THIRTY-FOURTH ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO, MAINE

1918

THIRTY-FOURTH ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO, MAINE

1918

UNIVERSITY OF MAINE

1918

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE

ORGANIZATION JANUARY TO JUNE, 1918

THE STATION COUNCIL

PRESIDENT ROBERT J. ALEY,	*President*
DIRECTOR CHARLES D. WOODS,	*Secretary*
FREELAND JONES, Bangor,	*Committee of Board of Trustees*
THOMAS V. DOHERTY, Houlton,	*Committee of Board of Trustees*
FRANK E. GUERNSEY, Dover,	*Committee of Board of Trustees*
JOHN A. ROBERTS,	*Commissioner of Agriculture*
EUGENE H. LIBBY, Auburn,	*State Grange*
WILSON W. CONANT, Buckfield,	*State Pomological Society*
FRANK S. ADAMS, Bowdoinham,	*State Dairymen's Association*
LEONARD C. HOLSTON, Cornish,	*Maine Livestock Breeders' Ass'n.*
WILLIAM G. HUNTON, Portland,	*Maine Seed Improvement Ass'n.*

AND THE HEADS AND ASSOCIATES OF STATION DEPARTMENTS, AND THE DEAN OF THE COLLEGE OF AGRICULTURE

THE STATION STAFF

ADMINISTRATION	CHARLES D. WOODS, Sc D.	*Director*
	MARIAN A. COUGLE,	*Clerk*
	ESTELLE M. GOGGIN,	*Clerk*
	CHARLES C. INMAN,	*Clerk*
BIOLOGY	FRANK M. SURFACE, PH. D.,	*Biologist**
	JOHN W. GOWEN, PH. D.,	*Assistant*
	RAYMOND PEARL, PH. D.,	*Collaborator*
	SILVIA PARKER, A. B.,	*Assistant*
	MILDRED R. COVELL,	*Clerk*
	HELEN A. RING,	*Laboratory Assistant*
CHEMISTRY	JAMES M. BARTLETT, M. S.,	*Chemist*
	HERMAN H. HANSON, M. S.,	*Chemist**
	ELMER R. TOBEY, B. S.,	*Assistant*
	ROLAND E. LORD,	*Laboratory Assistant*
ENTOMOLOGY	EDITH M. PATCH, PH. D.,	*Entomologist*
	ALICE W. AVERILL,	*Laboratory Assistant*
PLANT PATHOLOGY	WARNER J. MORSE, PH. D.,	*Pathologist*
	†MICHAEL SHAPOVALOV, M. S.,	*Assistant*
	†GLEN B. RAMSEY, A. M.,	*Assistant*
	VIOLA L. MORRIS,	*Laboratory Assistant*
AROOSTOOK FARM	JACOB ZINN, AGR. D.,	*Assistant Biologist*
	C. HARRY WHITE,	*Scientific Aid*
	JEREMIAH E. SULLIVAN,	*Superintendent*
HIGHMOOR FARM	WELLINGTON SINCLAIR,	*Superintendent*
	WALTER E. CURTIS,	*Scientific Aid*
ROYDON L. HAMMOND,		*Seed Analyst and Photographer*

* Absent on leave during period of war.

† In collaboration with U. S. Department of Agriculture.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE

ORGANIZATION JULY TO DECEMBER, 1918

THE STATION COUNCIL

PRESIDENT ROBERT J. ALEY,	*President*
DIRECTOR CHARLES D. WOODS,	*Secretary*
THOMAS V. DOHERTY, Houlton,	*Committee of Board of Trustees*
FRANK E. GUERNSEY, Dover,	*Committee of Board of Trustees*
JOHN A. ROBERTS,	*Commissioner of Agriculture*
EUGENE H. LIBBY, Auburn,	*State Grange*
WILSON W. CONANT, Buckfield,	*State Pomological Society*
FRANK S. ADAMS, Bowdoinham,	*State Dairymen's Association*
LEONARD C. HOLSTON, Cornish,	*Maine Livestock Breeders' Ass'n.*
WILLIAM G. HUNTON, Portland,	*Maine Seed Improvement Ass'n.*

AND THE HEADS AND ASSOCIATES OF STATION DEPARTMENTS, AND THE DEAN OF THE COLLEGE OF AGRICULTURE

THE STATION STAFF

ADMINISTRATION	CHARLES D. WOODS, Sc D.	*Director*
	ESTELLE M. GOGGIN,	*Clerk*
	CHARLES C. INMAN,	*Clerk*
	MARGARET A. PARKER,	*Clerk*
BIOLOGY	FRANK M. SURFACE, PH. D.,	*Biologist**
	JOHN W. GOWEN, PH. D.,	*Assistant*
	RAYMOND PEARL, PH. D.,	*Collaborator*
	HELEN A. RING,	*Laboratory Assistant*
CHEMISTRY	JAMES M. BARTLETT, M. S.,	*Chemist*
	HERMAN H. HANSON, M. S.,	*Chemist**
	ELMER R. TOBEY, B. S.,	*Assistant*
ENTOMOLOGY	EDITH M. PATCH, PH. D.,	*Entomologist*
	ALICE W. AVERILL,	*Laboratory Assistant*
PLANT PATHOLOGY	WARNER J. MORSE, PH. D.,	*Pathologist*
	†MICHAEL SHAPOVALOV, M. S.,	*Assistant*
	†DONALD FOLSOM, PH. D.,	*Assistant*
	VIOLA L. MORRIS,	*Laboratory Assistant*
AROOSTOOK FARM	JACOB ZINN, AGR. D.,	*Assistant Biologist*
	C. HARRY WHITE,	*Scientific Aid*
	JEREMIAH E. SULLIVAN,	*Superintendent*
HIGHMOOR FARM	WELLINGTON SINCLAIR,	*Superintendent*
	WALTER E. CURTIS,	*Scientific Aid*
ROYDON L. HAMMOND,		*Seed Analyst and Photographer*

* Absent on leave during period of war.

† In collaboration with U. S. Department of Agriculture.

The publications of this Station will be sent free to any address in Maine. All requests should be sent to

Agricultural Experiment Station,

Orono, Maine.

CONTENTS.

ANNOUNCEMENTS.

Establishment of the Station

The Maine Fertilizer Control and Agricultural Experiment Station, established by Act of the Legislature approved March 3, 1885, began its work in April of that year in quarters furnished by the College. After the Station had existed for two years, Congress passed what is known as the Hatch Act, establishing agricultural experiment stations in every state. This grant was accepted by the Maine Legislature by an Act approved March 16, 1887, which established the Maine Agricultural Experiment Station as a department of the University. The reorganization was effected in June, 1887, but work was not begun until February 16, 1888. In 1906, Congress passed the Adams Act for the further endowment of the stations established under the Hatch Act.

The purpose of the experiment stations is defined in the Act of Congress establishing them as follows:

"It shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantage of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manure, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories."

The work that the Experiment Station can undertake from the Adams Act fund is more restricted and can "be applied only to paying the necessary expenses for conducting original researches or experiments bearing directly on the agricultural industry of the United States, having due regard to the varying conditions and needs of the respective states and territories."

INVESTIGATIONS.

The Station continues to restrict its work to a few important lines, believing that it is better for the agriculture of the State to study thoroughly a few problems than to spread over the whole field of agricultural science. It has continued to improve its facilities and segregate its work in such a way as to make it an effective agency for research in agriculture. Prominent among the lines of investigation are studies upon the food of man and animals, the diseases of plants and animals, breeding of plants and animals, orchard and field experiments, poultry investigations, and entomological research.

INSPECTIONS.

Up to the close of the year 1913, it had been the duty of the Director of the Station to execute the laws regulating the sale of agricultural seeds, apples, commercial feeding stuffs, commercial fertilizers, drugs, foods, fungicides and insecticides, and the testing of the graduated glassware used by creameries. Beginning with January, 1914, the purely executive part of these laws is handled by the Commissioner of Agriculture. It is still the duty of the Director of the Station to make the analytical examination of the samples collected by the Commissioner and to publish the results of the analyses. The cost of the inspections is borne by fees and by a State appropriation.

OFFICES AND LABORATORIES.

The offices, laboratories and poultry plant of the Maine Agricultural Experiment Station are at the University of Maine, Orono. Orono is the freight, express, post, telegraph and telephone address for the offices and laboratories.

AROOSTOOK FARM.

By action of the Legislatures of 1913 and 1915 a farm was purchased in Aroostook County for scientific investigations in agriculture to be under "the general supervision, management, and control" of the Maine Agricultural Experiment Station. The farm is in the town of Presque Isle, about 2 miles south of the village, on the main road to Houlton. The Bangor and Aroostook railroad crosses the farm. A flag station, "Aroostook Farm," makes it easily accessible by rail.

The farm contains about 275 acres, about half of which is cleared. The eight room house provides an office, and home for the farm superintendent. A school house on a lot adjoining the farm was presented to the State by the town of Presque Isle and after being remodeled serves as a boarding house for the help. A greenhouse and a potato storage house have been erected at the farm by the U. S. Department of Agriculture for use in cooperative work on potato breeding. The large barn affords storage for hay and grain and has a large potato storage house in the basement.

HIGHMOOR FARM.

The State Legislature of 1909 purchased a farm upon which the Maine Agricultural Experiment Station "shall conduct scientific investigations in orcharding, corn, and other farm crops." The farm is situated in the counties of Kennebec and Androscoggin, largely in the town of Monmouth. It is on the Farmington Branch of the Maine Central Railroad, 2 miles from Leeds Junction. A flag station, "Highmoor," is on the farm.

The farm contains 225 acres, about 200 of which are in orchards, fields, and pastures. There are in the neighborhood of 3,000 apple trees upon the place which have been set from 20 to 30 years. Fields that are not in orchards are well adapted to experiments with corn, potatoes, and similar general farm crops. The house has 2 stories with a large wing, and contains about 15 rooms. It is well arranged for the Station offices and for the home of the farm superintendent. The barns are large, affording storage for hay and grain. The basement affords limited storage for apples, potatoes and roots. A substantially constructed building for apple packing was erected in 1912.

PUBLICATIONS.

The Station is organized so that the work of investigation is distinct from the work of inspection. The results of investigation are published in the bulletins of the Station and in scientific journals, both foreign and domestic. The bulletins for the year make up the annual report. The results of the work of inspection are printed in publications known as Official Inspections. These are paged independently of the bulletins and are bound in with the annual report as an appendix thereto. Miscellaneous publications consisting of newspaper notices of bulletins, newspaper bulletins and circulars which are not paged consecutively and for the most part are not included in the annual report are issued during the year. Weekly mimeograph publicity letters are sent to all papers within the State.

BULLETINS ISSUED IN 1918.

No. 269 Barn and Field Experiments in 1917. 44 pages.
No. 270 Eastern Aphids: A Few Species of Prociphilus. 55 pages. 2 pages plates.
No. 271 Apple Spraying Experiments in 1916 and 1917. 27 pages.
No. 272 Inheritance Studies of Color and Horn Characteristics. 19 pages. 4 illustrations.
No. 273 The Biology of Maine Species of Altica. 55 pages. 3 pages of plates.
No. 274 Report of Progress on Animal Husbandry Investigations in 1918.
No. 275 Abstracts of papers not included in Bulletins, Finances. Meteorology Index.

OFFICIAL INSPECTIONS ISSUED IN 1918

No. 86 Commercial Agricultural Seeds, 1917. Insecticides and Fungicides 1916 and 1917. 32 pages.
No. 87 Miscellaneous Food Materials. 27 pages.
No. 88 Commercial Agricultural Seeds, 1918. 15 pages.
No. 89 Commercial Feeding Stuffs, 1917-18. 23 pages.
No. 90 Commercial Fertilizers, 1918. 19 pages.

MISCELLANEOUS PUBLICATIONS ISSUED IN 1918

No. 535 How to Control Potato Enemies. 16 pages.

BIOLOGICAL PUBLICATIONS, 1918.

In the numbered series of "Papers from the Biological Laboratory":

120. Studies in Inheritance of Certain Characters of Crosses between Dairy and Beef Breeds of Cattle. By John W. Gowen. Journal of Agricultural Research Vol. XV, No. 1, pp. 1-57.
121. Studies on Milk Secretion.
IV. On the Variation and Mode of Secretion of Milk Solids. Journal of Agricultural Research Vol. No. pp.
122. Inheritance Studies of Certain Color and Horn Characters in First Generation Crosses of Dairy and Beef Breeds. By John W. Gowen. Maine Agricultural Experiment Station, Annual Report, for 1918, pp. 129-148.
123. Inheritance of Coat Color and Other Characters in First Generation Crosses of Dairy and Beef Breeds of Cattle. By John W. Gowen. Proceedings of the National Academy of Sciences.
124. Report of Progress on Animal Husbandry Investigations in 1918. By John W. Gowen. Maine Agricultural Experiment Station, Annual Report for 1918, pp.

ENTOMOLOGICAL PAPERS FROM THE MAINE AGRICULTURAL EXPERIMENT STATION, 1918.

Ent. 97. Eastern Aphids: A Few Species of Prociphilus. By Edith M. Patch. Bul. 270, Me. Agr. Exp. Station.
Ent. 98. Food Plant Catalogue of the Aphididae of the World. By Edith M. Patch. Bul. 270, Me. Agr. Exp. Station.
Ent. 99. The Meadow Plant Bug, *Miris dolabratus*. By Herbert Osborn. Journal of Agricultural Research, Vol. 15, No. 3.
Ent. 100. The Biology of Maine Species of Altica. By William Colcord Woods. Bul. 273, Me. Agr. Exp. Station.

(Bulletins 269 to 275 constitute the Report for 1918. In binding, pages i-xvi at the end of this bulletin should be detached and placed before Bulletin 269 which begins with page 1)

STAFF NOTES

Doctor Raymond Pearl, Biologist to the Station, on leave on war work since June 1917, resigned January 1, 1918 to become the head of the Department of Biometry and Vital Statistics at the newly established School of Hygiene and Public Health of the Johns Hopkins University. He continues with the Maine Station as Collaborator and will analyze and publish as

papers from this Station the large amount of data that have accumulated in the animal husbandry work, particularly in the poultry investigations, during the 10 years he was in charge of these investigations.

Doctor Surface, Biologist, absent on war work since June 1917, is in Paris. He is Food Statistician to the Peace Commission and Mr. Hoover's representative on the Inter Allied Statistical Board in charge of relief work.

Captain Herman H. Hanson, Chemist, absent on war leave since December 1917, is assigned as Nutrition Officer, Camp Lee, Petersburg, Virginia.

