 105. 59 (1906).

Crown Point, Port Henry, near Albany, Greenbush, Ogdensburg, Chapin, Hemlock lake; also in western New England, Quebec and southern Ontario.

Crataegus contortifolia Sargent

N. Y. State Mus. Bul. 105. 59 (1906).

North Albany and North Greenbush.

Crataegus ellwangeriana Sargent

Bot. Gazette XXXIII. 1184 (1902); Silva N. Am. XIII, 109, t. 671; Proc. Rochester Acad. Sci. IV. 112 (1903).

Ithaca, Ogdensburg, Chapinville, Canandaigua, Rochester, Hemlock lake, Portage, Salamanca; also in southern Ontario, Michigan and western Pennsylvania.

Crataegus robesonana Sargent

Rhodora, v. 110 (April 1903)

Crataegus spissiflora Sargent Proc. Rochester Acad. Sci. IV. 112 (June 1903); N. Y. State Mus. Bul. 105. 61 (1906).

Near Albany, Little Falls, Lenox, Ithaca, Rochester, Hemlock lake; also in southern Ontario and western Massachusetts.

Crataegus exclusa Sargent

Rhodora V. 108 (1903); N. Y State Mus. Bul. 105. 60 (1906).

Near Albany, Greenbush, Chapinville; also in western Vermont.

Crataegus urbica nov. nom. Sargent

Crataegus oblongifolia Sargent, N. Y. State Mus. Bul. 105. 60 (not K. Kock) (1906).

Near Albany.

Crataegus anomala Sargent

Rhodora III. 74 (1901).

Crown Point and Fort Ann; also in western Vermont and the province of Quebec.

Crataegus huntiana n. sp.

Leaves ovate, acute, rounded or abruptly cuneate at the broad base, coarsely often doubly serrate with straight glandular teeth, and slightly divided into short acuminate lateral lobes; about one-third grown when the flowers open the middle of June and then thin, light yellow-green and covered by short white hairs longest and most abundant on the lower side of the midribs and veins, and at maturity thin, blue-green, glabrous and lustrous on the upper surface, paler on the lower surface and slightly hairy on the prominent midribs and four or five pairs of primary veins arching obliquely to the points of the lobes, 7 to 8 cm long, 6 to 7 cm wide, and on vigorous shoots sometimes 10 to 12 cm long and 8 to 9 cm wide; petioles stout, densely villose early in the season, tinged with red and glabrous in the autumn, 2 to 3 cm in length. Flowers 1.8 to 2 cm in diameter, on slender villose pedicels, in small densely villose mostly 12-flowered corymbs, the long lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, densely villose, the lobes narrow, acuminate, conspicuously glandular-serrate, slightly villose; stamens seven to ten; anthers rose color; styles four or five. Fruit ripening early in October, on stout drooping slightly hairy pedicels, broadly obovoid, occasionally slightly decurrent on the pedicel, scarlet, very lustrous, marked by few large white dots, slightly pubescent at the ends, 1.8 to 2 cm long and 1.6 to 1.8 cm in diameter, villose at the base of the little enlarged calyx with a deep narrow cavity pointed in the bottom, and erect and incurved often deciduous lobes densely villose on the inner surface; flesh yellow, dry and mealy, of good flavor; nutlets four or five, placed above the middle of the fruit, broad and rounded at the apex, gradually narrowed to the base, rounded and slightly grooved on the back, 9 to 10 mm long and 5 to 6 mm wide, the conspicuous hypostyle extending nearly to the base of the nutlet.

A round-topped shrub 3 to 4 m high, with numerous stout erect stems and branches and slender slightly zigzag branchlets, light orange-green and thickly covered when they first appear with long white hairs, glabrous, light orange-brown, lustrous and marked by dark lenticels in their first autumn and light brown the following year, and armed with straight or slightly curved dark red-brown shining spines 2.5 to 5 cm long.

Roadsides and rocky pastures between Jordanville and Mud lake, on the headwaters of the Susquehanna river, Herkimer county; J. V. Haberer (no. 2450, type), June 16 and October 19, 1907; Haberer, Dunbar and Sargent, September 28, 1912.

This handsome shrub is named in memory of Edwin Hunt (1837–80), for many years professor of natural sciences in the Utica Free Academy, a successful teacher of botany and a careful and industrious student of the flora of central New York.

Crataegus radians Sargent

N. Y. State Mus. Bul. 122. 64 (1908).

Rochester.

Crataegus fulleriana Sargent

Proc. Rochester Acad. Sci. IV. 111 (1903).

Rochester.

DILATATAE

Crataegus dilatata Sargent

Bot. Gazette XXXI. 9 (1901); Silva N. Am. XIII, 113, t. 672; N. Y. State Mus. Bul. 105. 63 (1906).

Thompsons lake near Albany, Gansevoort; also New England and Province of Quebec.

Crataegus hudsonica Sargent

Man. 457, f. 373 (1905); N. Y. State Mus. Bul. 105. 63 (1906).

Near Albany and Greenbush.

Crataegus durobrivensis Sargent

Trees and Shrubs I. 3, t. 2 (1902); Rochester Acad. Sci. IV. 114 (1903); N. Y. State Mus. Bul. 105. 64 (1906).

Near Albany, Ithaca, Canandaigua, Rochester, Hemlock lake, Portage and Niagara Falls.

INTRICATAE

Crataegus intricata Lange

Bot. Tidskr. XIX. 246 (1894). Sargent, N. Y. State Mus. Bul. 105. 67 (1906).

Moores Mills, near Albany, Lansingburg, Coopers Plains; also in New England and southern Pennsylvania.

Crataegus cornellii Sargent

N. Y. State Mus. Bul. 122. 105 (1908).

Coopers Plains.

Crataegus verecunda Sargent

Proc. Rochester Acad. Sci. IV. 109 (1903); N. Y. State Mus. Bul. 105. 68 (1906).

Lansingburg, Corning, Ithaca, Rochester, Hemlock lake and Coopers Plains.

Crataegus modesta Sargent

Rhodora III. 28 (1901); N. Y. State Mus. Bul. 105. 68 (1906).

Moores Mills, near Albany, Coopers Plains; also in New England and eastern Pennsylvania.

Crataegus foetida Ashe

Ann. Carnegie Mus. I. pt III. 389 (1902). Sargent, N. Y. State Mus. Bul. 105. 68 (1906).

Crataegus baxteri Sargent, Proc. Rochester Acad. Sci. IV. 107 (1903).

Lansingburg, Albany, Ithaca, Chapinville, Rochester, Hemlock lake, Castile, Coopers Plains; also in western Massachusetts, eastern Pennsylvania and southern Ontario.

Crataegus bissellii Sargent

Rhodora V. 65 (1903).

Staatsburg; also in southern Connecticut.

Crataegus peckii Sargent

Rhodora V. 63 (1903); N. Y. State Mus. Bul. 105. 68 (1906).

Lansingburg.

ROTUNDIFOLIAE

Crataegus rotundifolia (Ehrhart) Moench

Baum. Weiss. 29, t. 1 (1785).

Crataegus coccinea var. rotundifolia Sargent, Bot. Gazette XXXI. 14 (1900); N. Y. State Mus. Bul. 105. 64 (1906).

Moores Mills, Albany, Crown Point, Lake Placid, Ogdensburg; also New England, Province of Quebec and Pennsylvania.

Var. pubera Sargent, Rhodora XI. 183 (1909).

Crataegus coccinea Sargent, Silva N. Am. XIII. 133, t. 683 (not Linneus) (1902); N. Y. State Mus. Bul. 105. 64 (1906).

Pawling, Albany, North Elba, Chateaugay, Lake Placid, Buffalo; also New England, eastern Canada, Quebec, Ontario and Michigan.

Crataegus dodgei Ashe

Jour. Elisha Mitchell Sci. Soc. XIX. 26 (1901). Sargent, N. Y. State Mus. Bul. 105. 64 (1906).

Near Albany, Elmira, Buffalo, Belfast, Tuscarora, Coopers Plains; also in New England, eastern Pennsylvania and in southern Ontario and Michigan.

Crataegus caesariata Sargent

N. Y. State Mus. Bul. 105. 604 (1906).

Near Albany.

Crataegus divergens Sargent

N. Y. State Mus. Bul. 105. 66 (1906).

North Greenbush.

Crataegus illuminata Sargent

N. Y. State Mus. Bul. 105. 65 (1906).

North Greenbush.

Crataegus maribella n. sp.

Glabrous with the exception of the hairs on the young leaves and calyx-lobes. Leaves elliptical to obovate or ovate, acute or acuminate, cuneate at the entire base, finely doubly serrate above with straight glandular teeth, and slightly divided above the middle into narrow acuminate lobes; about half grown when the flowers open the end of May and then thin, light yellow-green and roughened above by short white hairs and glaucescent and glabrous below, and at maturity thick, yellow-green, smooth and lustrous on the upper surface, pale on the lower surface, 6 to 8 cm long and 4 to 4.5 cm wide, with stout midribs and thin primary veins extending obliquely to the points of the lobes; petioles stout, red in the autumn, 2 to 2.5 cm in length; leaves on vigorous shoots ovate, rounded at the wide base, 7 to 8 cm long and 6 to 7 cm wide, with stout, winged glandular petioles. Flowers 2 cm in diameter, on long slender pedicels, in wide lax mostly 10–14-flowered corymbs, the much elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes separated by wide sinuses, gradually narrowed from the base, long-acuminate, coarsely glandular-serrate, slightly villose on the inner surface, reflexed after anthesis; stamens twenty; anthers white; styles two to four. Fruit ripening the end of September on slender drooping pedicels, short-oblong, rounded at the ends, crimson, lustrous, marked by large pale dots, 1 to 1.2 cm long and 9 to 10 mm in diameter; calyx little enlarged with a deep narrow cavity pointed in the bottom, and reflexed closely appressed lobes often deciduous from the ripe fruit; flesh thick, orange color, soft and mealy, nutlets two to four, usually three, narrowed and rounded at the ends, rather broader at the apex than at the base, ridged on the back with a high rounded ridge, 7 to 8 mm long and 4.5 mm wide, the broad hypostyle extending to just below the middle of the nutlet.

A broad shrub 3 to 4 m high, with erect stems, and stout zigzag branchlets light yellow-green when they first appear, becoming light chestnut-brown, very lustrous and marked by large dark lenticels at the end of their first season and pale gray the following year, and armed with numerous stout straight light chestnut-brown shining spines 3 to 4.5 cm long.

Rocky banks on the north side of the Mohawk river below Little Falls; J. V. Haberer (no. 2491, type), June 1, 1912; Haberer and Dunbar, September 22, 1912. Moss island in the Mohawk river, below Little Falls; J. V. Haberer (no. 2416), June 1, 1912; Haberer, Dunbar and Sargent, September 27, 1912.

This species is named in memory of Miss Mary Isabel Haberer, the companion and assistant of her father in his botanical explorations of the flora of central New York.

Crataegus macauleyae Sargent

Proc. Rochester Acad. Sci. IV. 130 (1903).

Chapinville and Rochester.

Crataegus noveboracensis Sargent

N. Y. State Mus. Bul. 116. 22 (1907).

North Elba and Keene.

Crataegus verrucalis Peck

N. Y. State Mus. Bul. 122. 123 (1908).

Adirondack region.

Crataegus puberis Sargent

N. Y. State Mus. Bul. 105. 73 (1906).

Near Belfast.

Crataegus proctoriana n. sp.

Leaves ovate, acute or acuminate, abruptly or broadly cuneate at the base, coarsely often doubly serrate with straight glandular teeth, and deeply divided into four or five pairs of narrow acuminate spreading or often slightly recurved lobes; about half grown when the flowers open the first of June and then thin, yellow-green, roughened above by short white hairs and glabrous below, and at maturity thin but firm in texture, dark, yellow-green and smooth or scabrate on the upper surface, pale yellow-green on the lower surface, 5 to 7 cm long and 4 to 6 cm wide, with slender midribs, and thin primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, glandular with occasional small persistent glands, 2 to 2.5 cm in length; leaves on vigorous shoots ovate, acuminate, abruptly cuneate, rounded or truncate at the wide base, coarsely serrate, deeply lobed, often 9 to 10 cm long and 8 to 9 cm wide, their petioles stout, narrowly wing-margined often to the middle, conspicuously glandular, 2.5 to 3 cm in length. Flowers 1.3 to 1.5 cm in diameter, on slender slightly hairy pedicels, in narrow mostly 8–10-flowered sparingly villose corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, covered at the base with long scattered white hairs, the lobes separated by wide sinuses, glabrous on the outer surface, slightly villose on the inner surface; stamens ten; anthers pink in the bud, fading white as the flowers open; styles three or four. Fruit ripening the end of September on slender pedicels, in few-fruited clusters, subglobose but often slightly longer than broad, crimson, lustrous, marked by large pale dots, 1 to 1.2 cm in diameter; calyx little enlarged, with a broad shallow cavity and reflexed appressed lobes; flesh thin, dry and mealy; nutlets three or four, rounded at the ends, rather broader at the apex than at the base, ridged on the back with a high deeply grooved ridge 7 to 8 mm long and about 4 mm wide, the broad conspicuous hypostyle extending to just below the middle of the nutlet.

A broad shrub 5 to 6 m high, with stout stems covered with dark scaly bark, erect spreading branches, and slender slightly zizag branchlets tinged with red and marked by numerous pale lenticels when they first appear, becoming dark chestnut-brown and lustrous at the end of their first season and ashy gray the following year, and armed with stout straight or slightly curved chestnut-brown shining spines 3 to 4.5 cm. long.

Swampy hilltops south of Utica, rare; J. V. Haberer (no. 2412, type), June 4, September 22 and October 6, 1907, September 19, 1912; Haberer, Dunbar and Sargent, September 28, 1912.

This interesting species is named for Thomas Redfield Proctor, a public-spirited citizen of Utica to whose generosity the city owes its public parks, covering an area of some five hundred acres.

Crataegus maligna n. sp.

Leaves elliptical to slightly obovate, acute or acuminate, gradually narrowed and cuneate or rounded at the base, finely serrate with straight glandular teeth, and divided above the middle into three or four pairs of short broad acute lobes; nearly fully grown when the flowers open the middle of June and then yellow-green and roughened above by short white hairs and glabrous below, and at maturity thin but firm in texture, glabrous, dark yellow-green on the upper surface, pale on the lower surface, 4 to 4.5 cm long and 3 to 3.5 cm wide, with thin midribs and primary veins; petioles slender, slightly wing-margined at the apex, glabrous, occasionally glandular, 1.5 to 2 cm in length; leaves on vigorous shoots ovate, rounded or abruptly cuneate at the wide base, 4.5 to 5 cm long and broad. Flowers 1.8 cm in diameter, on slender slightly villose pedicels, in wide mostly 15–20-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, slightly villose at the base, the lobes separated by wide sinuses, broad, acuminate, glandular-serrate, glabrous on the outer surface, villose on the inner surface, reflexed after anthesis; stamens five to ten; anthers pink; styles three or four, surrounded at the base by a narrow ring of white hairs. Fruit ripening the end of September on drooping red pedicels, short-oblong, slightly narrowed and rounded at the base, crimson, lustrous, marked by occasional pale dots, 1.2 to 1.3 cm long and 9 to 10 mm in diameter; calyx prominent with a short tube, a very deep narrow cavity pointed in the bottom, and reflexed appressed persistent lobes; flesh thin, dry and mealy; nutlets three or four, acute at the apex, broader and rounded at the base, ridged on the back with a low ridge, occasionally depressed on the inner surfaces, 7 to 7.5 mm long and 4 to 4.5 mm wide, the broad prominent hypostyle extending to just below the middle of the nutlet.

A shrub 3 to 4 m tall, with ascending stems covered at the base with scaly bark, ascending branches forming a compact head, and stout slightly zigzag glabrous branchlets light orange-green when they first appear, bright chestnut-brown, lustrous and marked by large pale lenticels at the end of their first season and dull gray-brown the following year, and armed with numerous slender straight chestnut-brown shining spines 7 to 8 cm long.

Open pastures in moist soil near Ogdensburg. J. Dunbar (no. 49, type), June 12 and September 28, 1907.

A slight depression which occurs on the inner faces of some of the nutlets indicates the relationship of this very distinct species with the Anomalae, but such depressions are not constant and in other characters it is more like the Rotundifoliae with which I have placed it rather than with the Anomalae.

Crataegus praecoqua Sargent

Rhodora V. 167 (1903).

Crataegus praecox Sargent. Rhodora III. 27 (not Loudon) (1902).

Crown Point, Fort Ann; also in northern Illinois, Wisconsin and the Province of Quebec.

Crataegus spissa Sargent

N. Y State Mus. Bul. 122. 122 (1908).

North Elba.

Crataegus chateaugayensis Sargent

N. Y. State Mus. Bul. 122. 121 (1908).

Near Chateaugay lake.

Crataegus harryi Sargent

N. Y. State Mus. Bul. 122. 124 (1908).

Richmond, Canadice lake and Honeoye lake.

Crataegus neo–baxteri Sargent

N. Y State Mus. Bul. 122. 74 (1908).

Tuscarora.

ANOMALAE

Crataegus saundersiana Sargent

Ontario Nat. Sci. Bul. 4. 66 (1908).

Palmyra; also in southern Ontario.

Crataegus brachyloba Sargent

N. Y. State Mus. Bul. 122. 75 (1908).

Buffalo.

Crataegus fallsiana n. sp.

Leaves obovate to ovate, acuminate, gradually or abruptly narrowed at the entire base, sharply and often doubly serrate above, with straight glandular teeth and divided above the middle into four or five pairs of short acute lobes; nearly one-third grown when the flowers open about the 10th of June and then yellow-green and roughened above by short white hairs and paler and glabrous below, and at maturity glabrous, dark yellow-green on the upper surface, light yellow-green on the lower surface, 6 to 10 cm long and 5 to 7 cm wide, with stout midribs and slender primary veins; petioles slender, wing-margined at the apex, glabrous, dark red in the autumn, 3 to 4 cm in length. Flowers 3 cm in diameter, on long slender glabrous pedicels, in wide lax mostly 6–10-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, its lobes gradually narrowed to the base, long, slender, acuminate, entire or slightly dentate near the middle, glabrous on the outer surface, villose on the inner surface, reflexed after anthesis; stamens twenty; anthers rose color; styles three to five. Fruit ripening the end of September on drooping pedicels, subglobose, truncate at the ends, slightly angled, scarlet, lustrous, marked by small pale dots, 1.4 to 1.5 cm in diameter; calyx little enlarged with a deep narrow cavity, and spreading and erect lobes often deciduous from the ripe fruit; flesh orange color, of good flavor; nutlets three to five, rounded at the ends, broader at the base than at the apex, ridged on the back with a wide grooved ridge, slightly and irregularly depressed on the inner faces, 7 to 8 mm long and 4 to 5 mm wide, the prominent hypostyle extending to below the middle of the nutlet.

An arborescent shrub or small tree sometimes 7 m high, with a stem 15 cm in diameter at the base, bark covered with small dark gray-brown scales, stout pale gray branches, and slender slightly zigzag branchlets light orange-color when they first appear, becoming light chestnut-brown, lustrous, and marked by numerous pale lenticels at the end of their first season, and armed with stout straight or slightly curved chestnut-brown shining spines 3.5 to 4.5 cm long.

Top of Falls hill south of the Mohawk at Little Falls, J. V. Haberer (no. 2464, type), June 12, 1912; Haberer, Dunbar and Sargent, September 27, 1912.

Crataegus dunbarii Sargent

Proc. Rochester Acad. Sci. IV. 126 (1903); N. Y. State Mus. Bul. 122. 76 (1908).

Rochester, Hemlock lake, Adams Basin and Buffalo.

Crataegus inopinata Sargent

N. Y. State Mus. Bul. 122. 108 (1908).

Coopers Plains.

Crataegus scabrida Sargent

Rhodora III. 29 (1901); Silva N. Am. XIII. 133, t. 677; N. Y State Mus. Bul. 122. 76 (1908).

Albany, Little Falls, New Hartford, Mohawk, near Utica, Hemlock lake, Belfast; also in New England, the Province of Quebec and southern Ontario.

Crataegus affinis Sargent

Ontario Nat. Sci. Bul. 4. 71 (1908).

Piseco, Hamilton co.; also near Toronto, Ontario.

Crataegus misella n. sp.

Leaves rhombic to obovate, acuminate and long-pointed at the apex, gradually narrowed and cuneate at the entire base, finely doubly serrate above with straight glandular teeth, and divided above the middle into three or four pairs of small acuminate spreading lobes; nearly fully grown when the flowers open at the end of May and then thin, yellow-green, roughened above by short white hairs and glabrous below, and at maturity thin, yellow-green, scabrate on the upper surface, paler on the lower surface, 5 to 6 cm long and 3.5 to 4 cm wide, with slender midribs, and thin primary veins extending obliquely to the points of the lobes; petioles slender, narrowly wing-margined at the apex, villose on the upper side while young, soon glabrous, 2 to 2.5 cm in length; leaves on vigorous shoots narrowed and rounded at the base, coarsely serrate, more deeply lobed and sometimes 6 cm long and 5 cm wide. Flowers 1.5 to 1.7 cm in diameter, on slender slightly villose pedicels, in 6–15-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous or slightly villose, the lobes slender, acuminate, glandular-dentate, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens five to seven; anthers rose color; styles three or four, surrounded at the base by a ring of pale hairs. Fruit ripening the middle of September on red pedicels, in erect clusters, short-oblong, rounded at the ends, crimson, marked by small pale dots, 1.2 cm long and 1 cm in diameter; calyx little enlarged with a deep cavity pointed in the bottom, and spreading closely appressed lobes; flesh thin, yellow, firm and bitter; nutlets three or four, rounded at the ends, broader at the base than at the apex, rounded and ridged on the back with a broad high ridge, usually irregularly depressed on the inner faces, 6 to 7 mm long and 3 to 4 mm wide, the narrow hypostyle extending nearly to the base of the nutlet.

A shrub 3 to 4 m high, with ascending stems and branches, and slender glabrous slightly zigzag branchlets tinged with red and marked by pale lenticels when they first appear, becoming chestnut-brown and lustrous at the end of their first season and dull gray-brown the following year, and armed with stout slightly curved chestnut-brown shining spines 4 to 5 cm long.

On hillsides in clay soil, near Belfast, Allegany county; Baxter and Dewing (no. 216, type), September 14, 1904, May 28 and September 17, 1905.

Crataegus asperifolia Sargent

Rhodora III 31 (1901); N. Y. State Mus. Bul. 105. 64 (1906).

Near Albany, Little Falls, Buffalo, Coopers Plains; also in New England, southern Ontario and the Province of Quebec.

Crataegus singularis Sargent, N. Y. State Mus. Bul. 122. 106 (1908), with more deeply lobed leaves can not otherwise be distinguished from Crataegus asperifolia and probably should be referred to that species.

Crataegus repulsans Sargent

N. Y. State Mus. Bul. 122. 107 (1908).

Coopers Plains.

Crataegus floridula Sargent

N. Y. State Mus. Bul. 122. 126 (1908).

Piseco.

Crataegus knieskerniana n. sp.

Glabrous with the exception of the hairs on the young leaves and calyx-lobes. Leaves ovate, acuminate, cuneate at the entire base, coarsely doubly serrate above with straight glandular teeth, and divided into five or six pairs of narrow acuminate lateral lobes; about one-third grown when the flowers open the end of May and then thin, dark yellow-green and roughened above by short white hairs and pale bluish green and glabrous below, and at maturity thin, yellow-green, smooth and lustrous on the upper surface, paler on the lower surface, 6 to 7 cm long and 4.5 to 5 cm wide, with thin midribs, and slender primary veins extending obliquely to the points of the lobes; pedicels slender, slightly wing-margined at the apex, red in the autumn, 2.5 to 3 cm in length; leaves on vigorous shoots ovate, acuminate, rounded, subcordate or occasionally cuneate at the broad base, coarsely serrate, more deeply lobed, 8 to 9 cm long and wide with glandular petioles. Flowers 1.5 to 1.8 cm in diameter, on long slender pedicels, in wide lax mostly 10–13-flowered corymbs, the thin much elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes long, slender, acuminate, entire, slightly dentate near the middle, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens ten; anthers rose color; styles three or four. Fruit ripening in October on slender drooping pedicels, short-oblong, rounded at the ends, scarlet, lustrous, marked by large pale dots, 1.3 to 1.4 cm long, 1 to 1.1 cm in diameter; calyx little enlarged, with a deep narrow cavity pointed in the bottom and spreading closely appressed lobes; flesh thin, yellow, dry and mealy; nutlets three or four, pointed at the apex, broader and rounded at the base, rounded and slightly ridged on the back, conspicuously depressed on the inner faces, 7 to 8 mm long and 4 to 5 mm wide, the narrow hypostyle extending nearly to the base of the nutlet.

A broad-topped shrub 2 to 4 m high, with stout stems covered with dark gray bark, and slender only slightly zigzag branchlets, light orange-brown and marked by pale lenticels when they first appear, becoming dark chestnut-brown and lustrous at the end of their first season and dull brown the following year, and armed with many slender straight or slightly curved chestnut-brown shining spines 3.5 to 5 cm long.

In gravelly soil along the top of the cliffs of West Canada creek north of East Herkimer; J. V. Haberer (no. 2524, type), May 28 and October 3, 1912.

This species differs from the other described species of Anomalae in the broad rounded or subcordate base of the leaves on the vigorous shoots. It is named in memory of Peter D. Knieskern (1798–1871), at one time a resident of Oriskany, New York, author of "A Catalogue of the Plants found in Oneida County," "an indefatigable collector, a keen observer, unsurpassed by few botanists in his knowledge of the plants of the region in which he resided."

TOMENTOSAE

Crataegus tomentosa Linnaeus

Spec. 467 (1753). Sargent, Silva N. Am. IV. 101, t. 183.

Watervliet, near Elmira, Ithaca, Chapinville, Hemlock lake, Coopers Plains, Geneseo, Buffalo, Salamanca; also to Missouri and North Carolina.

Crataegus efferata Sargent

N. Y. State Mus Bul. 122. 128 (1908).

Hemlock lake.

Crataegus diversa Sargent

N. Y. State Mus. Bul. 122. 109 (1908).

Coopers Plains.

Crataegus finitima Sargent

N. Y. State Mus. Bul. 122. 78 (1908).

Ithaca, near Utica, Belfast, Tuscarora and Niagara Falls.

Crataegus spinifera Sargent

N. Y. State Mus. Bul. 122. 118 (1908).

Canandaigua, Coopers Plains and Hemlock lake.

Crataegus menandiana Sargent

N. Y. State Mus. Bul. 105. 68 (1906).

Albany.

Crataegus structilis Ashe

Jour. Elisha Mitchell Sci. Soc. XIX. 12 (1903). Sargent, N. Y. State Mus. Bul. 122. 77 (1908).

Chapinville, Rochester, Hemlock lake, Coopers Plains, Salamanca; also in eastern Pennsylvania, southern Ontario and in Michigan.

Crataegus comans Sargent

N. Y. State Mus. Bul. 122 112 (1908).

Coopers Plains.

Crataegus truculenta n. sp.

Leaves obovate, acuminate, gradually narrowed to the entire base, finely doubly serrate above with straight glandular teeth, and divided above the middle into four to six pairs of small broad acute lobes; nearly fully grown when the flowers open the first week of June and then yellow-green and scabrate above, paler and soft pubescent below, and at maturity thick, dark yellow-green and nearly smooth on the upper surface, pale yellow-green and slightly villose along the thin midribs and primary veins on the lower surface, 5.5 to 6 cm long and 3.5 to 4 cm wide; petioles slender, wing-margined at the apex, villose on the upper side early in the season, becoming glabrous, 1 to 1.2 cm in length; leaves on vigorous shoots broadly ovate to elliptical, acuminate, gradually narrowed and rounded or cuneate at the base, more coarsely serrate and more deeply lobed, and 6.5 to 8 cm long and 6 to 6.5 cm wide, their petioles stout, broadly wing-margined to below the middle, 1 to 1.2 cm in length. Flowers 1.2 to 1.4 cm in diameter, on long slender villose pedicels, in wide 20–25-flowered corymbs, the much elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, coated at the base with long white hairs, the lobes long, broad, acuminate, laciniately divided, glabrous on the outer surface, slightly villose on the inner surface, reflexed after anthesis; stamens twenty; anthers yellow; styles two or three. Fruit on erect nearly glabrous pedicles, in board 5–15-fruited clusters, subglobose, dark red, marked by large pale dots, 7 to 8 mm in diameter; calyx prominent, with a wide shallow cavity broad in the bottom, and spreading and reflexed enlarged persistent lobes; flesh thin, firm and dry; nutlets two or three, pointed at the apex, rounded at the base, ridged on the back with a broad grooved ridge, penetrated on the inner faces by deep narrow cavities, 6 to 7 mm long and 3 to 5 mm wide.

A shrub 4 to 5 m high, with erect gray stems and branches, and slender, glabrous branchlets tinged with red and marked by pale lenticels when they first appear, becoming bright chestnut-brown and lustrous, and armed with numerous slender straight or slightly curved dark chestnut-brown shining spines 3.5 to 6 cm long.

In thickets in heavy clay soil, near Belfast, Allegany county, Baxter and Dewing (no. 214, type), May 30, 1903, September 14, 1904, September 19, 1905.

Crataegus ambrosia Sargent

N. Y. State Mus. Bul. 105. 69 (1906).

Albany.

Crataegus rhombifolia Sargent

Rhodora V. 183 (1903); N. Y. State Mus. Bul. 105. 71 (1906).

Crown Point, Whitehall, near Albany; also in western and southern New England.

Crataegus deweyana Sargent

Proc. Rochester Acad. Sci. IV. 133 (1903).

Ithaca, Rochester, Rush, Portage, Castile and Silver Springs.

Crataegus cupulifera Sargent

Proc. Rochester Acad. Sci. IV. 129 (1903).

Crataegus simulans Sargent. N. Y. State Mus. Bul. 122. 125 (1908).

Chapinville, Rochester, Hemlock lake and Coopers Plains.

Crataegus balkwillii Sargent

Ontario Nat. Sci. Bul. 4. 80 (1908).

Chapinville; also in southern Ontario.

Crataegus microsperma Sargent

Ontario Nat. Sci. Bul. 4. 82 (1908)

Little Falls, Coopers Plains; also in southern Ontario.

Crataegus flagrans Sargent

N. Y. State Mus. Bul. 105. 71 (1906).

North Greenbush.

Crataegus venustula Sargent

N. Y. State Mus. Bul. 122. 79 (1908).

Niagara Falls, Buffalo; also in southern Ontario.

Crataegus laneyi Sargent

Trees and Shrubs. I. 5, t. 3 (1902); Proc. Rochester Acad. Sci. IV. 136 (1903).

Near Herkimer, Rochester and Coopers Plains.

Crataegus succulenta Link

Handbook II. 76 (1811). Sargent, Silva N. Am. XIII. 139, t. 131.

Chapinville, Rochester, Belfast, Niagara Falls, Buffalo, Palmyra, Salamanca; also in southern New England, eastern and western Pennsylvania and southern Ontario.

Crataegus gemmosa Sargent

Bot. Gazette XXXIII. 119 (1902); Silva N. Am. XXIII. 141, t. 686; N. Y. State Mus. Bul. 105. 72 (1906).

Near Albany, Rochester, Hemlock lake; also in southern Ontario, Ohio and Michigan.

Crataegus calvinii Sargent

N. Y. State Mus. Bul. 122. 81 (1908).

Chapinville and Canandaigua.

Crataegus sonnenbergensis n. sp.

Leaves obovate, abruptly narrowed and acute at the apex, gradually narrowed and cuneate at the entire base, finely often doubly serrate above with straight teeth pointing toward the apex of the leaf, and slightly and irregularly divided above the middle into short acute lobes; more than half grown when the flowers open during the first week in June and then thin, glabrous and lustrous above and pale and covered below with short soft hairs most abundant on the midribs and veins, and at maturity 6 to 7 cm long and 4.5 to 5 cm wide, thick, dark blue-green and lustrous on the upper surface, pale blue-green and still slightly villose below along the prominent midribs, and six to eight pairs of thin conspicuous primary veins extending obliquely to above the middle of the leaf; petioles stout, narrowly wing-margined often to below the middle, tinged with red late in the season, 1.5 to 2.5 cm in length. Flowers 1.5 cm in diameter, on long slender villose pedicels, in lax few-flowered slightly hairy corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, covered with long pale hairs, the lobes slender, acuminate, glandular-serrate, glabrous on the outer, puberulous on the inner surface, reflexed after anthesis; stamens twenty; anthers pink; styles two. Fruit ripening the middle of October, on long slender red pedicels slightly villose near the apex, subglobose to short-oblong, crimson, lustrous, about 1 cm in diameter; calyx little enlarged, with a deep narrow cavity pointed in the bottom, the lobes generally deciduous from the ripe fruit; flesh yellow, becoming soft and succulent when the fruit is fully ripe; nutlets two, rounded at the obtuse ends, ridged on the back with a low rounded ridge, about 5 mm long and 3 mm wide, penetrated on the inner face by deep narrow cavities.

An arborescent shrub with stems spreading into great clumps, 5 to 10 m high, 30 cm in diameter and covered with very dark brown bark broken into small closely appressed scales, ascending branches, and slender glabrous branchlets pale yellow-green early in the season, becoming bright reddish brown before autumn, and armed with stout slightly curved spines 4 to 5 cm long.

Open pastures in heavy soil on Sonnenberg, the beautiful Thompson estate at Canandaigua, Ontario county; R. H. Slavin (no. 51, type), June 3 and October 15, 1909.

Crataegus frutescens Sargent

N. Y. State Mus. Bul. 122. 113 (1908).

Coopers Plains.

Crataegus honeoyensis Sargent

N. Y. State Mus. Bul. 122. 129 (1908).

Honeoye lake, Hemlock lake and Campbell.

Crataegus admiranda Sargent

N. Y. State Mus. Bul. 122. 80 (1908).

Niagara Falls.

Crataegus spinea n. sp.

Glabrous with the exception of the hairs on the inner surface of the calyx-lobes. Leaves rhombic, acute at the ends, finely serrate, often only above the middle, with straight glandular teeth, and slightly divided into three or four pairs of broad acuminate lobes; nearly fully grown when the flowers open at the end of May and then light yellow-green above and pale blue-green below, and at maturity thick, dark green and lustrous on the upper surface, pale on the lower surface, 4 to 5 cm long and 2 to 3 cm wide, with prominent midribs and veins deeply impressed on the upper side; petioles slender, wing-margined nearly to the base, 7 to 10 mm in length. Flowers 1.3 to 1.8 cm in diameter, on long slender pedicels, in lax 15–22-flowered corymbs, the elongated lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, wide, acuminate, laciniately glandular-serrate, reflexed after anthesis; stamens twenty; anthers small, rose color; styles two to four, mostly two or three. Fruit on erect pedicels, in broad clusters, subglobose to short-oblong, dark red, lustrous, marked by dark spots, 6 to 7 mm in diameter; calyx prominent with a short tube, a wide shallow cavity pointed in the bottom, and reflexed persistent lobes dark red on the upper side below the middle; flesh yellow, dry and mealy; nutlets usually two or three, rounded at the ends, ridged on the back with a narrow rounded ridge, penetrated on the inner faces by long deep narrow cavities, 4 to 4.5 mm long and 3 to 3.5 mm wide, the narrow hypostyle extending to the middle of the nutlet.

A round-headed shrub 3 to 4 m high, with stout stems spreading into large clumps and covered at the base with dark gray-brown checkered bark, ascending branches, and stout nearly straight branchlets orange-green and marked by large pale lenticels when they first appear, becoming light chestnut-brown and lustrous at the end of their first season and dull red-brown the following year, and armed with numerous slender straight dark chestnut-brown shining spines 5 to 7 cm long.

Low moist hillsides near Campbell; G. D. Cornell (no. 124, type), October 5, 1907, May 26, 1908.

Crataegus halliana Sargent

N. Y. State Mus. Bul. 105. 73 (1906).

Near Albany.

Crataegus conspicua Sargent

N. Y. State Mus. Bul. 105. 74 (1906).

Near Albany; also in western Vermont.

Crataegus beckiana Sargent

N. Y. State Mus. Bul. 105. 75 (1906).

North Greenbush.

Crataegus ogdensburgensis n. sp.

Leaves ovate to obovate, acute or acuminate, gradually narrowed and concave-cuneate at the entire base, sharply doubly serrate above with straight glandular teeth, and slightly divided above the middle into small acuminate lobes; fully grown when the flowers open in the first week of June and then thin, yellow-green, covered above by soft hairs and slightly villose along the midribs and veins below, and at maturity thick, dark green, smooth and lustrous on the upper surface, pale and nearly glabrous on the lower surface, 5 to 7 cm long and 4 to 5 cm wide, with stout rose colored midribs, and slender primary veins extending obliquely to the points of the lobes; petioles stout, wing-margined to the base, slightly villose on the upper side early in the season, soon becoming glabrous, 1 to 1.5 cm in length; stipules lanceolate, acuminate, slightly falcate, glandular-serrate, often persistent until the flowers open; leaves on vigorous shoots broadly ovate, often 9 to 10 cm long and 6 to 7 cm wide. Flowers 1.5 to 1.7 cm in diameter, on long slender slightly villose pedicels, in wide lax mostly 16–18-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes broad, long-acuminate, laciniately glandular-serrate, glabrous on the outer surface, villose on the inner surface, reflexed after anthesis; stamens ten; anthers pale pink; styles two or three. Fruit ripening the end of September on long pedicels, in wide drooping many-fruited clusters, subglobose to short-oblong, rounded at the ends, crimson, lustrous, marked by large pale dots, 9 to 11 cm in diameter; calyx prominent, with a short tube, a wide shallow cavity pointed in the bottom, and reflexed closely appressed persistent lobes dark red on the upper side below the middle; flesh thick, soft and succulent; nutlets two or three, rounded at the ends, rounded and slightly ridged on the back, penetrated on the inner faces by short narrow cavities, 6 to 7 mm long and 3 to 3.5 mm wide, the narrow hypostyle extending to below the middle of the nutlet.