Mr. Glen B. Ramsey, Assistant Pathologist, resigned June 1, 1918 to accept a position with the Bureau of Plant Industry of the United States Department of Agriculture.

Miss Parker, Assistant Biologist, resigned July 1, 1918 to go to a similar position at the School of Hygiene and Public Health of the Johns Hopkins University.

Mrs. Marian A. Cougle, Clerk, resigned September 1, 1918.

Mr. Michael Shapovalov, Collaborating Plant Pathologist, resigned October 15, 1918 to devote all of his time to the work of the Bureau of Plant Industry of the United States Department of Agriculture.

Margaret A. Parker appointed Clerk July 1, 1918 resigned November 30, 1918.

Mr. John R. Miner, Computer, absent on war leave, resigned December 1, 1918 to go to a similar position at the School of Hygiene and Public Health at the Johns Hopkins University.

Mr. Jeremiah E. Sullivan, Superintendent of Aroostook Farm, resigned December 31, 1918 to accept a commercial position as farm manager.

Donald Folsom, Ph. D. was appointed Assistant Plant Pathologist June 1, 1918.

Mr. C. Harry White was transferred from Scientific Aid to Assistant Chemist, October 15, 1918.

Miss Mary L. Norton was appointed Clerk December 1, 1918.

Mr. Walter E. Curtis was transferred from Scientific Aid to Superintendent of Aroostook Farm, January 1, 1919.

BULLETIN 269

BARN AND FIELD EXPERIMENTS IN 1917.

REPORTED BY CHAS. D. WOODS.

The work of investigation at the two Experiment Station farms (Aroostook Farm, Presque Isle, and Highmoor Farm, Monmouth) is planned by the Director, the Biologists, the Plant Pathologist and the Entomologist. The results of the more scientific phases of the studies are reported from time to time in the bulletins, but it always happens that there are results obtained that lie somewhat outside of the lines of work of any of the Station specialists. Some of the more popular and practical results are here reported. The carrying out of these experiments and the taking of the requisite notes devolved upon different members of the Staff.

ARE SWINE PROFITABLE IN WINTER?

In the winter of 1915-16 an experiment was undertaken on the care of manure. This was reported in Bulletin 260. In that experiment it was necessary to keep the manure well worked over and at the same time compacted so as to prevent losses from heating. As it was thought that swine might do this work at a less cost than for man labor, pigs were kept upon the manure. An exact account of feed and time for care was made and it was found after making allowances for certain unusual losses that the swine had been kept at a profit of about 15 per cent on the total investment. As the manure pit was maintained in the same way in the winter of 1916-17 an account of income and out go was kept as follows:

November 5, 1916, 16 eight weeks old pigs were purchased for $3 each, placed upon the manure and kept there until they were sold May 21, 1917. The swine were fed and handled as

the superintendent found convenient. In general the swine were fed cooked turnips with adition of ground feed. Corn on the cob was occasionally thrown over the manure to keep the swine at work stirring the manure. During the little over 6 months the swine were fed 600 pounds of small cull potatoes, 9130 pounds of turnips, 1375 pounds of middlings, 1030 pounds of corn meal, 300 pounds of soy bean meal and 2090 pounds of corn on the cob. This corn on the cob included the soft ears and nubbins and smaller ears after the better part of the corn had been selected for seed. It took about 15 minutes a day to feed and care for the swine and from one to two hours a week to cook the mash. The total time spent on the care and feeding was 85 hours. The food used cost $121.80. The cost of the labor was $17.50. These items added to the purchase price ($48.00) of the pigs made the entire cost $187.30. The pigs at the end of the experiment were sold for $218.40 leaving a cash income balance of $31.10. The value of the manure was sufficient to more than meet any charges for investment and upkeep. Based on the cost of the pigs the percentage gain was 65 per cent. Based upon the total cost it was a little over 15 per cent.

Beside being directly profitable swine materially improve farm manure, particularly that dropped by horses and sheep. It is a conservative estimate that the plant food annually voided by farm animals and poultry in Maine has a potential value of about $10,000,000 dollars, and it is doubtful if by present methods of care one-half of this plant food actually finds its way back to the soil. The trials reported last year in Bulletin 260 with the manure platform and swine indicate that by a little care most of this plant food can be saved. In the 2 years that the platform has been used the swine have made a good return on the investment and the added plant food saved was all clear profit. And in many instances this conserved plant food will be the difference between keeping live stock at a profit or keeping them at a loss.

ARE SHEEP PROFITABLE IN MAINE?

The Station Council, at its meeting in April 1914, authorized the purchase of grade sheep sufficient to stock Highmoor Farm for the purpose of studying the question as to whether sheep can or cannot be profitably raised in Maine. The sheep were not to be of a fancy type, or be pure bred so that none of the animals could be sold at a fancy price. Nor were they to be early bred to produce "hot house" lambs for the high price of the early market. They were to be just plain sheep such as any ordinary farmer could carry. While care was to be exercised in handling the sheep, no high priced labor was to be used. Nor was a special "shepherd" to be employed.

The sheep are grade Hampshire, but are so nearly pure Hampshire that only an expert could tell them from pure bloods. They are as fine a flock of sheep as one cares to see. The farm superintendent is an experienced man with sheep and they have excellent care. Two years ago the results of the first year's trial were published in Bulletin 246. This trial showed that the sheep were kept at a large loss. This publication led to the receipt of many letters and to the publication of some newspaper articles. It was evident from these that many owners thought they were making money from sheep. But no one was found who was keeping a flock of about 100 sheep who knew from actual figures whether they were or were not being kept at a profit. At the recent convention of the State Dairymen's Association a paper was read that showed a profit on a small flock, but many of the data cited were estimates.

It is probably true that on most farms a few sheep would be profitable, because they would be cared for in time that otherwise would not be profitably employed, and the sheep would be fed more or less of unmarketable produce and hay. A set of books in which everything was charged and credited would probably not show the balance on the credit side. Nevertheless, most farmers who are equipped for them would be better off with a few sheep, because of the salvage of time and materials that might otherwise be wasted. Thus with sheep it is the same as it is in the case of a few swine, a small flock of hens, a small area devoted to garden crops, etc. With certain

well known exceptions, very few of the farm items, charging labor at what it costs, food at what it is worth, and taking fixed charges into account, would show book profit. Nevertheless, on every hand there are farmers who with incomes derived from small flocks, small herds, and small areas devoted to crops, live comfortably, educate their children, and accumulate some bank surplus.

There will always be an expense for fitting up and maintaining pastures, buildings, etc., for sheep that will vary on different farms and with different farmers. The overhead charges, such as interest, taxes, and the like, will also vary with varying conditions. In an experiment conducted by the Station, where it is necessary to keep individual records, buttons for the ears and time involved in note taking are expense items that the ordinary farmer need not be at. For these and similar reasons the cost of fencing the pastures, erecting shelters in the pastures, fitting up the barns for winter quarters, expenses for piping water, water troughs, sheep dipping tanks, shearing machine, gas engine, root cutter, rent of land for pastures and crops for the sheep, while necessary expenses that must be taken into account by the practical farmer, are omitted from the following statement. The amounts included are the inventory value of the sheep, the cost of labor in caring for the sheep, cost of food purchased, the value of the hay and straw at the barn, the cost to grow the roots used. The credits are the sheep and wool sold and the inventory at the end of the year.

As reported in Bulletin 246, the year as given ran from July 1 to June 30. This is the fiscal year as prescribed by the State Auditor, but is not a good one for an experiment of this kind which far more naturally begins and ends either with turning the sheep out to pasture in the spring, or, still better, with the housing of the sheep in the fall. In order to make it possible to include practically all the income from the sheep within the year, the duration of the year is changed so that it now runs for 12 months from the first of November, instead of the first of July. In order to compare fairly the first report as given has been changed so as to make it begin November 1, 1914, instead of July 1, 1914, as it was previously reported.

The results of the experiment for the years 1914-15 and 1915-16 are reported in Bulletin 260 of this Station. The receipts and expenditures for 1916-17 follow.

Sheep Account for year Nov. 1, 1916 to Oct. 31, 1917.

Inventory and Expenditures.

38 original purchase ewes 7 1914 ewes 22 1915 ewes	67 at $5	$335.00	
20 1916 ewe lambs at $3		60.00	
2 registered Hampshire bucks		50.00	
1 Hampshire buck obtained in exchange for 2 ewe lambs		6.00	
1 pure bred Hampshire buck in exchange for lamb		25.00	
1 pure bred buck		35.00	
Hay, 40,200 pounds at $10 per ton		201.00	
Rowen 13,600 pounds at $8 per ton		54.80	
Straw 2150 pounds at $6 per ton		6.45	
Bran and mixed feed 6000 pounds at $1.80 per cwt.		108.00	
Corn meal, 1400 pounds at $2.25 per cwt.		31.40	
Oats 600 pounds at $2.15 per cwt.		12.90	
Turnips 41,800 pounds at cost of growing		102.00	
Rape and cost of growing		20.00	
Salt 2 bushels		.80	
20 gallons gasoline at 28 cents		5.60	
552 man hours at 20 cents		110.40	
10 horse hours at 15 cents		1.50	$1165.85

Receipts and Inventory.

Wool 548 ½ pounds 65 cents		356.53	
Pelts		3.60	
Sheep and lambs sold		421.61	
23 original purchase ewes 7 1914 ewes 19 1915 ewes 16 1916 ewes	65 head at $5	325.00	
30 1917 ewe lambs at $3		90.00	
3 rams at $30, $35, $40.		105.00	
Manure 40 tons with swine, 9 tons from sheep barn, 10 tons from summer sheds		*	$1301.74

*Value not included. See discussion in text.

THE FLOCK DURING THE YEAR.

When the sheep were put into their winter quarters the first of November, 1916 there were 90 head consisting of 38 of the original purchase ewes, 7 ewes born in 1914, 22 ewes born in 1915, 20 ewe lambs of the spring of 1916 and 2 thorough bred Hampshire rams and 1 Hampshire buck lamb. The 67 ewes gave birth to 79 lambs of which 74 were vigorous and were raised. During the year, and chiefly in the spring 10 of the older ewes died. Two died in lambing, 2 from grub in the head and 6 from undetermined causes. The general health of the flock was excellent. The sheep that died were in poor flesh and lacked in bodily vigor. The clip averaged 6.3 pounds for the flock, ewes, ewe lambs and rams. It was sold for 65 cents a pound.

The buck lamb obtained in the fall of 1916 in exchange for 2 ewe lambs was not promising as breeding stock and was sold for slaughter. One of the old rams had been lacking in vigor since the winter of 1916-17 and died in June. Two full blooded Hampshire rams were purchased. One of these cost $35 and the other was bought for $25 and a ram lamb. This is the one inventoried at $40. During the year 58 head were sold. At the close of the year, October 31, 1917, 98 head were put into winter quarters. The flock at that time consisted of 23 of the original purchase ewes, 7 ewes born in 1914, 19 born in 1915 and 16 born in 1916—65 ewes in all—30 ewe lambs born in 1916 and 3 full blooded Hampshire rams.

THE EXPENDITURES.

The inventory of the flock is at a much lower price than they could be purchased for or than they would be sold for. This bears only slightly on the experiment as the numbers of the sheep are kept fairly constant year after year. Rather more sheep were carried through the winter of 1915-16 than would usually be the case.

No account is taken of the feed consumed from the 3 pastures aggregating about 100 acres. Nor is rental charged for land used in growing crops such as rape and turnips for the use of the sheep. The concentrated feeds are charged at

about the average cost for each year, but this does not include freight or cartage. The hay and straw are priced at what they would have sold for at the barn each year. The turnips and rape are charged at what it costs to grow them without any overhead charges.

The only labor charged against the sheep is the actual time used in care, as feeding, shearing, etc. The work of keeping up pasture fences, buildings, making records, and other things incident to the experimental side that does not directly apply to the sheep, is not included in the tabulation.

RECEIPTS.

The wool and lambs sold each year were probably as well marketed as the average farmer could expect unless he put a good deal of his own time (and in the case of the Station that means added cost) into finding a market. With the constantly advancing price of wool it might have been held and likely later have been sold at a higher price. But that would not have been part of the experiment. It would be speculation as is all holding of crops for a better market. No attempt to market in any unusual way was made as that would be contrary to the plan of the experiment.

The manure from the sheep at the barns weighed 48 tons and that from the summer droppings in the pasture houses about 12 tons. As pointed out in Bulletin 260 the common practice of keeping the droppings under the sheep during the winter is wasteful. The manure is best removed at intervals of about a month and put under swine. It is difficult to at all accurately estimate the value of the manure. From this number of sheep handled as indicated above, the manure produced is worth at present prices of nitrogen, phosphoric acid and potash from $250 to $300 a year. This is not included in the receipts from the sheep. It is allowed as an offset to the overhead charges which as stated above are not included in this account with sheep.

The marked increase in value of the sheep since the experiment began is not taken into account as it is "an unearned increment" and is no part of the experiment.

THE THREE YEAR RESULTS.

If any farmer had started with a flock of about 100 sheep at the time this experiment was begun the marked advance in the value of the flock would have made the venture a profitable one. But the same would have been true if he had invested a like sum of money in any one of numerous commodities that have been advancing in price at leaps and bounds. While viewed from that standpoint the balance is on the right side of the ledger from the standpoint of sheep production alone the 3 years are still behind. The loss the first year was (without taking manure into account) $375, and $200 the second year. This year there is a credit balance of $135. The differences in values of hay in the different years largely accounts for the differences in the cost of the food consumed in the different years. If hay had been worth in 1916-17 $15 a ton as it was the year before the sheep would have about broken even. With the low price of hay the present year, unless some unexpected reasons cause marked falling off in price of mutton and wool, the sheep should show a profit.

Without taking into account the profit that came from the increased value of the sheep during the year, a man who had handled a flock of 100 sheep for profit in 1916-17 would have found a market for his hay at $15 a ton, kept the plant food in the hay on his farm, had 20 cents an hour for the time spent in care of the sheep and the approximately $250 worth of manure for rent of land, upkeep of buildings and fences, interest on investment and other overhead charges. Or reckoning the hay at its market value of about $10 a ton in the barn, by feeding it to the sheep he would have received about 45 cents an hour for the time given to their care.

FERTILIZER EXPERIMENTS ON APPLE TREES AT HIGHMOOR FARM.

As it is pretty generally known, when the State purchased Highmoor Farm it had something over 3,500 apple trees upon it. These trees were about 25 years old, but for the most part had been completely neglected, as regards pruning, fertilization, culture and spraying. The first season that the Station had the farm the orchards were plowed, cultivated and sprayed. Pruning was begun and has been continued until at the present time the orchards are in pretty fair shape. It was, of course, not desirable or practical to thin the trees out at the start to where they should be at the end, but the pruning while rather severe each year has been gradually decreased in amount. The trees are well cared for by spraying for insects and fungi.