A shrub 3 to 4 m high, with spreading ashy gray branches forming an open head, and stout slightly zigzag glabrous branchlets light orange-green when they first appear, becoming light chestnut-brown, lustrous and marked by pale lenticels at the end of their first season and unarmed or armed with occasional spines.

Rich pastures near Ogdensburg; J. Dunbar (no. 71, type), September 28, 1907, June 5, 1908.

Crataegus ferentaria Sargent

Proc. Rochester Acad. Sci. IV. 135 (1903); N. Y. State Mus. Bul. 105. 77 (1906).

Fort Ann, Albany, Frankfort, near Utica, Canandaigua, Rochester, Belfast, Coopers Plains, Buffalo; also in New England.

Crataegus hystricina Ashe

Bot. Gazette XXXV. 433 (1903). Sargent, N. Y. State Mus. Bul. 105. 77 (1906).

Near Albany; also in southern Connecticut.

Crataegus macracantha Koehne

Deutsche Dendr. 236 (1893). Sargent, Silva N. Am. XIII. 147, t. 689; Proc. Rochester Acad. Sci. IV. 135 (1903).

Ithaca, Rochester; also in New England and eastern Pennsylvania.

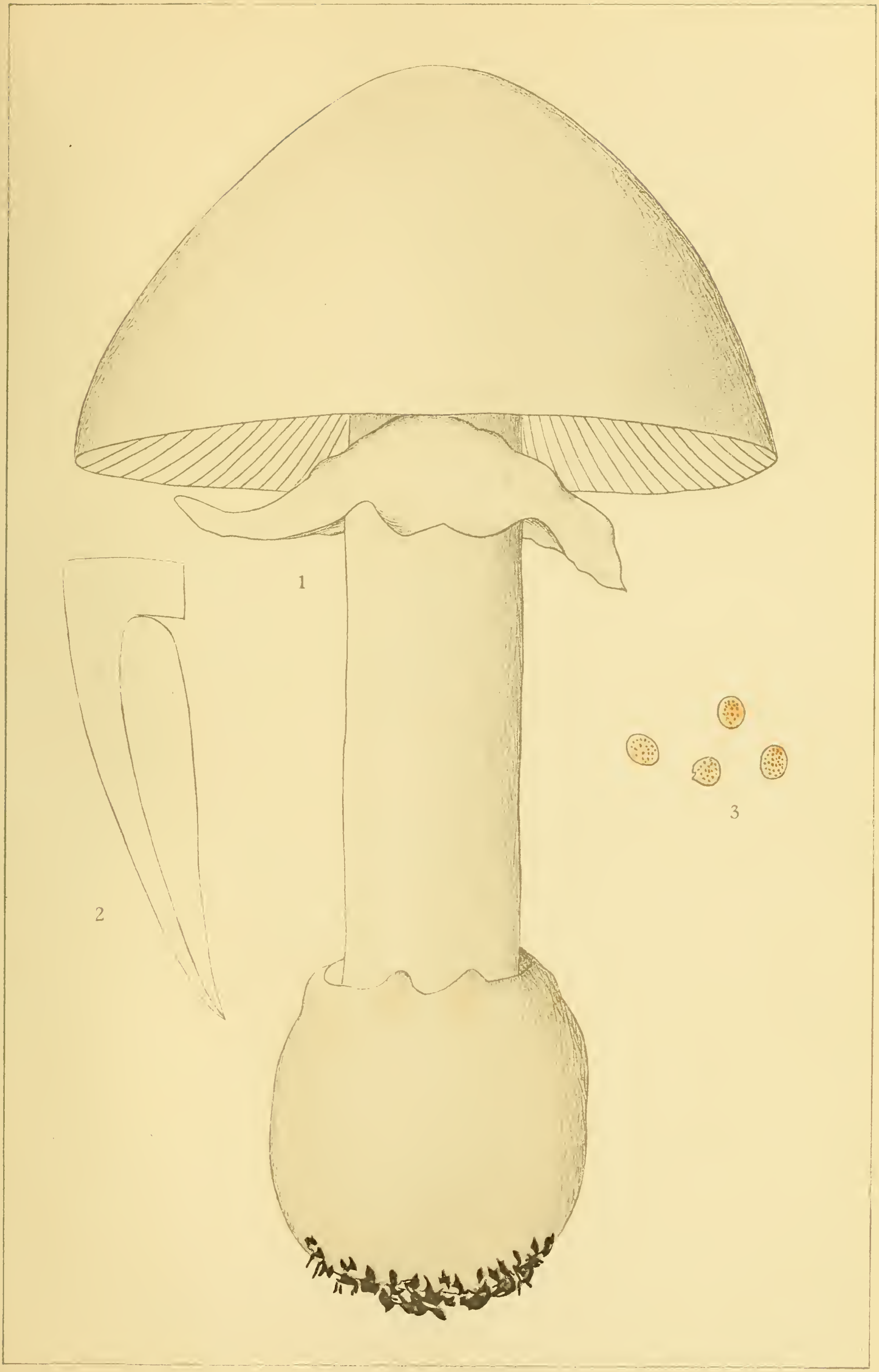
EXPLANATION OF PLATES

Plate 131

Amanita ovoidea Bull.

OVOID AMANITA

1 Plant with cap beginning to expand. About ½ natural size
2 Half vertical section of a pileus. About ½ natural size
3 Four spores x 400



AMANITA OVOIDEA BULL.
OVOID AMANITA

Plate 132

Tricholoma chrysenteroides Pk.

GOLDEN FLESH TRICHOLOMA

1, 2 Immature plants
3 Mature plant
4 Old plant
5 Vertical section of the upper part of an immature plant
6 Four spores x 400

TRICHOLOMA CHRYSENTEROIDES PK.
GOLDEN FLESH TRICHOLOMA

Plate IX

Russula ballouii Pk.

BALLOU RUSSULA

1 Plant showing upper surface of pileus and stem
2 Plant showing both upper and lower surface of pileus and stem
3 Vertical section showing half of the upper part of a plant
4 Four spores x 400

Tricholoma latum Pk.

BROAD CAP TRICHOLOMA

5 Immature plant
6 Mature plant
7 Vertical section of the upper part of an immature plant
8 Four spores x 400

FIG. 1-4
RUSSULA BALLOUII PK.
BALLOU RUSSULA

FIG. 5-8
TRICHOLOMA LATUM PK.
BROAD CAP TRICHOLOMA

Plate X

131

Mycena splendidipes Pk.

POISON MYCENA

1 Tuft of three very young plants
2 Immature plant
3 Single mature plant
4 Tuft of three mature plants and one very young plant
5 Mature plants with very long stems
6 Vertical section of the upper part of an immature plant

MYCENA SPLENDIDIPES Pk.
POISON MYCENA

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Appendix 5

Archeology

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JOHN M. CLARKE, Director

Museum Bulletin 163

THE CODE OF HANDSOME LAKE, THE SENECA PROPHET

BY

ARTHUR C. PARKER

New York State Education Department

Science Division, September 11, 1912

Hon. Andrew S. Draper LL.D.

Commissioner of Education

SIR: I transmit to you herewith and recommend for publication as a bulletin of the State Museum, a manuscript entitled *The Code of Handsome Lake, the Seneca Prophet,* prepared by Arthur C. Parker, Archeologist.

Very respectfully

JOHN M. CLARKE
Director

STATE OF NEW YORK
EDUCATION DEPARTMENT
COMMISSIONER'S ROOM

Approved for publication this 16th day of September 1912

A. S. Draper

Commissioner of Education

Plate 1

Photo 1900 by A. C. Parker

The old log Long House on the Cattaraugus reservation formerly situated on the Buffalo "Plank road"

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Museum Bulletin 163

THE CODE OF HANDSOME LAKE, THE SENECA PROPHET

BY

ARTHUR C. PARKER

INTRODUCTION

HANDSOME LAKE'S RELIGION

The Gai′wiio‘ is the record of the teachings of Handsome Lake, the Seneca prophet, and purports to be an exact exposition of the precepts that he taught during a term of sixteen years, ending with his death in 1815. It is the basis of the so-called "new religion" of the Six Nations and is preached or recited at all the annual mid-winter festivals on the various Iroquois reservations in New York and Ontario that have adherents. These reservations are Onondaga, Tonawanda, Cattaraugus and Allegany in New York and Grand River and Muncytown in Ontario.

There are six authorized "holders" of the Gai′wiio‘[1] among whom are John Gibson (Ganio‘dai′io‘) and Edward Cornplanter (Soson′dowă), Senecas, and Frank Logan (Adodār′ho), Onondaga. Chief Cornplanter is by far the most conservative though Chief Gibson seems to have the greater store of explanatory matter, often interpolating it during his exposition. Chief Logan is a devout adherent of his religion and watches the waning of his prophet's teachings with grave concern. His grief is like that of Hiawatha (Haiyoⁿ′wĕntha) and inclines him to leave Onondaga for a region where the prophet will not be jeered.

[1] Key to pronunciation of Indian words on page 139. See also Glossary, page 140.

The stated times for the proclaiming of the Gai'wiio' are at the Six Nations' meeting in September and at the midwinter thanksgiving in the moon Nĭsko'wŭknī, between January 15th and February 15th. At such times the Oñgwe''oñwekā or "faithful Indians" send for an expounder paying his traveling expenses and entertaining him during his stay. Usually reservations "exchange" preachers, Cornplanter going to Grand River or Onondaga and Chief Gibson to Cattaraugus or Allegany.

The time consumed in reciting the Gai'wiio' is always three days. At noon each day the expositor stops, for the sun is in midheaven and ready to descend. All sacred things must be done sĕdē'tciā, *early in the morning.* Before sunrise each morning of the preaching the preacher stands at the fireplace in the long house and sings a song known as the Sun Song. This is an obedience to a command of the prophet who promised that it should insure good weather for the day. "The wind always dies down when I sing that song," affirms Chief Cornplanter.

During the recital of the Gai'wiio' the preacher stands at the fireplace which serves as the altar. Sitting beside him is an assistant or some officer of the rites who holds a white wampum strand.[1] A select congregation sits on benches placed across the long house but the majority use the double row of seats around the walls. The women wear shawls over their heads and during affecting parts of the story hide their faces to conceal the tears. Some of the men, stirred to emotion, likewise are moved to tears but are unable to hide them. Such emotion once detected by the auditors sometimes becomes contagious and serves as the means of scores repledging their allegiance to the old religion. In 1909, for example, 136 Allegany Senecas promised Chief Cornplanter that they would stop drinking liquor and obey the commands of Handsome Lake. Visiting Canadian Oneida Indians at the Grand River ceremonies, as a result of such a "revival," petitioned for a visit of the Gai'wiio' preachers several years ago, saying that a portion of the Oneida of the Thames wished to return to the "old way." This some of them have done but they complain of the persecution of their Christian tribesmen who threatened to burn their council house. In other places the case seems different and the "prophet's cause" is not espoused with much enthusiasm by the younger element to whom the white man's world and thought present a greater appeal.

[1] The original Handsome Lake belt is still displayed at the religious council at Tonawanda. (See plate 15.)

Those who live in communities in which the prophet's word is still strong are drawn to the ceremonies and to the recitals because it is a part of their social system.

Its great appeal to the older people is that it presents in their own language a system of moral precepts and exhortations that they can readily understand. The prophet, who is called *"our great teacher"* (sedwa′gowā′nĕ'), was a man of their own blood, and the ground that he traversed was their ancestral domain. Patriotism and religious emotion mingle, and, when the story of the "great wrongs" is remembered, spur on a ready acceptance. The fraudulent treaty of Buffalo of 1838, for example, caused many of the Buffalo Senecas to move to the Cattaraugus reservation. Here they settled at Ganŭn′dasē‘ or Newtown, then a desolate wilderness. Their bitter wrongs made them hate white men and to resist all missionary efforts. Today there is no mission chapel at Newtown. All attempts have failed.[1] Whether future ones will readily succeed is conjectural. The Indian there clings to his prophet and heeds the word of his teacher. At Cold Spring on the Allegany is another center of the "old time people." On the Tonawanda reservation this element is chiefly centered "down below" at the long house. On the Onondaga reservation the long house stands in the middle of the Onondaga village and the Ganuñg′sĭsnē′ha (long house people) are distributed all over the reservation but perhaps chiefly on Hemlock road. It is an odd sight, provoking strange thoughts, to stand at the tomb of the prophet near the council house and watch each day the hundreds of automobiles that fly by over the State road. The Tuscarora and St Regis Indians are all nominally Christians and they have no long houses.

The present form of the Gai′wiio‘ was determined by a council of its preachers some fifty years ago. They met at Cold Spring, the old home of Handsome Lake, and compared their versions. Several differences were found and each preacher thought his version the correct one. At length Chief John Jacket, a Cattaraugus Seneca, and a man well versed in the lore of his people, was chosen to settle forever the words and the form of the Gai′wiio‘. This he did by writing it out in the Seneca language by the method taught by Rev. Asher Wright, the Presbyterian missionary. The preachers assembled again, this time, according to Cornplanter, at Cattaraugus where they memorized the parts in which they were faulty. The original text was written on letter paper and now is entirely de-

[1] See Caswell, Our Life Among the Iroquois. Boston, 1898.

stroyed. Chief Jacket gave it to Henry Stevens and Chief Stevens passed it on to Chief Cornplanter who after he had memorized the teachings became careless and lost the papers sheet by sheet. Fearing that the true form might become lost Chief Cornplanter in 1903 began to rewrite the Gai'wiio' in an old minute book of the Seneca Lacrosse Club. He had finished the historical introduction when the writer discovered what he had done. He was implored to finish it and give it to the State of New York for preservation. He was at first reluctant, fearing criticism, but after a council with the leading men he consented to do so. He became greatly interested in the progress of the translation and is eager for the time to arrive when all white men may have the privilege of reading the " wonderful message " of the great prophet.

The translation was made chiefly by William Bluesky, the native lay preacher of the Baptist church. It was a lesson in religious toleration to see the Christian preacher and the " Instructor of the Gai'wiio' " side by side working over the sections of the code, for beyond a few smiles at certain passages, in which Chief Cornplanter himself shared, Mr Bluesky never showed but that he reverenced every message and revelation of the four messengers.

HANDSOME LAKE

Handsome Lake, the Seneca prophet, was born in 1735 in the Seneca village of Conawagas (Gānoⁿ'wagēs) on the Genesee river opposite the present town of Avon, Livingston county. He is described by Buffalo Tom Jemison as a middle-sized man, slim and unhealthy looking. He was a member of one of the *noble* (hoya'nĕ') families in which the title of Ganio'dai'io' or Ska'niadar'io' is vested, thus holding the most honored Seneca title. What his warrior name was is not known and neither is it known just when he received the name and title by which he later became known. It is known, however, that he belonged to the Turtle clan. Later he was "borrowed" by the Wolves and reared by them. His half brother was the celebrated Cornplanter.

The general story of his life may be gleaned from a perusal of his code, there being nothing of any consequence known of his life up to the time of his "vision." In 1794 his name appears on a treaty but whether he took active part in the debates that led up to it is not known. It is known from tradition and from his own story that he was a dissolute person and a miserable victim of the drink habit. The loss of the Genesee country caused him to go with his tribesmen to the Allegany river settlements. Here he became afflicted with a wasting disease that was aggravated by his continued use of the white man's fire water. For four years he lay a helpless invalid. His bare cabin scarcely afforded him shelter but later he was nursed by his married daughter who seems to have treated him with affection. His sickness afforded him much time for serious meditation and it is quite possible that some of his precepts are the result of this opportunity. His own condition could not fail to impress him with the folly of using alcoholic drink and the wild whoops of the drunken raftsmen continually reminded him of the "demon's" power over thought and action. In the foreword of his revelation he tells how he became as dead, and of the visitation of the "four beings" who revealed the will of the Creator.

After this first revelation he seemed to recover and immediately began to tell the story of his visions. His first efforts were to condemn the use of the *"first word"* or the white man's "onē'gă." He became a temperance reformer but his success came not from an appeal to reason but to religious instinct. The ravages of intemperance for a century had made serious inroads on the domestic and social life of his people. It had demoralized their national life and caused his brother chiefs to barter land for the means of a debauch. It threatened the extinction of his people. Such were the factors that induced the revelation.

He was a man past the prime of life, a man weakened by disease and drunkenness. Yet he assumed the rôle of teacher and prophet. In two years' time his efforts were conducive of so much reform that they attracted the attention of President Jefferson who caused Secretary of War Dearborn to write a letter commending the teachings of Handsome Lake. The Seneca construed this as a recognition of the prophet's right to teach and prophesy. The nature of the document is revealed in the following letter, a copy of which is in the possession of every religious chief of the Six Nations:

> Brothers — The President is pleased with seeing you all in good health, after so long a journey, and he rejoices in his heart that one of your own people has been employed to make you sober, good and happy; and that he is so well disposed to give you good advice, and to set before you so good examples.
>
> Brothers — If all the red people follow the advice of your friend and teacher, the Handsome Lake, and in future will be sober, honest, industrious and good, there can be no doubt but the Great Spirit will take care of you and make you happy.

This letter came as one of the results of Handsome Lake's visit in 1802, to Washington with a delegation of Seneca and Onondaga chiefs. The successful results of his two years' ministry became more fruitful as time went on. In 1809 a number of members of the Society of Friends visiting Onondaga left the following record of the effects of the prophet's teachings: "We were informed, not only by themselves, but by the interpreter, that they totally refrained from the use of ardent spirits for about nine years, and that none of the natives will touch it."

The success of Handsome Lake's teachings did much to crystallize the Iroquois as a distinct social group. The encroachments of civilization had demoralized the old order of things. The old beliefs, though still held, had no coherence. The ancient system had no longer definite organization and thus no specific hold.

The frauds which the Six Nations had suffered, the loss of land and of ancient seats had reduced them to poverty and disheartened them. The crushing blow of Sullivan's campaign was yet felt and the wounds then inflicted were fresh. The national order of the Confederacy was destroyed. Poverty, the sting of defeat, the loss of ancestral homes, the memory of broken promises and the hostility of the white settlers all conspired to bring despair. There is not much energy in a despairing nation who see themselves hopeless and alone, the greedy eyes of their conquerors fastened on the few acres that remain to them. It was little wonder that the Indian sought forgetfulness in the trader's rum.

As a victim of such conditions, Handsome Lake stalked from the gloom holding up as a beacon of hope his divine message, the Gai′wiio‘. He became in spite of his detractors a commanding figure. He created a new system, a thing to think about, a thing to discuss, a thing to believe. His message, whether false or true, was a creation of their own and afforded a nucleus about which they could cluster themselves and fasten their hopes. A few great leaders such as Red Jacket denounced him as an imposter but this only afforded the necessary resistant element. The angels then conveniently revealed that Red Jacket was a schemer and a seller of land and an unhappy wretch doomed to carry burdens of soil through eternity as a punishment for perfidy. This was enough to create a prejudice among the Indians and one that lasts to this day among all classes of the reservation Iroquois. A few others endeavored to expose the prophet but this action only created a large faction that stood strongly for him.

Whatever may be the merits of the prophet's teachings, they created a revolution in Iroquois religious life. With the spread of his doctrines the older religious system was overturned until today it is to be doubted that a single adherent remains. Handsome Lake's followers were few at first. He was despised, ridiculed and subject to bodily insults. Certain failures to live up to a preconceived idea of what a prophet should be caused a continual persecution. Cornplanter, his half brother, continually harassed him, as may be seen in the relation. Some of his failures, real or fancied, caused calumny to be heaped upon him and they are current today among those inclined to scoff. It is said that he learned his ideas of morality from his nephew, Henry Obail (Abeal), who had been at school in Philadelphia. Henry, it is said, took him up in the mountains and explained the Christain Bible to him, thus giving him the idea of devising the Gai′wiio‘. Other tales are that he failed to find the great serpent in the bed of the Allegany river though he pretended to locate it and charge it with having spread disease among the people, and that he erected an idol on an island in the river, a thing which from more authentic accounts he did not do.

Previous to his residence at Tonawanda he had lived ten years at Cornplanter's town and two years at Cold Spring. At the latter place he made so many enemies that he resolved to leave with his followers. This was in about 1812. With him went his chief followers and his family, among them his grandson Sos′hēowă who later became his successor.

Sos′hēowă was born in 1774 in the old town of Ganowa′gēs, the home of both Cornplanter and Handsome Lake. Lewis H. Morgan, who knew him well, describes him as "an eminently pure and virtuous man . . . devoted . . . to the duties of his office, as the spiritual guide and teacher of the Iroquois."

Morgan gives a full account of the recitation of Sosehawa at the mourning council at Tonawanda in 1848[1] and credits the translation to Sosehawa's grandson, Ely S. Parker (Ha-sa-no-an-da).[2]

During the prophet's four years' stay at Tonawanda he became many times discouraged, "reluctant to tell," and though the people gradually became more friendly, he seemed loath at times to proclaim his revelations. Some Christian Indians have explained this as caused by an uneasy conscience that came with greater knowledge of the white man's religion but there is no evidence of this. During this stay he was invited to visit the Onondaga and this he did, though according to his visions it necessitated the singing of his "third song," which meant that he should die. In a vision which he related he saw the four messengers who said "They have stretched out their hands pleading for you to come and they are your own people at Onondaga" (section 122).

When the word was given, Handsome Lake with a few chosen followers started to walk to Onondaga. His prediction of his own death, however, caused many more to join the party when it became definitely known he had started. The first camping spot mentioned is at the old village, Gano^{n}′wa′gēs. Here upon retiring he commanded the company to assemble "early in the morning." At the morning gathering he announced a vision. It had been of a pathway covered with grass. At the next camp, at Ganundasa′ga, his vision was of a woman speaking. On the borders of Onondaga he discovered that he had lost a favorite knife and went back to find it. He was evidently much depressed and approached Onondaga with a reluctance that almost betokened fear. Upon his arrival he

[1] Morgan, League, p. 233, Rochester, 1851.

[2] Later known as Dionĭ′hogä′wĕ, *Door Keeper*, a sachem of the Seneca. Parker was Morgan's collaborator in writing the League of the Iroquois.

was unable to address the people because of his distress, so that it was said, " Our meeting is only a gathering about the fireplace." A game of lacrosse was played to cheer him but he could only respond to the honor by saying: " I will soon go to my new home. Soon will I step into the new world for there is a plain pathway before me leading there." He repaired to his cabin at the foot of the hill, in sight of the council house and there after a most distressing illness " commenced his walk " over the path that had appeared before him. He was buried under the council house with impressive ceremonies and his tomb may still be seen though the house has been removed. A granite monument, erected by the Six Nations, marks his resting place.

Handsome Lake lived to see his people divided into two factions, one that clung to the old order and one that followed him. After his death the older order gradually faded out of existence, either coming over to the New Religion or embracing Christianity. Thus by the time of the Civil War in 1861 there were only the two elements, the Christians and the followers of Handsome Lake. They stand so arrayed today but with the " new religionists " gradually diminishing in number. The force of Handsome Lake's teaching, however, is still felt and affects in some way all the New York reservations, except perhaps St Regis.

Handsome Lake as the founder of a religious system occupied such a position that his followers place implicit confidence in that system whatever his personal weaknesses and failures may have been.

" He made mistakes," said Chief Cornplanter, " many mistakes, so it is reported, but he was only a man and men are liable to commit errors. Whatever he did and said of himself is of no consequence. What he did and said by the direction of the four messengers is everything — it is our religion. Ganiodaiio was weak in many points and sometimes afraid to do as the messengers told him. He was almost an unwilling servant. He made no divine claims, he did not pose as infallible nor even truly virtuous. He merely proclaimed the Gai'wiio' and that is what we follow, not him. We do not worship him, we worship one great Creator. We honor and revere our prophet and leader, we revere the four messengers who watch over us — but the Creator alone do we worship." Such is the argument of his followers.

PRESENT EFFECTS OF HANDSOME LAKE'S TEACHING

There is no record of Handsome Lake's visiting Tuscarora, Oneida or St Regis. The result is that these reservations contain only Indians who are nominally Christian. The Oneida are virtually citizens, the Tuscarora as capable of being so as any community of whites, and the St Regis progressive enough not only to use all their own lands but to rent from the whites. Their "Indianess" is largely gone. They have no Indian customs though they are affected by Indian folk-thought and exist as Indian communities, governing themselves and receiving annuities. Their material culture is now largely that of the whites about them and they are Indians only because they dwell in an Indian reservation, possess Indian blood and speak an Iroquois dialect.

In contrast to these reservations where the Indian has become "whitemanized" stand out the reservations of the Seneca and Onondaga. On the latter the folk-ways and the "Indian way of thinking" struggle with the white man's civilization for supremacy. The Indian of the old way is arrayed against the Indian of the new way. The conservative Indian calls his Christian brother a traitor to his race, a man ashamed of his ancestors, a man who condones all the wrongs the white man has done his people, and a man who is at best an imitator and a poor one. On the other hand the Christain Indian calls his "feather wearing" (Adĭstowäe') brother, "a blind man in the wilderness," a nonprogressive, behind the times, a man hopelessly struggling against fate, a heathen and a pagan. Even so, the followers of Handsome Lake constitute an influential element and the other Indians are affected by their beliefs whether they are willing or not. As was remarked in the beginning, Handsome Lake crystallized as a social unit the people whom he taught and those who follow him today constitute a unit that holds itself at variance with the social and accepted economic systems of the white communities about them. They assert that they have a perfect right to use their own system. They argue that the white man's teachings are not consistent with his practice and thus only one of their schemes for deceiving them. They assert that they wish to remain Indians and have a right to be so and to believe their own prophet. They are largely instrumental in conserving the systems peculiarly Indian and though they are a minority they control a majority of the offices in the nations to which they belong. Among the Onondaga and Tonawanda Seneca they hold most of the offices. In connection with the Allegany and Cattaraugus Seneca I use the word control, advisedly, since there may be times when the majority of councilors may be of the Christian party. Even so, the "conservative" party controls enough to maintain the system that they deem right.

When their poverty is urged as an argument against their religion and social system they assert that the true follower of the prophet will be poor and suffer much in this world but that his condition in the "new world above the sky" will be in direct contrast. They therefore esteem poverty, lowly surroundings and sickness as a sure indication of a rich heavenly reward and point to the better material surroundings and wealth of their brethren of the white man's way as an evidence that the devil has bought them.

The writer of this sketch has no complaint against the simple folk who have long been his friends. For a greater portion of his lifetime he has mingled with them, lived in their homes and received many honors from them. He has attended their ceremonies, heard their instructors and learned much of the old-time lore. Never has he been more royally entertained than by them, never was hospitality so genuine, never was gratitude more earnest, never were friends more sincere. There is virtue in their hearts and a sincerity and frankness that is refreshing. If only there were no engulfing "new way" and no modern rush, no need for progress, there could scarcely be a better devised system than theirs. It was almost perfectly fitted for the conditions which it was designed to meet, but now the new way has surrounded them, everything which they have and use in the line of material things, save a few simple maize foods and their ceremonial paraphernalia, is the product of the white man's hand and brain. The social and economic and moral order all about them is the white man's, not theirs. How long can they oppose their way to the overwhelming forces of the modern world and exist? How long will they seek to meet these overwhelming forces with those their ancestors devised but devised not with a knowledge of what the future would require? My Indian friends will answer, "Of these things we know nothing; we know only that the Great Ruler will care for us as long as we are faithful." Asked about the clothes they wear, the houses they live in, the long house they worship in, they reply, "All these things may be made of the white man's material but they are outside things. Our religion is not one of paint or feathers; it is a thing of the heart." That is the answer; it is a thing of the heart — who can change it?

HOW THE WHITE RACE CAME TO AMERICA AND WHY THE GAIWIIO BECAME A NECESSITY

RELATED BY SO-SON-DO-WA

Now this happened a long time ago and across the great salt sea, odji'ʼke'dāgi'ga, that stretches east. There is, so it seems, a world there and soil like ours. There in the great queen's country where swarmed many people — so many that they crowded upon one another and had no place for hunting — there lived a great queen. Among her servants was a young preacher of the queen's religion, so it is said.

Now this happened. The great queen requested the preacher to clean some old volumes which she had concealed in a hidden chest. So he obeyed and when he had cleaned the last book, which was at the bottom of the chest, he opened it and looked about and listened, for truly he had no right to read the book and wanted no one to detect him. He read. It was a great book and told him many things which he never knew before. Therefore he was greatly worried. He read of a great man who had been a prophet and the son of the Great Ruler. He had been born on the earth and the white men to whom he preached killed him. Now moreover the prophet had promised to return and become the King. In three days he was to come and then in forty to start his kingdom. This did not happen as his followers had expected and so they despaired. Then said one chief follower, "Surely he will come again sometime, we must watch for him."

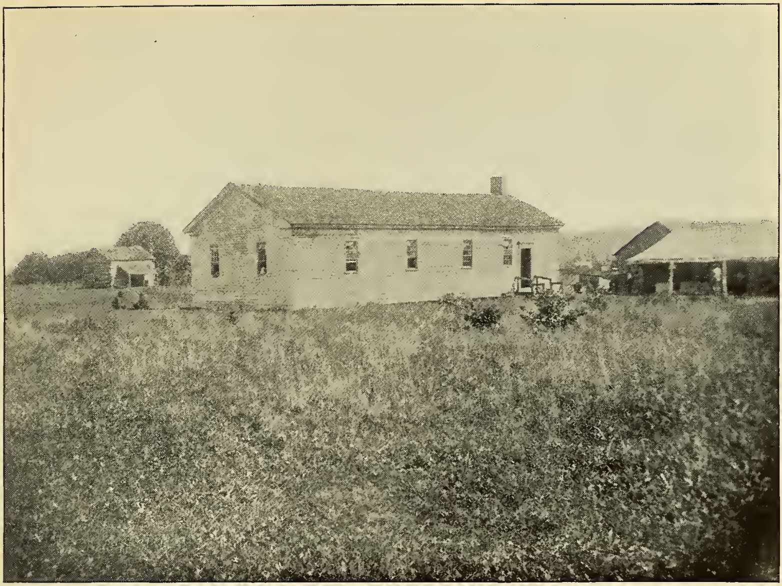
Then the young preacher became worried for he had discovered that his god was not on earth to see. He was angry moreover because his teachers had deceived him. So then he went to the chief of preachers and asked him how it was that he had deceived him. Then the chief preacher said, "Seek him out and you will find him for indeed we think he does live on earth." Even so, his heart was angry but he resolved to seek.

On the morning of the next day he looked out from the opening of his room and saw out in the river a beautiful island and he marveled that he had never seen it before. He continued to gaze and as he did he saw among the trees a castle of gold and he marveled that he had not seen the castle of gold before. Then he said, "So beautiful a castle on so beautiful an isle must indeed be the

Plate 2

So-son-do-wa or Edward Cornplanter, the Seneca teacher of Handsome Lake's Code

Plate 3



The Newtown Long House, Cattaraugus reservation. Chief Cornplanter lives near by.

Photo by George W. Kellogg

The Tonawanda Seneca Long House, near Akron, N. Y.

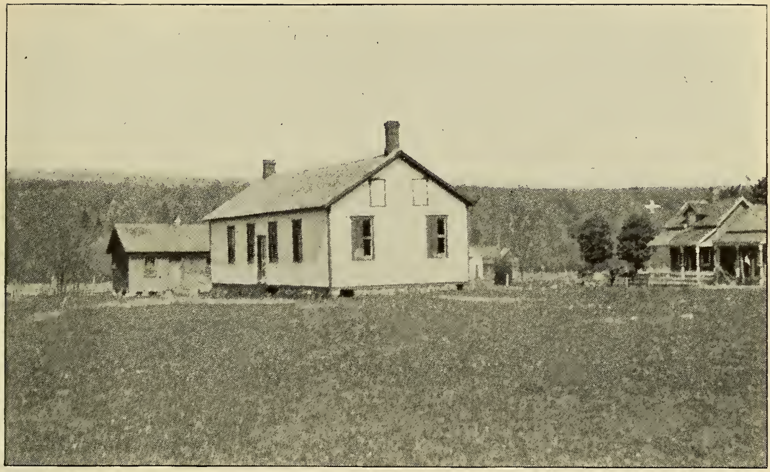
Plate 4

A typical family of the Seneca branch of the "vanishing race"

Photos by M. R. Harrington

A typical family at Newtown, Cattaraugus reservation. These people are all followers of Handsome Lake.

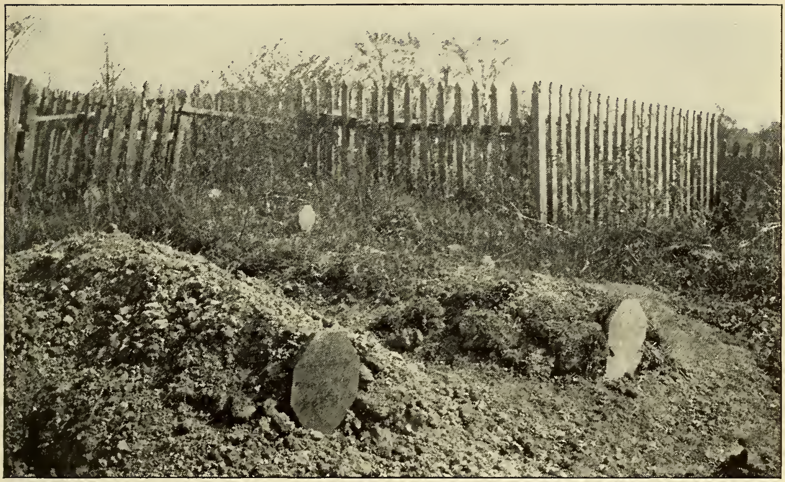
Plate 5



Onondaga Long House, Onondaga reservation. The Prophet's tomb is just below the spot marked +

The Long House at Pine Woods, Cattaraugus

Plate 6



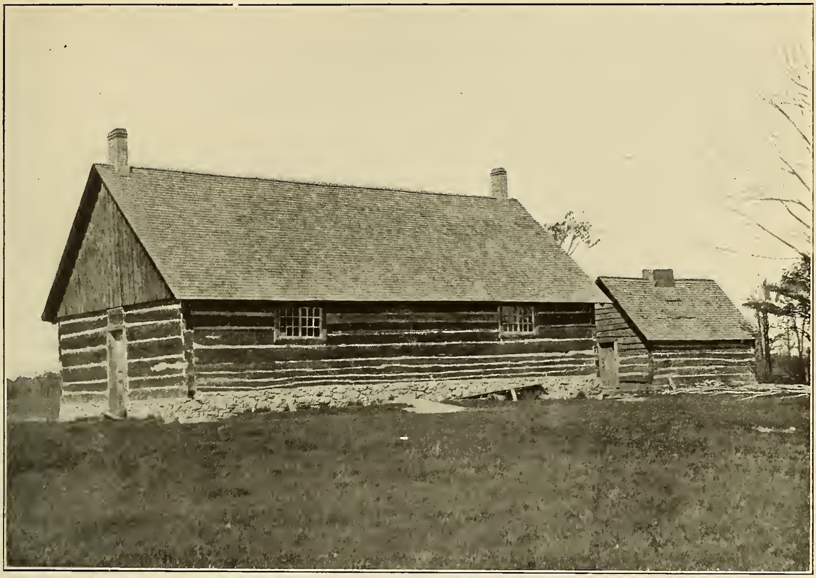
Graves near the Onondaga Long House near Six Nations, P. O. Ontario. In the lower right corner the charred embers of the grave fire may be seen.

One end of the upper Cayuga Long House near Ohsweken, Ont. Note the Feast Lodge in the rear.

Plate 7

Seneca Long House on Six Nations reservation, Brant county, Ontario

Plate 8



Long House of the Canadian Onondaga, Grand River reservation. It is here that the feasts and thanksgivings for the products of the fields are held by the Canadian Onondaga.

Environs of the Cayuga Long House, Grand River, Ontario, Canada

Plate 9

Tomb of Handsome Lake, near Onondaga council house

abode of him whom I seek." Immediately he put on his clothes and went to the men who had taught him and they wondered and said, "Indeed it must be as you say." So then together they went to the river and when they came to the shore they saw that it was spanned by a bridge of shining gold. Then one of the great preachers fell down and read from his book a long prayer and arising he turned his back upon the island and fled for he was afraid to meet the lord. Then with the young man the other crossed the bridge and he knelt on the grass and he cried loud and groaned his prayer but when he arose to his feet he too fled and would not look again at the house — the castle of gold.

Then was the young man disgusted and boldly he strode toward the house to attend to the business which he had in mind. He did not cry or pray and neither did he fall to his knees for he was not afraid. He knocked at the door and a handsome smiling man welcomed him in and said, "Do not be afraid of me." Then the smiling man in the castle of gold said, "I have wanted a young man such as you for some time. You are wise and afraid of nobody. Those older men were fools and would not have listened to me (direct) though they might listen to some one whom I had instructed. Listen to me and most truly you shall be rich. Across the ocean that lies toward the sunset is another world and a great country and a people whom you have never seen. Those people are virtuous, they have no unnatural evil habits and they are honest. A great reward is yours if you will help me. Here are five things that men and women enjoy; take them to these people and make them as white men are. Then shall you be rich and powerful and you may become the chief of all great preachers here."

So then the young man took the bundle containing the *five things* and made the bargain. He left the island and looking back saw that the bridge had disappeared and before he had turned his head the castle had gone and then as he looked the island itself vanished.

Now then the young man wondered if indeed he had seen his lord for his mind had been so full of business that he had forgotten to ask. So he opened his bundle of five things and found a flask of rum, a pack of playing cards, a handful of coins, a violin and a decayed leg bone. Then he thought the things very strange and he wondered if indeed his lord would send such gifts to the people across the water of the salt lake; but he remembered his promise.