The orchards were annually fertilized at the rate of 1,000 pounds per acre of a commercial fertilizer carrying 5 per cent of ammonia, 8 per cent of available phosphoric acid and 7 per cent potash. At the end of the third year the orchards had so far responded that they gave a good crop and since that time fertilizer experiments have been carried on in various portions of the orchards, as follows:

Nitrogenus Fertilizer Experiment.

The use of highly nitrogenous fertilizers has been advocated as a means of forcing trees into bearing and in some parts of the State has been tried with results that seemed to be gratifying. This method was first suggested by Doctor Fisher of Massachusetts and was tried by the Station several years ago in cooperative work with Mr. Pope in his orchard at Manchester without very decisive results. At Highmoor Farm a row of 32 Baldwin trees was divided into 3 sections. The trees were treated alike so far as the application of standard fertilizer was concerned, but 10 of the trees at each end of the row received in addition nitrate of soda at the rate of 100 pounds per acre. Also the Baldwin orchard was divided into 2 parts so that part of it received the usual treatment and in addition received 100 pounds of nitrate of soda per acre per year.

Exact records of yields and measurements of growth have been taken since the experiment was begun. No differences that could be attributed to the additional nitrogen in the fertilizer have been observed. It may be that when at the end of a period of years the data are carefully analyzed, results may be found that are not noticeable from general observations. The experiment is being continued.

EXPERIMENT IN BEN DAVIS ORCHARD NO. 1.

In experiments carried out at the New York State Experiment Station it was found that with their deep clay soils well suited to apple tree growth and apple bearing, there is no effect from the use of fertilizers either upon the growth of young trees, the wood growth on matured trees, or in the amount, coloring, or size of the fruit. To see if anything like this would hold with Maine conditions, particularly with the rather shallow soil and with the stubborn subsoil upon Highmoor Farm, an experiment was begun in 1912. It is to be remembered that the orchard had been cultivated and fertilized for the 3 preceding years and brought into good condition. About 400 trees were divided into 3 plots containing 12 rows extending clear across the large No. 1. Ben Davis orchard. Plot A (rows 1 to 4) has received no fertilizer since 1912. Plot B (rows 5 to 8) has received annually since 1912, 500 pounds per acre of a fertilizer carrying 4 per cent of nitrogen, 8 per cent of available phosphoric acid and 7 per cent of potash. Plot C (rows 9 to 12) has received annually since 1912, 1,000 pounds per acre of a commercial fertilizer carrying 4 per cent of nitrogen, 8 per cent of available phosphoric and 7 per cent of potash. The trees are spaced 25 feet by 25 feet and this amount of fertilizer is therefore at the rate of about 7.2 pounds in Plot 6 B and 14.2 pounds in Plot 6 C per tree.

TYPES OF TREES IN FERTILIZER EXPERIMENT AT HIGHMOOR FARM.

The records of the yields of the trees in the fertilizer experiment show that there are some trees in each of the plots that have never failed to bear heavy crops and others that have never failed to be light yielders. The Station has no information as to the reason for the differences but in the part of the

orchard in the fertilizer experiment there are at least 3 distinct types of trees.

Type 1 is a tree having a stocky appearance with the head made up of large limbs bearing many fruit spurs. Type 3 is a tree having no large main branches but with the head made up of many long slender limbs with the bearing wood mostly at their ends. Type 2 is a tree having a head that is intermediate between type 1 and type 3.

In plot 6 A. during a 4 year period there were 2 trees that were consistently heavy yielders and both were of type 1. In the same plot were 8 trees that were consistently low yielders of these 7 were of type 3 and 1 of type 2. *In plot 6 B.* for the same period there were 4 consistently high yielding trees 1 of which was of type 1 and 3 of type 2. In the same plot were 6 low yielding trees all of type 3. *In plot 6 C.* for the same period there were 9 high yielding trees all of type 1 and 5 low yielding trees all of type 3.

For these or similar reasons the following trees are not considered in the discussion of results here reported.

Row	1	trees	1, 2, 6, 7, 14, 18, 29, 33.
"	2	"	3, 7, 22, 23, 36.
"	3	"	1, 5, 7, 22.
"	4	"	5, 6, 8, 12, 19, 24, 31, 33.
Row	5	trees	3, 4, 9, 27, 28, 29, 33.
"	6	"	1, 2, 4, 12, 17, 23, 35.
"	7	"	1, 9, 10, 11, 25, 32, 33, 36.
"	8	"	1, 2, 9, 23.
Row	9	trees	1, 2, 3, 5, 8, 10, 22, 24.
"	10	"	3, 14, 20, 21, 24, 29, 30, 31, 33, 34.
"	11	"	1, 17, 30, 33.
"	12	"	4, 5, 31, 32, 33, 34.

CULTIVATED PLOTS AND PLOTS IN GRASS.

On all of the plots up to the summer of 1916 rye was sown in the late summer as a cover crop. This was plowed under early in the spring and the land was kept cultivated until August when the new cover crop was again sown. On the west half (cultivated plots) this practice is continued. On the east half (plots in sod) the grass is cut and applied as a mulch. The plant food stored up in the wood growth and that which is removed in the apple crop is taken from the soil, but

beyond that the soil is not asked to pay tribute to any crop removed from the plots.

In the following tables the western half of each plot is designated as cultivated plot and the eastern half as plot in grass. The plot in grass was really not in sod until 1917 previous to which, it was under cultivation the same as the other plots. The yields for the 4 years are given in the table that follows. In the upper portion of the table the parts cultivated and in sod are reported separately and in the lower portion the results are combined to show the average yields from the different fertilizer treatments.

Table Giving the Yields of Apples in Pounds Per Tree for Each Plot and Each Treatment for 4 Years.

Year	PLOT 6 A No fertilizer since 1912		PLOT 6 B 7.2 pounds 5-8-7 fertilizer per tree		PLOT 6 C 14.4 pounds 5-8-7 fertilizer per tree	
	Cultivated	In grass	Cultivated	In grass	Cultivated	In grass
1914	165.4	198.0*	145.9	179.6*	186.6	203.1*
1915	118.6	131.5*	134.9	149.0*	145.6	162.0*
1916	105.9	127.3*	141.2	137.6*	155.9	129.8*
1917	117.7	127.6	72.2	80.2	79.6	75.6
Average	126.9	146.1	123.6	136.6	141.9	142.6
	Both Parts		Both Parts		Both Parts	
1914	183.2		164.2		194.5	
1915	125.6		142.6		153.5	
1916	117.6		139.2		142.4	
1917	123.1		76.5		77.7	
Average	137.4		130.6		142.0	

*These were cultivated in years 1914, 1915, and 1916. Seeded to grass in August 1916.

As the parts in grass had been seeded only a single season the slight differences in yields between the cultivated parts of the plots and the parts in grass for the year 1917 are not discussed.

The interest therefore lies in the last half of the table in which the average yields from the trees in the differently fertilized plots are shown. The yields for 1913, the first year after the different fertilizer treatment began, are omitted. In the second year (1914) no differences that can be attributed to the fertilizing appear. In 1915 and 1916 there is a small but constant difference in favor of the fertilized plots. The yield increases with the amount of fertilizer applied. But in 1917

the yields for the fertilized plots dropped 40 per cent below the yields for the plot without fertilizer for the 4 years. Row 1 in Plot A, no fertilizer, has an open field on its north. It was thought that possibly this might have borne unusually heavy and explain the no fertilizer plot having the far larger yield. The table that follows shows the yield per tree in each row. The sharp falling off in yield from Row 4 of Plot 6 A to Row 5 Plot 6 B continues through all the other rows in Plots 6 B and 6 C.

Average Yields in Pounds per Tree by Rows in 1917.

Plot 6A No Fertilizer		Plot 6B 7.2 pounds Fertilizer		Plot 6C 14.4 pounds Fertilizer	
Row	Yield	Row	Yield	Row	Yield
1	137.8	5	93.7	9	88.6
2	120.1	6	74.7	10	79.9
3	118.3	7	68.9	11	78.1
4	113.9	8	69.2	12	65.2
Avg.	123.1	Avg.	76.5	Avg.	77.7

There is no doubt as to the fact, but the explanation of the fact is not evident. If the marked difference had been in favor instead of against the fertilizer plots or if the season had been deficient in rainfall so that the fertilizer might not have been available to the trees an explanation would suggest itself. There are too many trees in the experiment and the differences are too great, too marked and too uniform to be classed as coming within ordinary experimental error.

SOD VS. CULTIVATION.

The east half of the plots have been in sod only 1 year and it is too soon to look for any marked difference due to the treatment. As full growth notes are kept on all trees at Highmoor Farm the records of the size of the apples and their color for 1917 in which part of the plots have been in sod are tabulated below. For the sake of comparison the same notes are given for the 2 years before the east half was seeded to grass.

Table Giving the Number of Trees in Each Plot that Yielded Fruit of Large, Medium and Small Size for the 3 Years.

Plot and Year	Cultivated Part			Part in Grass		
	Large	Medium	Small	Large	Medium	Small
Plot 6A						
1915	52	0	0	65	0	0 Cultivated
1916	33	21	0	24	41	0 Cultivated
1917	10	32	12	10	39	16 In Grass
Plot 6B						
1915	53	0	0	62	0	0 Cultivated
1916	24	28	1	41	19	2 Cultivated
1917	0	27	26	2	26	35 In Grass
Plot 6C						
1915	56	0	0	50	0	0 Cultivated
1916	48	7	1	41	9	1 Cultivated
1917	45	9	1	0	16	35 In Grass

Table Giving the Number of Trees in Each Plot that Yielded Fruit of Good, Medium and Poor Color for the 3 Years.

Plot and Year	Cultivated Part			Part in Grass		
	Good	Medium	Poor	Good	Medium	Poor
Plot 6A						
1915	3	48	1	10	55	0 Cultivated
1916	5	45	4	28	36	1 Cultivated
1917	21	32	1	55	10	0 In Grass
Plot 6B						
1915	1	52	0	4	58	0 Cultivated
1916	15	38	0	6	56	0 Cultivated
1917	44	9	0	61	1	1 In Grass
Plot 6C						
1915	15	41	0	27	23	2 Cultivated
1916	2	54	0	4	47	1 Cultivated
1917	4	51	0	50	1	0 In Grass

Although the results from a single year's trial are not at all conclusive it is interesting to tabulate the results in a way that quite sharply points out any differences that do exist. In the following table this is done by weighing the results. The small in size, poor in color are considered as the unit. The medium in size or color are considered to have twice and the large in size or good in color 3 times the value of the small or poor. If one adds these values together and divides by the number of trees the following results are obtained.

Comparison of Grass and Cultivtaed Parts of the Plots.

The "part in grass" was really in cultivation in 1915 and 1916.

Plot and Year	Cultivated part		Part in grass		Part in grass compared with cultivated part	
	Size	Color	Size	Color	Size	Color
Plot 6A						
1915	300	204	300	216	0	+12
1916	246	202	237	242	— 9	+40
1917	196	237	191	285	— 5	+48
Plot 6B						
1915	300	202	300	207	0	+ 5
1916	243	228	261	210	+ 18	—18
1917	151	283	148	295	— 3	+12
Plot 6C						
1915	300	227	300	248	0	+21
1916	284	204	263	206	— 21	+ 2
1917	280	244	148	298	—132	+54

For the one year in grass there is a reduction in size and improvement in color as compared with the cultivated parts. In all the years there seems to be striking correlation between size and color. The larger the size of the fruit the poorer the color, and the smaller the fruit the better the color seems to be the rule.

It is planned to continue the experiment until decisive results are obtained and the unfertilized plot shows evidence of the need of plant food.

COMMERCIAL VARIETIES OF OATS GROWN AT HIGHMOOR FARM IN 1917.

The Maine Agricultural Experiment Station has been conducting tests of commercial varieties of oats at Highmoor Farm since 1910. The detailed results of these tests for the 4 years 1910 to 1913 inclusive were published in Bulletin 229, the results of the 1915 tests were published in Bulletin 246, and the results for 1916 in Bulletin 260.

The season of 1916 was very unfavorable for oats at Highmoor Farm and the yields were the lowest obtained since the Station has had the farm. The season of 1917 was unfavorable for even stands and good yields. The yields for 1917 are given in the table that follows. It will be noted that Early Pearl is in the lead of the commercial varieties. The high yields obtained with 5 new varieties bred at the Station and tested in tenth acre plots for the first time make it hopeful that one or more of these may prove superior to Maine 340 which has in favorable years given the highest yield and stood up the best of any variety grown at Highmoor Farm. Early Pearl and Minnesota 26 are excellent commercial varieties. The late maturing of the Early Pearl is not so objectionable in the central and southern parts of the State as it is in Aroostook County.

Yield Per Acre of Commercial Varieties of Oats Tested at Highmoor Farm 1917. Arranged in Order of Yield of Grain.

Variety	Yield per Acre	
	Grain bushels	Straw pounds
Maine #1667	69.9	3032
Maine #1741	66.5	2512
Maine #1479	64.0	2792
Early Pearl	58.3	2728
Maine #1628	58.1	2340
Maine #1644	57.1	2532
Minnesota #26	55.8	2336
Maine #1641	53.8	2269
Irish Victor	53.7	2353
Maine #355	53.2	2279
Maine #351	52.9	2128
Maine #337	52.0	2225
Maine #281	49.8	1893
Maine #340	49.7	2078
Maine #1650	48.8	1709
Gold Rain	48.3	2043
Banner	48.2	1908
Maine #1654	44.6	2101
Maine #1640	39.0	1872

SOIL TEST EXPERIMENT AT AROOSTOOK FARM.

Aroostook County, and particularly the part along the Aroostook River, has two characteristic soils that are used for cropping. These grade more or less from one into the other but nevertheless they are 2 well marked types. The best and most abundant potato soil, which occurs where the hard wood growth flourished, has been named by the United States Department of Agriculture's Bureau of Soils as Caribou Loam. This by imperceptable gradations shades off into a dark brown or gray soil where the land was originally covered with black growth (conifers). To this soil the name Washburn loam was given. The principal soil type is the well drained "Caribou loam." This is the great potato soil of Aroostook County. Interspersing this is the poorly drained inferior "Washburn loam." Originally these soils were similar in origin, but through the centuries of plant occupation they have become biologically different.