The young man looked about for a suitable man in whom to confide his secret and after some searching he found a man named Columbus and to him he confided the story. Then did Columbus secure some big canoes and raise up wings and he sailed away. He sailed many days and his warriors became angry and cried that the chief who led them was a deceiver. They planned to behead him but he heard of the plan and promised that on the next day he would discover the new country. The next morning came and then did Columbus discover America. Then the boats turned back and reported their find to the whole world. Then did great ships come, a good many. Then did they bring many bundles of the five things and spread the gifts to all the men of the great earth island.

Then did the invisible man of the river island laugh and then did he say, " These cards will make them gamble away their wealth and idle their time; this money will make them dishonest and covetous and they will forget their old laws; this fiddle will make them dance with their arms about their wives and bring about a time of tattling and idle gossip; this rum will turn their minds to foolishness and they will barter their country for baubles; then will this secret poison eat the life from their blood and crumble their bones." So said the invisible man and he was Hanĭsse′ono, the evil one.

Now all this was done and when afterward he saw the havoc and the misery his work had done he said, " I think I have made an enormous mistake for I did not dream that these people would suffer so." Then did even the devil himself lament that his evil had been so great.

So after the swarms of white men came and misery was thrust upon the Ongwe-oweh the Creator was sorry for his own people whom he had molded from the soil of the earth of this Great Island, and he spoke to his four messengers and many times they tried to tell right men the revelations of the Creator but none would listen. Then they found our head man sick. Then they heard him speak to the sun and to the moon and they saw his sickness. Then they knew that he suffered because of the cunning evils that Hanĭsse′ono had given the Ongwe-oweh. So then they knew that he was the one. He was the one who should hear and tell Gai′wiio‘. But when Ganio‘dai′io‘ spoke the evil being ceased his lament and sought to obstruct Gai′wiio‘, for he claimed to be master.

The Gai'wiio' came from Hodiänok'doo^{n} Hĕd'iohe', the Great Ruler, to the Hadiöyă''geono^{n}, the four messengers. From them it was transmitted to Ganio'dai'io', Handsome Lake who taught it to Ṡkandyo^{n}''gwadĭ (Owen Blacksnake) and to his own grandson, Sos'heowă (James Johnson). Blacksnake taught it to Henry Stevens (Ganishando), who taught it to Soson'dowa, Edward Cornplanter. "So I know that I have the true words and I preach them," adds Cornplanter.

NOW THIS IS GAIWIIO

The beginning was in Yai'ʹkni [May], early in the moon, in the year 1800.

It commences now.

A TIME OF TROUBLE

The place is[1] Ohi'io' [on the Allegany river], in Diono'sade'gĭ [Cornplanter village].

Now it is the harvest time, so he[2] said.

Now a party of people move. They go down in canoes the Allegany river. They plan to hunt throughout the autumn and the winter seasons.

Now they land at Ganowoñ'go^n [Warren, Pa.] and set up camp.

The weather changes and they move again. They go farther down the river. The ice melts opening up the stream and so they go still farther down. They land at Diondēgă [Pittsburgh]. It is a little village of white people [literally, " our younger brethren "[3]]. Here they barter their skins, dried meat and fresh game for strong drink. They put a barrel of it in their canoes. Now all the canoes are lashed together like a raft.

Now all the men become filled with strong drink (gonigä'nongi). They yell and sing like demented people. Those who are in the middle canoes do this.[4]

Now they are homeward bound.

Now when they come to where they had left their wives and children these embark to return home. They go up Cornplanter creek, Awe'gäo^n.

Now that the party is home the men revel in strong drink and are very quarrelsome. Because of this the families become frightened and move away for safety. So from many places in the bushlands camp fires send up their smoke.

Now the drunken men run yelling through the village and there is no one there except the drunken men. Now they are beastlike

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[1] The present tense is always used by Chief Cornplanter.

[2] The narrator, Handsome Lake.

[3] The Seneca term is Honio''o^n', meaning " our younger brother."

[4] The intoxicated men were put in the middle canoes to prevent their jumping into the water. The more sober men paddled from the outer canoes. This debauchery was common among the Six Nations at the beginning of the 19th century.

Plate 10

From a drawing by Jesse Cornplanter

The "Time of Trouble" at Cornplanter's village. (See p. 20.)

and run about without clothing and all have weapons to injure those whom they meet.

Now there are no doors left in the houses for they have all been kicked off. So, also, there are no fires in the village and have not been for many days. Now the men full of strong drink have trodden in the fireplaces. They alone track there and there are no fires and their footprints are in all the fireplaces.

Now the dogs yelp and cry in all the houses for they are hungry.

So this is what happens.[1]

THE SICK MAN

And now furthermore a man becomes sick. Some strong power holds him.

Now as he lies in sickness he meditates and longs that he might rise again and walk upon the earth. So he implores the Great Ruler to give hi n strength that he may walk upon this earth again. And then he thinks how evil and loathsome he is before the Great Ruler. He thinks how he has been evil ever since he had strength in this world and done evil ever since he had been able to work. But notwithstanding, he asks that he may again walk.

So now this is what he sang: O'gi'we,[2] Ye'ondă'thă,[3] and Gone'owo^{n}.[4] Now while he sings he has strong drink with him.

Now it comes to his mind that perchance evil has arisen because of strong drink and he resolves to use it nevermore. Now he continually thinks of this every day and every hour. Yea, he continually thinks of this. Then a time comes and he craves drink again for he thinks that he can not recover his strength without it.

Now two ways he thinks: what once he did and whether he will ever recover.

THE TWO WAYS HE THINKS

Now he thinks of the things he sees in the daylight.

The sunlight comes in and he sees it and he says, "The Creator made this sunshine." So he thinks. Now when he thinks of the sunshine and of the Creator who made it he feels a new hope within him and he feels that he may again be on his feet in this world.

Now he had previously given up hope of life but now he begs to see the light of another day. He thinks thus for night is coming.

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[1] See plate 10.

[2] The Death chant.

[3] The Women's song.

[4] The Harvest song, see p. 95.

So now he makes an invocation that he may be able to endure the night.

Now he lives through the night and sees another day. So then he prays that he may see the night and it is so. Because of these things he now believes that the Great Ruler has heard him and he gives him thanks.

Now the sick man's bed is beside the fire. At night he looks up through the chimney hole and sees the stars and he thanks the Great Ruler that he can see them for he knows that he, the Creator, has made them.[1]

Now it comes to him that because of these new thoughts he may obtain help to arise from his bed and walk again in this world. Then again he despairs that he will ever see the new day because of his great weakness. Then again he has confidence that he will see the new day, and so he lives and sees it.

For everything he sees he is thankful. He thinks of the Creator and thanks him for the things he sees. Now he hears the birds singing and he thanks the Great Ruler for their music.

So then he thinks that a thankful heart will help him.

Now this man has been sick four years but he feels that he will now recover.

And the name of the sick man is Ganio'dai'io'[2] a council chief [Hoya'ne].

THE STRANGE DEATH OF THE SICK MAN

Now at this time the daughter of the sick man and her husband are sitting outside the house in the shed and the sick man is within alone. The door is ajar. Now the daughter and her husband are cleaning beans for the planting. Suddenly they hear the sick man exclaim, "Niio'!"[3] Then they hear him rising in his bed and they think how he is but yellow skin and dried bones from four years of sickness in bed. Now they hear him walking over the floor toward the door. Then the daughter looks up and sees her father coming out of doors. He totters and she rises quickly to catch him but he falls dying. Now they lift him up and carry him back within the house and dress him for burial.

Now he is dead.

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[1] See plate 11.

[2] Handsome Lake, one of the fifty hereditary sachems, or lords. Hoya'ne means, *perfect one* or *noble*, and is translated *lord* by the Canadian Six Nations. See Hale, Book of Rites, p. 31, footnote.

[3] Meaning, *So be it*.

THE PEOPLE GATHER ABOUT THE DEAD MAN

Then the daughter says to her husband, "Run quickly and notify his nephew, Tää'wŏnyăs,[1] that he who has lain so many years in bed has gone. Bid him come immediately."

So the husband runs to carry the message to Tää'wŏnyăs. And Tää'wŏnyăs says, "Truly so. Now hasten to Gaiänt'wakă,[2] the brother of the dead man and say that he who lay sick for so many years is dead. So now go and say this."

So the husband goes alone to where Gaiänt'wakă lives and when he has spoken the wife says, "Gaiänt'wakă is at the island planting." So he goes there and says, "Gaiänt'wakă your brother is dead. He who was sick for so many years is dead. Go at once to his bed."

Then Gaiänt'wakă answers, "Truly, but first I must finish covering this small patch of seed. Then when I hoe it over I will come."

Now he who notifies is Hătgwi'yot, the husband of the daughter of Ganio'dai'io'. So now he returns home.

Now everyone hearing of the death of the sick man goes to where he lies.

Now first comes Tää'wŏnyăs. He touches the dead man on every part of his body. Now he feels a warm spot on his chest and then Tää'wŏnyăs says, "Hold back your sadness, friends," for he had discovered the warm spot and because of this he tells the people that perhaps the dead man may revive. Now many people are weeping and the speaker sits down by his head.

Now after some time Gaiänt'wakă comes in and feels over the body of the dead and he too discovers the warm spot but says nothing but sits silently down at the feet of the dead man.

And for many hours no one speaks.

Now it is the early morning and the dew is drying. This is a time of trouble for he lies dead.

Now continually Tää'wŏnyăs feels over the body of the dead man. He notices that the warm spot is spreading. Now the time is noon and he feels the warm blood pulsing in his veins. Now his breath comes and now he opens his eyes.

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[1] Meaning, Needle or Awl Breaker, one of the fifty sachems.

[2] Meaning, Planter, commonly called Cornplanter, the half brother of Handsome Lake. See p. 136.

THE DEAD MAN REVIVES

Now Tää'wŏnyăs is spea[illegible] "Are you well? What think you? (Isege^{n}' onĕnt'gayei' [illegible]nesni'goĕ')?"

Now the people notice that the man is moving his lips as if speaking but no words come. Now this is near the noon hour. Now all are silent while Tää'wŏnyăs asks again, "My uncle, are you feeling well? (onigĕnt'gaiye')."

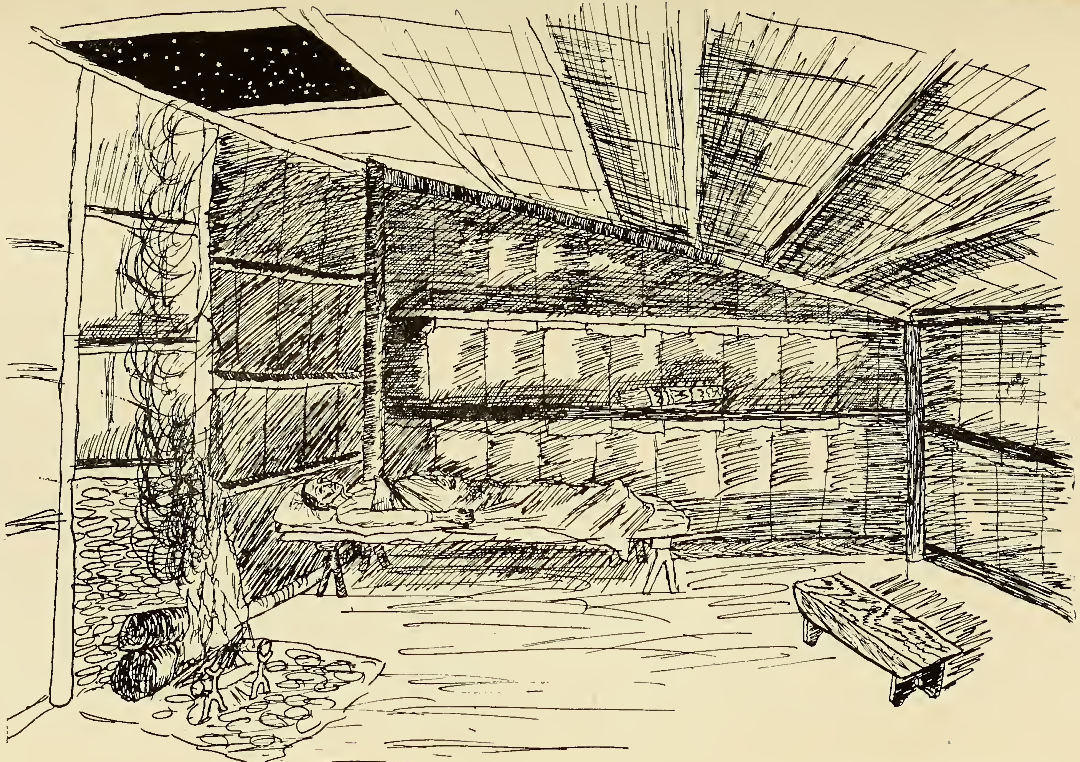
Then comes the answer, "Yes I believe myself well." So these are the first words Ganio'dai'io' spoke ("Iwi'' nai' o'nĕ't'gai'ye hĕ'' nekni'goĕ^{n})."

Now then he speaks again saying, "Never have I seen such wondrous visions! Now at first I heard some one speaking. Some one spoke and said, 'Come out awhile' and said this three times. Now since I saw no one speaking I thought that in my sickness I myself was speaking but I thought again and found that it was not my voice. So I called out boldly, 'Niio'!' and arose and went out and there standing in the clear swept space I saw three men clothed in fine clean raiment. Their cheeks were painted red and it seemed that they had been painted the day before. Only a few feathers were in their bonnets. All three were alike and all seemed middle aged. Never before have I seen such handsome commanding men and they had in one hand bows and arrows as canes. Now in their other hands were huckleberry bushes and the berries were of every color.

"Then said the beings, addressing me, 'He who created the world at the beginning employed us to come to earth. Our visit now is not the only one we have made. He commanded us saying "Go once more down upon the earth and [this time] visit him who thinks of me. He is grateful for my creations, moreover he wishes to rise from sickness and walk [in health] upon the earth. Go you and help him to recover."' Then said the messengers, 'Take these berries and eat of every color. They will give you strength and your people with us will help you rise.' So I took and ate the berries. Then said the beings, 'On the morrow we will have it that a fire will be in the bushes and a medicine steeped to give you strength. We will appoint Odjis'kwăthĕ^{n}[1] and Gayänt'gogwŭs,[2] a man and his wife, to make the medicine. Now they are the best of all the medicine people. Early in the morning we will see them and at that time you will have the medicine for your use, and before noon the unused medicine will be cast away because you will

[1] Dry Pudding. [2] Dipped Tobacco.

Plate 11



From a drawing by Jesse Cornplanter

The sick man meditating. (See p. 21.)

have recovered. Now moreover before noon many people will gather at the council house. These people will be your relatives and will see you. They will have gathered the early strawberries[1] and made a strawberry feast, and moreover will have strawberry wine sweetened with sugar. Then will all drink the juice of the berry and thank the Creator for your recovery and moreover they severally will call upon you by your name as a relative according as you are.'

"Now when the day came I went as appointed and all the people saw me coming and it was as predicted."

THE MESSAGE OF THE FOUR BEINGS

"Now the messengers spoke to me and said that they would now tell me how things ought to be upon the earth. They said: 'Do not allow any one to say that you have had great fortune in being able to rise again. The favor of the four beings is not alone for you and the Creator is willing to help all mankind.'

"Now on that same day the Great Feather[2] and the Harvest dances were to be celebrated and at this time the beings told me that my relatives would restore me. 'Your feelings and spirits are low,' they said, 'and must be aroused. Then will you obtain power to recover.' Verily the servants of the Creator (Hadio^{n}yă''geono^{n}) said this. Now moreover they commanded that henceforth dances of this same kind should be held and thanksgiving offered whenever the strawberries were ripe. Furthermore they said that the juice of the berry must be drunk by the children and the aged and all the people. Truly all must drink of the berry juice, for they said that the sweet water of the berries was a medicine and that the early strawberries were a great medicine. So they bade me tell this story to my people when I move upon the earth again. Now they said, 'We shall continually reveal things unto you. We, the servants of him who made us, say that as he employed us to come unto you to reveal his will, so you must carry it to your people. Now we are they whom he created when he made the world and our duty is to watch over and care for mankind. Now there are four of us but the fourth is not here present. When we called you by name and you heard, he returned to tell the news.

[1] The earliest of the wild strawberries are thought to be of great medicinal value and are eagerly eaten as soon as ripe. So sacred a plant is the strawberry that it is thought to grow along the "heaven road." A person recovering from a severe illness says, "I almost ate strawberries."

[2] The Osto'wä'gō'wā, the chief religious dance. See Morgan, p. 279.

This will bring joy into the heaven-world of our Creator. So it is that the fourth is not with us but you shall see him at another time and when that time is at hand you shall know. Now furthermore we must remind you of the evil things that you have done and you must repent of all things that you believe to have been evil. You think that you have done wrong because of O'gi'wē, Ye'ondă'thă and Gone'owo^{n}[1] and because you partook of strong drink. Verily you must do as you think for whatsoever you think is evil is evil.' "

GANIODAIIO COMMANDED TO PROCLAIM THE GAIWIIO

" 'And now behold! Look through the valley between two hills. Look between the sunrise and the noon!'

" So I looked, and in the valley there was a deeper hollow from which smoke was arising and steam as if a hot place were beneath.

" Then spoke the messengers saying, 'What do you see?'

" I answered, 'I see a place in the valley from which smoke is arising and it is also steaming as a hot place were beneath.'

" Then said the beings, 'Truly you have spoken. It is the truth. In that place a man is buried. He lies between the two hills in the hollow in the valley and a great message is buried with him. Once we commanded that man to proclaim that message to the world but he refused to obey. So now he will never rise from that spot for he refused to obey. So now to you, therefore, we say, proclaim the message that we give you and tell it truly before all people.'

" 'Now the first thing has been finished and it remains for us to uncover all wickedness before you.' So they said."

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1 See notes, p. 21.

THE GREAT MESSAGE

SECTION 1

"Now the beings spoke saying, 'We must now relate our message. We will uncover the evil upon the earth and show how men spoil the laws the Great Ruler has made and thereby made him angry.'

"'The Creator made man a living creature.'

"'Four words tell a great story of wrong and the Creator is sad because of the trouble they bring, so go and tell your people.'

"'The first word is One'ga'.[1] It seems that you never have known that this word stands for a great and monstrous evil and has reared a high mound of bones. Ga''nigoëntdo^{n}'tha, you lose your minds and one'ga' causes it all. Alas, many are fond of it and are too fond of it. So now all must now say, "I will use it nevermore. As long as I live, as long as the number of my days is I will never use it again. I now stop." So must all say when they hear this message.' Now the beings, the servants of the Great Ruler, the messengers of him who created us, said this. Furthermore they said that the Creator made one'ga' and gave it to our younger brethren, the white man, as a medicine but they use it for evil for they drink it for other purposes than medicine and drink instead of work and idlers drink one'ga'. No, the Creator did not make it for you."

So they said and he said. Eniā'iehŭk![2]

SECTION 2

"Now spoke the beings and said, 'We now speak of the second word. This makes the Creator angry. The word is Got'go^{n}'.[3]

[1] Whiskey or Rum.

[2] Eniā'iehŭk meaning, *It was that way.*

[3] A certain number of the Seneca Iroquois still cling to the belief in witchcraft although they are loath to admit it to any one in whom they have not implicit confidence. While they assert that witchcraft was introduced among them by some Algonquin tribe which they had adopted, their early legends and traditions contain many allusions to witches and witchcraft. There are at least two distinct methods employed by witches to accomplish their ends. The first, it is claimed, is the older way and is the employment

Witches are people without their right minds. They make disease and spread sickness to make the living die. They cut short the numbered days, for the Creator has given each person a certain number of days in which to live in this world.

" ' Now this must you do: When you have told this message and the witches hear it they will confess before all the people and will say, " I am doing this evil thing but now I cease it forever, as long as I live." Some witches are more evil and can not speak in public so these must come privately and confess to you, Handsome Lake, or a preacher of this Gai'wiio'. Now some are most evil and they must go far out upon an abandoned trail and there they must

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of what is described by informants as analogous to " malific mental suggestion," either verbal or telepathic. Such witches were able to assume the form of ancient monsters, the nia"gwahē or *mammoth bear* being the favorite form. They had power of transforming people into beasts, of imprisoning them within trees without destroying the human nature or sensibilities of their victims. Many stories are related of how chivalrous young men fresh from the dream fast were able to release the unhappy prisoners from the spells that bound them.

The second and modern class of witches work their evil spells by introducing into the bodies of their victims by supernatural means a small needle-like splinter pointed on either end and having a central eye to which was tied the hair of the witch, a splinter of bone from the fibula of a deer, a worm or some like object. Instances where such things have been drawn from bewitched persons are commonly reported.

A witch can work fearlessly and successfully as long as she remains unknown to the victim and under some circumstances even when known. A " witched " person is often able to see as in a vision the witch wherever she goes and is likewise able to tell when she is about to approach the house. Witches fear the threat of an angry person to kill them. Such a threat if an earnest one is an effectual charm against further annoyance. To burn the object that a witch has introduced into one's body will torture the witch and kill her. Such objects are not often burned. If revenge is desired the victim, if sufficiently angry, can throw the object through space and injure the witch wherever he wishes. A person who successfully resists and destroys another witch's power may become a witch if so desired.

To torture a witch, force a confession and exact a promise of repentance, take a living bird, black in color (a hen is now usually employed) and carry it into the woods at midnight. Here build a fire and then split open the bird's body, extract its beating heart and hang it by its chords over a small fire to roast slowly. The witch will then exert every possible means to reach the spot and beg that the heart be taken from the fire before it is consumed. At such a time any promise may be exacted, for the witch is powerless. If the heart is consumed the witch will die of a " burnt heart." Witch poison may be extracted by putting fine sifted ashes on the afflicted part and staying confess before the Creator alone. This course may be taken by witches of whom no one knows.

"'Now when they go they must say:

"Our Creator, O listen to me!
I am a miserable creature.
I think that way
So now I cease.
Now this is appointed
For all of my days,
As long as I live here
In this earth-world.
I have spoken."

"'In this manner all must say and say truly, then the prayer will be sufficient.'"

So they said and he said. Eniaiehuk.

SECTION 3

"Now the beings spoke again saying, 'This is the third word. It is a sad one and the Creator is very sad because of this third word. It seems that you have never known that a great pile of human bodies lies dead because of this word, Ono′ityi′yende, the nigă'hos′sää', the secret poisons in little bundles named Gawĕn-

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in bed until the poison comes out. The charm will then be found in the ashes. The spirits of great witches are able to return and possess another witch. A witch who has such a "friend" is especially favored, for in time of need the spirit-witch will direct her to money, goods or food. Witches do not always injure people who have offended them but more often their children or other near relatives. This is done that the person they desire to punish may see an innocent person suffer for their offense and so be tortured the more.

"Witch doctors" are of two classes: witches who are willing to pit their powers against other witches; and medicine men who have made a special study of the charms that will offset witch spells. This class may also be divided into two divisions, those who make a regular profession of dispelling witch influences, of discovering the cause of mysterious ailments, of extracting the object that causes the trouble and of identifying witches, and those who by reason of some special service they have rendered some spirit of nature have been rewarded with magical powers, great wisdom and immunity from malific influences. This class renders its services gratuitously. Small false faces worn on the person and frequent invocations of the Thunder spirit with liberal offerings of sacred tobacco are potent charms against witches. The False Face company has an annual ceremony in which witch spirits are expelled from the community. The I″dos company (q. v.) is said to be the survival of the older witch society introduced among the Seneca by the Nanticoke. Its members are reputed to possess magic powers.

nodŭs'hä (compelling charms[1]). Now the Creator who made us commands that they who do this evil, when they hear this message, must stop it immediately and do it nevermore while they live upon this earth-world. It matters not how much destruction they have wrought — let them repent and not fail for fear the Creator will not accept them as his own.' "

So they said and he said. Eniaiehuk.

SECTION 4

" ' Now another word. It is sad. It is the fourth word. It is the way Yondwi'nias swa'yas.[2]

" ' Now the Creator ordained that women should bear children.

" ' Now a certain young married woman had children and suffered much. Now she is with child again and her mother wishing to prevent further sufferings designs to administer a medicine to cut off the child and to prevent forever other children from coming.[3] So the mother makes the medicine and gives it. Now when she does this she forever cuts away her daughter's string of children. Now it is because of such things that the Creator is sad. He created life to live and he wishes such evils to cease. He wishes those who employ such medicines to cease such practices forevermore. Now they must stop when they hear this message. Go and tell your people.' "

So they said and he said. Eniaiehuk.

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[1] Charms. Should a person die holding a secret, one may discover it by sleeping upon the ground with a handful of the grave dirt beneath his head. Then, *if all conditions are perfect,* the dead person will appear in three successive visions and reveal its mystery.

A young man, wishing to become a swift runner, may add to his powers by concealing in his belt a bone from the grave of some celebrated runner of the past. It is said that most famous runners of the League carried these charms.

A warrior who wishes to guard against sudden attack from behind may make an unfailing charm by cutting three slits in the back of his neck and rubbing into the wounds the oil extracted from the scalps of enemies. A peculiar soft white flesh will fill up the cuts and when completely healed will protrude. Should an enemy then approach these protruding scars will quiver and warn the warrior of danger.

The most effective charm for drawing riches is the tooth of a nia'gwahē.

[2] Meaning "she cuts it off by abortion."

[3] The Iroquois knew of such an herb. I find it mentioned by Dr Peter Wilson, the Cayuga, and it was pointed out to me at Onondaga in 1911. The Seneca and Onondaga belief is that every woman has a certain number of children predestined to them and that they are fastened on a stringlike runner like tubers, or like eggs within a bird.

SECTION 6

" ' Now another message.

" ' Go tell your people that the Great Ruler is sad because of what people do.

" ' The Creator has made it so that the married should live together and that children should grow from them.

" 'Now it often happens that it is only a little while when people are married that the husband speaks evil of his wife because he does not wish to care for her children. Now a man who does that stirs up trouble with his wife and soon deserts her and his children. Then he searches for another woman and when he has found her he marries her. Then when he finds her with child he goes away from her and leaves her alone. Again he looks for another woman and when he has lived with her for a time and sees her growing large, he deserts her, the third woman.

" ' Now this is true. We, the messengers, saw him leave the two women and the Creator himself saw him desert the third and punished him. Now a sure torment in the after life is for him who leaves two women with child but the Creator alone knows what the punishment is for the man who leaves the third.' "

So they said and he said. Eniaiehuk.

SECTION 7

" ' Now another message.

" ' The Creator has ordered that man and wife should rear their children well, love them and keep them in health. This is the Creator's rule. We, the messengers, have seen both men and women desert each other when children come. The woman discovers that the man, her husband, loves his child and she is very jealous and spreads evil reports of him. She does this for an excuse before the world to leave him. Thus the messengers say that the Creator desires men and women to cease such mischief.' "

So they said and he said. Eniaiehuk.

SECTION 8

" ' Now another message.

" ' Tell your people that the Creator has ordered regular marriage customs. When the young people are old enough to marry, tell them so. When they marry they will live pleasantly. Now it may happen that the girl's mother discovers that she is very happy with her husband. Then she endeavors to make her daughter angry with her husband when he returns from a journey. But when the husband returns the young wife forgets the evil advice and greets him lovingly. Now the older woman, the mother, seeing this, speaks again hoping to stir up an ill feeling. Says the old woman, " My daughter, your spirits are dull, you are not bright. When I was young I was not so agreeable. I was harsh with my husband." Now the Creator is sad because of the tendency of old women to breed mischief. Such work must stop. Tell your people it must stop.' "

So they said and he said. Eniaiehuk.

SECTION 10

" ' Now another message to tell your people.

" ' The married often live well together for a while. Then a man becomes ugly in temper and abuses his wife. It seems to afford him pleasure. Now because of such things the Creator is very sad. So he bids us to tell you that such evils must stop. Neither man nor woman must strike each other.' So they said.

" Now furthermore they said, ' We will tell you what people must do. It is the way he calls best. Love one another and do not strive for another's undoing. Even as you desire good treatment, so render it. Treat your wife well and she will treat you well.' "

So they said and he said. Eniaiehuk.

SECTION 11

" ' Now another message to tell your people.

" ' This concerns short marriages.

" ' Now some live together peaceably and keep the family as should be. Then after a time the man resolves to go off on a hunting excursion in the woods for a certain number of days. So he goes, having agreed with his wife about it. All is well and he returns with a load of game. He feels well and thinks he is doing well in thus providing for his family. On his way homeward he meets some one who tells him that in his absence his wife has been living with another man. When he hears this report he feels sad and angry. He refuses to go to his home and turns from his path and goes to his relatives. Now whoever makes mischief of this kind does a great wrong before the Creator. So he bids his people to forever stop such evil practices.' "

So they said and he said. Eniaiehuk.

SECTION 12

" ' Now another message.

" ' Now this concerns both husband and wife. Now it may happen that a man and wife live together happily. At length the man thinks that he will go to another settlement to visit relatives there. His wife agrees and he goes. Now when he gets to the village he induces some agreeable woman to live with him saying he is single. Then after some time the man goes back to his own family. His wife treats him cordially as if no trouble had occurred. Now we, the messengers, say that the woman is good in the eyes of her Creator and has a place reserved for her in the heaven-world. Now the woman knew all that had been done in the other settlement but she thought it best to be peaceful and remain silent. And the Creator says that she is right and has her path toward the heaven-world, but he, the man, is on his way to the house of the Wicked One.' "

So they said and he said. Eniaiehuk.

SECTION 13

" ' Now another message.

" ' This concerns a certain thing that human creatures follow. It is concerning gakno'we'haat. Some men desire constant new experience, that is some men are always following yē'o^{n}'. Now it is a great evil for men to have such desires. This is a thing that the so sinful must confess. A man who desires to know gagwēgo^{n} yē'o^{n}'sho' will never be satisfied, for yē'o^{n}' will arise whom he can not know and he will fall flat. Now we, the messengers, say that all this is sinful and men must not follow such desires.' "

So they said and he said. Eniaiehuk.

SECTION 14

" ' Now another message.

" ' This is what your people do.

" ' An old woman punished her children [1] unjustly. The Creator is sad because of such things and bids us tell you that such practices must cease.' So they said.

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[1] Handsome Lake was ever the lover and champion of children. There are many instances in the Gaiwiio relating to the care and rearing of children. The mode of punishment here referred to was one of long usage. Sometimes the mother would fill her mouth with water and blow it into the face of the little offender, repeating until obedience was enforced. Punishment by violence as by whipping or striking was discountenanced. The mother

" 'Now this is the way ordained by the Creator: Talk slowly and kindly to children and never punish them unjustly. When a child will not obey let the mother say, " Come to the water and I will immerse you." If after this warning the child is still obstinate she must take it to the water's edge and say, " Do you now obey? " and she must say so again and if at the third time there is no obedience then the child must be thrust in the water. But if the child cries for mercy it must have it and the woman must not throw it into the water. If she does she does evil.' "

So they said and he said. Eniaiehuk.

SECTION 15

" 'Now another message of things not right.

" 'Parents disregard the warnings of their children. When a child says, " Mother, I want you to stop wrongdoing," the child speaks straight words and the Creator says that the child speaks right and the mother must obey. Furthermore the Creator proclaims that such words from a child are wonderful and that the mother who disregards them takes the wicked part. The mother may reply, " Daughter, stop your noise. I know better than you. I am the older and you are but a child. Think not that you can influence me by your speaking." Now when you tell this message to your people say that it is wrong to speak to children in such words.' "

So they said and he said. Eniaiehuk.

SECTION 16

" 'Now another message.

" 'Tell your people that the Creator is sad because of what they are doing.

" 'Some people live together well as man and wife and family, but the man of the family uses strong drink. Then when he comes home he lifts up his child to fondle it and he is drunk. Now we, the messengers of the Creator, say that this is not right for if a man filled with strong drink touches his child he burns its blood. Tell your people to heed this warning.' "

So they said and he said. Eniaiehuk.

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who was intrusted with the care of children was accustomed to tell her children what was wrong and allow them by experience to know that her word was to be relied upon. A boy remained under the discipline of his mother until the age of sixteen when he was turned over to the training of his father. If the boy was unruly and without ambition the mother received the blame and was sometimes punished.

SECTION 17

"'Now another message.

"'Some people live together righteously as man and wife according as the Creator ordained, but they have no child. When this is so let this be the way: If the wife's sister has children, of these let the wife without issue take from one to three and rear them and thereby fulfil her duty to the Creator. Moreover when a woman takes children she must rear them well as if born of herself. We, the messengers, say that you must tell this to your people.'"

So they said and he said. Eniaiehuk.

SECTION 18

"'Now another message.

"'Tell your people that ofttimes when a woman hears that a child is born and goes to see it, she returns and says in many houses where she stops that its mother's husband is not its father. Now we say that it is exceedingly wrong to speak such evil of children. The Creator formed the children as they are; therefore, let the people stop their evil sayings.'"

So they said and he said. Eniaiehuk.

SECTION 19

"'Now another message.

"'Now the Creator of mankind ordained that people should live to an old age. He appointed that when a woman becomes old she should be without strength and unable to work.[1] Now the Creator says that it is a great wrong to be unkind to our grandmothers. The Creator forbids unkindness to the old. We, the messengers, say it. The Creator appointed this way: he designed that an old woman should be as a child again and when she becomes so the Creator wishes the grandchildren to help her, for only because she is, they are. Whosoever does right to the aged does right in the sight of the Creator.'"

So they said and he said. Eniaiehuk.

(So many words, Odi'waga''de, end of first day's preaching)

Recitation of the second day

SECTION 20

"'Now another message.

"'A way that was followed.

[1] The wisdom of the aged, especially upon ceremonial matters, was never questioned.

" 'Sometimes a mother is ready to feed her family. When she is ready to bid them sit down, she glances out and sees some one coming and straightway hides the food. A woman visitor comes in. Now after some conversation the visitor says she is unwell and goes out. Then the family commences to eat. And the Creator says that who follow such tricks must repent as soon as they hear this message, for such practices are most wicked.' "

"Now the messengers said this."

" 'Now the Creator made food for all creatures and it must be free for all. He ordained that people should live in communities. Now when visitors enter a lodge the woman must always say, "Sede′konĭ′," *come eat*. Now it is not right to refuse what is offered. The visitor must take two or three bites at least and say, "Niawĕ^{n}′." Tell this to all your people.' "

So they said and he said. Eniaiehuk.

SECTION 21

" 'Now another message.

" 'Now this is right.

" 'When a woman hears children playing near her lodge she must call them in and ask them to eat. The Creator says that this is right for some children are of poor parents and have little to eat. The Creator loves poor children and whosoever feeds the poor and unfortunate does right before him.' "

So they said and he said. Eniaiehuk.

SECTION 22

" 'Now another message.

" 'When a woman sees an unfortunate girl who has neither parents nor settled home and calls her in and helps her repair her clothing, cleanse herself and comb her hair, she does right and has favor in the sight of her Creator. He loves the poor and the woman does right before him. So we, the messengers, say that you must tell your people to continue to do this good thing.' "

So they said and he said. Eniaiehuk.

SECTION 23

" 'Now another message.

" 'The Creator is sad because of the sins of the beings that he created.

" 'He ordained that mankind should live as social beings in communities.

" 'Now it may happen that a woman sets out to destroy good feelings between neighbors by telling go'diodia'se (stories that augment by repetition). Now this woman goes to a house and says, "I love you and because I do I will tell you a secret. The woman in the next house speaks evil of you." Now heretofore the two women had been friends but upon hearing this story the woman becomes an enemy of her former friend. Then the evil story-teller goes to the woman whom she lied about and tells her the hard words that the other woman has spoken. Then is the liar happy having started a feud, and she hastens from house to house to tell of it. Now great troubles arise and soon a fight, and one woman causes it all. Therefore the Creator is very sad. Tell your people that such things must stop the moment this message is told.

" 'Now the Creator has ordained another way. He has ordained that human creatures should be kind one to the other and help each other. When a woman visits another house she must help at the work in progress and talk pleasantly. If she relates jokes they must always be upon herself. If she speaks harshly of others the woman of the house must say, "I remember the desires of our Creator. I can not hear what you say. I can not take that evil story." So the trouble is ended there. Now the Creator says that the woman is true who refuses to hear evil reports. She cuts off the evil at its beginning and it does not go from her. So she has won favor before the Creator.' "

So they said and he said. Eniaiehuk.

SECTION 24

" 'Now another message.

" 'The Creator who made you is sad.

" 'The Creator made every person with a different face.

" 'Now a man talks saying that he is far more handsome than other men. He boasts that he is exceedingly handsome and grand. But the Creator says all this is very wrong. The vain must repent and never boast again.' So they said.

" 'Now animals seem alike to you. A wild animal that you have once seen you can not easily say you have seen again. But people are different before you. Now when a man is handsome let him thank his Creator for his comliness.' So they said.

" 'Now furthermore a man says "I am the strongest man of all. There is no one who can throw me to the ground." A man who talks thus is a boaster before the people. Now the Creator says that such boasting is evil. The Creator endowed the man with strength and therefore he should not boast but thank the giver who is the Creator. So tell your people these things.' So they said.

" 'Now furthermore a man says, " I am the swiftest runner of the world. No one can outrun me." Now he regards himself as a mighty man and boasts before his people. Now the Creator says that such boasting is evil. The Creator endowed the man with his speed and he should offer thanks and not boast. So we, the messengers, say your people must cease their boasting.' "[1]

So they said and he said. Eniaiehuk.

SECTION 25

" 'Now another message.

" 'Three things that our younger brethren (the white people) do are right to follow.

" 'Now, the first. The white man works on a tract of cultivated ground and harvests food for his family. So if he should die they still have the ground for help. If any of your people have cultivated ground let them not be proud on that account. If one is proud there is sin within him but if there be no pride there is no sin.

" 'Now, the second thing. It is the way a white man builds a house. He builds one warm and fine appearing so if he dies the family has the house for help. Whoso among you does this does right, always providing there is no pride. If there is pride it is evil but if there is none, it is well.

" 'Now the third. The white man keeps horses and cattle. Now there is no evil in this for they are a help to his family. So if he dies his family has the stock for help. Now all this is right if there is no pride. No evil will follow this practice if the animals are well fed, treated kindly and not overworked. Tell this to your people.' "

So they said and he said. Eniaiehuk.

SECTION 26

" 'Now another message to tell your relatives.

" 'This concerns education. It is concerning studying in English schools.

" 'Now let the Council appoint twelve people to study, two from each nation of the six. So many white people are about you that you must study to know their ways.' "

So they said and he said. Eniaiehuk.

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[1] A more complete catalog of the besetting sins of the Iroquois than set forth in the foregoing sections can not be found nor are they elsewhere more graphically described.

SECTION 27

"'Now another message to tell your people.

"'Now some men have much work and invite all their friends to come and aid them and they do so. Now this is a good plan and the Creator designed it. He ordained that men should help one another[1] (ādanidä'oshä').'"

So they said and he said. Eniaiehuk.

SECTION 28

"'Now another message of things not right.

"'People do wrong in the world and the Creator looks at all things.

"'A woman sees some green vegetables and they are not hers. She takes them wrongly. Now she is yeno^{n}'skwaswa'do^{n}', a thieving woman. Tell your people that petty thieving must cease.' So they said.

"'Now the Creator gave Diohe''ko^{n}[2] for a living. When a woman sees a new crop and wishes to eat of it in her own house, she must ask the owner for a portion and offer payment. Then may the owner use her judgment and accept recompense or give the request freely.'"[3]

So they said and he said. Eniaiehuk.

SECTION 29

"'Now another message for you to tell your people.

"'It is not right for you to have so many dances[4] and dance songs.

"'A man calls a dance in honor of some totem animal from which he desires favor or power. This is very wrong, for you do not know what injury it may work upon other people.

[1] The bee is a very popular institution among the Iroquois. See Museum Bulletin 144, p. 31.

[2] Meaning, "our life givers," the corn, beans and squashes. See Iroquois Uses of Maize, p. 36.

[3] One of the old methods of gardening was to clear a small patch in the woods by girdling the trees and planting in the mellow forest mold. The name and totem of the owner of the garden was painted on a post, signifying that the ground was private property. The clan totem gave permission to any hard-pressed clansman to take what he wished in emergency but only in such a case. These isolated gardens in the forests were objects of temptation sometimes, as the prophet intimates.

[4] The Seneca had thirty-three dances, ten of which were acquired from other tribes. See p. 81.

" ' Tell your people that these things must cease. Tell them to repent and cease.' "

So they said and he said. Eniaiehuk.

" ' Now this shall be the way: They who belong to these totem animal societies[1] must throw tobacco and disband.' So they said." " Now in those days when the head men heard this message they said at once, in anger, ' We disband,' and they said this without holding a ceremony as the messenger had directed."[2]

Eniaiehuk.

SECTION 30

" ' Now another message to tell your people.

" ' Four words the Creator has given for bringing happiness. They

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[1] Animal Societies and Totems. The Seneca firmly believe that by using the proper formula the favor of various animals can be purchased. The animal petitioned it is believed will make the person successful in any pursuit in which itself is proficient. The charm-animal was sometimes revealed in a dream, sometimes by a diviner of mysteries and was often sought directly. A warrior wishing to become a successful fisherman, for instance, might do any one of three things. He might seek for a dream that would show him what animal would make him an expert fisher, he might consult a " clairvoyant " or he might go directly to a stream of water and selecting some animal petition its favor.

The patron of the fisheries was the otter and there is a special society of those who have the otter for a " friend." The Society of Otters preserves the rites of invocation and the method of propitiation and also the method of healing afflicted members.

Other animals which are thought to be " great medicine " are the eagle, the bear, the buffalo and the mythical *nia'gwahē* or mammoth bear that was alternately a man and a beast. To be ungrateful to these givers of luck is a sin that arouses the ire of the animal who will punish the offender by inflicting him with some strange sickness. The offense may be one of neglect or altogether unintentional and unknown. It is then the duty of the society to appease the offended animal by performing the rites on a grand scale that the individual has failed to do in the ordinary way. The ordinary individual ceremony consisted simply of going to the bank of some clear stream, in the case of the Otters for instance, and after smoking sacred tobacco, casting the pulverized tobacco into the water at intervals during a thanksgiving and praise chant. Then will the otters know that their human brothers are not ungrateful for the fortune they are receiving.

There were four societies, having as their genii the spirits of the bear, the birds (eagle), the buffalo and the otter, respectively, and taking their names from their guardian animal (Secret Medicine Societies of the Seneca, p. 113).

[2] This was done at the suggestion of Cornplanter who is accused of endeavoring to upset the plans and prophecies of Handsome Lake in many sly ways.

are amusements devised in the heaven world, the Osto′wägo′wa,[1] Gonē′owo^{n}′, Ado^{n}′wē^{n} and Ganäwē^{n}′gowa.' "

So they said and he said. Eniaiehuk.

SECTION 31

" 'Now another message to tell your people.

" 'The Creator has sanctioned four dances for producing a joyful spirit and he has placed them in the keeping of Honon′diont[2] who have authority over them. The Creator has ordered that on certain times and occasions there should be thanksgiving ceremonies. At such times all must thank the Creator that they live. After that, let the chiefs thank him for the ground and the things on the ground and then upward to the sky and the heaven-world where he is. Let the children and old folk come and give thanks. Let the old women who can scarcely walk come. They may lean against the middle benches and after listening to three or four songs must say, " I thank the Great Ruler that I have seen this day." Then will the Creator call them right before him.

" 'It seems that you have never known that when Osto′wägo′wa was being celebrated that one of the four beings was in the midst of it, but it is so. Now when the time for dancing comes you must wash your faces and comb your hair, paint your face with red spots on either cheek, and with a thankful heart go to the ceremony. This preparation will be sufficient, therefore, do not let your style of dress hold you back.

" 'You have not previously been aware that when a Godi′ont is appointed that you have not appointed her. No, for the Great Ruler has chosen her. A road leads from the feet of every godi′ont and hodi′ont toward heaven. Truly this is so only of they who do right before the Creator.' "

So they said and he said. Eniaiehuk.

SECTION 32

" 'Now another message for your people.

" 'He who created us appointed that there should be chiefs, (hodi′ion'), and that they should do good for the people.' "

So they said and he said. Eniaiehuk.

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[1] The Great Feather dance, the Harvest dance, the Sacred Song and the Peach Stone game.

[2] *Honon′diont, overseers* or *keepers of ceremonies,* more often women than men. The word means *They are mountains.* (Hodi′ont is mas. sing.; Godi′ont, fem. sing.).

SECTION 33

" ' So now another.

" ' Tell your relations this. The Creator has sanctioned a feast to a medicine animal on a great day.' "

So they said and he said. Eniaiehuk.

SECTION 34

" ' Now another message to tell your people.

" ' Now the messengers said that this thing was beyond the control of Indians.

" 'At some future day the wild animals will become extinct. Now when that day comes the people will raise cattle and swine for feast food at the thanksgivings.' "[1]

So they said and he said. Eniaiehuk.

SECTION 35

" ' Now another message to tell your people.

" ' You have been ignorant of this thing.

" ' When the Honondi'ont go about to notify the community of a meeting for the celebration of Osto'wägo'wa, or for hearing the Great Ruler's message, the evil spirit at the same time appoints and sends another man, an invisible one, in his tracks saying, " Do not go. It is of no use, no benefit comes to you; rather do your own work at home and stay away." Now it is the messenger of the evil spirit that argues thus. Now know you that the evil spirit will hinder you in all good things but you can outwit him by doing the things that he does not wish you to do. Go then to the meetings. Then will the evil messenger follow you to the Long House and when from the outside you have heard the songs he will say that such is sufficient and that you may now return. Do not heed him but enter and take your seat. Then will he argue again saying that it is sufficient to listen and not take a part because you would not appear well in shabby clothing. Heed him not. Now this spirit speaks to your minds and his face is between you all.' "

So they said and he said. Eniaiehuk.

SECTION 36

" ' Now another message to tell your people.

" ' This will happen.

" ' We have told you to watch.

[1] Pork is now the principal ceremonial food.

" 'The Honon'diont will go out in fours for game for the feasts.

" 'You may think that they are fulfilling their duty to Gai'wiio'.

" 'The animals that fall must be thirty.

" 'But this will happen when Gai'wiio' is new. The Honon'diont will kill twenty-nine and the twenty-ninth will be a cub bear. So there will not be thirty.

" 'So this will be done when Gai'wiio' is new. It will be done at Adekwe'o^{n}ge, the Green Corn thanksgiving ceremony.' "

So they said and he said. Eniaiehuk.

SECTION 37

" 'Now another message to tell your people.

" 'Now this is a thing to happen.

" 'Hereafter we shall have a new species of deer.[1] The Creator will create somewhere a pair, male and female. The male deer will be spotted with white and the female striped with white over her back. This will be done and we say it.

" 'Now moreover the messengers command that these animals shall never be killed.' "

So they said and he said. Eniaiehuk.

SECTION 38

" 'Now another message for your people.

" 'If all the world would repent the earth would become as new again. Because of sin the under-world[2] is crumbling with decay. The world is full of sin. Truly, this is so.' "

So they said and he said. Eniaiehuk.

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[1] These deer are the sacred creations of the Great Ruler and as such no "pale invader" is permitted to see them, though a few of the faithful have at certain seasons seen them in the darkness fleeing from discovery. Cornplanter says these deer were killed by a jealous rival of the prophet while he yet lived, so defying the new command.

[2] The under-world was thought to be a dark region beneath the surface of the earth where were confined the creations of the evil-minded spirit. It was a vast cave full of winding chambers, dark turbid rivers, bottomless sloughs, hot springs and fetid odors, rapacious beasts, venomous serpents, poisonous insects and noxious weeds. The door of the under-world was guarded by the under-earth elves who had great difficulty in preventing the white buffaloes from escaping. Frequently they did and then began a great pursuit to kill or bring back the white buffaloes. At such a time the elves would tell the sun of the calamity and he would paint his face red as a sign to all the elves the world over that the chase was on. See Legend, Origin of Death Dance.

SECTION 39

" 'Now another message to tell your people.

" 'We, the messengers of the Creator, are of the opinion that the world will continue for three generations longer (or three hundred years).[1] Then will Gai'wiio' be fulfilled.' "

So they said and he said. Eniaiehuk.

SECTION 40

" 'Now another message to tell your people.

" 'The religious leaders and the chiefs must enforce obedience to the teachings of Gai'wiio'.' "

So they said and he said. Eniaiehuk.

SECTION 41

" 'Now another message to tell your people.

" 'This thing will happen when it is new.

" 'Truly men will repent and reform but it will happen that three certain ones will neither confess nor reform. Nothing will induce them to confess.

" 'There are grades of sin:[2] the sins of Hasan'owān'ĕ', the sins of Honon'diont and the sins of the ordinary people.

" 'Now when you are preaching repentance, Gaiänt'wakă will say that these men when they pass from this world are most vile. He will say, "Let us cast them into the water for they are not worthy to be dressed for the grave. The Creator will not receive them." Now no one will object to what Gaiänt'wakă says.' "

Now this thing did happen as predicted and when the messenger arose the first thing that he did was to spread the news and give the command that it must not be done.

" Now they said, 'The Creator will not give up hope of them until they pass from the earth. It is only then that they can lose their souls if they have not repented. So the Creator always hopes for repentance.' "[3]

So they said and he said. Eniaiehuk.

SECTION 42

" 'Now another message to tell your people.

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[1] Handsome Lake taught that the world would end in the year 2100.

[2] The higher the position the greater the sin, is the prophet's rule.

[3] See p. 61, Idea of soul.

"'Chiefs and high officers have spoken derisively of each other and quarreled.[1] What they have done must not be done again.'"

So they said and he said. Eniaiehuk.

SECTION 43

"'Now another message to tell your people.

"'Good food is turned into evil drink. Now some have said that there is no harm in partaking of fermented liquids.

"'Then let this plan be followed: let men gather in two parties, one having a feast of food, apples and corn, and the other have cider and whiskey. Let the parties be equally divided and matched and let them commence their feasting at the same time. When the feast is finished you will see those who drank the fermented juices murder one of their own party but not so with those who ate food only.'"

So they said and he said. Eniaiehuk.

SECTION 44

"'Now another message for your people.

"'You have had the constant fear that the white race would exterminate you.[2] The Creator will care for his Oñgwē′oⁿwe (real people).'"

So they said and he said. Eniaiehuk.

SECTION 45

"'Now another message for your people.

"'Some of your relatives and descendants will say, "We lack an understanding of this religion," and this will be the cry of the

[1] Jealousy was the principal cause of the dissension that led to the decay of the League of the Iroquois.

[2] The Iroquois saw that the white race had encircled them and were drawing the lines ever tighter. They saw that they were in a position of great disadvantage, living as they did in the midst of a people against whom they had fought not only in their own wars but also as allies of the British. They saw how all other native tribes had been swept away with the advance of the invading race and thus no wonder they feared. Yet today (1912) they still exist unabsorbed and as a distinct people in the midst of the civilization of the Empire State under their own tribal laws and recognized nominally as nations. The story of how they have preserved themselves through three centuries of contact with an invading race that had little love for them and whose policy like their own in ancient times, is to absorb or exterminate, to accomplish a thing that no other aboriginal race has done, is well worth a place in history as one of its marvels. "Truly the Creator has cared for his red children!"

people. But even we, the servants of the Creator, do not understand all things. Now some when they are turned to the right way will say, " I will continue so for all of my days," but this will not be so for they surely will fall short in some things. This is why even we can not understand all things.' "

So they said. Eniaiehuk.

SECTION 46

" At the time of this prophecy I was in the Cold Spring village. It occurred at this time. The prophecy was then new.

" At that time a woman and her daughter administered a witch-powder[1] to a man and he lost his mind. He wandered off alone and died and thus a great crime was committed.

" Now at that time it was said among the head men, ' We will punish the women.' So it was the plan that each chief give the women one lash.

" Now I, Ganiodai'io' heard the resolution of the chiefs and was of the opinion that the women would easily survive such punishment, so, also, the chiefs believed it.

" Now all this happened when the head men sat in council, the four messengers being present.

" Now this thing must never happen again. Such councils never accomplish good. It is natural that foolish women should have done what these did.

" Now at the time of the lashing it was in my mind that they would surely live.

" So this must never happen again because the Creator has not privileged men to punish each other." Eniaiehuk. [See plate 12.]

SECTION 47

" So now another story.

" It happened that at a certain time a certain person did not honor Gai'wiio'. At a gathering where Gai'wiio' was being told this was done. It was at Cold Spring village.

"A man was standing in the doorway showing disrespect to the proceedings within. The prophet was speaking and as he said in closing ' It is finished,' the man in the doorway dainĭ'dădi. Now that was the last. The man did not go home to his dwelling and

[1] Witch-powders were used for various purposes but generally as poisons or love charms. Their use is condemned in section 3 and the punishment of those who use them in section 104.

Plate 12

From a drawing by Jesse Cornplanter

The whipping of the witches. (See section 46 of the code, p. 46.)

Plate 13

The Spirit of the Corn speaking to Handsome Lake, the Seneca prophet. (From a drawing by Jesse Cornplanter, a Seneca boy artist)

the next day it was rumored that he was missing. A search was made and on the other side of the Allegany in a swamp two days later the man was found. He was sitting above it. He had broken branches and arranged them in the form of a nest upon which he sat devouring snakes. He was not in his right mind. They took him from his nest (ho'no^n'gwae') and soon he died." Eniaiehuk.

SECTION 48

" Now another story.

1 " Now it was that when the people reviled me, the proclaimer of the prophecy, the impression came to me that it would be well to depart and go to Tonawanda. In that place I had relatives and friends and thought that my bones might find a resting place there. Thus I thought through the day.

" Then the messengers came to me and said ' We understand your thoughts. We will visit you more frequently and converse with you. Wherever you go take care not to be alone. Be cautious and move secretly.'

" Then the messengers told me that my life journey would be in three stages and when I entered the third I would enter into the eternity of the New World,[1] the land of our Creator. So they said." Eniaiehuk.

2 " The day was bright when I went into the planted field and alone I wandered in the planted field and it was the time of the second hoeing. Suddenly a damsel[2] appeared and threw her arms about my neck and as she clasped me she spoke saying, ' When you leave this earth for the new world above, it is our wish to follow you.' I looked for the damsel but saw only the long leaves of corn twining round my shoulders. And then I understood that it was the spirit of the corn who had spoken, she the sustainer of life. So I replied, ' O spirit of the corn, follow not me but abide still upon the earth and be strong and be faithful to your purpose. Ever endure and do not fail the children of women. It is not time for you to follow for Gai'wiio' is only in its beginning.' " Eniaiehuk.

SECTION 49

" ' Now another message to tell your people.

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[1] The heaven described by Ganiodai'io' was called the New World because it had not been previously known. The generations before had not gone there, not having known the will of the Creator as revealed by the prophet.

[2] See plate 13, the Spirit of the Corn.

" ' There is a dispute in the heaven-world between two parties. It is a controversy about you, the children of earth. Two great beings are disputing — one is the Great Ruler, the Creator, and the other is the evil-minded spirit.

" ' You who are on earth do not know the things of heaven.

" ' Now the evil one said, " I am the ruler of the earth because when I command I speak but once and man obeys."

" ' Then answered the Great Ruler, " The earth is mine for I have created it and you have helped me in no part."

" ' Now the evil one answered, " I do not acknowledge that you have created the earth and that I helped in no part, but I say that when I say to men, ' Obey me,' they straightway obey, but they do not hear your voice."

" ' Then the Great Ruler replied, " Truly the children are my own for they have never done evil."

" ' And the evil one answering said, " Nay, the children are mine for when I bid one saying, ' Pick up that stick and strike your fellow,' they obey me quickly. Aye, the children are mine."

" ' Then was the Great Ruler very sad and he said, " Once more will I send my messengers and tell them my heart and they will tell my people and thus I will redeem my own."

" ' Then the evil one replied, " Even so it will not be long before men transgress your commands. I can destroy it with a word for they will do my bidding. Verily I delight in the name Hanĭssē'ono. It is very true that they who love my name, though they be on the other side of the earth, will find me at their backs the moment they pronounce my name."

" ' Now at that time the Great Ruler spoke to the four messengers saying, " Go tell mankind that at present they must not call me Hawi'n'io', the Great Ruler, until a later time, for the Evil One calls himself the Ruler of Mankind. So now whosoever is turned into my way must say when he calls upon my name, Hodiänok'doo^n Hĕd'iohe', our Creator. So also whosoever speaks the name of the evil one must say, Segoewa'tha, The Tormentor. Then will the evil one know that you have discovered who he is, for it is he who will punish the wicked when they depart from this world.' "[1]

So they said and he said. Eniaiehuk.

[1] A typical example of Iroquois philosophy. The Iroquois were fond of devising stories of this character and many of them reveal the subtle reasoning powers of the Indian in a striking manner.

SECTION 50

" ' Now another message to tell your people.

1 " ' Now we are of the mind that the cold of winter will take life away. Many will be taken away because of the changing cold. Moreover some will freeze because they are filled with strong drink. Then again when the earth grows warm and the warm changes come, many will perish because of strong drink. Now the Creator never intended that variations of weather and season, warm and cold, should cause death.' "

2 " ' The Creator made the waters of the earth, the rivers and lakes. These too will cause death and some filled with strong drink will be swallowed up by the waters.' "

3 " 'And now more. The Creator made fire and this will also cause death and some filled with strong drink will be destroyed by the flames.' "

" ' Verily he has said and ordained that they who disobey Gai′wiio‘ should fall into hardships.' "

So they said and he said. Eniaiehuk.

SECTION 51

" ' Now another message to tell your people.

" ' The messengers have given the promise to the prophet that he will be able to judge diseases and prescribe remedies.[1] So also he will be able to see far down into the earth as far as runs the elm's root. Then if any trouble comes and anyone asks the help of the prophet, he must give it freely, but they who ask must give an offering of tobacco. Now there will be some in your care who will be taken from your hands for other treatment. No wrong will be done and you must bear no ill will. It is said that the events of all our days are foreknown, so when the time comes for you to exercise your power we will tell you and then you may judge the earth and cure diseases.' "

So they said and he said. Eniaiehuk.

SECTION 52

" ' Now another message for your people.

" Now when my relatives heard all this they said, ' This man must be a clairvoyant (hĕnne′yo^{n}').'[2]

[1] See p. 113, medicine men.

[2] Diviners of mysteries have always been prominent characters among the Indians. Their office was to tell their clients the proper medicine society

" The news spread and Gaiänt'wakă came as a messenger.[1] Now he came to Ganiodai'io' and said, ' Why, having the assurance of powers, do you not commence now. Come prophesy! ' Now he had tobacco for an offering. Then he said, ' My daughter is very sick.'

" Now the diviner of mysteries did not respond to his entreaty and so Gaiänt'wakă went out but soon came running back. This second time he had the same request and plead more earnestly, but without avail.

" Then it was said that he would not respond to the cry of a brother and had no hearing for the voice of a brother.

"Again Gaiänt'wakă returned and urged his brother.

" Now the people said, ' Have we not something to say to you as well as the messengers of the Creator? '

" Then he answered and said, ' Truly the people say that I will not reason. Verily I am true to my words. Now I can do nothing but try but I have not yet the permission of the messengers.'

" Now he went into a deep sleep and when he awoke he told his vision. Now he said that O'gi'we[2] should be sung for the sick woman.

" Now it is said that at that time the first song was in order but every part of the song was silent.

" Now a rumor spread that after all it was not wrong to continue the ceremonial dances once forbidden. So many were sick because they had not observed the commanded method of closing the societies."

This was so when Gai'wiio' was new. Eniaiehuk.

SECTION 53

" ' Now another message.

" The four messengers arose from a sitting of the prophecy.

" Now he said that certain songs and parts of songs are not known and some societies are new and their powers untried. So

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that would be most efficacious in curing the sick, to discover the whereabouts of lost children or articles, to discover what witch was working her spells, and to tell fortunes, as well as to interpret dreams.

[1] Cornplanter again endeavored to get his brother into disfavor with the four messengers by forcing him to exercise his powers prematurely. For this reason the followers of Handsome Lake to this day regard Cornplanter as a malicious character who ever tried to upset the Gai'wiio'.

[2] The death chant, a ceremony belonging to the O'gi'weono' or Society of Chanters. See the legend *Origin of the Death Dance*.

make a feast and throw tobacco instead of singing. But the chiefs said that that plan should be laid aside and notwithstanding, the songs should be sung as far as possible.

"Now the messengers said that they should secure provisions enough for the feast and be sure. Some have planned to have strong drink used at the feast but this must not be tolerated. Only food must be used."[1]

So they said and he said. Eniaiehuk.

SECTION 54

"Now I will relate another.

"There is a certain ceremony in the midwinter.[2] It is said that it is most important to uphold the customs of midwinter and that any one having a part should fulfil it. It is said that to fulfil the customs they must go about the neighborhood holding dances. It is said that the Creator has sanctioned certain dances for thanksgiving."

"Now the messengers said that Ganio'dai'io' must sing[3] early in the morning on three mornings and give the cheer-cries of the Gai'wiio'."

So they said and he said. Eniaiehuk.

SECTION 55

"'Now another message.

"'It is said that all your relatives and friends must be told.

"'It is said that when these rites are performed one person is to be selected to offer thanks[4] to the Creator. Now when thanks are rendered begin with the things upon the ground and thank upward to the things in the new world above. Afterward any one so inclined may arise and thank the Creator in the manner he thinks best.'"

So it is said. Eniaiehuk.

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[1] It is related that at one period whiskey had so far debauched the Indians that their once sacred ceremonies, like those of the early Christians at Corinth, were made the excuses of the grossest licentiousness and drunken revelry. Whiskey had entirely supplanted the feast foods.

[2] See the Burning of the White Dog, p. 85.

[3] This song is still sung by the preacher of the Gai'wiio'. The preacher stands at the door of the Long House on three successive mornings of the new year's season and greets the sunrise with his song. It is said to be a charm against high winds and the faithful claim that Gao', the spirit of the wind, holds back his fury when the song floats over the settlement.

[4] See The Goneowo ceremony, p. 95.

SECTION 56

" ' Now another message.

" This happened when Gai'wiio' was new. It was the time when he dwelt at Diono^{n}''sodegĕ'.[1]

"A father and son appeared in Diono^{n}''sodegĕ'. Now the name of the son was Gani'seoñ. They were on a hunting journey and came from Gadäges'käo^{n}[2] with a horse and cart. Now they tarried in Diono^{n}''sodegĕ' for several nights before again taking up their journey.

" It was during the hunting season that the news spread that some one had returned from the hunting grounds without a companion. It was the young man who had returned. So they questioned him and asked where his father was. He answered, ' My father is lost. I went about searching for my father a number of days. I walked and searched and signalled with gun discharges hoping to find him. I could not find him and became weary waiting for his return.' So he said."

" Now Gaiänt'wakă when he heard this said, ' It is apparent to me that the young man has spoken the untruth.' So then they all went to the diviner of mysteries and Gaiänt'wakă spoke to him saying, ' It is my opinion that the boy has murdered his own father.' And the prophet answering said, ' They have not yet given me the power to see things but this will I do. Bring a bullet, a knife, and a hatchet that the boy may look upon these things when I speak and perhaps the truth will come (*see* plate 14). One of these things will move though not touched and he shall be the witness.' So the head men did as bidden and placed the objects as directed. In the middle of the floor they spread a blanket and put the articles upon it. Then they gathered around it and watched, and as they watched he spoke and the bullet moved. Thus it happened. Then spoke Ganio'dai'io', ' This brings the confirmation of the rumor. Truly the youth has murdered his father, and furthermore I say that the crime was committed between Gānos'[3] and Hanĕnk'gaek.[4] On the south side of a mountain, where half way up an elm is broken, leaning over on the downhill side to the west lies the body buried in the leaves of the top branches. He, the father, is buried in the leaves.' So he said when he spoke. The

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[1] Cornplanter village.

[2] Cattaraugus village, the principal town of the Cattaraugus region.

[3] Franklin, Pa.

[4] Oil City, Pa.

Plate 14

From a drawing by Jesse Cornplanter

The discovery of the murderer, section 56. (See p. 52.)

chiefs and head-men appointed a delegation to see if all he had said were true. So they went as they had been told and found the body of the father and brought it back with them." Eniaiehuk.

SECTION 57

" 'Now another message to tell your people.

" 'You may ask three questions concerning three privileges when you go among your relatives at the ceremony of Nĭsko'wŭknĭ[1] and ask what one is fitted for them.

" 'Who among you likes best to call upon the afflicted? Who among you loves to commune alone in the forests? Who among you is most anxious concerning religious conditions?' "

So they asked him. Eniaiehuk.

SECTION 58

" 'Now another message.

" 'Now this matter will devolve upon you.

" 'The people will assemble in council and ask, "Who among us is able to say, 'I compel you to assemble?' "

" 'Now when the question is set forth each person must make reply. The chiefs must demand it.'

"Now it happened that he fulfilled the requirements and all the people assembled and with one accord acclaimed that Ganio'dai'io' should lead them and that they should never murmur.

"Now that the people had done, he was patient to learn the result.

"The council adjourned and the messengers came and questioned him saying, 'How did you understand your people?'

"He answered, 'The majority consented that I should lead them.'[2]

"Then the messengers replied, 'Truly the greater number will follow you.' "

So they said and he said. Eniaiehuk.

SECTION 59

" 'Now another message.

" 'It is this: We, the messengers of our Creator, see strong drink used during the season when corn is planted. Now let those

[1] February, the moon of the midwinter, the time of thanksgiving.

[2] Because the people of this council elected that Handsome Lake should have authority over them he is ever after called Sēdwāgo'wānĕ, or chief leader, or our great teacher.

who use this evil drink know that it consumes the elements of life They must repent.' "

So they said and he said. Eniaiehuk.

SECTION 60

" ' Now another message.

" ' It is a custom for thanksgiving to be made over the hills of planted corn.[1] Let the head one of the family make an invocation over the planted hills that the corn may continue to support life. Now this will be a right thing and whosoever asks the help of the Creator will receive it.' "

So they said and he said. Eniaiehuk.

SECTION 61.

" ' So now another.

" ' Now it is understood that Dio'he''ko^{n} (the corn, bean and squash spirits), have a secret medicine, o'sagan'dă' and o'sdĭs'dani. So soak your seed corn in these two medicines before you plant your fields. The medicines grow on the flat lands near streams.' "

So they said and he said. Eniaiehuk.

SECTION 62

" ' Now another message.

" ' Now there are some who have boasted that they could drink all the strong drink in the world. Now we, the messengers, say that they who thus idly boast will never live to accomplish what they boast. White men will ever distil the evil liquor.' "[2]

So they said and he said. Eniaiehuk.

SECTION 63

" ' Now another message.

" ' Tell your friends and relatives that there will be two divisions

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[1] The ceremony of invoking the Creator over the hills of corn was an old one and like many other old customs was indorsed by the prophet. This custom is still continued among some of the Iroquois. " When the leaf of the dogwood is the size of a squirrel's ear, the planting season has come. Before the dawn of the first day of the planting a virgin girl is sent to the fields where she scatters a few grains of corn to the earth as she invokes the assistance of the spirit of the corn for the harvest."

[2] This section with others of similar import brings out the prophet's intense dislike of idle boasting.

of mind[1] among the chiefs and head-men and among the people. Nevermore will your race be united.' "

So they said and he said. Eniaiehuk.

SECTION 64

" ' Now another message.

" Now the messengers commanded him to give attention and he did. Then he saw a great assembly and the assembly was singing:

'The whole earth is here assembled,
The whole world may come to us.
We are ready.'

" Then said the messengers, ' What did you see when you gave attention? '

" He answered, ' I saw a great gathering of beings and the gathering was singing and the words of the song were:

'The whole earth is here assembled,
The whole world may come to us.
We are ready.'

" Then said the messengers, ' It is very true. The beings that you saw resemble human creatures. It is true that they are singing. Now the assembly is a gathered host of medicines for healing. Now let this be your ceremony when you wish to employ the medicine in a plant: First offer tobacco. Then tell the plant in gentle words what you desire of it and pluck it from the roots. It is said in the upper world that it is not right to take a plant for medicine without first talking to it. Let not one ever be taken without first speaking.' "[2]

So they said and he said. Eniaiehuk.

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[1] This seemingly obscure section is cleared of its mystery when the preacher explains that the divisions of mind refer to the Gaiwios'tŭk or Christian and Oñgwe'o^{n}wekā' or Indian parties. " Dewadia'ke' gani'goi', *broken in twain, the unity of purpose,"* is Chief Cornplanter's term.

[2] The ceremony of gathering herbs. When a Seneca wishes to gather medicinal herbs, he goes into the woods where they grow and builds a small fire. When there is a quantity of glowing embers he stands before it and as he speaks at intervals casts a pinch of tobacco on the coals. He speaks to the spirits of the medicines telling them that he desires their healing virtues to cure his people of their afflictions.

" You have said that you are ready to heal the earth," chants the gatherer of herbs, " so now I claim you for my medicine. Give me of your healing virtues to purge and cleanse and cure. I will not destroy you but plant your seed that you may come again and yield fourfold more. Spirits of the herbs, I do not take your lives without purpose but to make you the agent of heal-

SECTION 65

" 'Now another message.

" 'It has been a custom when a person knows of a healing herb to ask payment for giving it to a patient. Now we say that this is not right. It is not right to demand compensation for treating the sick. If such is done it adds greater afflictions to the sick one. The Creator has given different people knowledge of different things and it is the Creator's desire that men should employ their knowledge to help one another, especially those who are afflicted. Now moreover the person helped out ought only to give tobacco for an offering.' "

So they said and he said. Eniaiehuk.

SECTION 66

" 'Now another message.

" 'Now it is said that your fathers of old never reached the true lands of our Creator nor did they ever enter the house of the tormentor, Ganos'ge'.[1] It is said that in some matters they did the will of the Creator and that in others they did not. They did both good and bad and none was either good or bad. They are therefore in a place separate and unknown to us, we think, enjoying themselves.' "

So they said and he said. Eniaiehuk.

SECTION 67

" 'Now another message.

" 'Now it is said that your people must change certain customs. It has been the custom to mourn at each recurring anniversary of the death of a friend or relative.[2] It is said that while you are

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ing, for we are very sick. You have said that all the world might come to you, so I have come. I give you thanks for your benefits and thank the Creator for your gift."

When the last puff of tobacco smoke had arisen the gatherer of herbs begins his work. He digs the plant from the roots and breaking off the seed stalks drops the pods into the hole and gently covers them over with fertile leaf mold.

"The plant will come again," he says, "and I have not destroyed life but helped increase it. So the plant is willing to lend me of its virtue." *Gahadondeh, (Woodland Border), Seneca.*

[1] The evil spirit has no domain except his house. A land in which the condemned spirit might roam would not be so terrible but eternal confinement within a house was considered a horrible fate by the liberty-loving Iroquois.

[2] See Funeral and Mourning Customs, p. 107.

upon the earth you do not realize the harm that this works upon the departed.

" ' Now moreover it is said that when an infant is born upon the earth with which the parents are dissatisfied, it knows and says, " I will return to my home above the earth.' "

" Now it is said that our grief adds to the sorrows of the dead. It is said that it is not possible to grieve always. Ten days shall be the time for mourning and when our friends depart we must lay grief aside. When you, the beings of earth, lose one of your number you must bury your grief in their grave. Some will die today and some tomorrow for the number of our days is known in the sky-world. So hereafter do not grieve. Now it is said that when the ten days have elapsed to prepare a feast and the soul of the dead will return and partake of it with you. It is said moreover that you can journey with the dead only as far as the grave. It is said that when you follow a body to the grave you must have prepared for that journey as if to travel afar. Put on your finest clothing for every human creature is on its journey graveward. It is said that the bodies of the dead have intelligence and know what transpires about them.[1] It is true.' "

So they said and he said. Eniaiehuk.

SECTION 68

" Now it is said that when Ganio'dai'io' was at Tonawanda spreading Gaï'wiio' it happened that a certain man named Segwai''doⁿgwi said, ' I will also send a message to the four messengers and ask whether I am right in my belief in repentance and right doing.' So he sent his message upward in tobacco smoke."

Now when the messengers arose from a council with Ganio'dai'io' he reported what they had told him. " It is a hard matter for he, the questioner, is two-minded." So he said.

Then Segwai''doⁿgwi said, " Now this will I do: I will give a string of wampum, ot'go'ä, to the chiefs for a proof of my repentance, for though I have been thinking, yet I can not discover that I am two-minded."

Now when Gai'wiiostŭk (the Christian religion) came this man was the first to accept its teaching. When the chiefs heard of it they went to him and offered to return his wampum.

Then said the man, " I will not turn back because it is for the good of all that I have this religion."

[1] See, The death feast, p. 110.

Now all the chiefs and head-men could not persuade him to return to the right way.

So it is said. Eniaiehuk.

SECTION 69

" Now another message.

" Now it is said that you must relate what the messengers say about the coming end of the earth. Relate how all those who refuse to believe in Gai'wiio' will suffer hardships.[1] Now when the earth is about to end the chiefs and head-men will disagree and that will be a sign. So also, the Honon'doint will disagree. Then will the relations know the truth."

So they said and he said. Eniaiehuk.

SECTION 70

" Now another message.

" Now we say that you must tell your friends and relatives that there will be a time when all the earth will withhold its sustaining foods. Then will come the end of the world and those who refuse to believe in Gai'wiio' will suffer great hardships."

So they said and he said. Eniaiehuk.

SECTION 71

" Now another message.

" Now we think that a time will come when a great plague will kill many people and no one will know its cause. Then will you know that the end is near and those who do not believe will suffer great hardships."

So they said and he said. Eniaiehuk.

SECTION 72

" Now another message.

" Now we think that a time will come when a woman will be seen performing her witch spells in the daylight. Then will you know that the end is near. She will run through the neighborhood boasting how many she has slain by her sorcery. Then will you see how she who refused to believe in Gai'wiio' will suffer punishment."

So they said and he said. Eniaiehuk.

SECTION 73

" Now another message.

" In that time you will hear many rumors of men who say, ' I have spoken with the Creator.' So also will you see many wonders

[1] See Introduction, p. 26.

but they will not endure for they will be the work of the evil spirit.

"Verily we say that there will be none other than you who will receive a message from the Creator through us. This truth will be proclaimed when the end comes."

So they said and he said. Eniaiehuk.

SECTION 74

"Now another message.

"In that time every poisonous creature will appear. These creatures the Creator has imprisoned in the underworld and they are the creations of the evil-minded spirit. Now it is our opinion that when they are released many people will be captured and poisoned by them. Men will see these hardships when they fail to believe in Gai'wiio'."

So they said and he said. Eniaiehuk.

SECTION 75

"Now another message.

"Now there will be some who will enter into a sleep. When they lie down they will be in health and as they sleep the Creator will withdraw their lives for they are true. To the faithful this will happen." [1]

So they said and he said. Eniaiehuk.

SECTION 76

"Now another message.

"Now we think that the Creator will stop the earth and heavens. All the powers of nature will he suspend. Now they will see this who refuse to believe in Gai'wiio'."

So they said and he said. Eniaiehuk.

SECTION 77

"Now another message.

"Now we think that when the end comes the earth will be destroyed by fire and not one upon it will escape for all the earth will be enveloped in flames and all those who refuse to believe in Gai'wiio' will be in it."