One of the fundamental things in field agriculture is a knowledge of the soil that is being worked with. Much has been learned of Caribou loam from the experience of the men who have been cultivating it for a generation. Chemistry, soil physics, soil bacteriology and a study of the fungous organisms also contribute to the knowledge of this soil. But important as these sciences are they chiefly serve to explain results obtained. There is one way—and only one way—to adequately test a soil and learn its fertilizer needs. And that is by growing the plants to be studied in the soil.

After careful consideration of the difficulties and the expense involved the Station Council decided that all things considered there was no one thing that could be undertaken on Aroostook Farm better calculated to add to the knowledge of the permanent agriculture of the County than a long term experiment with fertilizers. The crops and the soil type were easily decided upon. Potatoes, oats and clover are now and are likely to be for many years to come the 3 standing staple crops of the county. And Caribou loam is the best and most common type of soil of the county.

THE PLAN OF THE EXPERIMENT.

The investment of time and money was to be so large that 2 years of time looking over literature, consulting with the best soil experimenters by letter and by visits to their operations were used before the final plans were adopted. As these plans are necessarily a compromise and cannot include all that one could wish and as it is hoped that this investigation may extend over many, many years of time the considerations that led to the adoption of the plan are here given in considerable detail.

The soil can be studied by growing plants in pots and under conditions where the growing conditions—moisture, shade, and the like—are under control or by growing the plants in the field. While there are many advantages in the green house method, if only one of these methods can be employed, the advantages of growing the plants in the field offset its disadvantages.

In soil test experiments as heretofore conducted in this country and abroad the general plan has been to decide somewhat arbitarily the amount of plant food to be used per acre and then apply the nitrogen, phosphoric acid and potash, each by itself, in combinations of 2, and finally all 3 combined in these fixed amounts upon the different plots. The great weakness in this plan is that one assumes at the start that the amounts of the ingredients decided upon are the amounts best adapted to the crop. A more logical method would be to apply each ingredient to different plots in varying amounts from none up to a point far beyond the amounts that would be likely to prove beneficial. After careful consideration this plan was adopted

THE TRIANGULAR DIAGRAM.

The triangular diagram as suggested by Schreinmacher, which has been of great service to physical chemistry where both theoretical and practical consideration of percentage composition of 3 component parts are concerned, has been adapted by Schreiner* to investigations in plant nutrition where it is desired

—Oswald Schreiner

*Bureau of Soils, U. S. Department of Agriculture Bulletin 70, Botanical Gazette, Vol. 1, No. 1, and elsewhere.

to consider the 3 component parts, ammonia, phosphoric acid and potash, of a fertilizer mixture. It is possible to represent graphically any possible combination of mixtures of these 3 component parts by the use of an equilateral triangular diagram, as shown in figure 1.

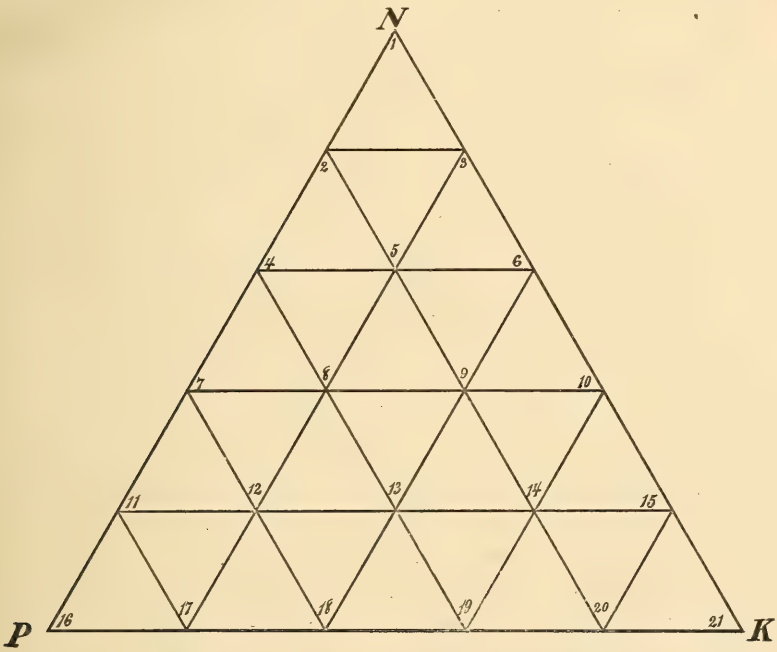

Fig. 1. The Triangular Diagram.

The extreme points of the angles represent 100 per cent respectively of the ingredients ammonia (nitrogen) prosphoric acid (phosphorus) and potash (potassium). Obviously each side of the triangle can be divided into as many equal parts as may be desired. Schreiner in his work in the green house with cultural solutions has been able to carry enough different combinations so as to divide the sides into tenths. That, however, makes 66 different combinations which is a far larger number than we could carry in this field test. Each side, therefore, is divided into fifths in the plan of the experiment here begun. And as explained beyond for the purpose of making the comparisons easier for the practical man familiar with usual fertili-

zer formulas, the 5-8-7 formula, which makes a total of 20 per cent of ammonia, available phosphoric acid and potash was used as a starting point. Hence, in the diagram here shown the extreme points of the triangle represent 20 per cent instead of 100 per cent as used by Schreiner. Although the fertilizer mixtures are in reality based upon the percentages expressed in terms of ammonia, phosphoric acid and potash the symbols N, P, and K for the elements nitrogen, phosphorus and potassium, which are the characteristic elements of these 3 constituents, are used in lettering. Wherever N is used in diagrams or text it refers to ammonia in available form, P refers to available phosphoric acid and K to water soluble potash.

The relation of the plots to each other is clearly seen by following the lines on the triangle. The maximum phosphoric acid (P) is at the left lower angle, the maximum potash (K) at the right lower angle and the maximum ammonia (N) is at the top of the triangle. From these points the different ingredients diminish. On all of the horizontal lines the phosphoric acid diminishes from left to right and the potash from right to left. On all of the lines inclined to the right the phosphoric acid decreases from bottom to top and the nitrogen decreases from top to bottom. On all of the lines inclined to the left the potash diminishes from the bottom to the top and the ammonia diminishes from the top to the bottom.

This plan calls for 21 plots. Obviously an indefinite number of plots could be introduced. To graduate on a scale of tenths would give finer distinctions but would treble the plots over a division into fifths as shown in the illustration and as adopted in this experiment. In the scheme here adopted combinations of the 3 fertilizers in the amounts indicated at the intersection of the lines were used. The actual percentage composition of the fertilizers are given in Figure 3 and others beyond. Obviously the plot at each apex and the 2 adjoining carries the maximum amount of ammonia, phosphoric and potash respectively, while the 6 central plots carry mixtures of all 3 constituents.

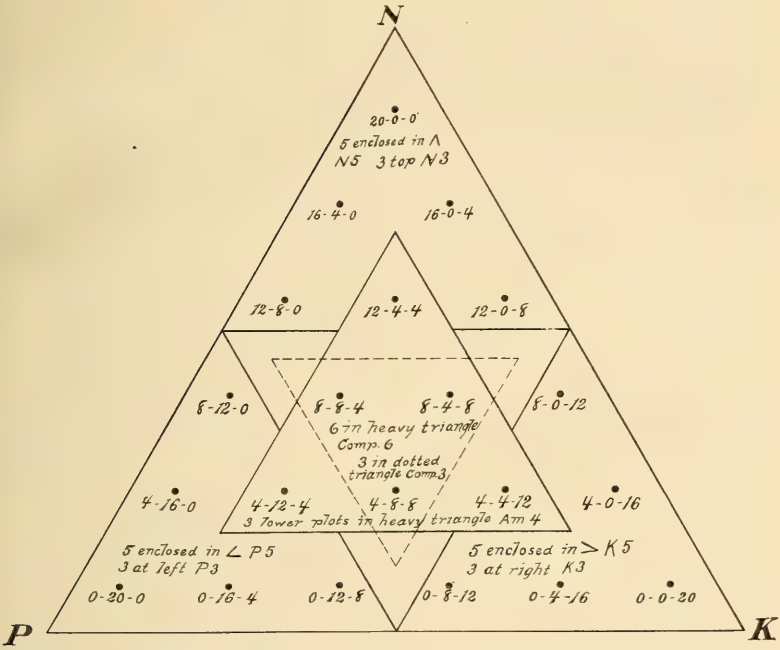

Fig. 2. The Relation of the plots in Groups.

Figure 2 shows diagramatically the relation of these plots in groups. The 5 plots enclosed in the ∧ at the top of the figure are those in which ammonia predominates. The 3 plots nearest the top have the highest amounts of ammonia. In like manner the 5 plots enclosed in the < at the left at the bottom of the figure are those in which available phosphoric acid is the leading constitutent with the 3 highest nearest the angle. Included in the > at the right corner of the figure are those highest in potash. The 6 plots in the heavy triangle in the center of the figure contain all 3 of the ingredients and the 3 plots in the dotted triangle have them in somewhat more near to ordinary percentages than do the others. While the 3 lowest plots in the heavy triangle have the ammonia in the amount that is fairly common in many high grade fertilizers. As noted in the figure for convenience of reference in the text, these groups are called N5, N3, P5, P3, K5, K3, Comp 6, Comp 3 and Am4. This plan and diagramatic arrangement makes comparative studies of the different combinations easier and

more clearly shown than by any other method that has come to the attention of the writer.

THE FERTILIZING MATERIALS.

In the field experiments at Aroostook Farm with potatoes a 5-8-7 fertilizer or one that carries 5 per cent of ammonia, 8 per cent of available phosphoric acid and 7 per cent of potash has been used at the rate of 1200 pounds per acre. The same formula at the rate of 300 pounds per acre is used when seeding to oats and at the rate of 150 pounds per acre as a top dressing on mowing fields. Obviously a 5-8-7 fertilizer carries 20 per cent of plant food. This amount of 240 pounds is absurdly high and it was, therefore, taken as a maximum in the scale so that on the diagram where ammonia is shown as 20 per cent it represents 240 pounds of ammonia. This amount of ammonia would be furnished by 4800 pounds of a 5-8-7 fertilizer.

The ammonia is one-third in the form of ammonium nitrate and two-thirds in the form of sulphate of ammonia. The phosphoric acid is in the form of acid phosphate. The potash is all water soluble and is being applied during the war in the form that can be obtained. In 1917 it was in the form of sulphate.

The weights of ammonia, phosphoric acid and potash applied to each plot when the crop is potatoes is shown in the table that follows.

Application of Fertilizers Per Acre for Potatoes.

Treatment No.	Ammonia	Phosphoric Acid	Potash
1	0	240	0
2	0	192	48
3	48	192	0
4	0	144	96
5	48	144	48
6	96	144	0
7	0	96	144
8	48	96	96
9	96	96	48
10	144	96	0
11	0	48	192
12	48	48	144
13	96	48	96
14	144	48	48
15	192	48	0
16	0	0	240
17	48	0	192
18	96	0	144
19	144	0	96
20	192	0	48
21	240	0	0

For the 1-40 acre plots these amounts are divided by 40. These amounts are further reduced for application to oats by dividing by 120 and for application to grass by dividing by 240.

It was also desired to compare the usual potato formulas of 5-8-7 and 3-8-10 goods, insoluble phosphate rock in the form of finely ground floats with acid phosphate, and nitrogen in the form of dried blood and in tankage with the mineral nitrogen used in the soil test. These 5 additional plots with 6 check plots increase the number of plots to 32.

FIELD ARRANGEMENT OF PLOTS.

It was thought that to overcome lack of uniformity in soil each plot should be in triplicate. This makes a total of 96 plots. As potatoes are the important cash crop of Aroostook County it seemed important that potatoes should be grown annually. As it was prohibitive to increase the number of plots much above 100 because of the cost of caring for a larger number, it was decided to grow the plots in a 3 year rotation of potatoes, oats and clover. This plan not only gives a potato crop each year but it makes the experiment better in that the effects of unfavorable weather conditions of any single year are minimized. The field selected for the location of the plots contains about 5 acres. It is isolated from the other cultivated fields on the farm. It has a gentle slope toward the west.

The plots are in 3 series: A, consisting of 33 plots, one extra check plot being added to this series, B, 32 plots and C, 32 plots. The several plots in each series are separated by pathways 33 inches wide running lengthwise and 36 inches wide running crosswise, while the different series are separated by roadways 6 feet in width, running lengthwise. The arrangement of the plots in the field is shown in Figure 3 on page 24.

For convenience of reference the plots are numbered by row and by plot. Thus Plot 11 is the first plot in the first row, while plot 36 is the sixth plot in the third row.

OUTLINE OF THE EXPERIMENT IN 1917.

The field was in potatoes in 1914 and fertilizer was used at the rate of 1500 pounds per acre of a 5-8-7 fertilizer. In 1915, it was seeded to timothy and oats.

SERIES A.

11 0-20-0	12	13	14 8-4-8	15 CHECK	16 12-0-8	17 0-4-16	18 4-12-4	19 0-8-12
21 (1) 4-8-8	22 CHECK	23	24 0-0-20	25 4-4-12	26 8-8-4	27 CHECK	28 (2) 4-8-8	29 5-8-7
31 12-4-4	32 16-0-4	33 4-8-8	34 CHECK	35 4-16-0	36 4-8-10	37 4-0-16	38 12-8-0	39 0-16-4
41 CHECK	42 8-12-0	43 16-4-0	44 (3) 4-8-8	45 8-0-12	46 CHECK	47 0-12-8	48 20-0-0	49 CHECK

SERIES B.

51 20-0-0	52 0-12-8	53 CHECK	54 8-0-12	55 5-8-7	56 16-4-0	57 8-12-0	58 CHECK
61 12-8-0	62 4-0-16	63 (1) 4-8-8	64 4-16-0	65 CHECK	66 4-8-8	67 16-0-4	68 12-4-4
71 4-8-10	72 CHECK	73 8-8-4	74 4-4-12	75 0-0-20	76 0-16-4	77 CHECK	78 (2) 4-8-8
81 4-12-4	82 0-4-16	83 12-0-8	84 CHECK	85 8-4-8	86 (3) 4-8-8	87 0-8-12	88 0-20-0

SERIES C.

91 CHECK	92 0-16-4	93 4-4-12	94 12-4-4	95 12-0-8	96 CHECK	97 5-8-7	98 0-4-16
101 8-0-12	102 4-8-8	103 CHECK	104 16-0-4	105 (1) 4-8-8	106 0-8-12	107 20-0-0	108 CHECK
111 0-0-20	112 16-4-0	113 4-16-0	114 4-8-10	115 CHECK	116 0-20-0		
121 (2) 4-8-8	122 CHECK	123 12-8-0	124 8-12-0	125 8-8-4			
131 8-4-8	132 0-12-8						
141 4-0-16	142 4-12-4						
151 (3) 4-8-8							

1 FLOATS.
2 DRIED BLOOD.
3 H. G. TANKAGE.

Fig. 3. Arrangement of plots in Field.