So they said and he said. Eniaiehuk.

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[1] Because Handsome Lake did not die in this manner some of his half believing followers at Onondaga repudiated his teaching.

Recitation of the third day

NOW AT TONAWANDA

SECTION 78

" Now another message. Tell it to those at Tonawanda.

" Now they said to him, ' Watch a certain place.' So he did and he saw a certain person holding meat in his hands. The man was rejoicing and was well clothed and fed and his name was Tă'dondä'ieha', and he recognized him."

" Then said they to him, ' How is it? '

" He answered, ' I recognized Tă'dondä'ieha' and he held meat in his hands.' So answered he who talked religiously."

" Then the messengers answered, ' Truly you saw a man with meat enjoying himself. He was joyous because he was a prosperous and successful hunter and gave game as presents to his neighbors. So his neighbors were grateful and thanked him. Now the man you saw has departed from the earth. In his earth-life he cleansed himself each day, visited and enjoyed himself in his best clothing. He was ever good to his fellow-beings and so he is blessed and will receive the reward reserved for him by his Creator."

So they said and he said. Eniaiehuk.

SECTION 79

" Now another message.

" This will happen.

" You will sing three times and the third time you sing you will step into oyă'dedion'diade', the other world.[1] That you go there will be the earnest wish of all who have heard your message."

So they said and he said. Eniaiehuk.

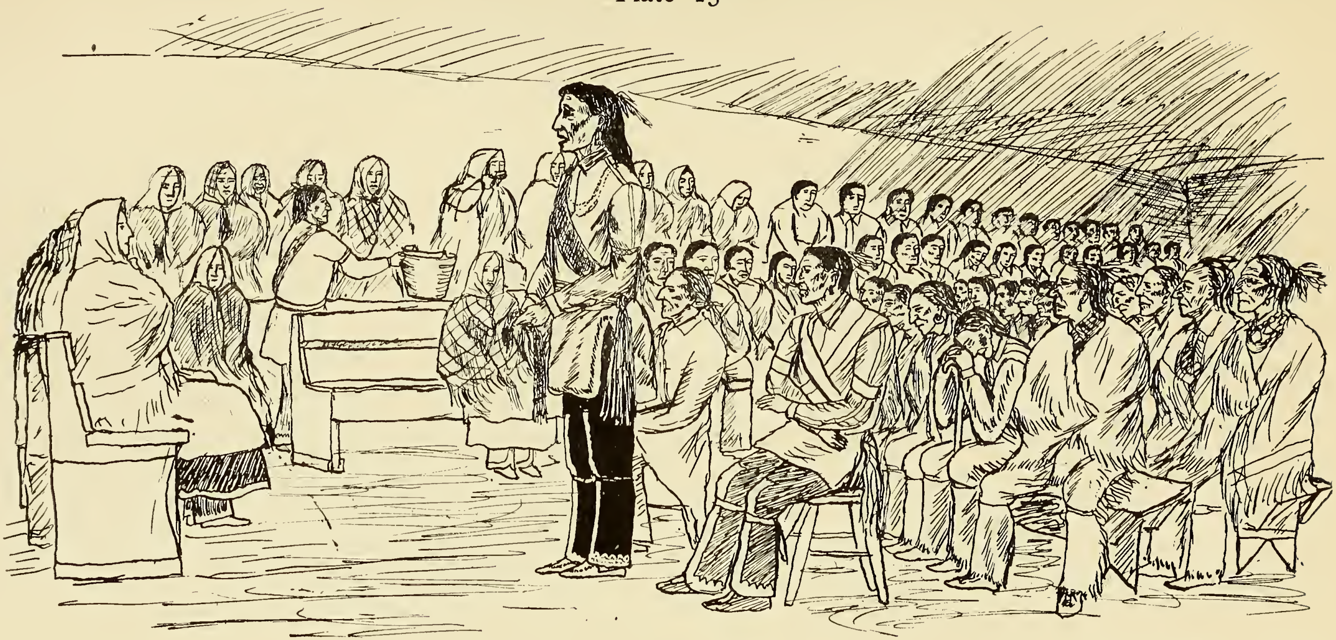
SECTION 80

" Now another message.

" Every person has a song to sing when the time comes to leave the earth. When a person is departing he must sing that song

[1] It was customary for the friends and relatives to address the body of the dead and give expression to one's desires, etc. The soul when it reached the heaven-world would then tell the Great Ruler who would attend to the wishes expressed.

Plate 15



From a drawing by Jesse Cornplanter

Handsome Lake preaching at Tonawanda

and continue to sing on his journey to the other world.[1] They will do this who have repented and who believe in Gai'wiio'."

So they said and he said. Eniaiehuk.

SECTION 81

" Now another message.

" Now the messengers said, ' Look you back in a vision to Cornplanter village and the place where the creek empties into the river.' So he looked and saw a large number of canoes gathered there. Many people were assembled and there were barrels of strong drink at the place. The people were making much noise. Now moreover there was a man there, hopping from canoe to canoe and singing Dji'hayā, the song of the evil-minded spirit. Now the words that he sang were these:

> ' More happy am I in my own house,
> Far more happy there than here.'

" Yet the man seemed to be greatly enjoying himself.

" Then said the messengers, ' You have been observing, now what did you see? '

He answered, ' I saw a man hopping from canoe to canoe singing the song of the evil-minded one. He said that his house was more happy a place than that where he was. The people about I should judge were filled with strong drink.' So he said in answer to the messengers.

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[1] Ideas of the soul. The following ideas of the human soul were anciently held by the Iroquois and their influence on the teachings of Handsome Lake's teachings will be noted upon reading the Gai'wiio':

Every soul has a path to its destiny after death.

Every soul retains its personal identity whatever form it may inhabit.

Soul differs from life.

When the soul leaves the body life does not necessarily.

When life leaves the body the soul generally does, though not always immediately but may linger for ten days.

The soul may pass from a living body and enter any object or go to any place to acquire wisdom and returning reveal it to the person in dreams or visions.

Should a person refuse persistently to heed these warning visions the soul is liable to desert him, leaving the person simply a creature without power to resist or understand the influence of the various spirits good or bad.

Thinking that by some oversight or evil doing that he may lose his soul the Indian often offers sacrifice to his evil spirit. This is to satisfy his evil spirit with other things than wrong doing and thereby not offend his good spirit.

" Then answered the messengers, 'What you say is true. The man was the punisher and his delight is to see people filled with strong drink.' "

So they said and he said. Eniaiehuk.

THE JOURNEY OVER THE GREAT SKY-ROAD

SECTION 82

" ' Now another message.

" ' Now it is the time for our departure. We shall now go on a journey and then you shall see the coming of the fourth messenger, the journey of our friends and the works of the living of earth. More, you will see the house of the punisher and the lands of our Creator.' "

So they said. Eniaiehuk.

SECTION 83

" ' Now another message.

" Suddenly as they looked, a road slowly descended from the south sky[1] and came to where they were standing. Now thereon he saw the four tracks of the human race going in one direction. The footprints were all of different sizes from small to great. Now moreover a more brilliant light than the light of earth appeared."

So they said. Eniaiehuk.

SECTION 84

" ' Now they said unto him, ' We will tarry here a while in order that you may see.'

" Now as he watched and believed, he saw a large woman sitting there. Now the woman was grasping frantically at all things within her reach, and it seemed that she could not stand because of her great size. That was what he saw.

" Then they said to him, ' What did you see?'

" He answered, ' It is hard to say. I saw a woman sitting and she was large of size and snatching at everything about her. I am of the opinion that she can not rise.' So he answered when he spoke.

" Then the messengers answered, ' It is true. That which you saw was the evil of stinginess. She can not stand and thus she will

[1] The great sky-road of the Gai'wiio' is the milky way. The souls of the dead are supposed to journey over the broad band and divide at the forks. The multitude of stars are thought to be the footprints of the dead.

remain forever. Thus it will be with those who forsake religious teachings and think more of the things of earth than of the new world above. (Having glutted themselves with the things of earth they are unable to stand upon the heaven road.)' "[1]

So they said and he said. Eniaiehuk.

SECTION 85

" Now they said, 'We shall proceed.' Now the farther they went the more brilliant the light became. They had not gone far when the four messengers said, 'Now we will stop again. Look attentively at what you see.'

" So he looked and saw three groups of people and each group was of a different size. The first was large, the second small and the third still smaller.

" Then the messengers asked him, 'What do you see?'

" He answered, 'I saw three groups, the first a large group, the second half as large as the first and the third still smaller.' That is what he said when he answered.

" Then they replied, 'Truly you have seen. The groups represent the people of earth. The first group you saw was composed of those who have not repented; the second group was inclined half way, and the third group, the smallest one, was composed of those who have repented. They are protected by the true belief in Gai'wiio'.' "

So they said and he said. Eniaiehuk.

SECTION 86

" So they proceeded a short distance and again came to a halt. Then the messengers pointed out a spot and bade him watch attentively. Then he saw a house strongly built and within it he saw three different things. The first was a pair of handcuffs, the second a whip and the third a hang-rope."

" Then asked the messengers, 'What did you see?'

" He answered, 'The house I saw was strongly built and within the house I saw three different things. The first was a pair of handcuffs, the second a whip and the third a hangman's rope.' So he answered.

[1] Those who gain great riches and lack humility can not stand upon the sky-road nor can they walk. The poor and meek only can travel skyward and not even the poor unless their ways have been humble and marked with virtue. Thus it is said, "It is better to be poor on earth and rich in the sky-world than to have earth riches and no heaven."

" Then they replied, ' Truly it is a strongly built house. It is a prison. Now it is true that three things are there for punishment. How hard it is for a transgressor to see that he should be punished; yet it is the cry of the people that the laws of the white man are better than the teachings of Gai'wiio'. This frightens even the Great Spirit for he knows the punishment of those who say such things.' "

So they said and he said. Eniaiehuk.

SECTION 87

" So they proceeded and it was not long before they said, ' We must stop here.' Then they pointed in a certain direction and commanded him to watch. So he watched and as he did he saw a house with a spire and a path leading into the house and none out. There was no door, neither were there any windows in the house. Within was a great noise, wailing and crying, and the house was hot.

" Then the messengers asked him what he saw.

" He answered, ' I saw a house with a spire and a path leading to the house. There was no door, neither were there any windows in the house. Within was a great noise, wailing and crying, and the house was hot.'

" Then they replied, ' You have truly seen. It is a hard matter for Indians to embrace these conditions, that is, to embrace the belief of Bible believers.' "

So they said and he said. Eniaiehuk.

SECTION 88

" So they proceeded and had not gone far when the messengers said, ' Look downward upon the Buffalo Creek reservation.'

" Se he looked and the place seemed honeycombed and covered with a net.

" Then the messengers asked him what he saw.

" He answered, ' I saw the Buffalo Creek reservation and it seemed honeycombed like ice and covered with a net.' So he replied.

" Then the messengers said, ' Truly! We think that this reservation will fall.' Now they said moreover that it was the duty of the chiefs to preserve it but it should be hard for some should take an upper hand.' "

So they said and he said. Eniaiehuk.

SECTION 89

" So they proceeded a little ways farther and soon they said, ' We will stop here.' Then they pointed out a certain spot and said, ' Watch! Look upon the eastern heavens and observe!'

"So he looked and saw two immense drops (or balls of liquid) hanging, one red and one yellow. It seemed that they were suspended only for an instant and would momentarily fall.

"Then the messengers asked, 'What did you see there?'

"He answered, 'I saw two drops, one red and one yellow, suspended as if about to fall.'

"Then the messengers replied, 'Truly you have spoken. It is so. Should one of those drops fall it would bring great calamity upon the earth. Many people would leave the earth should one drop but we are doing our utmost to prevent such an event.'"

So they said and he said. Eniaiehuk.

SECTION 90

"So they proceeded but had not gone a long distance before they said, 'We will stop and watch a certain place. Now listen to the earth.'

"So he listened and as well as he could understand he thought that he heard wailing and mourning. The sounds seemed to be the crying of children.

"Then the messengers asked, 'What did you observe?'

"He answered, 'I thought that I heard the wailing of the aged and the crying of children.'

"Then the messengers replied, 'It is true. What you have heard is the substance of life going back to the Creator. When this time comes there will be great misery upon the earth.'"

So they said and he said. Eniaiehuk.

SECTION 91

"So they proceeded a little ways farther and in a short time they reached a certain spot and stopped.

"Then said the messengers, 'Look toward the setting sun.'

"So he looked and saw. Now as he looked he seemed to see a man pacing to and fro. He seemed to be a white man and in his hand he seemed to have a bayonet with which he prodded the ground. Now moreover he seemed very angry.

"Then said the messengers, 'What did you see?'

"He answered, 'I saw what seemed to be a man pacing to and fro. He seemed to be a white man and in his hand he seemed to have a bayonet with which he prodded the ground, and, moreover, it seemed that he was angry.' So he said when he answered.

"Then the messengers said, 'It is true. He is a white man and in a temper. It is true. Indians must not help him and the head-men must honestly strive to prevent their followers from helping him.' "[1]

So they said and he said. Eniaiehuk.

SECTION 92

" So they proceeded on their journey and had not gone far when they stopped.

" Then the messengers said, ' Watch attentively.' Then they pointed out to him a certain spot midway between the earth and the clouds. So he watched there. Now this is true. He saw a house suspended there and on the veranda with a railing about it, a man walked and with him was a penny dog (kwĕn′nĭs dji‘′yä). Now moreover the man was rejoicing and he was a white man.

" Then said the messengers, ' What did you see? '

" He answered, ' I saw a house suspended in the air and on the porch with a railing about it a man was walking and with him was a penny dog. Now moreover the man was a white man.'

" Then the messengers said, ' Truly you have seen. It is said that the man is the first and oldest president of the United States. Now he enjoys himself and he is the only white man so near the new world of our Creator. Now it is said that there was once a time when the Thirteen Fires and the King[2] were in trouble. The Thirteen Fires were victorious and this man won the victory from the king. Said the king, " You have overpowered me, so now I release everything that was in my control, even these Iroquois who were my helpers. It rests with you what shall be done with them. Let them be to you a thing for a sacrifice." Then said the president, " I shall let them live and go back to the places that are theirs for they are an independent people." So it is said. Now this man did a great work. He has ordered things that we may enjoy ourselves, as long as the sun shines and waters run. This is the doing of our Great Creator.' "[3]

So they said and he said. Eniaiehuk.

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[1] This section refers to the " war in the west," probably General Harrison's campaign against Tecumseh in 1811. Red Jacket and all the principal chiefs were anxious to preserve peace and did all within their power to prevent their young warriors from enlisting on either side but were not entirely successful. The issue was of such moment that the prophet deemed it wise to reveal the will of the four messengers in the matter.

[2] The word here is feminine and should be translated queen but this would manifestly not be in accord with truth. The error was made by Chief John Jacket who wrote out the Gai′wiio‘ in Seneca in 1860, during the reign of Queen Victoria.

[3] See Washington and the Iroquois, p. 137.

SECTION 93

" So then they proceeded on their journey but had not gone far when they stopped.

" Then the messengers said, ' Watch,' and pointed to a certain spot toward the setting sun.

" So he watched and saw a large object revolving. It was white and moving slowly.

" Then said the four messengers, ' What did you see? '

" He answered, ' I saw a large object revolving. It was white and moving slowly.'

" Then said the messengers, ' It is true. The thing is that which regulates the air over the earth. It is that which we call the Odā'eo (the veil over all). It is said that it would bring great calamity should it revolve too fast. Should it turn faster it would injure mankind. Now we are the regulators and watchers of the veil over all.' "

So they said and he said. Eniaiehuk.

SECTION 94

" So they proceeded on their journey and it happened that a vision appeared unto them. They seemed to be advancing toward an approaching man. Soon they met him and passed. Now when they were a distance apart they turned and he was facing them. So they greeted each other. Then said the man, ' Sedwāgo'wanĕ, I must ask you a question. Did you never hear your grandfathers say that once there was a certain man upon the earth across the great waters who was slain by his own people? ' That was what he said when he spoke.

" Then answered Sedwāgo'wanĕ, ' It is true. I have heard my grandparents say this.'

" Then answered the man, ' I am he.' (Sega^{n}'hedŭs, *He who resurrects*). And he turned his palms upward and they were scarred and his feet were likewise and his breast was pierced by a spear wound. It appeared that his hands and his feet were torn by iron nails.

"All this was true. It could be seen and blood was fresh upon him.

" Then said the man, ' They slew me because of their independence and unbelief. So I have gone home to shut the doors of heaven that they may not see me again until the earth passes away. Then will all the people cry to me for succor, and when I come it will be in this wise: my face will be sober and I shall turn it to my people. Now let me ask how your people receive your teachings.'

"He answered, 'It is my opinion that half my people are inclined to believe in me.'

"Then answered he, 'You are more successful than I for some believe in you but none in me. I am inclined to believe that in the end it will also be so with you. Now it is rumored that you are but a talker with spirits (djĭs′gä^{n}dătăha‘ [1]). Now it is true that I am a spirit and the one of him who was murdered. Now tell your people that they will become lost when they follow the ways of the white man.'"

So that is what he said. Eniaiehuk.

SECTION 95

"So they proceeded on their journey and had not gone far when they came to a halt.

"Then the messengers pointed out a certain spot and said, 'Watch attentively,' and beheld a man carrying loads of dirt and depositing them in a certain spot. He carried the earth in a wheelbarrow and his task was a hard one. Then he knew that the name of the man was Sagoyewat′ha, a chief.

"Then asked the messengers, 'What did you see?'

"He answered, 'I beheld a man carrying dirt in a wheelbarrow and that man had a laborious task. His name was Sagoyewat′ha, a chief.'

"Then answered the messengers, 'You have spoken truly. Sagoyewat′ha is the name of the man who carries the dirt. It is true that his work is laborious and this is for a punishment for he was the one who first gave his consent to the sale of Indian reservations. It is said that there is hardship for those who part with their lands for money or trade. So now you have seen the doom of those who repent not. Their eternity will be one of punishment.'" [2]

So they said and he said. Eniaiehuk.

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[1] See Spiritism, p. 126.

[2] The followers of the Gai′wiio‘ to this day mention the name of Red Jacket with contempt. While they acknowledge his mental superiority they have no other admiration for him. He was ever the enemy of Cornplanter and Ganiodaiio with whom he had frequent collision and recognized the sachem-prophet only as an impostor. The teachings of Ganiodaiio have done much to prejudice the Iroquois against Red Jacket.

SECTION 96

"Now again they took up their journey and had not traveled far when they saw a crowd on both sides of the road. And when they came to where it was they saw that they were at the forks of the road. One road, on the right, was a narrow one and the tracks upon it were mostly those of children and all were pointed in one direction. Few adults had their tracks on this road, the road rough and wide. Now as they watched they saw a woman approaching the forks of the road from behind them. She came to where the road divided and as she halted before the roads a man who stood to the left shouted, 'To this side.' (Now the road of the wicked is owa'ĕtgäⁿ, a rough road.) Then the man on the right said, 'Not so. This woman has done her whole duty. She has truly repented.' Then answered the man on the left, 'You are wrong, for her repentance has been of short duration and so of slight effect. But the man on the right replied, 'Truly in her earth-life she repented and was faithful to her promises. This is all that is required and she will walk upon the narrow road.'

"Now one of the messengers turned to him and said, 'The woman has lived a repented life for three days and has entered into the happy eternity. It was not an easy matter for her to do so of herself, but we, the messengers, have plead before the Creator and he has heard us. Three times we assist every one who believes to continue in the faith of the Gai'wiio'. At this division in the great road we guide the spirits of the earth into Tain'tciadĕ (heaven land). At the forks of the road the spirits of the dead are divided. The narrow road leads to the pleasant lands of the Creator and the wide and rough road leads to the great lodge of the punisher.'"

So they said and he said. Eniaiehuk.

SECTION 97

"So now another.

"'Verily you have seen the breast of a man hanging here by the road and in the center of that breast you saw a bullet hole.[1] Now we have caused this thing to be placed there. All will see it and he will see it who did the wrong when he comes upon the great road and know that he must turn aside and enter upon a journey over the wide and rough road.'"

So they said and he said. Eniaiehuk.

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[1] See section 56.

SECTION 98

"Now again they told him that they would take up their journey and as they went they drew near to the house of the punisher. As they went over the broad road they walked well on the sides for the path was very stony. Now, strange, this was true; some great force seemed pushing them onward toward the house of the punisher.[1] Soon they began to inhale heated air and soon they heard the far away echoes of mournful cries borne on the blasts of the hot wind. At times the air was suffocating and the cries of the doomed were distressing."

So he said. Eniaiehuk.

SECTION 99

"Now they approached a great lodge. It seemed constructed of iron that had been highly heated and allowed to cool. Within the building hot vapor was rising from the fire pits.

"Now the messengers spoke saying, 'Let us tarry here a while.' Then one of the beings took from his bosom a crystal and pointed it at the lodge. He approached holding the glass at arm's length and as he came near the lodge arose to the height of the man so powerful was the crystal." Eniaiehuk.

SECTION 100

"Now they saw and then everyone knew that the house was very long and extended far out of the eye's reach. Now this is true. When a certain woman within saw the four and him drawing near she stretched out her arms and cried for help. Then answered the four, 'It is beyond our power to alter your condition now. Our work was with you on earth. Too late.'"

So they said and he said. Eniaiehuk.

SECTION 101

"Now as they looked they saw a being walking about as if he were the master of the lodge. He seemed continually distorting himself. At times horns shot out from his forehead, at times a cloven foot appeared and at times a tail was visible.[2]

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[1] The prophet here alludes to the ease with which one may glide over the broad road. "It is no work to sin," says the preacher, "for the devil furnishes the legs for you."

[2] The prophet has very evidently borrowed his devil from transatlantic sources.

"Then said the four messengers to Ganiodai'io', 'That being is the punisher. It is he who torments those who have refused the words of Gai'wiio' when they heard them on the earth.'"

So they said. Eniaiehuk.

SECTION 102

"In a loud voice the punisher cried to a certain person saying, 'Come hither.' The punisher held a drinking vessel in his hand and within it was molten metal and thrusting it in the hands of the man he had called he said, 'Now warm yourself again as was your custom while on the earth for you loved hot drink.' Now the man pleaded but the punisher compelled him to swallow the molten metal. Then the man screamed in a loud voice and fell prone upon the ground with vapor steaming from his throat. Now he cried no more.

"Then said the four messengers, 'You have seen the manner of punishing those who persist in taking the fiery drink.'"

So they said. Eniaiehuk.

SECTION 103

"Now as they looked the master of the house spoke saying, 'Come.' Now the master knew the name of every one within the house. And straightway a woman came to where he stood. Then he grabbed her and forced her body into a great cauldron filled with a boiling liquid. Frequently he looked down into the cauldron to see if the woman had come again to the top. Suddenly she shot to the surface crying in a strange voice like some unknown animal and then sank down again. Soon again she appeared and cried, 'O, it is too hot! I should have an interval in which to cool myself!' Answered the punisher, 'Thou are not one-minded,' and jerking her out he flung her on one side. But the woman screeched in agony, 'O, it is too cold!' and her complaint was continuous and she moaned, 'It is too cold!' Then the punisher thrust her back into the boiling cauldron and immediately her bones rattled to the bottom. Such was the punishment given by the keeper of the house of torment.

"Then spoke the four messengers and said, 'This is the punishment given those who practice witchcraft. The woman whom you saw will suffer two deaths in this place and when her body is reduced to dust the punisher will gather them up again and conjure the dust back into a living body and continue his sport until finally he has become weary when he will blow her ashes to destruction. Such things happen to those who will not believe in Gai′wiio‘.' "

So they said and he said. Eniaiehuk.

SECTION 104

" Now he saw a certain nude woman coming out from a crowd and in all the hair of her body were writhing serpents. Her cheeks were parched to the bone where she had been wont to color them and likewise where her hair was parted there was no flesh. Now she was greatly ashamed but she could not cover her nakedness. So in this condition he saw her.

" Then said the four messengers, ' Saw thou that woman? In life she was wont to give on′oityi′yĕnde, [secret powders] to men to attract them to her. So you have seen the punishment meted out to those who do this and do not repent.' "

So they said. Eniaiehuk.

SECTION 105

" Now they revealed another.

" Now the master of the house looked about and saw another person. So he said, ' Come here, my nephew, I wish to see you flog your wife as was your custom on the earth.' The punisher then pointed out the image of a woman heated hot with fire and commanded the man to beat the image. Then the man pleaded with moans to be released from the command but the punisher forced him to strike the image with his bare hands, and the man fell in agony prostrate upon the floor screaming. So he saw.

" Then said the four messengers, ' You have seen the punishment given to the man who beat his wife. Thus it will be with all who fail to repent and fail to believe in Gai′wiio‘. Now such was the evil that this man did to grieve his Creator.' "

So they said and he said. Eniaiehuk.

SECTION 106

" Now they revealed another.

" The master of the house called out the names of two persons, saying, ' Come here, my nephews,'[1] and straightway they stood before him. Then said he, ' Commence an argument, you two, for you are the man and wife who in your earth-life were wont to

[1] The Seneca term means, " my sister's children," thus both nephews and nieces.

quarrel continually, so quarrel again!' Then when he saw that the people were reluctant he compelled them to argue. Then they disputed until their eyes bulged from their heads, their tongues lolled out and flames of fire shot from ganä'shoo'. So this was what he saw.

"Then said the messengers, 'This is the punishment reserved for those who quarrel without ceasing and fail to repent.'"

So they said. Eniaiehuk.

SECTION 107

"Now they showed him another.

"Now the punisher called out a certain woman's name saying, 'Come to me, my niece,' and straightway she came. Then said he, 'It was once your delight gaknowe'haat.' As he said this he lifted up an object from a pile and thrust it within her. Now the object was like ha'ji'no' gănää'', and it was red hot. Then she cried aloud in agony and she fell with steam issuing from her body. Now there were three piles of gă'nää', the first white, the second red and the third black and all were gă'nää'.' So this was what he saw.

"Then the messengers said, 'You have seen the punishment of the immoral woman.'"

So they said. Eniaiehuk.

SECTION 108

"Now they showed him another.

"Now the punisher called out in a loud voice saying, 'My nephew, come hither,' and the man stood before him. 'Now, nephew, play your violin as was once your delight.' The punisher handed the man a bar of hot iron and forced him to rub it upon his arm. So he played and the cords of his arm were the strings of the instrument and made the music. So in great agony he cried and screamed until he fell.[1]

"Then said the four messengers, 'You have seen the punishment of the man who failed to repent.'"

So they said. Eniaiehuk.

SECTION 109

"Now they revealed another.

"Now the punisher called out in a loud voice and commanded two persons to appear before him. Now when they stood before

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[1] The pagan Indians detest the "fiddle" and "fiddle dances" as things of great evil and assert that they produce as much wickedness as drunkenness.

him he handed them what seemed a pack of red hot iron cards. Then he forced the two to sit down facing each other and compelled them to shuffle the cards and as they did flames spurted out from between them. So they cried out in great agony, sucked their fingers in their mouths, handled the cards again until their flesh was eaten away and the meat fell off. So this is what he saw.

"Then the messengers said, 'This is the punishment meted out to those who handle cards and repent not.'"

So they said. Eniaiehuk.

SECTION 110

"Verily he saw those who were upon the earth and those who were alive and he saw the wicked in the house of torment. He saw Gowono^{n}′′gowa [she great talker], Găkon′go' [she-glutton animal], Gănonjoni′yon [hanging kettle] and Hano′ēs [head-eater]. Verily he saw these four persons.

"Then said the four messengers, 'These four have committed the great sin and can not be forgiven.'"

So they said. Eniaiehuk.

SECTION 111

"Then said the messengers, 'We will proceed on our journey. It would be a hard thing should we tarry too long and meet the Creator on the road before we reach his pleasant lands. If we should meet him you should be compelled to stay here forever.'"[1]

So they said. Eniaiehuk.

SECTION 112

"Then they went out upon the narrow road and had not gone far upon it when a far more brilliant light appeared. It was then that they smelled the fragrant odors of the flowers along the road. Delicious looking fruits were growing on the wayside and every kind of bird flew in the air above them. The most marvelous and beautiful things were on every hand. And all these things were on the heaven road." Eniaiehuk.

SECTION 113

"So they continued on their journey and after a short time they came to a halt. Then spoke the messengers, 'This place is called, "the spring" and it is a place for rest.' Then behold he saw the spring and he thought that he had never seen so beautiful and

[1] See legend, Two brothers who went to the sky, p. 132.

clear a fount of water. Then said the four, 'This is a place of refreshment.' One of the four drew a bottle from his bosom, so it seemed and it was, and dipped it in the spring. Then he said, 'You must partake first,' and so he took it, but when he looked at it he thought it was not enough. So he said, 'I think that this is not sufficient.' And when he had said this the messengers looked at one another and smiled and one said, 'Truly it is enough. If it lacks, there is still the spring and the vessel may be refilled. So all took and drank and all the drink that all wished was in the bottle. Then said the messengers, 'This is a place of meeting. Now we will go on our journey.'" [There are also said to have been two other meeting places, Diogē′′djaie, Grassy Place, and Dion′dot, The Tree.]

So they said. Eniaiehuk.

SECTION 114

"So then they proceeded on their journey and had gone but a short way when they saw someone coming toward them and it was not long before they met. Then he saw it was a dog and when they met, the dog began to wag its tail and sprang upon him. Then he recognized the animal as his own dog and it appeared just as it had when he had decorated it for the sacrifice in the Hadidji′yontwŭs [New Year's ceremony]. Then said the four, 'This thing attests to the value of our thankoffering to the Creator.'"[1]

So they said. Eniaiehuk.

SECTION 115

"So they took up their journey again and in a short time came to a halt. In the distance before them a man appeared to be coming and soon he came nearer. Then he saw that the man was guiding two others, one on either side of him. Now as he looked he saw that one was the daughter of Gaiänt′wakă and it appeared that she was a large child. With her was his (Ganio‘dai′io‘) own son, an infant, and they greeted one another, the son and the daughter. Now one could see that they were not strangers for they were friendly. Now moreover a fourth person was leading them all." Eniaiehuk.

SECTION 116

"Now that person spoke and said, 'I brought them with me to testify to the truth that those of the lower world when they pass away come hither.'

[1] See p. 85, Sacrifice of the white dog.

"Then spoke the daughter of Gaiän'twakă, 'I send a message. It is this: It grieves me to know that my brothers on the earth disagree with my father. Bid them cease their disagreement.' So she said."

Eniaiehuk.

SECTION 117

"So they took up their journey again and in a short time came to a halt. There was a more brilliant light and as they stood suddenly they heard the echo of a commanding voice calling the people together for the performance of the great feather dance.

"Then asked the four messengers, 'What think you has happened?'

"He answered, 'I heard the commanding voice of Joi'ise calling the people to celebrate the great feather dance.'

"Then replied the four messengers, 'Verily, Joi'ise, your friend is he who calls. He it was who was faithful and good and when he passed away in the lands of the Creator he continued as on the earth [to be a leader].'"

So they said. Eniaiehuk.

SECTION 118

"So they took up their journey again and after a ways the four messengers said, 'We have arrived at the point where you must return. Here there is a house prepared for your eternal abode but should you now enter a room you could never go back to the earth-world.'"

So they said. Eniaiehuk.

SECTION 119

"Now when he arrived in Tonawanda having come from Diono^{n}'sădegĕ he was reluctant in performing his religious duties."

SECTION 120

"Now he was at Cornplanter ten years, at Cold Spring two years and at Tonawanda four years. From there he went to Ganonktiyuk'gegäo, Onondaga, and there fell our head man."

SECTION 121

"Now it happened that while he still abode at Tonawanda an invitation was extended by the people of Onondaga asking him to come and preach Gai'wiio' to the chiefs and head men there."

SECTION 122

" Now it happened that the four messengers appeared to him when the invitation was extended, they the four speakers and messengers of the Great Spirit of the worlds.

" Now the first words that they spoke were these, ' They have stretched out their hands pleading for you to come and they are your own people at Onondaga. Let this be the way, prepare yourself and cleanse your body with medicine.[1] It is necessary moreover for you to secrete yourself in some hidden spot and await our call to start.' "

So they said. Eniaiehuk.

SECTION 123

" Now there will be another and his name will be the New Voice, Hawĕnose".

" So now it was that Ganio'dai'io' was bidden the third time to sing his song and this the messengers said would be the last.

" Now then he said, ' There is nothing to incumber me from fulfilling my call.' "

So said our head man. Eniaiehuk.

SECTION 124

" Thus it happened in the past and it is the truth.

" ' I must now take up my final journey to the new world,' he thought, and he was greatly troubled and longed for the home of his childhood and pined to return.

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[1] Purification. The herb used most extensively by the Iroquois for " purification " was witch hopple, the bark of which was used both as an emetic and a purgative. For an emetic the bark was peeled upward and for a purgative downward.

Early in the spring during the spell of warm days the people would take their kettles, jars of soup and deerskins and go alone into the woods for their ceremony of purification. Here they would scrape the bark, build a fire and make a strong infusion of the witch hopple bark. The drink was taken in large quantities and then the Indian would sit wrapped in his deerskin to await the results. From sunrise to sunset the drink would be taken until the alimentary tract was completely emptied. Toward sundown a little soup would be sipped to ward off excessive weakness, and give strength to return home. The next morning sweat baths were often taken, though not always, and then solid food was eaten. This process was thought to purify the body and without doubt did much to do so. Besides the customary spring purification others were sometimes ordered for disease and for preparations for ordeals, tests and ceremonial purposes. The process was again repeated in the autumn.

" Then came the four messengers to him and said, ' The children will comfort you in your distress for they are without sin. They will elect a certain one from among them to plead that you continue to abide among them.' "

So they said. Eniaiehuk.

" Now it happened that it came to pass that all the children assembled and their spokesman did his utmost to exact a promise from Ganio'dai'io'. So great was his grief that after he had spoken a short time he could no longer plead. Then another boy was appointed by the children, a boy not bashful but rough and bold. So he, too, endeavored to persuade Ganio'dai'io', but it was a difficult task for him and he could scarcely speak, but he did. Then Ganio'dai'io' made an answer to the children. He rose and exhorted them to ever be faithful and a great multitude heard him and wept." Eniaiehuk.

SECTION 125

" Now at this time there was a man and his name was New Voice, a chief of equal rank with Cornplanter. Now this man urged Ganio'dai'io' to accept the invitation of his friends and relatives of Onondaga. He said, ' It is as if they were stretching forth their necks to see you coming. Now I am going forth to a gathering of chiefs at Buffalo on the long strip that is the fireplace of the Six Nations,[1] the great meeting place of human creatures. I will go so that I may believe that you are on your journey and I will ride away as fast as my horse can go.' So he said."

SECTION 126

" Now then Ganio'dai'io' started on his journey and a large number followed him that they might hear him speak. They had no conveyances but traveled afoot.

" Now when they came to their camping spot at Ganowa'gĕs,[2] he said to them in a commanding voice, 'Assemble early in the morning.' Now when they did he offered thanks and afterward he said, ' I have had a dream, a wondrous vision. I seemed to see a pathway, a trail overgrown and covered with grass so that it appeared not to have been traveled in a long time.' Now no one spoke but

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[1] At this time there was an Onondaga village on the Buffalo Creek tract. It became therefore a legal meeting place for the Six Nations. The Canadian refugees often returned to council there.

[2] The site of the village opposite the present Avon, N. Y.

when all had heard and he had finished they dispersed and they continued on their journey."

SECTION 127

"Now their next camping spot was near Ganŭndase'ge'.[1]

"Now when they had all come up to the spot he called out in a commanding voice, 'Come hither and give thanks.' Now when the ceremony was over he said, 'I heard in a dream a certain woman speaking but I am not able to say whether she was of Onondaga or of Tonawanda from whence we came.' So this was what he said when he related his dream. Then all the company dispersed." Eniaiehuk.

SECTION 128

"So they proceeded on their journey.

"Now it happened that when they were near the reservation line he said, 'Let us refresh ourselves before going farther.' So they sat down and ate and then they continued on their journey."

"Now it happened that when they were over the reservation line that he said, 'I have forgotten my knife. I may have left it where we stopped and ate last. I can not lose that knife for it is one that I prize above many things. Therefore I must return and find it.'

"The preacher went back alone and there was no one to go with him. Now he became very ill and it was with great difficulty that he returned. The others had all gone on to the council but he was not able to get to it for he was very sick and in great distress. So when he did not come it was said, 'Our meeting is only a gathering about the fireplace.'" Eniaiehuk.

SECTION 129

"Now it happened that they all wished to comfort him. So for his pleasure they started a game of lacrosse[2] and played the game well. It was a bright and beautiful day and they brought him out so that he might see the play. Soon he desired to be taken back into the house." Eniaiehuk.

SECTION 130

"Now shortly after he said a few words. To the numbers gathered about him to hear his message he said, 'I will soon go to

[1] The Seneca village near the present site of Geneva, N. Y.

[2] Games were often played to cheer and cure the sick. Special foods were given the players.

my new home.[1] Soon I will step into the new world for there is a plain pathway before me leading there. Whoever follows my teachings will follow in my footsteps and I will look back upon him with outstretched arms inviting him into the new world of our Creator. Alas, I fear that a pall of smoke will obscure the eyes of many from the truth of Gai'wiio' but I pray that when I am gone that all may do what I have taught.'

"This is what he said. This is what Ganio'dai'io', our head man, said to his people." Eniaiehuk.

[Then the preacher says:] "Relatives and friends: His term of ministry was sixteen years. So preached our head man, Ganio'-dai'io'.

"Let this be our thanks to you and to the four messengers also. I give thanks to them for they are the messengers of our Creator. So, also, I give thanks to him whom we call Sĕdwāgowānĕ, our great teacher. So, also, I give thanks to our great Creator.

"So have I said, I, Sosondowa (Great Night), the preacher."