The field was plowed shortly after cutting the grass in 1916. Early in the spring of 1917 the 97 plots required to carry on this experiment were surveyed, each plot being 1 rod wide by 4 rods long, or one-fortieth of an acre in area. The ingredients for the several fertilizer mixtures were weighed and thoroughly mixed by hand. To insure even distribution each lot and plot were subdivided into fourths for the application of the fertilizer.

SERIES A. POTATO PLOTS. 11-43.

In preparing these plots for planting, furrows were made 33 inches apart, thus giving 6 rows per plot. The fertilizer was distributed in these furrows on May 16 and planting was completed the same day. The seed used was of the Norcross variety. The pathways, running lengthwise, were also planted and the plants allowed to grow throughout the season. By so doing the undesirable influence of marginal plants was, to a large exten, overcome. The pathways, running crosswise, were kept open. The plots were well cultivated and the plants thoroughly sprayed with bordeaux mixture and, nothwithstanding the prevalence of late blight throughout Aroostook County, hardly a trace of this disease could be found on the vines.

The variation in vine color, due to the differences in fertilizer mixtures, on these plots was very striking, ranging from a very light to an extremely dark green. The vines were green and vigorous until killed by frost.

The plots were harvested on September 22 and 24. The tubers were clean and free from rot. The yields are given in the table on page 26.

SERIES B. OAT PLOTS. 51-88.

Fertilizer was applied broadcast on these plots May 21 and planting completed the same day. Maine 340 oats were sown at the rate of 14 pecks per acre and a mixture of equal parts of Red and Alsike clover seeded at the rate of 12 pounds per acre. The stand of both oats and clover was excellent, but the excessive rainfall, coming at the time when the oat seedlings were about 2 inches high, gave them a setback from which they did not recover during the season.

The plots were harvested on August 31. Each plot was threshed separately and record made of the yield in both grain and straw. The yields were very uneven, due to the uneven stand. They are here included merely as a matter of record and not for any immediate consideration.

SERIES C. CLOVER PLOTS. 91-151.

Fertilizer was applied broadcast on these plots May 21 and planting was completed the same day. A mixture of equal parts of Red and Alsike clover was used at the rate of 12 pounds per acre. An excellent stand was obtained. The crop on these plots was not harvested but was plowed under in the fall of 1917 in preparation for the next season's potato plots.

Soil Test Experiment. Series A Planted to Potatoes in 1917.

The table shows the number of the plots, the yields per plot and the calculated yields per acre. Each plot is one rod by four. They are arranged in rows 11-19, 21-29, etc.

Plot No.	Fertilizer[1]	Yield per Plot		Yield per Acre Hundredweight		
		Merchantable	Culls	Merchantable	Culls	Total
		lbs. oz.	lbs. oz.			
11	0-20-0	245—14	16— 0	98.3	6.4	104.7
12	Not planted					
13	Not planted					
14	8-4-8	342—15	13— 4	137.8	5.3	143.1
15	Check	266—10	16—14	106.7	4.0	110.7
16	12-0-8	335— 3	21— 4	134.0	8.5	142.5
17	0-4-16	240— 1	12— 2	96.0	4.8	100.8
18	4-12-4	308— 6	16— 3	123.3	6.5	129.8
19	0-8-12	212— 7	12— 1	85.0	4.8	89.8
21	4-8-8[2]	335—10	12— 2	144.2	4.9	149.1
22	Check	312—15	18— 8	125.1	7.4	132.5
23	Not planted					
24	0-0-20	258—11	21—13	106.0	8.7	114.7
25	4-4-12	372— 7	20— 4	148.9	8.1	157.0
26	8-8-4	365—13	27— 7	146.3	11.0	157.3
27	Check	225— 5	24— 9	90.1	9.9	100.0
28	4-8-8[3]	299— 0	15—11	119.6	6.3	125.9
29	5-8-7	288— 7	25— 9	115.4	10.2	125.6
31	12-4-4	394— 5	19—14	157.7	8.0	165.7
32	16-0-4	392— 7	18— 2	157.0	7.3	164.3
33	4-8-8	411— 7	21— 9	164.6	8.6	173.2
34	Check	274— 0	22—10	109.6	9.1	118.7
35	4-16-0	340—12	22— 2	136.3	8.9	145.2
36	4-8-10	328— 5	23—11	131.3	9.5	140.8
37	4-0-16	306— 8	16— 8	122.6	6.6	129.2
38	12-8-0	347— 4	17—15	138.9	7.2	146.1
39	0-16-4	136—10	12— 4	54.7	4.9	59.6
41	Check	247—14	23—12	99.2	9.3	108.5
42	8-12-0	358— 5	21— 7	143.3	8.6	151.9
43	16-4-0	356— 2	30—15	142.5	12.4	154.9
44	4-8-8[4]	369— 1	18— 9	147.6	7.4	155.0
45	8-0-12	339— 1	34— 0	135.6	13.6	149.2
46	Check	228— 1	41—13	91.2	16.7	107.9
47	0-12-8	220— 7	16— 3	88.2	6.5	94.7
48	20-0-0	354—14	21— 6	142.0	8.6	150.6
49	Check	180—15	22—14	72.4	9.2	81.6

[1]The percentages of fertilizer are indicated in the order of ammonia, phosphoric acid and potash. Thus 0-20-0 means ammonia 0 per cent, available phosphoric acid 20 per cent and potash 0 per cent. Except as indicated otherwise in the footnote one-third of the ammonia is in the form of nitrate of soda and two-thirds as sulphate of ammonia; the phosphoric acid as acid phosphate and the potash in water soluble form. [2]Phosphoric acid in form of floats. [3]Ammonia in form of dried blood. [4]Ammonia in form of tankage.

Soil Test Experiment. Series B Planted to Oats in 1917.

The table shows the number of the plots, the yields per plot and the calculated yields per acre. Each plot is one rod by four.

Plot No.	Fertilizer[1]	Total Yield	Weight of Grain	Weight of Straw	Bushels per Acre
51	20-0-0	66	28	38	35.00
52	0-12-8	59	30	29	38.00
53	Check	68	33	35	41.00
54	8-0-12	34	19	15	24.00
55	5-8-7	40	21	19	26.00
56	16-4-0	36	19	17	24.00
57	8-12-0	44	17	27	21.00
58	Check	21	10	11	13.00
61	12-8-0	52	23	29	29.00
62	4-0-16	35	19	16	24.00
63	4-8-8[2]	44	24	20	30.00
64	4-16-0	25	13	12	16.00
65	Check	16	9	7	11.00
66	4-8-8	43	21	22	26.00
67	16-0-4	60	29	31	36.00
68	12-4-4	40	19	21	24.00
71	4-8-10	56	26	30	33.00
72	Check	38	20	18	25.00
73	8-8-4	47	23	24	29.00
74	4-4-12	41	22	19	28.00
75	0-0-20	23	12	11	15.00
76	0-16-4	47	23	24	29.00
77	Check	35	19	16	24.00
78	4-8-8[3]	28	14	14	18.00
81	4-12-4	58	27	31	34.00
88	0-20-0	35	18	17	23.00
		51	23	28	29.00
82	0-4-16	43	23	20	29.00
83	12-0-8	44	21	23	27.00
84	Check	50	23	27	29.00
85	8-4-8	36	20	16	25.00
86	4-8-8[4]	29	15	14	19.00
87	0-8-12				

[1]The percentages of fertilizer are indicated in the order of ammonia, phosphoric acid and potash. Thus 0-20-0 means ammonia 0 per cent, available phosphoric acid 20 per cent and potash 0 per cent. Except as indicated otherwise in the footnote one-third of the ammonia is in the form of nitrate of soda and two-thirds as sulphate of ammonia; the phosphoric acid as acid phosphate and the potash in water soluble form.

[2]Phosphoric acid in form of floats.

[3]Ammonia in form of dried blood.

[4]Ammonia in form of tankage.

Soil Test Experiment—Series A—Potatoes in 1917.

ARRANGED IN TRIANGULAR DIAGRAM.

The letters N, P and K indicate the parts of the triangle where ammonia, available phosphoric acid and potash are respectively at their maximum amounts. The upper numbers above each * are the plot numbers. The numbers arranged in threes and connected by - give the composition of the fertilizer used. The numbers below the * give the yields per acre ex-

pressed in hundredweights. The plots below the heavy dotted line are outside of the triangle. They are check plots and specially treated plots.

N

48 20-0-0 * **151**					
43 16-4-0 * **155**	32 16-0-4 * **164**				
38 12-8-0 * **146**	31 12-4-4 * **166**	16 12-0-8 * **143**			
42 8-12-0 * **152**	26 8-8-4 * **157**	14 8-4-8 * **143**	45 8-0-12 * **149**		
35 4-16-0 * **145**	18 4-12-4 * **130**	33 4-8-8 * **173**	25 4-4-12 * **157**	36 4-0-16 * **129**	
11 0-20-0 * **105** P	39 0-16-4 * **60**	47 0-12-8 * **95**	19 0-8-12 * **90**	17 0-4-16 * **101**	24 0-0-20 * **115** K

15 0-0-0 * **111**	22 0-0-0 * **133**	27 0-0-0 * **100**	34 0-0-0 * **119**	41 0-0-0 * **109**	46 0-0-0 * **108**
49 0-0-0 * **82**	29 5-8-7 * **126**	36 4-8-10 * **141**	21 4-8[1]-8 * **149**	28 4[2]-8-8 * **126**	44 4[2]-8-8 * **155**

[1]Phosphoric acid in form of floats
[2]Ammonia in form of dried blood
[3]Ammonia in form of tankage

DISCUSSION OF RESULTS.

This is designed as a long term experiment and very little can be learned from a single year's results. As stated above the oat yields were uneven largely because of the uneven stand due to seasonal causes. The detailed plot yields of the oats and straw are given in the table on page 27, and for the potatoes on page 26. The results in hundredweight for the potato yields are given in the triangular diagram on page 28.

Plot 39 showed lack of vigor throughout the season and the yields from 19, 29 and 49 were smaller than expected. These 4 plots are nearer the woods and it may be that detailed soil examinations that are to be made of all of the plots will show differences in soil type. There is no apparent reason for check plot 22 having the high yield that it gave.

Grouped by the plots at the points of the triangle and by the center plots the average yields are:

	Hundredweight per acre
Three ammonia plots N3 in diagram*	157
Five ammonia plots N5 in diagram	152
Three available phosphoric acid plots P3 in diagram	103
Five available phosphoric acid plots P5 in diagram	111
Three potash plots K3 in diagram	115
Five potash plots K5 in diagram	117
Three center plots Comp 3 in diagram	158
Six center plots Comp 6 in diagram	154
Three lower center plots Am4	153
Seven check plots	109

The small yield from plot 39, 0-16-4, is due to other cause than the fertilizer and the high yield on plot 35, 4-16-0, is doubtless due to the ammonia. Neglecting both of these does not affect the yield from the phosphoric acid corner as plot 11, 0-20-0, yielded 105 hundredweight.

The preponderance of ammonia is shown by arranging the results in the order of the percentage of ammonia in the fertilizer mixtures.

---

*See page 21

No ammonia 5 plots*	101 hundredweight per acre
Four per cent ammonia 5 plots	147 hundredweight per acre
Eight per cent ammonia 4 plots	150 hundredweight per acre
Twelve per cent ammonia 2 plots	152 hundredweight per acre
Sixteen per cent ammonia 2 plots	160 hundredweight per acre
Twenty per cent ammonia 1 plot	151 hundredweight per acre

*Omitting plot 39

But as is discussed beyond (page 350), it would not do to infer from this series of experiments a general proposition that Caribou loam is deficient in ammonia.

As phosphoric acid was not a limiting factor plot 21 in which the phosphoric acid is in the form of floats would be expected to give as it did a yield as high as the same formula with acid phosphate as the source of the phosphoric acid. Plot 44 in which the ammonia was in the form of tankage gave results (155 cwt.) as would be expected. The low yields of 126 hundredweight from plots 28 and 29 may be due to soil or subsoil differences.

EFFECT OF OMITTING POTASH FERTILIZATION UPON THE OAT CROP.

Owing to the shortage of potash caused by the war it is very important to have as much information as possible regarding the value of this element for various crops. In 1915 the Maine Agricultural Experiment Station began a series of experiments at Aroostook Farm with the object of determining the value of potash for potatoes. In general these results have shown that there is sufficient available potash in Aroostook soils to mature a profitable crop of potatoes. Nevertheless the addition of relatively small amounts of potash has resulted in a marked increase in yield.

In order to obtain some information relative to the value of potash for oats experiments were begun at both of the experiment farms in 1916. The stand was so poor and uneven because of heavy rains that no records of importance were obtained at Highmoor Farm in 1916. The results obtained at Aroostook Farm in 1916 were published in Bulletin 260. The experiment was continued at both farms in 1917. The results are given in the tables that follow.

Table Showing Yields Per Acre in No Potash Experiment with Maine 340 Oats on Aroostook Farm 1917.

Plot No.	Amount of Potash	Straw Pounds	Grain Bushels
714	None	2110	43.4
719	None	1080	33.8
Average		1595	38.6
715	None + Common Salt	2020	46.2
720	None + Common Salt	1220	36.7
Average		1620	41.5
716	2 per cent potash	1580	38.1
721	2 per cent potash	1204	37.6
Average		1392	37.9
717	5 per cent potash	1880	44.4
722	5 per cent potash	1670	38.4
Average		1775	41.4
718	7 per cent potash	2230	45.9
723	7 per cent potash	1420	43.1
Average		1825	44.5

Table Showing Yields Per Acre in No Potash Experiment with Maine 340 Oats at Highmoor Farm 1917.

Amount of Potash	Straw Pounds	Grain Bushels
No Potash	1913	45.3
No Potash + Common Salt	1817	43.3
3 per cent Potash	1786	41.4
5 per cent Potash	1517	38.4
7 per cent Potash	1338	31.6

Average Yields Per Acre in No Potash Experiment with Oats in 1916 and 1917.

Amount of Potash	Bushels of Grain		
	Average	1916	1917
None	55	68	41
None plus salt	55	67	42
2 per cent	52	65	39
5 per cent	54	68	40
7 per cent	55	69	40

There are no appreciable differences in the yields with the different treatments. Evidently on Aroostook Farm it is indicated by these trials that potash is not a limiting factor in growing oats. The stands were too uneven at Highmoor Farm to warrant conclusions. It is not probable that the addition of potash explains the reduced yields that apparently uniformly followed its increased application at Highmoor Farm.

EFFECT OF OMITTING POTASH FERTILIZATION UPON THE POTATO CROP.

Since the introduction of potash in commercial fertilizers in the early seventies of the last century, many experiments have been made and many treatises written showing the value of potash in crop growing. The experimental data on growing crops without potash are very few.

Potatoes are the chief cash crop grown in Maine. It is of first importance for the growers to have what facts are available relative to the likelihood of obtaining a crop in 1918 without the application of potash. Foreseeing the possibility that, with the continuance of the war, very little potash would be available for fertilizers, the Maine Agricultural Experiment Station began in 1915, at Aroostook Farm, a series of experiments to determine the effect of different amounts of potash. The results obtained in 1915 were published in Bulletin 246. Those for 1916 were published in Bulletin 260.

Five different mixtures were used. In each case the fertilizers contained 5 per cent of ammonia of which one-third was in the form of nitrate of soda, and 8 per cent of available phosphoric acid. The potash varied as follows: On one plot there was no potash. The next plot also had no potash but common salt was mixed with the fertilizer at the rate of 300 pounds of salt per acre. The salt was used to see whether this would aid in freeing potash already in the soil and not in a form available for plant food. The fertilizer for the remaining 3 plots contained respectively 3 per cent, 5 per cent and 8 per cent potash. In each case the fertilizer was applied at the time of planting, at the rate of 1500 pounds per acre. Each plot was slightly less than one-half acre in area. The area of each plot was obtained by actual measurement and the yields are based on the weighed potatoes from each plot. Norcross potatoes were used for seed. Other than in respect to potash all plots were treated exactly alike. The land used for this experiment had been in sod for 2 years. The experiment was made in duplicate and is separately reported.

Yield Per Acre in No Potash Experiment with Potatoes. 1917.

Plot No.	Amount of Potash	Merchantable			Culls		
		Cwt.	Bbls.	Bus.	Cwt.	Bbls.	Bus.
	SERIES 1						
755	None	131.0	79.4	218.4	4.1	2.5	6.9
756	None + Salt	136.0	82.4	226.8	4.6	2.8	7.7
757	3 per cent Potash	135.3	82.0	225.5	3.1	1.9	5.2
758	5 per cent Potash	130.8	79.3	218.8	2.6	1.6	4.4
759	7 per cent Potash	138.6	84.0	231.0	2.5	1.5	4.1
	SERIES 2						
760	None	139.5	84.6	232.7	4.0	2.4	6.6
761	None + Sa't	144.0	87.3	240.1	3.6	2.2	6.1
762	3 per cent Potash	149.3	90.5	248.9	3.5	2.1	5.8
763	5 per cent Potash	157.4	95.4	262.4	3.8	2.3	6.3
764	7 per cent Potash	160.4	97.2	267.3	3.8	2.3	6.3

The yields for the 3 years 5 series are summarized in the table that follows.

No Potash Experiment with Potatoes. 1915-1916-1917. Yield in Hundredweight Per Acre.

Amount of Potash	1915	1916		1917		Average
		Series 1	Series 2*	Series 1	Series 2	
None	182	172	198	131	140	156
None + Salt		193	200	136	144	158
3 per cent Potash	191	254	193	135	150	182
5 per cent Potash	191	254	191	131	157	183
8 per cent Potash	198	244	226	139	160	185

*In this series the potatoes followed potatoes. Omitted from average.

From the results of these 4 trials in 3 seasons on sod land the following tentative conclusions may be drawn: The addition of 300 pounds of common salt per acre made a small but uniform increase in yield. The addition of as little as 45 pounds (1500 pounds of 3 per cent goods) per acre of potash uniformily increased the yield of potatoes and profitably. That on Aroostook Farm soil nothing was gained by a larger application. That good yields were obtained without any potash. It will also be noted that in the soil test experiment (page 17) that nitrogen and not potash seems to be the limiting factor in potato production on Aroostook Farm.

THE POTATO CROP IN ITS RELATION TO SOIL AND FERTILIZER.

If one could only know the exact amount of plant food that a given crop could avail itself of in a given soil the question of application of plant food in the form of a fertilizer would be much simplified. Caribou loam is the potato soil of Aroostook County. Interspersed with it are patches of greater or less extent of the much less desirable Washburn loam. It is perfectly easy to select typical Caribou loam soils. Will the same fertilizer give the same results—other conditions being as equal as may be—on different fields with this type of soil?

This Station has made a series of studies upon the need of potash to grow potatoes upon Caribou loam. In 1917 the division of Soil Fertility Investigation and the division of Cotton, Truck and Forage Crop Disease Investigations of the Bureau of Plant Industry of the U. S. Department of Agriculture in searching for the probable cause of the "new disease" of potatoes noticed in 1916 made a series of trials with fertilizers using the triangle scheme that this Station has adopted from them and which is discussed on pages 23 to 26 of this Bulletin. They were interested in comparing results obtained on Caribou loam with those obtained on Washburn. It is interesting to compare the results they obtained on Caribou loam with those obtained by this Station on Aroostook Farm Caribou loam. All of the experiments were near Aroostook Farm and had the same weather conditions. The results from Aroostook Farm are given in the column headed A. The other letters refer to the tests made by the Department of Agriculture but the letters used are merely distinguishing but not identifying. They are grouped according to the triangle diagram. (See page 21).

Fertilizer treatment	Hundred weight per acre of potatoes			
	A	N	S	Y
Three ammonia plots	157	95	93	39
Three phosphoric acid plots	103	109	85	100
Three potash plots	115	123	116	79
Seven check plots	109	87	94	53
Six center (Complete) plots	154	125	159	120

It is evident as discussed above that ammonia is the limiting factor on the soil test experiment field of the Station at Aroostook Farm. Not only does ammonia give a higher result than either phosphoric acid or potash but it gives a yield equal to that obtained with a complete fertilizer. The yields from the different plots N show potash as the limiting factor but with some response from phosphoric acid and ammonia. The yields obtained with potash equal those from the complete fertilizer plots. With S potash gives increased yields while ammonia and phosphoric acid do not. But the yields from the 3 potash plots are much lower than from the complete plots. The yields obtained by Y are not helped by ammonia, are helped some by potash and markedly by phosphoric acid. But the complete outyields the phosphoric acid.

These 4 fields all with Caribou loam and situated near each other in the Aroostook Valley indicate different values for each of the fields. On A ammonia is the essential. On N it is Potash that is needed. On S potash is the valuable constituent but it needs a complete fertilizer to bring the maximum yield. While on Y phosphoric acid doubles the yield, ammonia does not affect the yield and potash adds 50 per cent to the yield. From this evidence on A one would expect ammonia to be profitable. On N potash will be needed for results. On S potash pays but the complete fertilizer gives the maximum yields. On Y both potash and phosphoric acid are needed to produce the maximum yields and ammonia has no effect.

It is needless to say that no definite conclusions can be drawn from these results. They are only one year's results and as explained on page 18, it is planned to continue this work through a long period of years.

POTATOES GROWN AT AROOSTOOK FARM ON FERTILIZERS CONTAINING AMMONIA (NITROGEN) IN DIFFERENT FORMS.

A few years ago there was quite a general failure of the crop of potatoes in Aroostook County where a certain brand of fertilizer was used. This fertilizer was analyzed by the Station chemists and found to be high grade. While it was not quite up to its guaranty in some particulars it did carry enough nitrogen, phosphoric acid and potash to more than grow a good crop of potatoes. This fertilizer carried none of its nitrogen in the form of nitrate of soda, but it was all in the form of sulphate of ammonia and high grade organic materials. This led to the stronger reaffirming of the position which the Station had taken relative to the use of nitrate nitrogen in the potato crop. In earlier publications it has been pointed out that the potato makes its demands for nitrogen early in the season and that in the cold, late springs so common in Aroostook County, the crop demands that part of the nitrogen should be immediately available. For this reason the Station has strongly urged that about one-third of the nitrogen in a potato fertilizer be nitrate nitrogen.

In the process of making gas and coke from coal there is developed a large amount of sulphate of ammonia, which in many coke and gas plants is still going to waste. In some plants this now is being conserved and many thousand tons of sulphate of ammonia are thus obtained each year. With the increasing use of high grade organic nitrogen for food of animals, the price of tankage has been going higher and higher year by year. It is, of course, desirable, if it can be done, that as much as possible of this sulphate of ammonia, which is a comparatively cheap source of nitrogen, be used in Maine fertilizers.

Because of these facts, arrangements were made to begin in 1914 a series of experiments to run over a period of several years. The "base" which was used in these goods was made by the wet process, whereby nitrogen from rather low grade goods is made as available as from high grade goods. The available

phosphoric acid was furnished in the form of acid phosphate and the potash in the form of sulphate of potassium. The fertilizer was free from chlorides so as to preclude the possibility of the formation of poisonous ammonium chloride. The base carried approximately one-third of the nitrogen that went into the formula. The remainder of the nitrogen was furnished in the form of nitrate of soda and sulphate of ammonia, as indicated in the following plan:

Plot 1. Basal mixture and 2-3 of the nitrogen in form of nitrate of soda.

Plot 2. Basal mixture and 2-3 of the nitrogen in form of sulphate of ammonia.

Plot 3. Basal mixture and 1-3 of the nitrogen in form of nitrate of soda and 1-3 in form of sulphate of ammonia.

Plot 4. Basal mixture and 1-3 of the nitrogen in form of high grade organic and 1-3 in form of nitrate of soda.

Plot 5. Basal mixture and 1-3 of the nitrogen in form of high grade organic and 1-3 in form of sulphate of ammonia.

In each case the finished fertilizer analyzed 5 per cent ammonia, 8 per cent available phosphoric acid and 7 per cent potash. In each year the fertilizer has been applied in the planter at the rate of 1500 pounds per acre. Other than the fertilizer used the plots were planted, cultivated, sprayed and cared for in all particulars alike. In each year duplicate plots each about one-half acre in area have been grown with each mixture.

The results for 1914 and 1915 are reported in detail in Bulletin 246 and those for 1916 in Bulletin 260. The detailed results for the experiment in 1917 are given in the table that follows. The results for the 4 years the experiment has been conducted are given in the table below.

Growing Potatoes with Application of Different forms of Nitrogen Yield of Potatoes Per Acre.

Plot No.	Treatment	Merchantable			Culls		
		Cwt.	Bbls.	Bus.	Cwt.	Bbls.	Bus.
765	⅔ Nitrate of Soda	143.9	87.2	239.8	4.5	2.7	7.4
770	⅔ Nitrate of Soda	135.9	82.4	226.6	2.5	1.5	4.1
Average		139.9	84.8	233.2	3.5	2.1	5.7
766	⅔ Sulph. of Ammon.	140.3	85.0	233.7	4.6	2.8	7.7
771	⅔ Sulph. of Ammon.	143.2	86.8	238.7	3.5	2.1	5.8
Average		141.7	85.9	236.2	4.5	2.5	6.8
767	⅓ Nit. of Soda, ⅓ Sulph. Ammon.	134.5	81.5	224.1	3.1	1.9	5.2
772	⅓ Nit. of Soda, ⅓ Sulph. Ammon.	145.0	87.9	241.7	2.8	1.7	4.7
Average		144.8	84.7	241.3	2.9	1.8	4.9
768	⅓ Nit. of Soda, ⅓ Organic	132.0	80.0	220.0	3.5	2.1	5.8
773	⅓ Nit. of Soda, ⅓ Organic	143.7	87.1	239.5	3.1	1.9	5.2
Average		137.9	83.6	229.8	3.3	2.0	5.5
769	⅓ Sulph. Ammon., ⅓ Organic	136.6	82.8	227.7	3.7	2.3	6.3
774	⅓ Sulph. Ammon., ⅓ Organic	150.0	90.9	250.0	3.0	1.8	5.0
Average		143.3	86.8	238.9	3.4	2.1	5.7

Growing Potatoes with Application of Different forms of Nitrogen in 1914-1915-1916 and 1917. Yield in Hundredweight Per Acre.

Treatment	1914	1915	1916	1917	Average
⅔ Nitrate of Soda	198	186	231	140	189
⅔ Sulphate of Ammonia	182	198	231	142	188
⅓ Nit. Soda ⅓ Sulph. Ammon.	191	196	226	145	190
⅓ Nit. Soda ⅓ Organic	198	183	231	138	188
⅓ Sulph. Ammon. ⅓ Organic	182	180	236	143	185

From the results of these trials it appears that there is little choice in the form that nitrogen is used on potatoes in Aroostook County and that the supposition made in the first paragraph of this report has not held true at Aroostook Farm in the past 4 years. The experiment is to be continued at least one more year.

PLANT BREEDING AT AROOSTOOK FARM IN 1917.

OATS.

Oat breeding experiments have been conducted at Aroostook Farm since 1914. This work has been directed toward developing new and improved varieties of oats which would be better adapted to the conditions in the northern part of this State than those now grown. The work has been carried on along three principal lines: (1) variety tests, (2) pure line selections and (3) hybridization work.

Comparative trials of commercial varieties more popular in the central part of the State, were begun in 1914, and were continued in 1915 and 1916. The detailed results of these experiments were published in Bulletins 246 and 260. These results indicate that certain varieties of oats which are well adapted to the conditions in the central and southern part of the State are not suited to Aroostook conditions. It was proposed to continue these variety tests for a number of years. Owing, however, to the movement for increased production of farm products in connection with the war emergency, it was deemed advisable to temporarily discontinue the variety test in 1917, and seed the acreage available for small grains to Maine 340 which has proven to be one of the best varieties so far obtained for Aroostook County.

As a further means of developing new and better varieties the work with pure line selections was undertaken. The principle of this work is based on the isolation of prepotent individual plants out of standard commercial varieties. In 1914 several hundred individual plants were selected from varieties known to have been grown in Aroostook for several years. In 1915 the seed from each of these plants was sown in a separate row in the nursery or breeding garden. Thus the plants of each row were the offspring of a single, self-fertilized plant of the year before, and represented what is called a "pure line." Careful notes were taken on each row, and those that showed the most desirable characters were harvested and threshed, each row by itself. In 1916 the seed of each of the most promising rows was planted in 5 replicate plots each 1-2000 acre in area. The rather high number of replications offered a safer basis

in the subsequent analysis of the merits of each pure line than when only one or 2 plots to each strain are used. In the latter case the real differences in the character of a strain may be obscured by soil irregularities. Out of the 100 strains grown in 1916 only 20 pure lines were continued in 1915 in 1-20 acre plots. In 1918 about 10 of these pure lines will be tested and propagated under field conditions using triplicate plots 1-10 acre to each strain.