[*Signed*] EDWARD CORNPLANTER, *Sosondowa*

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[1] Handsome Lake died August 10, 1815, at Onondaga. His last moments were spent in a small cabin near the creek that runs into Onondaga creek at the foot of the terrace. Three persons attended him and swore to keep all details secret. He is said to have died before his nephew, Henry Obeal, could reach him.

PART 2

FIELD NOTES ON THE RITES AND CEREMONIES OF THE GANIO'DAI'IO' RELIGION [1]

GÄNÄ'YASTA'

The midwinter festival of the Iroquois, commonly called Indian New Year.

On the third day of what the Seneca term Niskowŭkni ne'' Sadē'goshä or the moon of midwinter, a council of head men is called and officers elected to officiate at the Gänä'yasta' or midwinter thanksgiving ceremony to be held two days later. Officers are chosen from each of the two brotherhoods [2] of clans.

On the first day of the ceremony officers called Ondeyä, dressed in buffalo skins, meet and lay out a route of houses which each pair of Ondeyä is to visit. This settled, they draw the buffalo heads over their heads and start out.

There are three excursions of Ondeyä from their lodges, one at about 9 a. m., one at about 12 m. and one at about 3 p. m. Two Ondeyä, carrying corn pounders painted with red stripes, knock at the door of a house and entering intone:

Hail, nephews. Now also the cousins with you. Now also you see the big heads.

> Ye hē! Gwäwandĕ!
> Oneⁿ''dĭq wodewĕ'noyē ne' nē'sēso gwäwandĕ!
> Oneⁿ''dĭq īswāgēⁿ' noĭwane'!

This is repeated and the Ondeyä depart.

At noon the Ondeyä repair to their meeting place and emerging again go over the same route. Their message as they enter a lodge at this time is.

Hail. Be clean! Do not be confused, O nephews. Do not tread upon things, nephews, cousins, when you move.

> Yĕhe! Jokwehoⁿ! sänon'di gwä'wandĭ! dänondodädĕ, gwä'wandĭ nene'sēso nänondo''yäno'!

At 3 p. m., returning to the same lodge, the message is:

> Yĕhē! Oiseⁿdase' susniun'nano ne'' swaisĕ'' dŭgayio' säⁿdo.'
> One'' dĭq ĭtchigaine'soⁿ nongwŭk'sado' nenwande' sä'noⁿ dĭq ĭtch'nonadoktē' ongwŭkädo'. One'' dĭq nĕkho'' non'jiyē.

[1] Taken at Newtown, Cattaraugus reservation, January 1905, by A. C. Parker.

[2] See Phratries.

After one has intoned this message or announcement the other pokes up the ashes with a basswood paddle and sings a song.

The first day is spent in this way, formal announcements being given by the officers.

On the morning of the second day all the lodges are visited by officers called Hadēiyäyo'. Later, say 9 a. m., clan officers, known as Hanä'sishĕ, begin their round of visits. Two men and two women are chosen from the phratries and going in couples to the various houses conduct a thanks or praise service. The burden of their words is a thanksgiving to God for the blessings that have been received by that house during the past year.

When this ceremony is over these officers throw up a paddle (Wadigusä'wea) signifying that the ceremony is over. At this time a chief makes a long thanksgiving speech in the council house.

At noon the "big feather" dancers visit every lodge and dance the sacred dance. Two women at least must participate. On entering a lodge the leader of the feather dancers must say:

> Onĕⁿ''dĭq' hodo''issoin'yŭnde sedwā'ă'wŭk gäoⁿ'ya'ge' honoñ'ge'. Nēkho''nai' hodo'isshoⁿgoⁿoindi ne'' häwoⁿn'. Hodawisa'sē' Osto'wägowă.
>
> Onĕⁿ''dĭq'dji'wŭsnowät nĕ'' gissäⁿ äyĕⁿoñgwē' Osto'-wägowă. Gagwēgoⁿ,' onĕⁿ'' dĭq,' djiwŭsnowät heniyoⁿ' swao'iwayandoⁿ'!
>
> Da'neho''!

At about 2 p. m. public dances begin in the "long house."

The Society of Bears, which during the early afternoon had been holding a session in the house of some member, enter the long house and dance publicly. The same is true of the False Face Company.

Other dances are the Pigeon song dance (Tcä'kowa) and the Gădā'ciot. The only dance in which physical contact is permitted is the Yĕndonĭssontă' or "dance of the beans." Dancers hold each other's hands as they circle around the singers. This is to represent the bean vine as it clings to a sapling or corn stalk.

On the morning of the third day the priest arises before daylight and standing at the door of the council house begins his song of thanks. The song is sung until dawn appears and then the priest ceases. Should a fierce wind be blowing it is believed that when the words of the song float upward the Great Spirit will say, "Cease your movements, Oh wind, I am listening to the song of my children."

The first verse is as follows:

Onĕⁿ′′ dĭq′ okno′wi, Onĕⁿ′′ dĭq,′ dasĕnni′′dottondē
Găo′yä gütci′ja‘! Yoändjă′gĕ igĕⁿ′s
Onĕⁿ′′ dĭq′ o‘gai′wayi‘ onĕ′′
Dĕawĕn′nissĕ no‘gowĕs
Dĕowiono‘gowes
Saiwisa‘honio‘
Onĕⁿ′′ dĭq′ wadi′wayēĭs.

The song begins with the singer's face to the west; he turns and sings in all directions, that all may hear his voice.

A legend relates that this song originated ages ago. An old woman is said to have been with child and before her son was born, from the heavens came this song.

Only one or two Indians sing this now, no others being able for some reason. After the song the priest calls upon the Great Spirit in these words:

Ye, ye-e, yēē!
Dane′′agwa none′′neⁿgä′ nē′wa
Onĕⁿ′′ dĭq dasa′′tondat′ gäogĕ‘gĕ‘
tci′ja′, etc., etc.

At about 9 a. m. another officer of religion enters the long house and sings the Ganio‘dai′io‘ song:

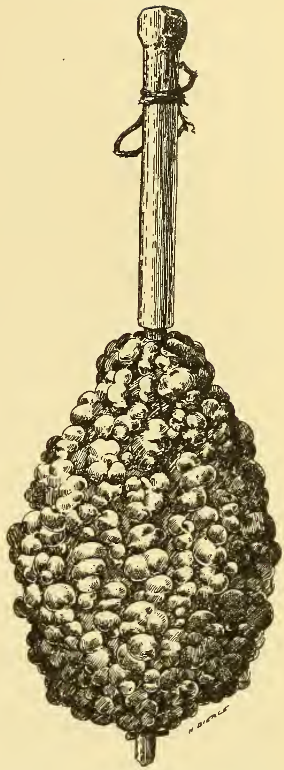

Fig. 1 Prayer rattle made from a dried squash. Allegany Seneca specimen.

Translation:

I love my world, I love my time, I love my growing children, I love my old people, I love my ceremonies.

At noon various societies and companies which have been holding sessions in private lodges adjourn to the council house to engage in public ceremonies. The great feather dance is celebrated at noon. Afterward nearly all the common dances are given, among which is the woman's football game and dance.

The morning of the third day is greeted as the previous day, by the song and prayer of the priest.

At 9 a. m. of the fourth day the Gonio'dai'io' song is chanted again. Meanwhile the company of harvest dancers hold their dances at private houses going to the long house (gano^{n}'sŭsge^{n}') at noon. Soon after the Bird Society or Gane''gwäē enters the council house and begins its dance. Two dancers are chosen from each phratry, as are also two speakers. The evening is devoted to the Trotting, Fish, Pigeon, Bear, False Face, Buffalo and other dances. At 10 p. m. the ceremonies cease.

On the fifth day the dawn ceremony is repeated and at 9 a. m. the Ganio'dai'io' song is sung. Societies hold meetings in their own lodges.

At about 1 p. m. a company of women dancers visit each house, dance and sing and return to the long house. False Face beggars also roam from lodge to lodge in search of sacred tobacco. In the afternoon and evening various dances are held in the long house. At about 11 p. m. the Husk Face Company enters the long house and engages in their public ceremony. After this dance the people are dismissed by a chief.

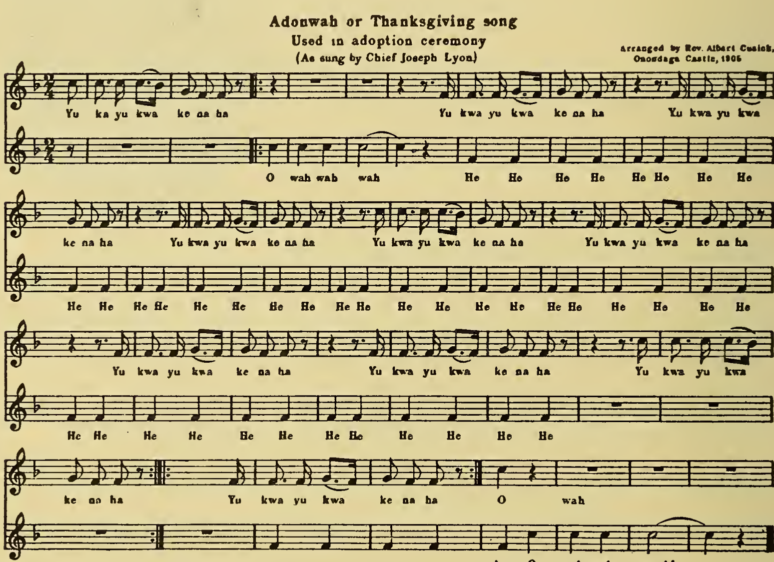

Fig. 2 The Thanksgiving song

The morning of the sixth day is devoted to the dog sacrifice and the tobacco offering. Afterward the Ado^{n}'we' are sung. This song may be translated: I am now going home, I step upon another world, I turn and extend my arms for a friend to lead me, I pray all may go where I go. Now the earth is smoky and none can see the other world [as I do].

On the seventh day the Honon'diont hold a morning dance and then proceed to cook the feast. Costumed feather dancers enter the long house and dance. The "wind is open for names," or opportunity is now given to bestow names. At this point if a boy is to be named the priest rises and says, "Hio'gĕnē'', dji'wagä ne-e!"

"Hu'', hu'', hu''hu''-ā!" respond the people.

If a girl is to be named there is no ceremony other than the mere announcement of the name. A speech is now made by a chief bidding people make ready for the sacred bowl game.

Honon'diont visit each lodge exacting from every person stakes for the sacred gamble. Each phratry is to play against the other The Honon'diont then meet and match articles, value for value.

The night previous every person endeavors to have a prophetic dream, whereby they may know the result of this game. No one must cheat in this game for "it is God's."

The great feather dance is repeated and names bestowed on this day. At night the Husk Faces return and give a grand final dance.

The ninth day is the last one of the midwinter's ceremony. Early in the morning the priest gives a thanksgiving "sermon." At 5 p. m. occurs the dance in honor of the "three sisters," Diohē''ko, (these-we-live-on). Afterward the woman's dance is held, alternating with the following men's dances, Trotting, Pumpkin, Pigeon and Beans. The feast is then distributed and the people disperse.

THE WHITE DOG SACRIFICE[1]

A preliminary translation of the ceremonial prayer at the burning of the white dog at the Seneca Indian new year's ceremony (February).

Wotok'waiiendakwa Gaiantguntgwaa

(wotok'waiien'dakwa gaiänt'guntgwā')

Gwa! Gwa! Gwa!
So now this is the appointed time!
Oh listen, you who dwell in the sky!

[1] Recorded February 1906, at Cattaraugus reservation.

Our words are straight —
Only these can we speak unto you,
Oh you from whom we are descended,
Oh you who dwell in the sky!
You look down upon us and know that we are all children.
Now we petition you as we burn this sacred tobacco!
Now we commence our invocation,
Now we speak of all that you have created.
Now [in the beginning] you did think that men-beings should inherit the blessings of your creations,
For you did say, "Earth was my birthplace!"
Now we have spoken in this incense [throws tobacco upon the flames].
Oh now inhale the smoke, so listen to our words.
Now we commence, we are all that remain upon the earth.
You behold the places that once were filled but now are empty;
We were unable to change it for you made the law.
Now you think that there should be two conditions of temperature upon the earth;
One you thought should be cold and one should be warm
And when the warm season came that Diohē′′ko, our substance, should spring from the bosom of Earth, our mother.
Now we have harvested the Diohe′′ko from whence our living is
For the warm season has gone and we have here assembled.
Now we have made inquiries among all the people and they remember their promises,
For they promised you that they should assemble again at Gaiwanos′kwa gowa′
On the fifth sun of the moon Nĭskowŭk′nĭ.
So all fulfilled the plan and gathered together in the moon Nĭs′a, even those here present,
Oh you who were born of Earth, yet dwell in the sky!
Now all have fulfilled the law, for you did plan that the rites should be perpetuated even forever.
Now we are commencing, Oh you who were born of Earth!
Upon the first day the Great Feather dance went through the village for your pleasure.
The honon′diont and their cousins did their full duty.
Now on the next day Ganēo′ was celebrated; at midday they went through the village,

And you did give us great joy because we performed this ceremony
For you did think that Ganēo' should be celebrated upon the earth for thine own self.
Thus did we fulfil your desires, Oh you who were born of Earth, yet live in the sky!
Now on the next day Gagandot was played.
Truly we did fulfil your desires,
Oh you who were born of Earth, you who live in the sky!
You did see all that was done,
Oh you who were born of Earth, you who live in the sky!
In the beginning you thought that you would lay this sacred tobacco by man's side
That men should have an incense with which to send his words up to the sky,
With which to lift his words when the year ended.
Truly we have fulfilled your desires and here we have that basket of sacred tobacco,
Oh you who were born of Earth, you who dwell in the sky!
[Throws tobacco on the flames.]
So now the smoke arises!
Oh inhale the incense as you listen!
For now do we commence to speak of what you have created.
In the beginning you thought that there should be a world
Upon which men beings should travel
That you might say, " They are my descendants."
Now there is a shaft that reaches up to you, Ganeowi, the sacred song of the morning it is.
Now of your descendants as many as remain are gathered here.
Now you thought that there should be two sexes of men-beings,
That one should be the male and one should be the female,
And the function of the female should be the rearing of children.
Truly the females are fulfilling the design of their creation
For in their arms we see their children.
Truly it is in progress what you planned for them.
Now the smoke arises!
So now inhale this sacred incense!
Now we petition you that this thing should continue so henceforth,
And shall continue as long as the earth endures.
Now you thought that there should be a world
Upon which grasses of different kinds should grow

And that some should be medicinal,
And that some should yield fruits for a help to the men-beings who dwell upon the earth.
Thus did you think, O you who dwell in the sky!
Now it was ordered to be so when the warm season warmed the earth
And that it should be fulfilled them and that your descendants should see the return of things.
Now again the smoke arises
And the people speak through it to you,
Oh you who dwell in the sky!
Now we implore you that it may so occur again when the earth warms,
That your desires may be fulfilled and that your descendants may again see your creations.
Now again the smoke arises
And the people speak through it to you,
Oh you who dwell in the sky
Yet were born of Earth!

Now our sustenance you thought should be placed beside us,
And that men-beings should labor for their living.
These plans are all in progress
All see from whence their living comes.
Now we implore you that when the earth warms again that sustaining food may grow.
This we ask by the power of the incense tobacco,
Oh inhale it and listen to us,
Oh you, our great ancestor,
You who dwell in the sky!

You thought that there should be veins and that there should be fountains of water;
Now this thought is made a fact and is occurring
So we ask that this shall continue.
Now again the smoke arises
To you the father of all men-beings,
To you who dwell in the sky!

Now you thought that there should be living creatures,
Inhabiting the waters, useful to the people.

Now your thoughts have happened and we implore you that it may not be withdrawn,
Oh you who were born of Earth,
Oh you who dwell in the sky!
But may continue as long as earth endures.

So now another.
You did think that there should be world
And that bushes should grow upon it for a help to the people,
That the bushes should yield various fruits for the benefit of men-beings,
Oh you who were born of Earth,
Oh you who dwell in the sky,
May this continue as long as earth endures!

Now again the smoke arises,
Oh inhale the incense and continue to listen
Oh you who were born of Earth
Oh you who dwell in the sky!

So now another.
Now you did think that there should be forests upon the earth
And that they might be a help to the people.
So now moreover you did think that there should be a certain tree
That should yield sweet water from its trunk.
Now that tree is the Maple and it is faithful to its design
May this continue to be,
Oh you who dwell in the sky!

Now again the smoke arises,
And the people pray that this may still continue when the earth becomes warm again!
So now this thing is done.
Our words are as straight as we could make them.
Only this can we do for we are all young
Oh you who were born of Earth,
Oh you who dwell in the sky!
So now this one thing ends.

So now another.
You have created wild animals that roam in the forests,
You did think that they would be a pleasure to men-beings

Who should remember and say, "We are his descendants."
Now may they continue so to be,
Oh you who were born of Earth,
Oh you who dwell in the sky!

So now another.
The people are speaking;
They are continuing from the commencement of creation
Discussing those things that you didst think would be a benefit to men-beings,
Oh you who were born of Earth,
Oh you who dwell in the sky!

Now the birds that inhabit the air,
Birds from the low world to the great birds,
Birds that float above the clouds.
All these you did think would be a benefit to mankind.
Oh you who were born of Earth,
Oh you who dwell in the sky!
Now we ask that this thought should be forever
Even as long as earth endures.

Now again the smoke arises,
Continue to listen as you inhale this incense,
For we are discussing the things of your creation
That you did think should be a benefit to mankind,
Oh you who were born of Earth,
Oh you who dwell in the sky!
Now you did think that there should be a world and that it should become cold,
At a recurring season become cold again.
Now we implore thee that it should not be too great a cold
And likewise when the earth becomes warm again,
That the heat should be moderate and comfortable.
Now again the smoke arises
To you who were born of Earth,
To you who dwell in the sky!

So now another.
Continue to listen!
You did think that there should be a wind
And that it should be a help to the world.

Now the wind is here.
And the people pray that it may continue to be so as long as earth endures.

Now again the smoke arises
To you who were born of Earth,
To you who dwell in the sky!
Now they came from the west.
Ti′sōt we call them,
Our great grandfathers the Thunderers;
You did make them our relatives.
They were placed in a high position
That they might care for the earth
And feed the waters that flow over the world and purify them,
And freshen all things that grow.
A certain season was appointed for their activity
The season when the earth commences to become warm again.
Now again the smoke arises,
It lifts our words to you,
Oh inhale the incense and continue to listen,
Oh you who were born of Earth,
Oh you who dwell in the sky!
Now the whole world prays that you will listen,
May all these things continue as long as earth endures,
Oh you who were born of Earth,
Oh you who dwell in the sky!

So now again another.
You did think that there should be a sky
And that within it should be something to illuminate the world,
Ĕndē′ka gää′′kwa, our great brother, the mighty warrior, the Sun,
And that so it should be called so.
He has a high position that shall last as long as earth endures.
Now again the smoke arises and so smoke tobacco as you listen,
Oh you who were born of Earth,
Oh you who dwell in the sky!
Now the people of all earth with one voice implore you
That your plan may be carried out and continue as long as earth endures,
So do your descendants pray.

So now another.
It is of Soi'kā gâä''kwa, our grandmother, the Moon in the sky.
You did make her a sign for reckoning the years of children.
Now she has fulfilled the design of her creation so far.
Now again the smoke arises.
Inhale the incense as you continue to listen,
Oh you who were born of Earth,
Oh you who dwell in the sky!
Through the smoke we pray that this may be so as long as earth endures,
So pray your descendants,
Oh you who were born of Earth,
Oh you who dwell in the sky!
So have they said,
Oh you who were born of Earth,
Oh you who dwell in the sky!

Now you did think that there should be a sky
And that spots should be in the sky
For signs unto the people.
So did you design this to be so as long as the earth endures.
And the people implore thee that this may continue to be as long as the earth endures.
Now again the smoke arises,
And through it the people speak.
Oh inhale as you continue to listen,
Oh you who were born of Earth,
Oh you who dwell in the sky!
Now you did design all that which should occur in the world,
And planned the four sacred ceremonies
That should be perpetuated forever
And celebrated by the people each year.
Be celebrated by these who call themselves your descendants;
That there should be head ones and their assistants
To perpetuate the four ceremonies.
Now as many men-beings as remain on earth are here,
Gathered about this pole.
Now then you have seen that we commenced at the new part of day.
Now you shall know that you are invited to listen to thanking songs this day!

[The head chief yells Yokadi! Gowagannie!
The people answer wo' wo' wo'!]

Now tomorrow morning you must consider yourself invited to the Great Feather Dance!

[Cries by the head chief Hioh, hiu, hiu, hiu!
The people answer Io' io' io' io' io'!]

Two parts will be celebrated, the Great Feather Dance and the Harvest Thanksgiving.

[Cries by the head chief; Ganio ganio ganio!
Answers by the the people Ho-ni ho-ni!]

These two ceremonies will be in progress tomorrow,
Oh you who were born of Earth,
Oh you who dwell in the sky
And the next day you are invited to the sacred game.

[Cries by the head chief, Ba-a'! ba-a'! ba-a'! ba-a'! ba-a'!
Answers by the people, Hoie! hoie! hoie! hoie!]

Now again the smoke arises
The incense of the sacred tobacco,
To you who were born of Earth,
Yet dwell in the sky
Only this can we do
To fulfil the law.
All the things of your creation that you have made visible to us
We thank you for and for all the things that you have created.
In the manner that you did think, we have thanked you,
From low earth upward to the great sky where you are living.
With all their strength the people thank you and you have seen it,
Oh you who were born of Earth,
Oh you who dwell in the sky!
So now it is done.
Now you did think that you would appoint four messengers whose work should be to watch over earth
And the people that dwell in the world
To keep them all from harm,
For men-beings are your children.
Now do I say, the voices of the people combine as one
To thank you.
We have done as best we can in giving thanks to the four messengers.
Now again the smoke arises,
And we speak through its incense.
Inhale the smoke as you do listen.
Oh the great Handsome Lake!

We believe that he is happy in the place that you have prepared for him.
Moreover we thank him.
Oh you who were born of Earth,
Oh you who dwell in the sky!
Now only this can we do.
You thought that it should be this way,
Oh you that were born of Earth,
Oh you who dwell in the sky!
Now we thank you, the Creator of the World.
Here are gathered so many people as remain,
Few head men remain.
Only this can we do,
And they say how the people should act.
Of the head men and their cousins only so many are left,
[But they with] the men and the women
The children that run and the children that creep
As one man-being offer you thanks.
They are your descendants,
Oh you who dwell in the sky!
Now you did think that we should offer you tobacco when we addressed you.
And we have fulfilled your request and used tobacco.
We leave our words with you until the next great thanksgiving,
Until then may the people continue in health.
Now the smoke arises!
Oh inhale as you do listen!
Only this can we do
For all the words are spoken
To you, our great ancestor,
Oh you who dwell in the sky.
Oh you who were born of Earth!

NE GANEOWO[1]

One of the four sacred ceremonies of the Seneca

The Gānē′o^{n}wo^{n} is a ceremonial thanksgiving in which two "preachers," standing on either side of a long bench around which a company of religious dancers have arranged themselves, alternately intone sections of the Gānē′o^{n}wo^{n} ritual. At the end of

[1] Ne″gānē′o^{n}wo^{n}, recorded and translated at Newtown, Cattaraugus reservation, January 1906.

each section the speaker starts a chant which is taken up by the singers who sit on the benches. A drummer keeps time by beating a water drum and the dancers gracefully circle around the benches. The direction of this dance, as all Iroquois dances, is counterclockwise. When the chant and dance have continued a period deemed sufficient by the opposite speaker, he halts the singing and dancing by the exclamation "Gwi''yă'!" and then commences his intonation.

The writer had recorded the entire Gānē'o^{n}wo^n ritual, speeches and songs, on a set of phonograph records, especially for preservation by the New York State Education Department. Unfortunately these perished in the Capitol fire of March 29, 1911. About 100 other ceremonial records on wax cylinders were also destroyed at that time.

[PRELIMINARY] TRANSLATION OF THE GANEOWO RITUAL OF THE SENECA

I Gwi''ya'!
Now the whole assemblage is offering thanks!
This day [there] is occurring what the Creator has made pleasing for his own self.
We are thankful that what he has made for himself is accomplished.
[Singing and dancing].

II Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
The Creator thought that there should be men-beings,
And he thought that there should be chiefs to regulate the actions of these men-beings.
So now we thank him that what he thought has come to pass!
[Singing and dancing are resumed].

III Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
Now he thought that there should be two sexes,
That one should be the female
That children might grow from her.
We thank the women that they are doing their duty in fulfilling the design of their creation.
[Singing and dancing resumed].

IV Gwi'′ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be a difference in the length of lives,
And that children should run about and some creep.
So this is what he has done.
We are thankful that this is fulfilled.
[Singing and dancing resumed].

V Gwi'′ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that certain ones should be the leaders of the people,
The same for both male and female, to preserve the four ceremonies.
So we thank these head ones that they are dutiful to the calling of their Creator.
[Singing and dancing resumed].

VI Gwi'′ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be a world and that people should be upon the world,
That they should draw their sustenance from the world.
So we thank the Creator that what he thought has come to pass.
[Singing and dancing resumed].

VII Gwi'′ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be things in the world for sustenance
And that people should labor for their sustenance.
Now we petition the Creator that we may again see the season of things growing from which our living is.
[Singing and dancing resumed].

VIII Gwi'′ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be herbs of different kinds
And that these should grow when the earth is warm
And that these herbs should be a help to the people when medicine was needed.

So we thank the Creator that what he thought is now occurring.
[Singing and dancing resumed].

IX Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be two different varieties of trees and that one should yield fruit.
Now the first fruit of the year is the strawberry
And he thought that when the strawberries are ripe his creatures should thank him,
Thank him in a great feast and dance ceremony.
Now I ask that the time of strawberries may return again.
[Singing and dancing resumed].

X Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage offers thanks!
He thought that there should be trees for a help to the people of earth.
So now we thank the Creator because what he thought is fulfilled and is a help to the people.
[Singing and dancing resumed].

XI Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage offers thanks!
He thought that there should be a certain tree to bear fruit.
So we are thankful that all things are that he has ordained
And shall be as long as the world endures.
[Singing and dancing resumed].

XII Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be forests upon the earth
That these should be a help to the people of earth.
So we thank the Creator that what he thought has come to pass.
[Singing and dancing resumed].

XIII Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be a certain tree

From which sweet waters should flow when the earth warmed.
That this tree should be the maple and that men-beings should tap it,
And that this should be a help to the people.
So we thank the Creator that what he thought is occurring.
[Singing and dancing resumed].

XIV Gwi″ya'! [Singing and dancing stop].
Now the entire assemblage is offering thanks!
He thought that there should be a certain tree to yield nuts,
So we are thankful that what he thought is so.
[Singing and dancing resumed].

XV Gwi″ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that he would create wild beasts
And that men-beings should derive benefits from them.
So we thank the Creator that they are [yet] for our help.
[Singing and dancing resumed].

XVI Gwi″ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be certain ones who should be his servants,
And that they should come from the west and care for the world,
That they should cause the earth to become wet
Thereby feeding the springs and waters that flow
Moreover that they should be called Hadiwĕnnoda'diē's, the Thunderers.
So we thank the Creator that they have always fulfilled the purpose of their creation.
Now we put everything together and say
We are thankful that all things are doing that for which they were created.
[Singing and dancing resumed].

XVII Gwi″ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be a sky over head;
He thought that there should be stars in that sky

That the men-beings that he put upon the earth might be guided thereby;
That certain stars should guide the people.
So we thank the Creator that what he thought is so.
[Singing and dancing resumed].

XVIII Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
Now he thought that there should be a certain one in the sky.
And that he should give light a certain period of time
And that they should call him "our brother, ĕndē'ka gä'äkwa',"
Now, as we are all gathered together, we thank the sun that he is eternally dutiful.
[Singing and dancing resumed].

XIX Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there should be another in the heavens
Who should reveal itself when the sun went under
And that people should call it ăksō'ōt, our grandmother, Soi'kāgä'äkwa.
Now, as we are all gathered together, we thank the moon that she is eternally dutiful.
[Singing and dancing resumed].

XX Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that there must be a certain one who should reveal what he thought.
He thought that he should lay the Gai'wiio' before the people,
So he revealed the Gai'wiio' to Ganio'dai'io'
And he did his duty as the Creator had ordained,
He preached and taught until he died.
So we all render our thanks for he has done his duty
For we now follow in the way he taught
And we will remember forever.
[Singing and dancing resumed].

XXI Gwi''ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!

He thought that he should have four beings for his messengers
Who should watch over the people of earth and that on their strength their living should be.
Now we thank the four messengers that they are faithful to the design of their creation.
[Singing and dancing resumed].

XXII Gwi"ya'! [Singing and dancing stop].
Now the whole assemblage is offering thanks!
He thought that the people should commence with the lower earth to thank him
For all that he had created and should offer thanks for things from below up to himself in the high world.
We therefore, gathered together in this assemblage, thank our Creator,
Yea all of his creatures who are living in this world.
[Singing and dancing resumed].

XXIII Gwi"ya'! [Singing and dancing stop].
Now all the people offer thanks!
He thought that there should be certain persons to sing for the dances he had made.
Now you who have sung and are singing, we thank you.
[Singing and dancing resumed].
[Speaker exhorts all the people to join in the dance].

OUTLINES OF THE CORNPLANTING AND THE MAPLE THANKSGIVINGS

AN OUTLINE PROGRAM OF WAANO'′NAOGWĀ'′CIOT, THE CORNPLANTING CEREMONY

1 Opening address by a chief
2 A Thanksgiving speech
3 Ne′′äskä′nīe', the women's dance
4 Ne′′ga'dā′ciot, the jubilee dance
5 Ne′′gusshēdon′dada', the jug shaking dance
6 Ne′′äskän′īe', the women's dance
7 Ne′′yiĕndonĕsshontă', the old women's song
8 Ne′′äskä′nīe', the women's dance
9 Ne′′gaianon′gayo^{n}ka
10 Ne′′ostō′wägo′wa, the great feather dance
11 Closing address
12 Distribution of the feast

The object of the Cornplanting ceremony is to secure divine favor and help in the spring planting. Everyone is invoked to till the ground and earn the bread they eat. The ceremony lasts about four or five hours.

THE MAPLE FESTIVAL

A council is called to set the time for this festival which has no exact day but varies according to the weather. However, it takes place soon after the sap commences to run. Its object is to thank all trees for their services to man and invoke their protection and good will for the coming year.

Outline program

1 The address to the maple tree. A fire is built at the foot of a large maple tree. The people gather around and a special officer advances with a basket of tobacco which he sprinkles on the fire as he recites the address to the maple:

> Ne' nĕ^{n}gä′ gägwā′ani saiwisa′ane gäni′sĕ swĕn′iio'
> Seane ganigä′o ne′′niganigai′isek
> One′′ dĭq′ oyän′kwa (owe) soi′yĕ'
> Negihedahadondi gaiyehonoshäs henizaiwissaho^{n}'
> One^{n}′′ dĭq′ kejedai' soñgwāni, etc.

The prayer at the maple festival

Wa′′da Tadinion′nio′o‘

Maple Thanksgiving

Ēs^{n}waiyĭgwa‘showine‘′ odēha′donni. Ne′′wainnondoi′shoñk
Oh partake of this tobacco the forests. This we petition
nega′dogä nayŭt′däo^{n} näĕtgonĕ′igais näwă′′dă
may you continue the production of sweet water Oh maple
Hawe′o^{n} Nawĕnniio‘ ĕ^{n}gäo^{n}dadegao^{n} ĕ^{n}gani′gaiksēk
The will of the Creator that a certain tree water flows from
Ne′′nē^{n}gä′ ĕ^{n}gä′oñk hadieo‘′shä deodo^{n}o^{n} ne′′ hē‘′hadidŭk′kēno^{n}diēs
This it may not accidents occur the running about
hadĭksā′sho^{n}′o′ gahadĕgon^{n}sho^{n}
the children in the woods.

Ne′′ ne^{n}gä′′ wănĭshäde‘ īs′ ĕsswai′ya′dagwäni′yothet
Now this day you it belongs to you to enjoy
nĕ^{n}gä′′ wănĭshäde‘.
this day.

Djasayawa′godŭk Hawĕn′iio‘ cia′′dadē gäoya‘gē′tciojo‘′.
We give thanks oh God to you the dweller of the heavens.
Agwai′wayiis ne′′gaiyiwanda′kho.
We have done it what devolved upon us.
Osŭt′gāt′ho djogwŭtgwēnio‘.
You have seen what we have done.
Da′nē‘ho′.
So, it is.

The address to the maple, the chief of trees and the prayer to the Creator

A Seneca ceremony

The priest stands at the roots of a maple. A fire is burning and the priest casts tobacco in the fire and as its smoke arises he says:

To the tree:

“ O partake of this incense,
You the forests!
We implore you
To continue as before,
The flowing waters of the maple.

To the Creator and the tree:

It is the will of the Creator
That a certain tree
Should flow such water.
Now may no accidents occur
To children roaming in the forests.
Now this day is yours
May you enjoy it,— this day.

To the Creator:

We give thanks, oh God, to you,
You who dwell in heaven.
We have done our duty
You have seen us do it.
So it is done."

SPECIAL ANNUAL CEREMONIES

I Dä′nondinônnio″ Ĕdē‘kwa gää′kwa‘, the Sun Dance.
II Dä′nondinônnio″ Soi′ka gää′kwa‘, the Moon Dance.
III Wasaze,[1] the Thunder Dance.

I

1 Dä′nondinônnio″ Ĕndē′ka gää′kwa‘, the Sun dance, is designed to honor the sun.

2 This ceremony has no certain time for its celebration but may be called by anyone, at any time, who dreams it necessary for the welfare of the settlement.

3 The ceremony begins at noon when arrows are shot up toward the sun while the populace shout their war cries.

4 A fire is built outside and tobacco is thrown by a priest who chants the sun-rite.

5 Three times during this ceremony a shower of arrows are shot up to the sun accompanied by a chorus of cries, intended to notify him that they are addressing him.

6 Immediately afterward the Osto′wägowa is engaged in as the only fitting dance to perform before the mighty Sun.

II

1 Dä′nondinônnio″ Soikagää′kwa‘, the Moon Dance ceremony, is convened by anyone who dreams it necessary or by the advice of a clairvoyant.

[1] Meaning, Dakota, or Sioux.

2 A thanksgiving speech is recited by a chief while he burns the tobacco offering to the moon.

3 As the peach stone gambling game is thought especially pleasing to the moon, the company gambles away the evening.

4 The distribution of the feast terminates the ceremony.

III

1 Wasaze, the Thunder Dance, is one designed to please the spirit of Thunder, Hi″non.

2 A council is called when the first thunder of the year is heard and a time as immediate as possible set for the Wasaze.

3 The dancers assemble without the council house, an opening address is made by a priest or chief and the dance immediately starts.

4 The line of dancers dance into the long house.

5 Hi″non is supposed to delight in war songs and these are sung to please him.

6 Tobacco is burned and a thanksgiving speech made to Hi″non, for his services in the past and he is prayed to continue his favors.

LEGEND OF THE COMING OF DEATH[1]

When the world was first made, men-beings did not know that they must die some time. In those days everyone was happy and neither men, women nor children were afraid of anything. They did not think of anything but doing what pleased them. At one time, in those days, a prominent man was found on the grass. He was limp and had no breath. He did not breathe. The men-beings that saw him did not know what had happened. The man was not asleep because he did not awaken. When they placed him on his feet he fell like a tanned skin. He was limp. They tried many days to make him stand but he would not. After a number of days he became offensive.

A female man-being said that the man must be wrapped up and put in the limbs of a tree. So the men did so and after a while the flesh dropped from the bones and some dried on. No one knew what had happened to cause such a thing.

Soon afterward a child was found in the same condition. It had no breath. It could not stand. It was not asleep, so they said. The men-beings thought it was strange that a girl man-being should act this wise. So she was laid in a tree. Now many others did these things and no one knew why. No one thought that he himself would do such a thing.

There was one wise man who thought much about these things and he had a dream. When he slept the Good Minded spirit came to him and spoke. He slept a long time but the other men-beings noticed that he breathed slowly. He breathed [nevertheless]. Now after a time this man rose up and his face was very solemn. He called the people together in a council and addressed the people. The head men all sat around with the people.

The wise man spoke and he said, " The Good Minded spirit made every good thing and prepared the earth for men-beings. Now it appears that strange events have happened. A good word has come to me from the Good Minded spirit. He says that every person must do as you have seen the other persons do. They have died. They do not breathe. It will be the same with all of you. Your minds are strong. The Good Minded spirit made them that way so that you could endure everything that happened. So then do not be downcast when I tell you that you all must die. Listen

[1] Related by Edward Cornplanter, March 1906.

further to what I say. The name of the one that steals away your breath is S'hondowěk'owa. He has no face and does not see any one. You can not see him until he grasps you. He comes sometimes for a visit and sometimes he stays with us until many are dead. Sometimes he takes away the best men and women and passes by the lesser ones. I was not told why he does this thing. He wants to destroy every person. He will continue to work forever. Every one who hears me and every one not yet born will die. There is more about you than living. Any moment you may be snatched by S'hondowěk'owa, he who works in the thick darkness.

You must now divide yourselves into nine bands, five to sit on one side of the fire and four on the other and these bands shall care for its members. You must seek out all good things and instruct one another, and those who do good things will see when they die the place where the Maker of all things lives."

THE FUNERAL ADDRESS[1]

Awēyondo' Gawen'notgä'o

Now all hearken to what must be said!

We are gathered here because of what our Creator has done. He made it so that people should live only a certain length of time-none to be more favored than another.