The hybridization work with oats, while primarily conducted in the interest of scientific investigations regarding the mode of inheritance of the various characters of oats, promises also results of commercial value. The relatively short growing season prevailing in Aroostook has led the farmers to grow early maturing oat varieties. The majority of these early varieties, however, are light yielding oats. Consequently, in the breeding work the attempt is being made to combine, through crossing, the high yielding qualities of medium late and late varieties with the character of earliness of the Aroostook grown varieties. Since 1915 several crosses have been made which will be tested in 1-2000 acre plots in 1918. In addition to hybrid oats originated in the breeding work at Aroostook Farm, oat crosses between varieties which appear promising for Aroostook conditions, have been taken from Highmoor Farm, and tested in garden rows and small plots at Aroostook Farm.

WHEAT.

The object of this work is to secure a wheat of good quality. The quality of wheat is principally determined by the milling or flour yield and the flour strength. The flour strength is closely correlated with the gluten content of wheat, and is measured by the volume and texture of the bread loaf produced from the flour. The hard wheats furnish, as a rule, flour of high strength. The majority of Aroostook grown varieties of wheat develop soft grain producing flour of inferior grade. Wheats imported from the Northwest after one season's growth in Aroostook lose their character of "hardness". These conditions have led the Station to undertake some definite breeding work with wheat at Aroostook Farm. The principal aim of this work is to secure a hard wheat that would maintain its hardness under Aroostook conditions. The methods followed

in this work include pure line selections and hybridization work.

Since the imported northwestern wheats showed such a rapid deterioration and lack of adaptation it was thought advisable to confine the selection work chiefly to Maine grown varieties of wheat. In 1915 a large number of plants were selected from commercial wheat varieties grown at Aroostook Farm as well as on several farms in the County. The seed from individual wheat ears was planted in garden rows in 1916 giving rise to about 300 pure lines of wheat. The seed of each row was harvested separately and tested in the laboratory with a grain tester for hardness. About 100 pure lines were retained and continued in duplicate 1-2000 acre plots in 1917. Each of the pure lines grown in 1917 furnished enough seed so that protein analyses could be made with each line. The analyses show a marked variation in the protein content which, however, is generally quite high. Using these analyses and the field notes as a basis a further scrutiny of these pure lines of wheat will be made and the inferior strains eliminated. Several of these lines are very promising and will be propagated in 1-80 acre plots in 1918. It may be of interest to state that the most promising strains represent selections from Maine grown wheats. In the hybridization work with wheat several crosses have been made between hard northwestern and Aroostook grown high yielding wheats.

TIMOTHY IMPROVEMENT.

The hay crop is an important source of income in Aroostook County. The yield of the hay crop as of any other crop can be improved by breeding more productive strains. In this State the merchantable hay crop is chiefly made up of timothy. It was thought desirable to undertake some work with a view toward improving the commercial timothy seed grown in this State. Selection of most promising plants and their vegetative propagation by means of bulbs or slips is the method followed in this work.

Seed was collected from individual heads of vigorous tall culms borne by good plants growing in meadows and fields. The seed was planted in flats each row representing the progeny of a single head. After the plants produced the third leaf they were transplanted into the grass garden. The seedlings from

one head were planted in a row by themselves. Owing to the short growing season in Aroostook the starting of the seedlings and their transplanting is done in the spring, as in the fall the seedlings would not become well rooted before the winter comes on. In the second summer the best individual plants were selected, dug out and propagated by bulbs or slips giving rise to clonal* strains or varieties. As the timothy plant is a cross-fertilizing plant it is desirable to interpose between the selection of best individuals and their propagation a period of purifying of these individuals by self-fertilization in order to eliminate all possible hybrid mixtures and secure pure strains that breed true. The clonal varieties from single timothy heads are being tested in small plots at Aroostook Farm, and the seed of the ultimate best strains will be retained. In the summer of 1918 these plots will furnish enough seed to plant fairly large plots.

STRAWBERRIES.

Small fruit culture is only slightly followed in Aroostook County. The wild strawberry flourishes. Because of many inquiries indicating interest on the part of Aroostook people in small fruits the Station Council in the spring of 1916 decided to begin investigations with strawberries at Aroostook Farm. This work is being taken up along the same general lines of the other plant breeding work at the farms. Standard commercial varieties are tested to learn which of these are best adapted to Aroostook conditions and also to furnish plants for breeding work both by selection and by hybridization.

In the spring of 1916, 15 varieties of strawberry plants were purchased. When they reached the farm 2 lots were so badly wilted that they could not be revived. The remaining 13 varieties consisted of 11 standard and 2 of the everbearing type. Ten additional varieties were added to the testing plot in 1917.

The yields per acre and the length of the fruiting season for the varieties set out in 1916 which fruited in the summer of 1917 are given in the table that follows. The 2 everbearing varieties are marked with a * and the 2 varieties having im-

*A clon is a plant group the members of which have been grown from an original stock but which do not come true from seed.

perfect flowers are marked with a †. Glen Mary while classed as a perfect variety has weak pollen and should be set with perfect varieties in order to insure pollination. That is it should, in our experience, be treated as though it bore imperfect flowers.

Data on Strawberries Fruiting at Aroostook Farm in 1917.

Variety	Quarts per Acre	Fruiting Season First Picking	Duration in Days
Pearl	282	July 28	7
Chesapeake	571	July 17	16
Marshall	712	July 16	12
Superb*	1960	July 11	21
William Belt	2345	July 16	17
Magic Gem	2614	July 17	16
Progressive*	2817	July 9	17
Early Ozark	2940	July 11	15
Premier	2971	July 11	22
Sample†	3071	July 16	17
Dr. Burrill	3898	July 11	22
Glen Mary	4055	July 16	17
Crescent†	4719	July 13	23

*Everbearing. †Pistillate varieties.

Owing to the danger of early frost in this section it is doubtful if the everbearing varieties can be depended upon for more than the ordinary spring crop. During the season of 1917 no ripe fruit was produced by these plants later than August 2. They were, however, heavily laden with immature fruit when further progress toward maturity was stopped by frost.

Several of the native wild strawberry plants, so abundant in Aroostook, were placed in the plot for breeding purposes. While they responded to cultivation in so far as producing a heavy growth of vine is concerned, the yield of fruit was extremely small and but little increase in the size of berries over those produced under natural conditions was observed.

The results from a single year's test are not conclusive but it would be unwise to set for fruit in Aroostook County any of the varieties like the Pearl, Chesapeake or Marshall that gave small yields with a short fruiting season.

BULLETIN 270

EASTERN APHIDS: A FEW SPECIES OF PROCIPHILUS.*

EDITH M. PATCH.

There is evidently still considerable work to be done with the migratory Pemphiginae before we have their life histories in hand. Among the single genus *Prociphilus* in the Eastern States alone, several unfinished problems are presented. In fact, the complete American food cycle has been ascertained for but two of the species found in New England,—*P. tessellata*† *and P. venafuscus.*

The second of these, indeed, was not definitely located as to its summer residence until two years ago when the writer secured winged material from pupae collected on the roots of young balsam fir, October 19, 1915 (144-15), though this tree had been under suspicion for several years.‡

P. xylostei, to be sure, has been recorded as a root form on "Fichten" (Tullgren 1909, p. 93) for Europe and its habits in America are not likely to be different.

Besides *P. venafuscus,* we have two ash species in the East, *P. fraxinifolii* and *P. approximatus,* the alternate host of neither having yet been reported.

That the several species already mentioned are all easily to be distinguished, a little study of Figure 5 will show.

---

*Papers from the Maine Agricultural Experiment Station: Entomology No. 97.

†1908. Entomological News. p. 484.

‡1913. Maine Agricultural Experiment Station, Bulletin 207, p. 448.

Figure 4, however, includes some features that concern problems still unsolved. 164-12 represents the fall migrant of a species found congregating in enormous numbers about the base of a mountain ash tree (*Pyrus* sp) on the University of Maine Campus. This has never been taken by the writer except in 1912. It is apparently *P. fitchii* Baker and Davidson, as it closely resembles the type slide of *P. pyri* (Fitch). In structure it is nearer to *P. venafuscus* than to any other species.

Figure 4 (2-15) shows the antenna of the apterous viviparous female of a root species, common on certain Compositae in Maine, which I have considered to be *Trama erigeronensis*. That this is the root form of a species present in Spring upon other vegetation from which it migrates, seems probable. Individuals with wing pads in the underground colonies are frequently found, which would indicate a return fall migration; but I have only once succeeded in obtaining the mature winged forms, (78-06). The antenna and thoracic waxplates of this collection are given in Figure 4. If I am correct in my determination this fall migrant proves that *erigeronensis* should be withdrawn from *Trama* and placed in the genus *Prociphilus*. This insect comes nearer to *P. corrugatans* migrating from *Crataegus* or *P. alnifoliae* from *Amelanchier* than to any other member of the genus known to me; and it may be discovered that the so called *Trama erigeronensis* is the summer root form of a species migrating from hawthorn or Juneberry. So much variety exists in migrants from these two plants that I am not at present confident that only two species are concerned. I do not yet know what the specific characters are as any I have tried to use for separation of these migrants seem to merge more or less.

This brief paper is written as a report of the present status of this group in the East, in the hope that what slight new data it contains may fit in with information which may be available elsewhere. At any rate, eleven years seems long enough to with-hold the winged form of *P. (Trama) erigeronensis* unpublished, in continued hope of linking it definitely into some incomplete cycle.

FOOD PLANT CATALOGUE OF THE APHIDAE OF THE WORLD.

PART V.*

EDITH M. PATCH.

PITTOSPORACEAE.

PITTOSPORUM.

P. eugenioides A. Cunn. Tarata.
Aphis pomi DeGeer. Essig, 1917a, p. 341.
Rhopalosiphum persicae (Sulzer). Essig, 1917a, p. 332.

P. tobira. Japanese Pittosporum.
Mocrasiphum solanifolii (Ashmead). Essig, 1917a, p. 329.
Rhopalosiphum persicae (Sulzer). Essig, 1917a, p. 331.

P. tenuifolium Gaertn. Tawhiwhi.
Aphis pomi DeGeer. Essig, 1917a, p. 341.

P. undulatum Vent. Victorian Box.
Rhopalosiphum persicae (Sulzer). Essig, 1917a, p. 332.

ROSACEAE. ROSE FAMILY.

ACAENA.

A. splendens Vahl.
Myzus michaelseni Schouteden. Schouteden, 1904, p. 3.
Rhopalosiphum acaenae Schouteden. Schouteden, 1904, p. 4.

AGRIMONIA. Agrimony.

A. eupatoria L.
Nectarophora agrimoniella Cockerell. Cockerell, 1903a, p. 168.

AMELANCHIER. Juneberry.

A. alnifolia Nutt.
Illinoia macrosiphum Wilson. Wilson, 1912a, p. 155.
Pemphigus alnifoliae Williams. Williams, 1910 (1911), p. 7.
Prociphilus corrugatans (Sirrine). Quaintance & Baker, 1917, p. 19.

A. canadensis (L.) Medic. Shad Bush. Service Berry.
Prociphilus corrugatans (Sirrine). Patch, 1915c, p. 253.

---

*Papers from the Maine Agricultural Experiment Station: Entomology No. 98.

COTONEASTER.

C. franchetii Bois.

Aphis pomi DeGeer. Essig, 1917a, p. 341.

C. vulgaris.

Aphis pomi DeGeer (mali Fabricius non Oestlund etc.) (oxyacanthae Schrank non Koch) (padi Sanderson non Linnaeus) (pyri Kittel non Boyer, Koch etc.), Theobald, 1916a, p. 176.

C. sp.

Aphis pomi DeGeer. (mali Fab.) (aucupariae Buckton) (crataegi Buckton), van der Goot, 1915, p. 210.

CRATAEGUS. Hawthorn.

C. Azarolus L.

Aphis crataegi Kalt. (pyri Koch). Passerini, 1863, p. 35.

Prociphilus corrugatans (Sirrine). Quaintance & Baker, 1917, p. 19.

C. coccinea L.

Aphis crataegifoliae Fitch. Monell, 1879, p. 21.

Aphis (Adactynus) crataegus-coccinea Rafinesque. Rafinesque, 1818.

Siphocoryne avenae (Fab.) (mali Fitch) (avenae Fitch) (prunifoliae Fitch) (annuae Oestlund) (fitchii Sanderson) (Siphonophora avenae Thos. in part), Pergande, 1904a, p. 8.

Siphonophora crataegi Monell. Monell, 1879, p. 21.

C. crusgalli (lucida).

Aphis mali Fab. (A. pomi DeGeer) (A. oxyacanthae Schrank), Passerini, 1863, p. 40.

Eriosoma lanigera (Hausmann) (Schizoneura crataegi Oestlund), Becker 1918a, p. 255.

Pemphigus corrugatans Sirrine. Gillette, 1909a, p. 355.

C. macrocapetra.

Pemphigus corrugatans Sirrine. Gillette, 1909a, p. 355.

C. monogyna.

Aphis pomi DeGeer. (mali Fabricius non Oestlund etc.) (oxyacanthae Schrank non Koch) (padi Sanderson non Linnaeus) (pyri Kittel non Boyer, Koch), Theobald, 1916a, p. 176.

C. occidentalis.

Pemphigus corrugatans Sirrine. Gillette, 1909a, p. 355.

C. oxyacantha L. English Hawthorn.

Aphis crataegi Kalt. Buckton, 2, p. 37.

Aphis crataegi Kalt. (pyri Koch), Ferrari, 1872, p. 62.

Aphis crataegi Kalt. (non Koch) (non Buckton), Theobald, 1911-1912.

Aphis crataegi Koch. Koch, p. 64.

Aphis crataegiella Theobald. (crataegi Buckton non Kaltenbach), Theobald, 1911-1912.

Aphis crataegifoliae Fitch. Davidson, 1910, p. 377.