Now our uncles made provisions for this event, and our grandfathers and the chiefs when they first thought of this thing [death] in those days. They had never seen death [before]. Their first knowledge came when they saw a person in an assembly die. [Strangely] no one was surprised. Soon afterwards they saw another death in the manner of the first. Soon again another died. Then did the chiefs consider the matter, saying, "We were not born to live forever." Then did the people see that they were not to live forever but only for a certain period of time. Therefore, they made certain rules. Then did they divide the people into clans, kashadenioh. Then did they divide the clans into two divisions. Now when a death occurred the other division [phratry] was to officiate at the funeral. The side that lost one of its members must quietly mourn and say nothing. The cousins must do the speaking. They must speak telling the mourners what they must think. So now first they should say, "Keep your minds up."

The preacher then turns to the mourners and addresses them as follows:

There are many of your own relations yet remaining, there are old folk and there are children. So let these lift up your minds. Moreover here is the earth upon which we tread, everything upon it is for our comfort. There is water, springs of water and streams of water flowing over the earth. There are different plants and trees. All of these our Creator has given us. So let this lift up your minds.

So now then another.

There is the sky above our heads. There are many things there. In the forms of the stars are signs to guide us. The sun gives us light. The moon gives us light. She is our grandmother. The sun is our brother. All these are performing that for which they were created. So let this lift up your minds.

So now then another.

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[1] Related by Skidmore Lay, Cattaraugus chief, March 1906.

It is the Gai'wiio', the good word of our Creator. Our Creator thought that the people should hear what was in his mind. So he sent word down to the earth. He thought that the people should know what his words were. Now this should lift up your minds.

So now then another.

It is the four geniewage [ceremonies]. Now this should lift up your minds.

[If the dead person is a chief the preacher here ceases to give the chief on the mourning side an opportunity to reply. The reply is as follows]:

Cousin! I have heard all that you have laid before us — how we should keep our minds. We have commenced from the beginning of the world when the Creator made us. We have thought of the water, the springs and the streams of water. We have thought of the sky and everything therein, the sun and the moon, the words of our Creator and the four ceremonies. These things you have pointed out, Oh Cousin! These things will lift up our minds. Now, Cousin, you should know that we accept all that you have said. We can not say that we do not accept what you have said. Now we put all of your words together; we accept them all. So is the reply.

[The preacher then arises and continues]:

So now again listen, all of you!

Now let every one listen.

[The preacher makes an extemporaneous speech in which he addresses the entire assembly. Afterward he selects passages from the Gai'wiio' among which the following is always repeated]:

So now another message.

Now it is said that your people must change certain customs. It has been the custom to mourn at each recurring anniversary of the death of a friend or relative. It is said that while you are on earth you do not realize the harm that this works upon the departed.

[Now moreover, it is said that when an infant is born upon the earth with which the parents are dissatisfied it knows and says, " I will return to my home above the earth."]

Now it is said that grief adds to the sorrows of the dead. It is said that it is not possible to grieve always. Ten days shall be the time for mourning and when our friends depart we must lay grief aside. When you, the beings of the earth, lose one of your number you must bury your grief in their grave. Some will die today and some tomorrow, for all our days are numbered. So hereafter do not grieve. Now it is said that when the ten days have elapsed to prepare a feast and the soul of the dead will return and partake of it with you. It is said moreover that you can journey with the dead only as far as the grave. It is said that when you follow a body to the grave you must have prepared for that journey as if to travel afar. Put on your finest clothing for every human creature is on its journey graveward. It is said that the bodies of the dead have intelligence and know what transpires about them. It is true.

So they said and he said. Eniaiehuk. (Section 67 of the Gai'wiio'.)

[The preacher then announces certain decisions of "the dead side" and then continues with the established funeral rite, as follows]:

When the body of the dead is buried we must become resigned to our loss. It can not be helped.

[The preacher speaks to the fathers]:

Now do you also do the same as the dead side and become resigned to your sorrow?

[The preacher addresses the relatives afar off]:

And now you afar off who are the relatives of the dead, do you become resigned also when you hear of the loss?

The things of the past shall continue. It [death] should not hamper or stop any ordination of the Creator. Let not a death stop an event in course of progress. Let us fulfil the law of mourning for a ten-day period and have the feast at the end. We believe that the dead will return at the end of ten days. Now the Creator said, "The customs ordained by the early chiefs [regarding mourning] are right. They had no knowledge of what would happen in the future when they made the customs but the Creator soke to Ganio'dai'io and said, 'True and good is the ceremony of your grandfathers for the time of mourning and also the death feast.'"

[When the face of the dead is unwrapped for its friends to look upon for the last time the preacher says]:

Now let all journey to the grave with the body of the dead for it is as far as we can go.

[At the grave the preacher turns to the crowd and says]:

So now we thank all those who have come to this funeral ceremony to help us. So it is done.

[The body is then covered with earth.]

THE DEATH FEAST [1]

Wainonjää'ʼkoⁿ'

Now let all listen, all ye who are here assembled!

Cousins! We all are familiar with the happening of a few days ago. We are [therefore] here because of what the Creator has done.

Now the relatives have made arrangements. They have promised to obey the commands of the four messengers who said, "It is right to have a feast for the dead. Therefore this thing should be done."

Ten days have passed. Now the relatives of the dead have made preparations and the feast is ready for the dead. Now let this be in your minds, all ye who are here present.

[The preacher here pauses. At his side sits the speaker for the mourners. In his charge is a bundle containing various gifts for those who have aided the bereaved family. The speaker has been told to whom the various presents are to go, and as the preacher pauses and bends down to receive the formal instructions he hands him the first gift. Sitting among the women mourners is a woman, the "mistress of the ceremonies," whose duty is to deliver the gifts to the intended recipients.

After listening to the directions of the speaker the preacher resumes]:

So now the bereaved offer thanks. They thank the one who cared for the body of the dead and dressed it for burial. To that one they give this as a testimony. [The preacher names the article and the matron rising from her seat receives it and delivers it to the person named].

[The preacher again bends to the speaker at his side and receives the "second word." Again facing the audience he proceeds]:

So now of another they have thought. It is of the night watcher [or night watchers]. To this one [or to these ones], they give this roll of cloth [or skins]. And this is your thanks.

[The speaker hands the preacher the roll and he hands it to the matron who delivers it. Stooping and listening to the whispered instructions for the delivery of the next gift, the preacher after making sure that he understands straightens and again speaks]:

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[1] Related by Edward Cornplanter, March 1906.

Now to him who wrapped the body in its burial covering [or made the coffin], the relatives offer thanks.

[The gift is bestowed as previously described.]

Now the matron who has managed the funeral receives a gift of thanks.

[This named person being the one who has first received and given the gifts now remains seated while the wife or sister of the preacher rises and receiving the gift bestows it. According to Iroquois etiquette it would be an improper thing for the matron to receive her own gift and bear it before the eyes of the crowd to her seat. The recipients are supposed not to be eager to receive the gifts, the things that once belonged to the dead. Besides according to Iroquois philosophy one can not give one's self a thing.]

Now she who notified the people — the relatives desire to give thanks and offer this gift.

Now those who dug the grave — to you the relatives give thanks and offer gifts.

And now you the good friends and relatives, of what is remaining receive you this gift. [The preacher names each person for whom a gift is intended, repeating the formula given. If property of considerable value as live stock or lands is left, the speaker for the mourners in behalf of the council of heirs tells the preacher their decisions and they are announced before the audience. The modern " death feast law " provides that in the event of a man's death his property must go to his children. If he is without issue, then it reverts to his wife. If he was unmarried it was given to the nearest of kin. The law further provides that the property must be divided and apportioned at the " death feast." By the old law the nearest of kin on the clan (maternal) side received the property. Children did not ordinarily inherit their father's property, but their mother's. Their " mother's husband's " belongings went to the kin of the clan to which he belonged.]

[If the dead were an officer of any kind, the preacher announced who was to take his or her place. In order that this election be valid the person chosen must stand, if possible, in the very spot where the dead person expired.]

Now I have finished speaking for the relatives.

Now listen to another matter, all ye who are here present.

Now at this time let the [mourning] relatives cease their grieving. Now may they go and do whatsoever they wish. They are the same as ever and may speak as they please again. Now can they be notified of things to be done. They have now the right to engage in any current happening. No longer think their hands must be held back. If it is possible to do, now do, for the time of mourning has passed.

So now we have done our part for you, cousins. So I have done.

[The preacher resumes his seat.]

[The speaker for the mourning side arises and addresses the officiating side] :

Now listen cousins!

We have heard all that you have said and [know that] you have done your part. We believe that you have done your part. You must hold in your minds that we thank you for what you have done for us. Now I give you this [the object is named] for your trouble.

[Although the speaker is standing at the side of the preacher, the latter can not receive the gift direct, but the matron rising from her seat takes the offering and holds it out to him. Even then he does not take it but points to his wife or mother, indicating that it is to be placed in her keeping.]

[The speaker continues] :

Now we must ask your pardon for giving so small a gift; it is small and your services have been great.

Now we relieve you of your duties, the duties for which we bound you. Now you are relieved.

[The preacher rises and says] :

Now all listen to a few more words that I shall say!

Let all the people here gathered keep silent. Now is the time for the distribution of the feast. It will now be distributed, for it has been prepared and we must eat. Now let they who did the cooking distribute. Let all tarry until the feast is finished. Let hard feelings affect no one and let the matrons divide equally and overlook none. So it is finished.

SECRET MEDICINE SOCIETIES OF THE SENECA[1]

During the last six years the writer has made a detailed field study of the various phases of Iroquois culture, special attention being directed to the rites and ceremonies of the semisecret orders and societies that yet survive among the so-called pagan Iroquois. It was only after diligent inquiry that the actual existence of these societies was clearly established. The False Face Company and the Secret Medicine Society, better termed The Little Water Company, have been known to ethnologists for some time, but no one has adequately described them or has seemed fully aware of their significance. Likewise certain dances, such as the Bird, the Bear, the Buffalo, the Dark, and the Death dances, have been mentioned. Ceremonies also, such as the Otter ceremony and the Woman's song, have been listed, but that back of all these ceremonies there was a society never seems to have occurred to anyone. The Indians do not volunteer information, and when some rite is mentioned they usually call it a dance. Through this subterfuge the existence of these societies has long been concealed, not only from white investigators but from Christian Indians as well, the latter usually professing ignorance of the "pagan practices" of their unprogressive brothers.

Even so close an observer as Lewis H. Morgan says: "The Senecas have lost their Medicine Lodges, which fell out in modern times; but they formerly existed and formed an important part of their religious system. To hold a Medicine Lodge was to observe their highest religious mysteries. They had two such organizations, one for each phratry, which shows still further the natural connection of the phratry and the religious observances. Very little is now known concerning these lodges or their ceremonies. Each was a brotherhood into which new members were admitted by formal initiation."[2]

Morgan's experience is that of most observers, close as their observation may be. The writer, with the assistance of his wife, however, living with the "pagans" and entering fully into their rites, discovered that the "medicine lodges," so far from having become extinct, are still active organizations, exercising a great

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[1] Adapted from the author's article in American Anthropologist, 2:2, April-June, 1909.

[2] Morgan, Ancient Society, p. 97, ed. 1907.

amount of influence not only over the pagans but also over the nominal Christians.

It was found that the organization and rites of the societies might best be studied among the Seneca, who have preserved their rituals with great fidelity. The Onondaga, although keeping up the form of some, have lost many of the ancient features and look to the Seneca for the correct forms.

The teachings of Ganio'dai'io', Handsome Lake, the Seneca prophet, revolutionized the religious life of the Iroquois to a large extent, its greatest immediate effect being on the Seneca and Onondaga. Later it greatly influenced the Canadian Iroquois, excepting perhaps the Mohawk about the St Lawrence. Handsome Lake sought to destroy the ancient folk-ways of the people and to substitute a new system, built of course upon the framework of the old. Finding that he made little headway in his teachings, he sought to destroy the societies and orders that conserved the older religious rites, by proclaiming a revelation from the Creator. The divine decree was a command that all the animal societies hold a final meeting at a certain time, throw tobacco in the ceremonial fires, and dissolve. The heavenly reason for this order, Handsome Lake explained, was that men were acquainted with the effects of their familiarity with the spirits of the animals, which, although they might bring fortune and healing to the members of the animal's order, might work terrible harm to men and to other animals.

The chiefs who were friendly to the prophet and others who were frightened by his threats met in counsel and proclaimed that all the animal and mystery societies should immediately dissolve, and, by their order, were dissolved and disbanded. This they did without holding a hayänt'wŭtgŭs, tobacco-throwing ceremony, as directed. The members of the societies, therefore, declared that the order of the council was illegal and not binding, that the sin of disobedience was upon the chiefs and not upon the body of members. The societies consequently continued their rites, although they found it expedient to do so secretly, for they were branded as witches and wizards,[1] and the members of one society at least were executed as sorcerers when they were found practising their arts.

The existence of the societies became doubly veiled. The zealous proselytes of the New Religion denied their legality and even their existence, and the adherents of the old system did not care to

[1] The modern Iroquois call all sorcerers and conjurers, regardless of sex, "witches." They never use the masculine form.

express themselves too strongly in the matter of proclaiming their sacred orders still very much alive. The rites of the societies were performed in secret places for a number of years after the advent of the prophet, but as the adherents of the New Religion became more conservative, the societies again gradually entered into public ceremonies held in the council houses on thanksgiving occasions. At such times some of them gave public exhibitions of their rites; others had no public ceremonies whatsoever. With the gradual acceptance of the New Religion by the great majority of the people, the older religious belief was blended into the new. The Iroquois regard it as their Old Testament. The tabooed societies became bolder in their operations, and the new religionists entered their folds with few if any qualms.

It was about this time that their policy seems to have changed, for after some inquiry the writer can find no restriction placed on membership by reason of phratry or clanship. Candidates might join any society regardless of clan except the society of Men-who-assist-the-women's-ceremonies, which is not a secret organization. This society consists of two divisions, the membership of a division being determined by phratry. It is purely a benevolent society, however, and has nothing to do with "medicine." The various societies of all kinds had, and still have, individual lodges, each of which is nominally independent of any jurisdiction save that of its own officers. The leaders, however, confer and keep their rites uniform. At present, especially in the Little Water Company, it is not even necessary for the song-holder, the chief officer, to be a pagan. This company is the only one which can boast of any great Christian membership or of a lodge composed entirely of nominal Christians. This lodge is the Pleasant Valley Lodge of the Little Water Company on the Cattaraugus reservation. Mrs Harriet Maxwell Converse joined this lodge in 1892, afterward joining the pagan lodge at Newtown.

A careful study of the Iroquois societies will lead to the conclusion that most of the societies are of ancient origin and that their rituals have been transmitted with little change for many years. Indeed, that under the circumstances any changes should have been made would be stranger than that none had occurred at all. Most of the rituals are chanted in unison by the entire company of members, and any change in note, syllable, or word would immediately be detected. Rites transmitted by song are more difficult to change than simple recitals where musical rhythm is not correlated with the word. Some of the rituals, moreover, contain archaic words and expressions, and even entire sentences are not understood by the singers.

Each society has a legend by which its origin and peculiar rites are explained. Most of these legends portray the founder of the society as a lost hunter, an outcast orphan, or a venturesome youth curious to know what was farther on. The founder got into strange complications, saw strange or familiar animals engaged in their rites, was discovered, forgiven, adopted, kept a captive, and finally, after long study and many warnings, was sent back to his people to teach them the secrets of the animals and how their favor could be obtained. The secrets were to be preserved by the society which the hero was to found.[1] There are some variations of this abstract, but it covers the general features of most of the legends.

The study of the societies was commenced by the writer in 1902, and during the years 1905–6 an almost uninterrupted study was made for the New York State Education Department, and the results deposited in the State Library. Since that time the research has been continued for the New York State Museum. Paraphernalia have been collected, phonograph records have been made of many of the songs and ceremonial speeches, texts have been recorded and translated, legends have been gathered, and some music has already been transcribed. There still remains an enormous amount of work to be done, and it is greatly to be regretted that a multiplicity of duties bars the way for as speedy progress in this work as might be desirable, especially since many of the informants are old people and in ill health.

A brief outline of the various societies is presented in this paper. It is impossible for the sake of brevity to present a fair compend or even a systematic outline. The main features of the less known organizations and some neglected facts of the few that are better known are mentioned, it being hoped that even such statements may be useful to students of ethnology. The list follows.[2]

NIGANĔGA′′A‘ OÄ‘ NO’, OR NE‘′ HONO’′TCINO’′GÄ, THE LITTLE WATER COMPANY

This society is perhaps the best organized of all the Seneca folk-societies. It holds four meetings each year, but only on three occasions is the night song, Ganoda, chanted. To describe ade-

[1] Myths and Legends of the Iroquois, N. Y. State Mus. Bul. 125, p. 176.

[2] A description of some of these societies was prepared for incorporation in the Fifth Annual Report of the Director of the State Museum, 1909.

quately the rites of this society would require a small volume. For the purposes of this paper, since the society has been described at greater length elsewhere, only a few notes can be given.

The company is organized to perform the rites thought necessary to preserve the potency of the " secret medicine," niganĕga"a', known as the " little-water powder." The meetings, moreover, are social gatherings of the members in which they can renew friendship and smoke away mutual wrongs, if any have been committed. It is contrary to the rules to admit members having a quarrel unless they are willing to forgive and forget. Both men and women are members. Its officers, in order of their importance, are: the song-holder, the chief matron, the watcher of the medicine, the feast-makers, invoker, flute-holder, and announcers and sentinels. There are two altars, the Altar of the Fire and the Altar of the Mystery. The ritual consists of three sets of songs describing the various adventures of the founder, known as the Good Hunter. At the close of each section the feast-makers pass bowls of berry juice, giving each singer a draft from a ladle. In some lodges a pipe is passed. An intermission then follows, during which the members, men and women alike, smoke the native home-grown tobacco. The singing is accompanied by the shaking of gourd rattles, and each member shakes one while he sings. Only purified members are supposed to enter. Unclean men or women, even though members, are debarred. The society has no public ceremony and no dances. Only members are supposed to know the precise time and place of meeting. The songs must never be sung outside of the lodge-room, but special meetings are sometimes called for the purpose of instructing novices. The office of song-holder by the Cattaraugus Seneca is hereditary to the name O'dän'kot, Sunshine. The present song-holder of the Ganun'dasē lodge, the pagan lodge at Newtown, Cataraugus reservation, is a youth who is learning the song, George Pierce, the former O'dän'kot, having recently died. Visitors may listen to the songs in an outer room, but are debarred from viewing the " mysteries." Each member, on entering, deposits his medicine packet on the Altar of the Mystery and places his contribution of tobacco in the corn-husk basket. The tobacco is thrown into the fire by the invoker as he chants his prayer to the Creator, the Thunder Spirit, and to the Great Darkness. The flute-song is played during the second and third sections. At the close of the ceremony a pig's head is passed and pieces of the boiled meat are torn from the head with the teeth, the members cawing in imitation of crows. In early times a bear's head was eaten. The food is then distributed, and the meeting or

Fig. 3 The medicine outfit, husk tray, medicine bundle, rattle and flute

" sitting " is concluded. The ceremony commences at about 11 o'clock p. m. and is adjourned at daybreak. The sun " must not see the rites." The business of the society is all conducted before the ceremony commences: reports of the officers are given and the treasurer's report read. The paraphernalia of this society consist of the medicine bundles, the flute, gourd rattles for each singer, the sacred tobacco basket and a bark dipper. The necessary furnishings are a table and a fireplace, these being the " altars," and a lamp. The " medicine " is not used in the ceremonies; it is simply " sung for." Its power is conserved for use by the medicine people in healing ceremonies. The singing of the ritual is conducted in total darkness, the lights being brought in only during the intermissions.

DEWANONDIISSO^{n}DAIK′TA‘, PYGMY SOCIETY, THE DARK DANCE CEREMONY

The ritual of this society consists of 102 songs, divided into four sections, as follows: The first section, 15 songs; the second, 23 songs; the third, 30 songs, and the fourth, 34 songs. The order of the ceremony is somewhat like that of the Medicine Company. All the songs are sung in darkness. It is believed that the spirit members of the society come and join in the singing, and their voices are thought to be audible at times.

The water drum and the horn rattle are used in this ceremony for keeping time. There is a brief dance. The Dark ceremony is designed to appease certain spirits and to procure the good offices of others. Meetings are called at any time for the purpose of appeasing the spirits of certain charms that have become impotent or which may become so, or are called by members and even by nonmembers who are troubled by certain signs and sounds, such as the drumming of the water fairies or stone throwers, pygmies, who by their signs signify their desire for a ceremony. Nonmembers become members by asking for the services of the society. The rites are preeminently the religion of the "little folk" whose good will is sought by all Indians living under the influence of the Ongwe‘′-oñwe‘ka′, Indian belief. The Pygmies are thought to be "next to the people" in importance, and to be very powerful beings. They demand proper attention or they will inflict punishment upon those who neglect them. This society, however, "sings for" all the "medicine charms" and all the magic animals. These magic animals are members of the society, and in order of their importance are: Jo^{n}gä′o^{n}, Elves or Pygmies; Jodi′′gwado^{n}‘, the Great Horned Serpent; Shondowĕk′owa, the Blue Panther, the herald of death; Dewŭtiowa′is, the Exploding Wren. Other members, equal in rank, are: Diatdagwŭt′, White Beaver; O‘nowaot′gont, or Gane′′onttwŭt, the Corn-bug; Otnä′yont, Sharp-legs; O′wai′ta, Little Dry Hand; Dagwŭn′noyaĕnt, Wind Spirit, and Nia′′gwahē, Great Naked Bear.

These charm-members are called Ho‘tcine′gada. The charms or parts of these members, which the human members keep and sing for, are: none of the first two, because they are very sacred and "use their minds" only for charms; panther's claw; feathers; white beaver's castor; corn-bug dried; bone of sharp-legs; dry hand; hair of the wind, and bones of Nia′′gwahē. Some of these charms bring evil to the owners, but must not be destroyed under any circumstance. Their evil influence can be warded off only by the ceremonies. The owner or his family appoints someone to "hold the charm" after the first owner's death. Other charms are only for benevolent purposes, but become angry if neglected. Of the evil charms, the sharp bone may be mentioned; and of the good charms the exploding bird's feathers. Most of them are regarded, however, as ot′gont. The members of this society save their fingernail parings and throw them over cliffs for the Pygmies.

The ceremonies of the societies are always opened with a speech by the invoker. The following speech is that of the Pygmy Society, and in a general way is the pattern of nearly all opening invocations.

Yotdondak'o', Opening Ceremony of the Pygmy Society

We now commence to thank our Creator.

Now we are thankful that we who have assembled here are well.

We are thankful to the Creator for the world and all that is upon it for our benefit.

We thank the Sun and the Moon.

We thank the Creator that so far tonight we are all well.

Now I announce that A B is to be treated.

Now this one, C D, will throw tobacco in the fire.

Now these will lead the singing, E and F.

So I have said.

[The "tobacco thrower" advances to the fire and, seating himself, takes a basket of Indian tobacco and speaks as follows:]

Now the smoke rises!

Receive you this incense!

You who run in the darkness.

You know that this one has thought of you

And throws this tobacco for you.

Now you are able to cause sickness.

Now, when first you knew that men-beings were on earth, you said,

"They are our grandchildren."

You promised to be one of the forces for men-beings' help,

For thereby you would receive offerings of tobacco.

So now you get tobacco — you, the Pygmies. [Sprinkles tobacco on the fire.]

Now is the time when you have come;

You and the member have assembled here tonight.

Now again you receive tobacco — you, the Pygmies. [Throws tobacco.]
You are the wanderers of the mountains;
You have promised to hear us whenever the drum sounds,
Even as far away as a seven days' journey.
Now all of you receive tobacco. [Throws tobacco.]
You well know the members of this society,
So let this[1] cease.
You are the cause of a person, a member, becoming ill.
Henceforth give good fortune for she (or he) has fulfilled her duty and given you tobacco.
You love tobacco and we remember it;
So also you should remember us.
Now the drum receives tobacco,
And the rattle also.
It is our belief that we have said all,
So now we hope that you will help us.
Now these are the words spoken before you all,
You who are gathered here tonight.
So now it is done.

DAWANDOʻ, THE SOCIETY OF OTTERS

This is a band of women organized to propitiate the otters and other water animals who are supposed to exercise an influence over the health, fortunes, and destinies of men. The otter, which is the chief of the small water animals, including the fish, is a powerful medicine-animal, and besides having his own special society is a member of the Yē′dos, or I′′dos, and the Hono′′tcino′′gäʻ.

The Otters may appear at any public thanksgiving, as the Green Corn dance and the Midwinter ceremony. After a tobacco-throwing ceremony, hayänt′wŭtgŭs, the three women officers of the Dawan′doʻ each dip a bucket of the medicine-water from the spring or stream, dipping down with the current, and carry it to the council house where they sprinkle everyone they meet by dipping long wisps of corn husk in the water and shaking them at the people. If the women succeed in entering the council house and sprinkling everyone without hindrance, they go for more water and continue until stopped. The only way in which they may be forced to discontinue their sprinkling is for someone, just before she sprinkles him, to snatch the pail and throw the entire contents over her head.

[1] The malific influence causing sickness.

The Otter woman will then say, "Hat'gaiī', niawē'!"— meaning, "Enough, I thank you!" She will then retire.

The Otters are especially active during the Midwinter ceremony, and when the water is thrown over their heads it very often freezes, but this is something only to be enjoyed. When possessed with the spirit of the otter, the women are said to be unaware of their actions, and sometimes, when they are particularly zealous, the whistle of the otter is heard. This greatly frightens the people, who regard it as a manifestation of the presence of the "great medicine otter." The women afterward deny having imitated the otter's call, saying that they were possessed of the otter and had no knowledge of what they did.

The Otter Society has no songs and no dances. Its members are organized simply to give thanks to the water animals and to retain their favor. When one is ungrateful to the water animals, as a wasteful fisherman, or a hunter who kills muskrats or beaver without asking permission or offering tobacco to their spirits, he becomes strangely ill, so it is believed. The Otters then go to a spring and conduct a ceremony, after which they enter the sick man's lodge and sprinkle him with spring water, hoping thereby to cure him.

I′′DOS OÄ′NO', SOCIETY OF MYSTIC ANIMALS

The I′′dos Company is a band of "medicine" people whose object is to preserve and perform the rites thought necessary to keep the continued good will of the "medicine" animals. According to the traditions of the company, these animals in ancient times entered into a league with them. The animals taught them the ceremonies necessary to please them, and said that, should these be faithfully performed, they would continue to be of service to mankind. They would cure disease, banish pain, displace the causes of disasters in nature, and overcome ill luck.

Every member of the company has an individual song to sing in the ceremonies, and thus the length of the ceremony depends on the number of the members. When a person enters the I′′dos, he is given a gourd rattle and a song. These he must keep with care, not forgetting the song or losing the rattle.

The head singers of the I′′dos are two men who chant the dance song. This chant relates the marvels that the medicine man is able to perform, and as they sing he proceeds to do as the song directs. He lifts a red-hot stone from the lodge fire and tosses it like a ball in his naked hands; he demonstrates that he can see through a carved wooden mask having no eyeholes, by finding various things about the lodge; he causes a doll to appear as a living being, and mystifies the company in other ways. It is related that new members sometimes doubt the power of the mystery-man and laugh outright at some of the claims of which he boasts. In such a case he approaches the doll, and though his face be covered by a wooden mask, cuts the string that fastens its skirt. The skirt drops, exposing the legs of the doll. Then the doubting woman laughs, for everyone else is laughing, at the doll she supposes, but shortly she notices that everyone is looking at her, and to her utmost chagrin discovers that her own skirt-string has been cut and that she is covered only by her undergarments. Immediately she stops laughing and never afterward doubts the powers of the medicine-man, who, when he cut the doll's skirt-string by his magic power, cuts hers also.

The I′′dos is said to have been introduced among the Seneca by the Huron. The ritual, however, is in Seneca, though some of the words are not understood. The principal ceremonies are: (*a*) Gai‘yowĕ^{n}′ogowa, The sharp point; (*b*) Gahadi′yago^{n}, At the wood's edge; (*c*) Gai‘′do^{n}, The great Gai‘′do^{n}. Other ceremonies are: O‘to'do^{n}gwa‘′, It is blazing; and Tci′gwawa, The other way around. During ceremonies *b* and *c* only individual members sing. The chief of the society is said to be a man who is able to see through a wooden mask which has no eye-openings. By his magic power he is able to discover hidden things previously concealed by the members, probably by some particular member. He discovers the ceremonial, no matter where hidden, and juggles with a hot stone drawn from the fire. When the ceremonies are finished the members feast on a pig's head. In early times a deer's head was used. As do the members of the Medicine Lodge upon such an occasion, the members tear the meat from the head with their teeth. The ceremonies of the society are now considered an efficacious treatment for fevers and skin diseases. The rites are supposed to be strictly secret.

The writer has transcribed the entire text of the I′′dos ritual in Seneca and has translated it. Three masks are used in the rites — the Conjuror's mask, the Witch mask, and the Dual-spirit's mask. These masks are never used in the rites of the False Face Company, and differ from them in that they have no metal eyes. A flashlight picture of a corner of the I′′dos lodge was made by the writer in January 1909, but the session of the lodge was not one of the "regular" ones.

SHA′′DOTGE′A, THE EAGLE SOCIETY

The ritual of the Eagle Society consists of ten songs and a dance. The song is called Ganĕ′′gwaē oä‛′no‛. Every member participating in the ceremony paints on each cheek a round red spot. No one but members may engage in its ceremonies, even though these be performed publicly. The Eagle Society's ceremony is regarded as most sacred, in this respect next to the Great Feather Dance, O‛stowä′gowa. It is believed that the society holds in its songs the most potent charms known. It is said that the dying, especially those afflicted with wasting diseases, and old people, have been completely restored by its ceremonies. This is because the Dew Eagle, to which the society is dedicated, is the reviver of wilting things.[1] The membership is divided into two classes by phratryship. A person may become a member by dreaming such a thing necessary, or by receiving the rites of the society in case of illness. Special costumes are worn in the ceremonies. In the dance the members divide and stand opposite each other according to phratry, the animals opposite the birds. Two dancers from each phratry are chosen, and one singer from each. The dancers assume a squatting posture and imitate the motions of birds. The physical exertion is intense and requires constant interruption. The dancers and singers continue to dance and sing until completely exhausted, unless someone strikes the signal pole and makes a speech. The dancers then retire to their benches until the speech ends, when the singers take up their song and the dance is continued. After his speech, the speaker, who may be any member, presents the dancers for whom he speaks with a gift of money, tobacco, or bread; but the old custom was to give only such things as birds liked for food. The speeches are usually in praise of one's own clan and in derision of the opposite phratry. At the close, the speakers all apologize for their clannish zeal, and say, as if everyone did not known it, that their jibes were intended only as jests. The dancers each hold in their left hands a calumet fan, made by suspending six heron or four eagle feathers parallel and horizontally from a rod or reed. In their right hands they hold small gourd rattles with wooden handles, or small bark rattles made of a folded strip of hickory bark patterned after the larger False-face bark rattles. The signal pole and the striking stick are spirally striped with red paint. After the

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[1] The Dew Eagle refreshed the scalp of the Good Hunter by plucking a feather from its breast and sprinkling the scalp with dew from the lake in the hollow of its back.

ceremony, when held in a private lodge, the members feast on a pig's head; but this is a modern substitute for a bear's or a deer's head, though crows' heads once were eaten also.

NIA‘GWAI‘′ OÄ‘′NO’, THE BEAR SOCIETY

The ritual of the Bear Society consists of twenty songs and a dance. During the intermissions in the dance, that is, between songs, the participants eat berries from a pan on the dance-bench, or, in winter, eat honey, taking portions of the comb and eating it as they walk about the bench. The ceremony is opened by making a tobacco offering to the spirits of the bears, during which the chief Bear-man makes an invocation. The high officer of the society, however, is a woman. The symbol of membership is a black streak drawn diagonally across the right cheek. The object of the society is to cure the diseases of its members and candidates by chanting and dancing. The ceremony is believed to be a remedy for fevers and rheumatism, as well as to bring good fortune. In a healing ceremony the chief woman blows on the head of the patient. After a ceremony the members carry home with them pails of bear pudding, a sweetened corn pudding mixed with sunflower oil. The Bears use the water drum and horn rattles. All Seneca dances are counterclockwise.

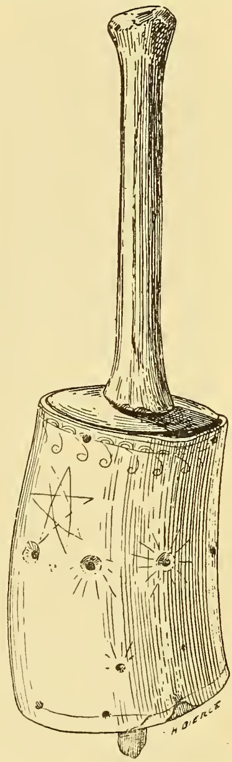

Fig. 4 Horn Rattle used in the Seneca Bear Dance

DEGI′YA’GO^{n} OÄ‘′NO’, THE BUFFALO SOCIETY

The ritual of this society consists of a number of songs which relate the story of the origin of the order. After a ceremony in which there is a dance, the members depart, carrying with them the buffalo pudding. The dancers imitate the action of buffalo when stamping off flies, and the pudding is supposed to be of the consistency of the mud in which the buffalo stamps. When it is eaten it acts as a charm that "stamps off" disease or ill fortune. The Buffalos use the water drum and horn rattles.

O'GI'WĒ OA'NO', CHANTERS FOR THE DEAD

The O'gi'wē ceremony is called for by any member who dreams of the restless spirit of some former member, relative, or friend. At the ceremony the set of songs is sung, the large water drum beaten, and a feast indulged in. The food is supposed to satisfy the hungry ghosts that for some reason are "earth-bound," as spiritists might express it. The O'gi'wē ceremony must not be confused with the Death Feast ceremony, which is a clan affair. The diviner of the O'gi'wē people is able to identify the unknown spirit which may be troubling the dreams of a member. The sickness and ill fortune caused by evil ghosts may be dispelled by the ceremony. The chief officer is a woman.

DESWADENYATIONDOTTǓ', THE WOMAN'S SOCIETY

This society preserves the ritual by which good fortune and health are obtained for women. The singers, fourteen in number at Cattaraugus, are all men. During their singing the women dance. The office of chief singer is hereditary. The women join in a chorus as the men sing. Horn rattles and water drums are used.

TOWII'SAS, SISTERS OF THE DIO'HĒ'KO

This society is composed of a body of women whose special duty is to offer thanks to the spirits of the corn, the beans, and the squashes, Dio'hē'ko (these sustain our lives). By their ceremonies of thanksgiving the Towii'sas propitiate the spirits of growth, and people are assured of a good harvest. The Towii'sas have a ceremonial song and a march, but no dances. The legend of the society relates that the entire band of Towii'sas, in the latter part of the seventeenth century, was captured by the Cherokee and carried down the Ohio river. Thereafter two men were admitted as escorts in their march through the woods. At the closing of the ceremony the head-woman chants the Dio'hē'ko song as she leads her band about a kettle of corn pudding. She carries an armful of corn on the cob; in her right hand she holds some loose beans, and in her left some squash seeds, the emblems of fertility. The Towii'sas hold one ceremony each year, unless some calamity threatens the harvest. The rattle of this society is made of a land tortoise (box-turtle) shell. These are often found in graves, but their exact use in the Iroquois territory has not generally been known to archeologists. The leg rattle is another variety having several perforations.

HADIGO^{n}'SA SHO^{n}O', THE FALSE FACE COMPANY

This organization is one of the better known societies of the Iroquois, and its rites have often been described, though not always correctly interpreted. There are three divisions of the False Faces, and four classes of masks — doorkeeper or doctor masks, dancing masks, beggar masks, and secret masks. The beggar and thief masks form no part of the paraphernalia of the true society, and the secret masks are never used in public ceremonies in the council house at the midwinter ceremony. The False Face ceremonies have been well described, though by no means exhaustively, by Morgan[1] and Boyle.[2] The main features are generally known.

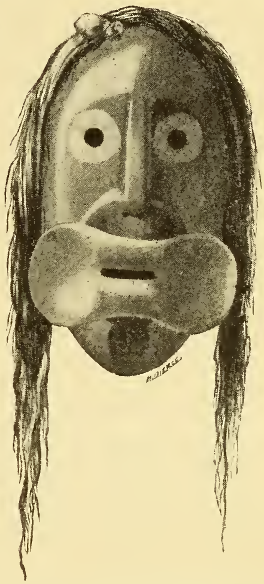

Fig. 5 Typical medicine mask

The paraphernalia of this society consist of the masks previously mentioned, turtle-shell rattles (snapping turtles only), hickory bark rattles, head throws, a leader's pole upon which is fastened a small husk face, a small wooden false face, and a small turtle rattle, and a tobacco basket.

There are two Seneca legends setting forth the origin of the False Faces, and three with the Mohawk story. These stories, however, explain the origin of different classes of masks. Each mask has a name. One story relates that the False Faces originated with the Stone Gaints. However this may be, the writer obtained in 1905, from a woman claiming to be the keeper of the secret masks, a mask representing the Stone Gaint's face. With it was a mask made of wood, over which was stretched a rabbit skin stained with blood. This mask was supposed to represent the face of a traitor as he would look when drowned for his infamy. Chief Delos Kettle said it was used to cure veneral diseases.

There is some dispute as to the antiquity of the False Face Company. Doctor Beauchamp, in his History of the Iroquois,[3] says it is comparatively recent. From a study of the Seneca society, however, the writer is inclined to believe that it is quite old with them,

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[1] Morgan, Fifth Annual Report New York State Cabinet (Museum), 1852, p. 98.

[2] Boyle, Archaeological Report, Provincial Museum, Toronto, 1898, p. 157.

[3] N. Y. State Mus. Bul. 78, p. 141.

although it may be more recent with the other Iroquois. Early explorers certainly could not have seen everything of Iroquois culture, especially some of the secret things, and their lack of description may be regarded as negative testimony rather than as positive evidence of the nonexistence of certain features which later students have found. It is quite possible that the author of "Van Curler's" Journal of 1634–35 mentions a false face when he writes: "This chief showed me his idol; it was a head with the teeth sticking out; it was dressed in red cloth. Others have a snake, a turtle, a swan, a crane, a pigeon for their idols. . . ." The Seneca at present drape their false faces when they hang them up for safe keeping, and use them as well as turtle and snake charms as bringers of good fortune. Some pipes from seventeenth-century graves seem to represent blowing masks. Mr M. R. Harrington and the writer found one in 1903 while excavating a seventeenth-century site, since learned to be of Seneca occupancy, on Cattaraugus creek, near Irving. The counterpart of this pipe was found by R. M. Peck on the Warren site, near West Bloomfield, N. Y. The Indians say it is a False Face blowing ashes, and such it may represent. Mr Harrington, and the writer as well, have found what may be false face eye-disks, as well as turtle-shell rattles, in Seneca and Erie graves.

The principal False Face ceremonies are: Ganoi′′iowi, Marching Song; Hodigosshos′ga, Doctors' Dance, and Yea^{n}sĕ^{n}dădi′yas, Doorkeepers' Dance.

THE OPENING OR TOBACCO THROWING CEREMONY OF THE FALSE FACE COMPANY

Now receive you this tobacco, you, Shagodiowĕ^{n}′gowa, the great false face.

Now it is that you have come to where your grandchildren are gathered.

Now you are taking the place of the great false faces who are wandering in the rocky valleys and mountains.

Now you are the ones who think much of this sacred tobacco.

Now we wish to make a request of you. So we always offer this sacred tobacco [literally, real tobacco], when we ask anything of you.

We pray that you help us with your power.

You can go over all the earth.

In the center of the earth is a great pine tree and that is the place of your resting. It is there that you rub your rattle when you come to rest.

Now then this tree receives this tobacco.

We ask that you watch over us and exercise your power to protect us from anything harmful.

We hold in mind that you have ever done your duty in past times and we ask that you continue [vigilant] henceforth.

We use this tobacco when we ask favors of you for you are very fond of this tobacco.

Now your cane gets tobacco. The great pine tree to its top is your cane.

Now you, the husk faces, you get tobacco also.

You have been associated with the false faces in times past. Now you receive tobacco for you have done your duty.

So it is finished.

GAJI''SASHO^{n}O', THE HUSK-FACES

This society seems rather loosely organized among the Seneca, but its chief members act as water doctors. They endeavor to cure certain diseases by spraying and sprinkling water on the patients. Two Husk-faces are admitted with the False Faces in their mid-winter long-house ceremony, and act as door-openers. As a company they also have a ceremony in which the Grandfather's Dance is featured. The grandfather is attired in rags, and, holding a cane stationary, dances in a circle about it, using the cane as a pivot. The company dance is one in which all the members participate. Non-members may partake of the medicine influence of the ceremony by joining in the dance at the end of the line when the ceremony is performed in the council house at the midwinter festival.

That the foregoing so-called societies are in fact organizations, and that their rites are not merely open ceremonies in which anyone may engage, is apparent from the following considerations:

1 The organizations have permanent officers for the various parts of their rites.

2 They have executive officers.

3 They have certain objects and stand for specific purposes.

4 They have stable and unchangeable rituals.

5 Those who have not undergone some form of an initiatory rite are not allowed to enter into their ceremonies.

6 They have legends by which the origin and objects of the rites are explained.

7 It is not permissible to recite the rituals or to chant any of the songs outside of the lodge to anyone who has not been inducted into the society.

Some of the societies have other features, such as stated meetings and officers' reports, but the foregoing characteristics apply to all the Seneca secret or semisecret ceremonies and entitle them to the name of *societies*.

When an Indian is afflicted with some disorder which can not be identified by the native herb doctors, the relatives of the patient consult a clairvoyant, who names the ceremony, one of those above described, believed to be efficacious in treating the ailment. Some times several ceremonies are necessary, and as a final resort a witch-doctor is called upon.

As to the influence of these organizations on the people, while it must be confessed that they foster some "superstitions" inconsistent with the modern folk-ways of civilized society, they serve more than any other means to conserve the national life of the people. The strongest body of Iroquois in New York today are the two bands or divisions of the Seneca, and the Seneca have the largest number of "pagans." They are perhaps likewise the most patriotic, and struggle with greater energy to retain their tribal organization and national identity.

The customs of these adherents of the old Iroquois religion react on and influence the entire body of the people, "pagans" and Christians alike.

Plate 16

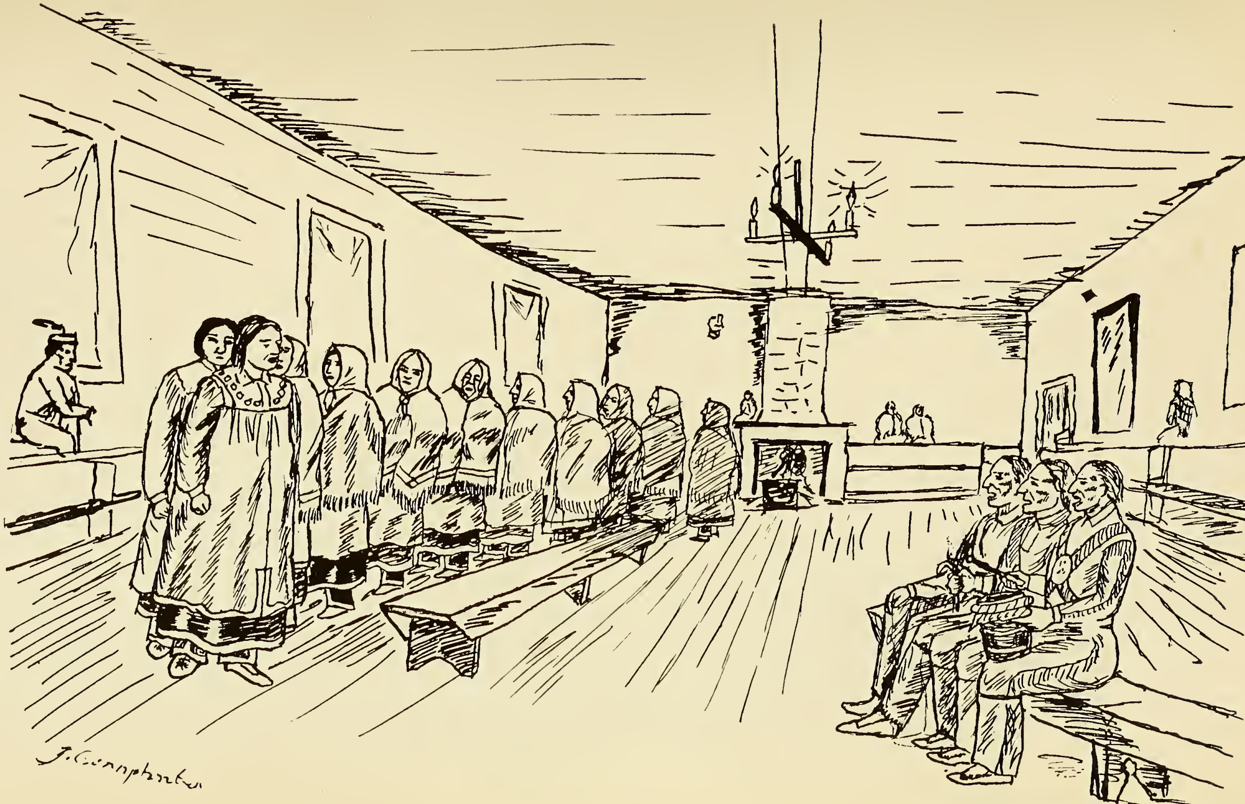
The women's dance

Plate 17

From a drawing by Jesse Cornplanter

The Seneca buffalo dance

Plate 18



From a drawing by Jesse Cornplanter

The death chant and march at the Newtown Long House

Plate 19

From a drawing by Jesse Cornplanter

The Spirit of the Hurricane

Plate 20

Sacrifice of the White Dog on the Grand River reservation of the Six Nations, Canada

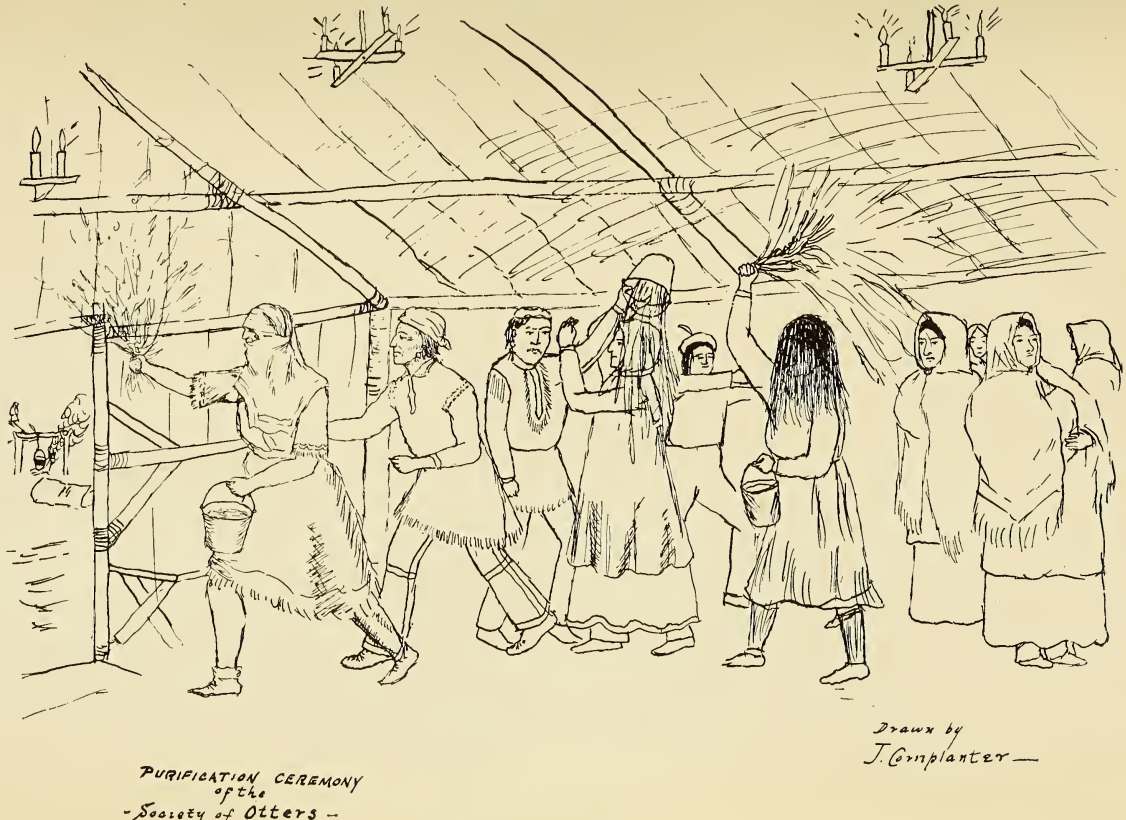
Plate 21

A corner of the I'dos lodge at Newtown, Cattaraugus reservation

Plate 22

Ceremonial march of the Toñ'wisas Company. The leader carries an armful of ears of corn in one arm and a tortoise shell rattle in her outstretched right hand. From a drawing by Jesse Cornplanter, Ganundaiyeoh, a Seneca boy)

Plate 23



Purification ceremony of the Society of Otters, a Seneca women's winter ceremony

IROQUOIS SUN MYTHS[1]

The Iroquois of New York and Canada still retain vestiges of their former adoration of the sun, and observe certain rites, very likely survivals of more elaborate sun ceremonies.

The writer has witnessed several so-called "sun dances" among the Iroquois; but in every case the dance was the Ostowä′′gowa, or Great Feather Dance, the prime religious dance of the Gai′wiio‘ religion. This modern religion was originated about 1800 by Ganio‘dai′io‘ ("Handsome Lake" the Seneca prophet) and almost entirely revolutionized the religious system of the Iroquois of New York and Ontario. Few of the early folk beliefs have survived the taboo of the prophet; and these beliefs are not easily traced, or even discovered, unless one has before him the Gai′wiio‘ of Handsome Lake and the Code of Dekanowi′da, the founder of the Confederacy.

The Seneca sun ceremony, Ëndéka Dä′kwa Dännon′dinon′nio′ ("Day Orb-of-light Thanksgiving"), is called by any individual who dreams that the rite is necessary for the welfare of the community. The ceremony begins promptly at high noon, when three showers of arrows or volleys from muskets are shot heavenward to notify the sun of the intention to address him. After each of the volleys the populace shout their war cries, "for the sun loves war." A ceremonial fire is built — anciently by the use of a pump-drill, modernly by a match — and the sun-priest chants his thanksgiving song, casting from a husk basket handfuls of native tobacco upon the flames as he sings. This ceremony takes place outside the long house, where the rising smoke may lift the words of the speaker to the sun. Immediately after this, the entire assemblage enters the long house, where the costumed Feather dancers start the Ostowä′′gowa.

Among the Onondaga of the Grand River reserve in Ontario, the leader of the sun ceremony carries an effigy of the sun. This is a disk of wood ten inches in diameter, fastened to a handle perhaps a foot long. The disk is painted red in the center, and has a border of yellow. Around the edge are stuck yellow-tipped down-feathers from some large bird. The New York Iroquois have no such effigies, and the writer seriously doubts that the preachers of Handsome Lake's Gai′wiio‘ would permit such a practice, it being a viola-

[1] A. C. Parker in the Journal of American Folk Lore, October–December 1910.

tion of the prophet's teaching. The Canadian Iroquois, however, received the revelations later than their New York brethren, and were longer under the influence of the older religion, which may account for the survival and use of the sun-disk.

The writer has discovered several sun myths among the Seneca, the one which follows being related by Edward Cornplanter, Soson′dowa ("Great Night"), the recognized head preacher of the Gai′wiio‘ of Handsome Lake. Cornplanter is a Seneca, and a descendant of Gaiänt′waka, the prophet's brother.

The fragments of the cosmological myths which conclude this article are from a mass of ethnological and folk-lore data which it is hoped will shortly be edited and published.

THREE BROTHERS WHO FOLLOWED THE SUN UNDER THE SKY'S RIM

This happened in old times, when there were not many people. There were three brothers and they were not married. They were hunters and had spent their lives hunting. When the brothers were young they enjoyed the excitement of hunting; but as they grew older it did not give them so much pleasure. The youngest brother suggested that for new experiences they walk to the edge of the earth, where the sky comes down and touches the big sea of salt water. There is salt water west, and this world is an island. The other brothers thought the plan a good one; and when they had prepared everything they started on the journey. They traveled a good many years and a good many things happened to them. They always went straight westward.

At last the brothers came to a place where the sun goes under the sky's edge. The sky bends down there and sinks into the water. They camped there for a month and watched the things that happened there. They noticed how the sun got under the rim of the sky and went away quickly. Some men came there and tried to get under the edge of the sky, but it descended quickly and crushed them. There is a road there. Now they noticed that when the sky came up, the water sank lower; and that when the sky went in the water, the water rose higher.

The younger brothers desired to pass under the rim of the sky when the sun slipped under on his road; but the elder brother said that the happenings were too evilly mysterious, and that he was afraid. The younger brothers ran under the rim of the sky quickly, and the rim was very thick. They kept on the road, and water was on each side. They were afraid that the sky would come down and crush them. Now, the oldest brother, it is said, watched them; and when he saw that nothing happened to injure his brothers, he began to run after them. The younger brothers turned from their safe place to encourage him; but the sky came down on the sun's road and crushed him, but they saw his spirit (notwai′shä^n) shoot by quickly. The brothers felt sad.

On the other side of the sky everything is different, so it is said. Before the brothers was a large hill; and when they had ascended it, they saw a very large village in the distance. A man came running toward them. He was in the distance; but he came nearer, and he called out, "Come!" It was their elder brother. "How did you come so quickly, brother?" they asked. "We did not see you come."

The brother answered only, "I was late." He passed by on a road.

An old man came walking toward them. He was youthful and his body was strong, but his hair was long and white. He was an old man. His face was wise-looking, and he seemed a chief.

"I am the father of the people in the Above-the-Sky-Place," he said. "Hawĕni′io‘ is my son. I wish to advise you because I have lived here a long time. I have always lived here, but Hawĕni′io‘ was born of the woman on the island. When you see Hawĕni′io‘, call quickly, 'Niawĕ^n′′skäno^n′!' If you fail to speak first, he will say, 'You are mine,' and you will be spirits, as your brother is."

The brothers proceeded and saw a high house made of white bark. They walked up the path to the door. A tall man stepped out quickly, and the brothers said, "Niawĕ^n′′skäno^n′!" and the great man said, "Dogĕ^{n}s′, I have been watching you for a long time." The brothers entered the house. Now, when they were in the house, the man said, "In what condition are your bodies?" The brothers answered, "They are fine bodies." The great man answered, "You do not speak the truth. I am Hawĕni′io‘, and I know all about your bodies. One of you must lie down, and I will purify him, and then the other."

One brother lay down, and Hawĕni′io‘ placed a small shell to his lips, and put it on the brother's mouth. He also tapped him on the neck, and sealed the shell with clay. He began to skin the brother. He took apart the muscles, and then scraped the bones. He took out the organs and washed them. Then Hawĕni′io‘ built the man again. He loosened the clay and rubbed his neck. He did this with both brothers; and they sat up, and said, "It seems as if we had slept." Hawĕni'io' said, "Every power of your bodies is renewed. I will test you."

The brothers followed Hawĕni'io' to a fine grove of trees surrounded by a thick hedge. All kinds of flowers were blooming outside. "My deer are here," said Hawĕni'io'.

A large buck with wide antlers ran toward them. "He is the swiftest of my runners. Try and catch him," said Hawĕni'io'.

The men ran after the deer, and rapidly overtook him. "He has given us good speed," the brothers said. They soon discovered that they had many surpassing abilities, and the great man tested them all on that day.

They returned to the white lodge, and the brothers saw a messenger running toward them. Upon his wide chest was a bright ball of light. It was very brilliant. In some unknown language he shouted to Hawĕni'io' and dashed on.

"Do you understand his words, or do you know that man?" asked Hawĕni'io'. "He is the sun, my messenger. Each day he brings me news. Nothing from east to west escapes his eye. He has just told me of a great war raging between your people and another nation. Let us look down on the earth and see what is happening."

They all went to a high hill in the middle of the country, and looked down through a hole where a tree had been uprooted. They saw two struggling bands of people and all the houses burning. They could hear people crying and yelling their war cries.

"Men will always do this," said Hawĕni'io', and then they went down the hill.

The brothers stayed a long time in the upper world, and learned so much that they never could tell it all. Sometimes they looked down on the earth and saw villages in which no one lived. They knew that they were waiting for people to be born and live there. In the upper world they saw villages, likewise, awaiting the coming of people. Hawĕni'io' told them a good many things, and after a time told a messenger to lead them to the path that the sun took when he came out on the earth in the morning. They followed the messenger and came out on the earth. They waited until the sun went over the earth and had gone to the west. Again then they went under the edge of the sky in the east, and came out in their country again. It was night, and they slept on the ground. In the morning they saw their own village, and it was overgrown with trees. They followed a path through the woods and came upon another village. Their own people were there, and they went into a council house and talked. They told their story; and no one knew them except their own sister, who was an aged woman.

"The war of which you speak took place fifty years ago," the sister said.

The brothers did not care for the earth now, but wished themselves back in the upper world. They were not like other men, for they never grew tired. They were very strong and could chase animals and kill them with their hands. Nothing could kill them, neither arrows nor disease. After a while, both were struck by lightning, and then they were both killed.

It seems quite likely that there are modern features in this legend; but my informant assured me that the portion relating to the sky and the sun was very old. He said also that he had always heard the upper world described as related in the legend. He added that the sun loved the sound of war, and would linger in his morning journey to see a battle, but that after he reached midheaven he traveled at his usual speed.

Mrs Asher Wright, who spoke Seneca perfectly, and who labored as a missionary among them for fifty years, recorded two Seneca myths as they had been related to her by Esquire Johnson, an old Seneca chief. One describes the origin of good and evil, and says that the sun was made by the Good-minded spirit from the face of his mother. That legend makes the first woman the mother of the twins. The second manuscript, dated 1876, relates practically the same story, but mentions the Sky-woman as having borne first a daughter, who became, without any knowledge of man, the mother of the twins. The mother, having died at their birth, was buried by her mother. The Sky-woman, the grandmother, then turned and addressed the Good-minded spirit, according to Esquire Johnson, quoted by Mrs Wright, as follows:

"Now you must go and seek your father. When you see him, you must ask him to give you power." Pointing to the east, she said, "He lives in that direction. You must keep on until you reach the limits of the Island, and then upon the waters until you reach a high mountain which rises up out of the water, and which you must climb to the summit. There you will see a wonderful being sitting on the highest peak. You must say, 'I am your son.'"

The "wonderful being" appears from the succeeding text to be the sun, although not specifically so named.

We thus have three conflicting ideas presented — the sun as the messenger of the Creator and as the patron of war, as the face of the first mother, and as the father of mankind of earthly origin, although this latter conclusion may be disputed by some for lack of a definite reference.

This leads us to the fact that Iroquois mythology in its present state has been derived from several sources. This has been caused, without doubt, by the policy of adopting the remnants of conquered tribes. Thus we may expect that in Iroquois mythology are the survivals of early Huron, Neutral, Erie, and Andaste elements. It is now possible to trace only the Huron. Algonquian elements came in through the Delaware, the Chippewa, the Shawnee, the Munsee, the Mahikan, and possibly the Nanticoke. It is not difficult to trace Siouan influence.

The writer has been able to trace some of the influencing elements to their sources, but it is nevertheless admitted that the problem of critically sifting and comparing Iroquois myths is a delicate task.

ANECDOTES OF CORNPLANTER

Related by Emily Tallchief, his great great granddaughter

CORNPLANTER MAKES PEACE

" Now these stories are true and came to Solomon Obail from Cornplanter, and Solomon, my father, told me.

" The Cornplanter reservation Senecas often traveled by canoes down the Allegany river to Pittsburgh. On a certain occasion Cornplanter went with a party of canoeists down the Allegany to Pittsburgh. While on his journey one of the paddlers sang Woine'owi as he paddled. Now as he sang the party was startled by a voice that called from the cliff above, ' Halt ye! ' The paddler grounded the canoe and Cornplanter went ashore, where, ascending the cliff, he found a number of Indians gathered about a tree to which a white man was bound. ' So now Cornplanter,' said the chief of the band, ' I have called you to kill this man. You may now do as you please with him and we will be satisfied.' Cornplanter drew forth his long hunting knife and feeling of its sharp edge said ' So I may do as I wish. Truly then I shall do so.' So saying he rushed toward the man with upraised knife and brought it down with a flourish. The man was not injured but instead stepped out from the tree free, for Cornplanter's knife had severed the thongs. ' Now,' said Cornplanter, after some conversation with the man, ' I will hire a guide to take this man back to his home in Philadelphia.' A warrior accepted the commission and guided the prisoner safely back to his home where he found him to be a man of prominence, a chief among his people."

"So I say this," added Mrs Tallchief, "to show that my grandfather was a good man, just and kind. Because of these qualities he became influential."

CORNPLANTER AND WASHINGTON

"Now during the war of the thirteen fires against the king of Great Britain, we, the Iroquois, were loyal to our old allies, the British. We fought for them, but, alas for us they were beaten. Now Washington, the great leader of the thirteen fires, was determined to punish us for our part in the war, for he did not realize that we were but keeping our treaties with the British when we fought. So Washington said, 'Depart from among us and go to the west far from the white people.' But Cornplanter said, 'Not so. We are determined not to move. We have long lived here and intend to continue in our own territory as long as we are able to hold it.' 'Not so,' answered Washington, 'you fought against us and therefore you must move on to the west and if you refuse we shall compel you.' 'Then,' answered Cornplanter, 'we will resist you by force of arms. If you win we will have to go, otherwise we will remain where we now are.'

"Cornplanter returned from Washington to his people and spread the news. Quickly it traveled among all the Indians to the south, the east and the west. All were very angry and said, 'We will fight. When the white man tries to move us as they please it is time that we moved a few white men.' Then the western Indians began to massacre the settlers. The news came to Washington. 'It is a mistake to encourage another Indian war,' he said and then sent for Cornplanter. 'I want to settle our difficulties,' said he, 'and I wish peace. I do not wish war, therefore you, Cornplanter, must pacify your people.' 'I care not to meddle further with matters,' said Cornplanter. 'But you must go,' insisted Washington, 'you are the only man who can restore peace and good will.' Thus it was that Cornplanter accepted the commission. He returned home and collecting a party of chiefs sent abroad declarations of peace. The delegation went through Sandusky into the farther west. There Cornplanter called a council and said, 'We must be peaceful with the white men and cease tormenting them.' Now the tribe was a very fierce one and was very angry that Cornplanter advised peace. They mixed poison with the food which they served the delegation and a number died. Cornplanter also was made severely ill. Then Cornplanter became very angry and calling a council said, 'You have acted with treachery. Now I cease to plead. I now command that you let the white people live in peace. Do not kill another one. If you do I will bring the whole Five Nations against you and with a great army of white men will kill every one of you. The Senecas are the greatest nation of all nations and whatever they plan they do. We are always successful and always victorious in sport, debate or battle. So beware.' Now the western Indians councilled among themselves and said, 'We must hastily agree for if the Senecas come against us we surely will be defeated.'"

ORIGIN OF THE NAME CORNPLANTER

"Gaiänt'wakĕ', the great chief, once went to Philadelphia.

"'How do your people procure food?' asked a white man, a Quaker.

"'We are hunters,' answered the chief.

"'Have you not observed our great fields of corn and grain?' asked the white man, 'and did you know that we never have famines as you do? Why do your people not cultivate gardens of size and till large fields of grain?'

"'My people used to do so,' said the chief, 'and not many years ago when they dwelt in the valley of the Genesee. Now I think that I will encourage this practice again.'

"This conversation so impressed the chief that when he returned he spoke of the matter before the councils and exhorted people in private to plant more and hunt less. Because of this he received the name of *The Planter,* but the whites called him Cornplanter."

KEY TO PHONIC SYSTEM

a as in *father, bar;* Germ. *haben*
ā the same sound prolonged
ă as in *what;* Germ. *man*
ä as in *hat, man, ran*
ai as in *aisle,* as i in *mine, bind;* Germ. *Hain*
au as ou in *out,* as ow in *how;* Germ. *Haus*
c as sh in *shall;* Germ. sch in *schellen;* cio-sho as in *show*
d pronounced with the tip of the tongue touching the upper teeth
e as e in *they,* as a in *may;* Fr. *ne*
ĕ as in *met, get, then;* Germ. *denn;* Fr. *sienne*
g as in *gig;* Germ. *geben;* Fr. *gout*
h as in *has, he;* Germ. *haben*
i as in *pique, machine;* ie as ye in English *yea*
ī the same sound prolonged io as yo in *you*
ĭ as in *pick, pit*
j as in *judge*
k as in *kick, kin*
n as in *no, nun, not*
ñ as ng in *ring, sing*
o as in *note, boat*
q as ch in Germ. *ich*
s as in *see, sat*
t pronounced with the tip of the tongue on the upper teeth
u as in *rule;* Germ. *du;* Fr. ou in *doux*
ŭ as in *rut, shut*
w as in *wit, win*
y as in *yes, yet*
dj as j in *judge*
tc as ch in *church;* tci-chee as in *cheese*
^{n} marks nasalized vowels as a^n, e^n, ĕ^n, o^n, ă^n, ai^n, etc.
ʻ indicates an aspiration or soft emission of the breadth which is initial or final, thus ʻh, ĕ^{n}ʻ, oʻ, etc.
’ marks a sudden closure of the glottis preceding or following a sound, thus ’a, o’, ä’, ă’, etc.
′ marks the accented syllable of a word
t and *h* in this system are always pronounced separately

GLOSSARY OF SENECA WORDS

(For key to pronunciation see page 139)

Adanidä′oshä (cooperative labor), 39

Adekwe′o^{n}ge (green corn thanksgiving), 43

Adĭstowä′e (feather wearing; name applied to conservative Indians by the more radical), 14

Ado^{n}dār′ho (meaning snaky headed), 5

Ado^{n}′wĕ^{n} (thanking or cheer songs), 41; figure, 84

Askä′nīe′ (women's dance), 101

Awē′yondo′ gawen′notgä′o (the funeral address), 107

Dagwŭn′noyaĕnt (the wind spirit), 119

Daitdagwŭt′ (white beaver), 119

Dänondinōñ′yo (Thanksgiving), 103

Dawan′do‘ (other ceremony), 121

Degi′ya′go^{n} oä′′no′ (Buffalo Society), 125

Dewŭtiowa′is (exploding wren), 119

Diogē′′djaie (grassy place), 75

Diohe′′ko^{n} (the corn, bean and squash triad; the word means, They sustain us), 39, 54, 86

Diondēgă′ (Seneca name of Pittsburgh)

Dion′dot (tree), 75

Dionĭ′hogä′wĕ (Open Door, or Door Keeper, name of Seneca war sachem, once held by Gen. Ely S. Parker), 12

Diono′sade′gĭ (place of burnt houses; the Seneca name for Cornplanter village), 20, 52

Djĭs′gä^{n}dă′taha‘ (ghost talker), 68

Dogĕ^{n}s′ (truly a reply), 113

Ĕndē′ka gää′′kwa (daytime brilliant orb, the sun), 91

Enīa′iehŭk (it was once that way; the closing word of each section of the Gai′ wiio‘)

Gadă′ciot (the trotting dance), 82, 101

Gadägĕs′käo^{n} (fetid banks), Cattaraugus

Gagwē′go^{n} (all, everyone, entirely), 33

Gahadi yago (at the wood's edge, a ceremony), 123

Gaiänt′wakă (The Planter, commonly called Cornplanter. A Seneca pine tree chief name. The half brother of Handsome Lake), 23, 24, 44, 50

Gai‘′do^{n}	(an I′′dos ceremony), 123
Gai‘yowĕ^{n}′ogowă	(the sharp point; a ceremony), 123
Gại′wiio‘	(meaning the good message; pronounced as if spelled guy-we-you), 5, 6, 26, 43
Gai‘wiios′tŭk	(the Christian religion), 57
Gaji‘′sasho^{n}ọ‘	(husk false face), 129
Gaknowe′haat	(to copulate), 73
Găko′go’	(she is a gluttonous beast, a name), 74
Ganäwĕ^{n}′gowa	(great bowl game), 41
Gänä‘yasta‘	(midwinter ceremony), 81
Ganĕ‘′gwaē	(the Eagle dance song), 124
Gane′o^{n}wo^{n}	(the harvest thanksgiving ceremony), 21, 26, 41, 94
Ganio‘dai′io	(Handsome or Beautiful Lake, the title of the sachem name held by the prophet), 5, 18, 22, 46, 80
Ganōda	(night song), 116
Gănonjoni′yon	(Kittle Hangs, a name), 74
Ganonktiyuk′gegäo	(name of Onondaga), 76
Ganos′ge’	(house of the tormentor), 56
Gāno^{n}′wagĕs	(fetid water, Seneca name for their village near present site of Avon, Livingston co., N. Y.), 9, 78
Ganowoñ′go^{n}	(in the rapids, name of Warren, Pa.), 20
Ganŭn′dasē‘	(Ga-nun-da-se, meaning *a town new* or Newtown. Name of non-Christian Seneca village on Cattaraugus reservation)
Ganŭndase‘′ge’	(place of a new town; Seneca name of Geneva), 79
Ganuñg′sĭsnē′ha	(long house people), 7
Gat′go^{n}’	(witchcraft), 27
Gawĕnnodŭs′hä	(compelling charm; charm used to compel persons to obey the charm holder), 29, 30
Gayänt′gogwus	(tobacco thrown down, "Dipped" Tobacco, a woman's name), 24
Go‘diodia′se	(a lying tale, slander), 37
Gonoigä′nongi	(drunken), 20
Gowono^{n}′′gowa	(Large Talker, a name), 74
Gushēdon′dada	(jug shaking dance), 101
Gwi′′yă’	(an exclamation in the ganē′wo song), 85, 100

Hanĭssē′ono (ha-nĭs-sē′-o-no, the devil), 18

Hadēiyäyo‘ (new year announcers), 82

Hadidji′yontwŭs (the new year ceremony), 75

Hadigo^{n}′săsho^{n}o‘ (False Face company), 127

Hadio^{n}yă′′geono (they are messengers; the four angels), 19, 25

Hadiwĕnnoda′dies (the thunderers), 98

Ha’dji′no (male), 73

Haiyon′wĕntha (Hai-yon′-wĕnt-ha, a sachemship title meaning, *he has lost it and searches, knowing where to find it.* The Seneca name for Hiawatha)

Hanä′sishĕ (new year ceremonial officers), 82

Hasan′owānĕ’ (exalted name, the word applied to a chief), 44

Hătgwi′yot (the son-in-law of Handsome Lake), 23

Hawĕni′o‘ (good ruler, God; the name mostly used by the Christian Seneca), 48, 133

Hayänt′wŭtgŭs (tobacco throwing ceremony), 121

Hĕnne′yo^{n}‘ (a clairvoyant), 49

Hi’′no^{n} (the Thunderer), 104

Hodiänok′doo^{n} Hĕd′-iohe’ (the Creator), 19, 48

Honio′′o^{n} (white man), 20

Ho’no^{n}′gwae (a nest), 47

Honon′diont (overseer of the ceremonies), 411, 421

Hono’′tcino′′gä (the guardian company), 116

Ho‘tcine′gada (company of charm holders; note that "tci" is pronounced as "*chee*" in *cheese*), 119

Hoyā′nĕ (noble born, good in character, applied as a title to sachems. The Mohawk form Rhoya′nĕ’ is sometimes translated "*lord*"), 9, 22

I′′dos (a charm society), 121, 122

Jodi′′gwado^{n}‘ (a great horned serpent), 119

Jo^{n}gä′o^{n} (elves of pygmies), 119

Joi′ise (New Voice, a man’s name), 76

Niagă’hos′sää’ (small bundle of magic substance), 29

Nia′′gwahē (great naked bear or mammoth bear, a mythical beast), 28; footnote, 40; 119

Nia‘gwai‘′	(bear, bear ceremony), 125
Niawĕ^{n}′	(thanks are given), 36
Niawĕ″skäno^{n}’	(thank you, you are strong), a greeting, 133
Nīganĕga″a‘	(little water) a medicine powder, 116
Niio’	(so be it, or it is well, "all right"), 22
Nĭs′a	(name of a month), 86
Nĭsko′wŭkni	(nĭs-ko′-wŭk-ni, the moon of midwinter), 6, 53
Notwai′shä^{n}	(spirit), 133
Oä′no‘	(a dance, or society)
Odā′eo	(the veil over the world), 67
O‘dän′kot	(Sunshine, a name), 117
Odjis′kwăthē^{n}	(Pudding Dry, a man's name), 24
O’g‘i′wē	(the death chant, a ceremony), 21, 26, 50, 126
Ohī′īo‘	(river beautiful, name applied to the Allegany river), 20
Ondē′yä	(ceremonial officers, "buffalo robed"), 81
One′gă	(whiskey or rum), 9, 27
Oñgwe″oñwe	(real men, Iroquois), 18, 45
Oñgwe″oñwekā′	(Oñgwe″-oñwe-kā′, literally, *men beings—real*—emphatically so), 6
Ono′ityi′yĕnde	(witch poison), 29, 72
Onondaga	(meaning, upon the hills)
Osto′wä’gō′wa	(Great Feather dance, the chief religious dance), 25, 42
Ot’go′ä	(wampum), 57
Otnä′yont	(sharp bone charm), 119
O‘to’do^{n}gwa‘′	(it is blazing, a ceremony), 123
Owa′ĕtgä^{n}	(road bad; a rough road), 69
O’wai′ta	(dried hand charm), 119
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Sedékonĭ″	(you come to eat), 36
Sedē′tciā	(early in the morning), 6
Sedwā′gowā′nĕ’	(Se-dwā′-go-wā′-nĕ’) Teacher-great, name applied to Handsome Lake, 71; footnote, 53; 67
Sega^{n}′hedŭs	(*He resurrects;* Christ), 67
Segoewa′t‘ha	(the tormentor, devil), 48

Segwai′′do^{n}gwi	(a man's name), 57
Sha′′dotgéa	(the Eagle ceremony), 124
S'hagodiowĕ^{n}′gowa	(the false face spirit chief), 128
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Skandyo^{n}'′′gwadĭ	(Seneca name of Owen Black Snake), 19
Skäno^{n}′	(strength, health), 133
Soi′kāgää′′kwa	(night shining orb, the moon), 92
Sos′hēowă	(name of Handsome Lake's grandson and one of his successors, the grandfather of Gen. Ely S. Parker. English name was James Johnson), 12, 19
Soson′dowă	(S'o-son′-do-wă, *Night-Great,* the teacher of Handsome Lake's religious code. His English name is Edward Cornplanter, q. v.), 5, 16, 19, 80
Tää′wŏnyăs	(Awl Breaker, sometimes called Needle Breaker. The name of a Seneca chief), 23
Tă'dondä′ieha'	(a masculine proper name), 60
Tain′tciadĕ	(heaven world), 69
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Wa′′da Tādinion′nio'o'	(maple thanksgiving), 102
Wadigusä′wea	(to throw up the paddle, meaning, "it is finished," a ceremonial term), 82
Wainonjää′′ko^{n}	(the death feast), 110
Wasa′z'ĕ	(Sioux; means also *warlike*), 103
Yai′′kni	(month of May), 20
Yē′o^{n}'	(a woman), 33
Yeo^{n}′skwaswa′do^{n}'	(a thieving woman), 39
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