Aphis mali Fab. (A. pomi DeGeer) (A. oxyacanthae Schrank), Passerini, 1863, p. 40.
Aphis mali Fab. (Puceron du pomier Gotze) (pomi DeGeer) Buckton, 2, p. 46.
Aphis oxyacanthae Koch. Buckton, 2, p. 37.
Aphis pomi DeGeer. (mali Fabricius non Oestlund etc.) (oxyacanthae Schrank non Koch) (padi Sanderson non Linnaeus) (pyri Kittel non Boyer, Koch), Theobald, 1916a, p. 176.
Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli), van der Goot, 1915, p. 224.
Dentatus (Aphis) crataegi Kalt. (pyri Boyer) (ranunculi Kalt.) van der Goot, 1915, p. 176.
Macrosiphum crataegaria (Walker) (non Buckton). Theobald, 1913, Jour. Econ. Biol., Vol. 8, p. 53.
Ovatus (Myzus) mespili van der Goot. van der Goot, 1915, p. 138.
Prociphilus crataegi Tull. Tullgren, 1909, p. 102.
Siphonaphis padi L. (avenae Fab.) van der Goot, 1915, p. 244.
Tetraneura ulmi Geoffrey. (Aphis). Ferrari, 1872, p. 83.
Myzus oxyacanthae (Koch). Bayer, 1914a, p. 142.

C. punctata Jacq.

Aphis crataegifoliae Fitch. Thomas, 1879, p. 101.
Schizoneura crataegi Oestlund. Oestlund, 1887, p. 28.

C. tomentosus L.

Aphis crataegifoliae Fitch. Sanborn, 1904, p. 53.
Schizoneura crataegi Oestlund. Williams, 1910, p. 20.

C. sp.

Aphis avenae (Fab.). Patch, 1915c, p. 256.
Aphis bakeri Cowen. (cephalicola Cowen). Gillette and Taylor, 1908, p. 28.
Aphis brevis Sanderson. Patch, 1915c, p. 257.
Aphis crataegifoliae Fitch. Quaintance and Baker, 1917, p. 18.
Aphis edentula Buckton. Buckton, 2, p. 41.
Aphis marutae Oestlund. Hunter, 1901, p. 101.
Pemphigus corrugatans Sirrine. Jackson, 1908, p. 216.
Schizoneura lanigera Hausmann (S. americana in part, of authors) Patch, 1912a, p. 395.

CRATAEGO-MESPILUS. (hybrid).

C.-Mespilus.

Aphis crataegi Buckton. Lingelsheim, 1916a.
Myzus oxyacanthae Koch. Lingelsheim, 1916a.

DUCHESNEA. Indian Strawberry.

D. indica (And). Focke (Fragaria indica).

Aphis gossypii Glover. (citrifolii Ashm. In part) (citrulli Ashm.) (cucumeris Forbes) (forbesi Weed?), Pergande, 1895, p. 314.

ERIOBOTRYA.

E. japonica Lindl.

Aphis eriobotryae Schouteden. Schouteden, 1905a, p. 165.

FILIPENDULA.

F. ulmaria (L.). Maxim (Ulmaria ulmaria L) (Spiraea ulmaria) (Spirla by misprint) Queen of the Meadow.

Aphis spiraeella Schouteden. (schoutedeni Kirkaldy) (spireae Schouteden nec Oestlund) Schouteden, 1906a, p. 228.

Siphonophora pisi Kalt. Buckton, 1, p. 135.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch), Passerini, 1863, p. 13.

FRAGARIA. Strawberry.

F. indica. See Duchesnea indica.

F. vesca L.

Aphis chloris Koch. Passerini, 1863, p. 39.

Aphis fragariae Walker. Walker, 1848b, p. 431.

Rhizobius sonchi Pass. Kaltenbach, 1874, p. 484.

Siphonophora fragariae Koch. Buckton, 1, p. 126.

F. virginiana Duchne.

Aphis sp. Sanborn, 1904, p. 63.

Myzus porosus Sanderson. Patch, 1915c, p. 258.

F. sp.

Aphis aparines Fab. Williams, 1891, p. 24.

Aphis forbesi Weed. Weed, 1888, p. 273.

Aphis fragariae Koch. Kaltenbach, 1874, p. 231.

Aphis gossypii Glover. (citrifolii Ashm. in part) (citrulli Ashm.) (cucumeris Forbes) (forbesi Weed?), Pergande, 1895, p. 314.

Aphis maidiradicis Forbes. Vickery, 1910, p. 111.

Macrosiphum fragariellum Theobald. (S. fragariella), Cockerell, 1905, p. 309; Theobald, 1913, Jour, Econ. Biol. Vol. 8, p. 53.

Macrosiphum rogersii Theobald. Theobald, 1913, Jour. Econ. Biol. Vol. 8, p. 53.

Macrosiphum trifolii Pergande. Pergande, 1904a, p. 22.

Myzus fragaefolii Cockerell. Cockerell, 1901a, p. 101.

Myzus fragariae Theobald. Theobald, 1912.

Myzus porosus Sanderson. Sanderson, 1900, p. 205.

Siphonophora fragariae var. *immaculata* Riley. Pergande, 1904a, p. 22.

Siphonophora minor Forbes. Forbes, 1884, p. 79.

GEUM. Avens.

G. urbanum L.

Macrosiphum gei Koch. Theobald, 1913, p. 53.

Macrosiphum ulmariae (Schrank) (gei Koch) (urticae Kalt?) van der Goot, 1915, p. 104.

Siphonophora ulmariae (Schrank) (onobrychis Boyer) (pisi Kalt.) (gei Koch). Ferrari, 1872, p. 55.

MESPILUS.

M. germanica.
Aphis pomi DeGeer. Lingelsheim, 1916a.
Aphis fitchii Sanderson. Lingelsheim, 1916a.

NUTTALLIA. (Osmaronia).

N. cerasiformis Torr-Gray.
Illinoia osmaroniae Wilson. Wilson, 1912a, p. 153.

PHOTINIA.

P. arbutifolia Lindl.
Rhopalosiphum nervatum Gillette (arbuti Davidson). Essig, 1917, p. 330.

P. serrulata Lindl. (Crataegus glabra).
Myzus cerasi Fab. Macchiati, 1883, p. 234.

PHYSOCARPUS. (Neillia) (Opulaster). Nine-bark.

P. opulifolius (L). Maxim. (Neillia opulifolius).
Aphis neilliae Oestlund. Oestlund, 1887, p. 59.

POTENTILLA. (Tormentilla). Cinquefoil.

P. Anserina L. Silver Weed.
Aphis dianthi Schrank. Walker, 1850a, p. 394.
Macrosiphum potentillae (Aphis Walker). Theobald, 1913, p. 150.
Myzus rosarum (Walker) (potentillae Oestlund). Oestlund, 1887, p. 73.
Nectarophora potentillae Oestlund. Oestlund, 1887, p. 83.
Phorodon galeopsidis (Kalt.) Pass. (Walker ex parte). Passerini, 1863, p. 19.

P. arguta Pursh.
Myzus potentillae Williams. Williams, 1910 (1911), p. 66.

P. hippiana Lehm. (pulcherrima).
Nectarophora martini Cockerell. Cockerell, 1903a, p. 171. (pulcherrima?).

P. reptans L.
Phorodon galeopsidis Kalt. Macchiati, 1883, p. 232.

P. tormentilla Scop.
Aphis tormentillae Pass. Del Guercio, 1909, (1910), Redia VII, p. 297.

PRUNUS. (Amygdalus) (Cerasus) (Padus) (Persica). Plum. Cherry.

P. americana Marsh. Wild Plum.
Aphis cerasi Schrank. (A. prunicola Kalt.) Lingelsheim, 1916a.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

P. Amygdalus Baill. (Amygdalus communis L.) Almond.
Aphis amygdali Blanch. Thomas, 1879, p. 102.
Aphis amygdalinus Schouteden. Schouteden, 1905a, p. 164.
Lachnus fuliginosus Buckton. Buckton, 1891, p. 41.
Rhopalosiphum nympheae (Linn.). Davidson, 1917a, p. 350.

P. armeniaca L. Apricot.
Aphis persicariae Hartig. Hartig, 1841, p. 370.
Aphis pruni Reaum. (prunifoliae Fitch?) (Prunifex Amyot) (Calamaphis Amyot). Buckton, 2, p. 65.
Aphis prunorum Dobrowljansky. Dobrowljansky, 1913, p. 45.
Hyalopterus arundinis Fabr. Clarke, 1903, p. 249.
Hyalopterus pruni (Fab.) Koch (Prunifex Amyot). Buckton, 2, p. 111.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.
Rhopalosiphum nympheae (Linn.). Davidson, 1917a, p. 350.

P. avium L. Sweet Cherry. Mazzard.
Aphis cerasina Walker. Kaltenbach. 1874, p. 177.
Myzus cerasi (Fab.) Pass. Passerini, 1863, p. 22.

P. cerasus L. (Cerasus vulgaris). Sour or Morello Cherry.
Myzus cerasi Fab. Gillette and Taylor, 1908, p. 43.
Myzus cerasi (Fab.) Pass. (Cerasaphis Amyot). Buckton, 1, p. 175.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

P. chamaerasus Jacq.
Aphis insititiae Koch. Cholodkovsky, 1910, p. 146.

P. domestica L. Common Garden Plum.
Aphis alamedensis Clarke. Clarke, 1903, p. 251.
Aphis convecta Walker. Walker, 1849c, p. 37.
Aphis deposita Walker. Walker, 1848c, p. 2250.
Aphis detracta Walker. Walker, 1849c, p. 38.
Aphis egressa Walker. Walker, 1849c, p. 38.
Aphis humuli Schrank. (A. pruni Scop.) Koch, p. 115.
Aphis internata Walker. Walker, 1849c, p. 37.
Aphis persorbens Walker. Walker, 1849c, p. 37.
Aphis pruni Fab. Kaltenbach, 1874, p. 176.
Aphis pruni Koch. (Aphis cardui Linn.) Dobrowljansky, 1913, p. 45.
Aphis prunicola Kalt. Passerini Flora.
Aphis prunina Walker. Passerini, 1863, p. 37; Walker, 1848c, p. 2250.
Aphis setariae Thomas. Quaintance and Baker, 1917, p. 19.
Aphis similis Walker. Walker, 1848c, p. 2249.
Aphis transposita Walker. Walker, 1849c, p. 37.
Aphis sp. Quaintance and Baker, 1917, p. 19.
Myzus persicae Sulzer. Gillette and Taylor, 1917, p. 36.

P. insititia L. Bullace Plum.
Anuraphis prunicola Kaltenbach. Del Guercio, 1909 (1910), p. 297.

Aphis insititia Koch. Kaltenbach, 1874, p. 177.
Brachycaudus helichrysi Kalt. (myosotidis Koch) (pruni Koch). van der Goot, 1915, p. 257.
Phorodon humuli Schrank. (A. pruni Scop.). van der Goot, 1915, p. 134.

P. Mahaleb L. Perfumed Cherry.
Aphis frangulae Kalt. (A. rhammi Kalt. *not* Boyer). Koch, p. 120.
Myzus cerasi Fab. (Aphis). Ferrari, 1872, p. 61.
Myzus mahaleb (Koch) Pass. (A. pruni mahaleb Boyer) (A. humuli Walker partim?).
Phorodon pruni "n. sp?" Ferrari. (A. humuli Koch partim). Ferrari, 1872, p. 60.

P. melanocarpa.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

P. mume.
Macrosiphum mumecola Matsumura. Matsumura, 1917a, p. 361.

P. padus L.
Aphis padi Reaum. Buckton, 2, p. 62.
Aphis padi L. Kaltenbach, 1874, p. 176.
Aphis padi Kalt. (A. avenae Fab. Kalt.). Mordwilko, 1897, p. 282.
Lachnus padi Hartig. Hartig, 1841, p. 368.
Siphonaphis padi Linn. (A. avenae Fab.). van der Goot, 1915, p. 244.

P. pennsylvanica L. Wild Red, Bird, Fire or Pin Cherry.
Aphis cerasifoliae Fitch. Gillette, 1910, p. 405.

P. persica (L.) Stokes. (Persica vulgaris) (Amygdalus persica). Peach.
Abura momocola Matsumura. Matsumura, 1917a, p. 363.
Aphis amygdali Boyer. (persicae Boyer). Buckton, 2, p. 105.
Aphis amygdalinus Schouteden. Theobald, 1909, p. 324.
Aphis persicae Koch. (persicae Boyer? persicae Kalt?). Koch, pp. 61 and 62.
Aphis infuscata Koch. van der Goot, 1915, p. 205.
Aphis persicae Kalt. Kaltenbach, 1843, p. 93.
Aphis persicae Boyer. (insititiae Koch). Ferrari, 1872, p. 73.
Aphis persicae-niger Smith. Gillette and Taylor, 1908, p. 37.
Aphis persicariae Hartig. Hartig, 1841, p. 370.
Aphis persicophila Rondani. Passerini, 1860, p. 36.
Aphis pruni Reaum. (prunifoliae Fitch?) (prunifex Amyot) (Calamaphis Amyot). Buckton, 2, p. 65.
Aphis prunicola Kalt. (cerasi Schrank). Ferrari, 1872, p. 74.
Aphis scotti Sanderson. Smith, 1905, p. 99.
Aphis setariae Thom. Quaintance and Baker, 1917, p. 19.
Brachycaudus amygdali Buckton. (A. persicae Fonsc.) (cerasi Schrank) (prunicola Kalt.). van der Goot, 1915, p. 253.
Dryobius amygdali van der Goot. van der Goot, 1912, p. 282.

Hyalopterus pruni (Fab.) Koch. (Prunifex Amyot). Buckton, 2, p. 111.
Lachnus fuliginosus Buckton. Buckton, 1891, p. 41.
Lachnus (Pterochloris) persicae Chol. Cholodkovsky, 1908, p. 688.
Myzus momonis Matsumura. Matsumura, 1917a, p. 362.
Myzus (Aphis) persicae Pass. Kaltenbach, 1874, p. 151.
Myzus persicae Pass. Passerini, 1863, p. 25.
Myzus persicae (Sulzer). (insititia Koch) (persicaecola Boisduval) (persicophila Rondani). Buckton, 1, p. 180.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.
Myzus varians Davidson. Essig, 1917a, p. 335.
Rhopalosiphum dianthi (Schrank) Koch (persicae Puceron du pecher Morren) (rapae Curtis) (A. floris rapae Curtis) (dubia? Curtis) (vastator Smee) (persicaecola Boisduval) (R. persicae Pass.) Buckton, 2, p. 17.
Rhopalosiphum nympheae (Linn.) Davidson, 1917a, p. 350.
Rhopalosiphum persicae (Sulzer) Pass. (A. dianthi Schrank) (A. vulgaris Kyber) (A. rapae Curtis) (A. dubia Curtis) (A. vastator Smee). Passerini, 1863, p. 21.

P. pseudo-cerasus.

Myzus sasaki Matsumura. Matsumura, 1917a, p. 362.

P. sachalinensis.

Myzus sakurae Matsumura. Matsumura, 1917a, p. 362.

P. serotina Ehrh. (Cerasus serotina) Wild Black or Plum Cherry.

Aphis cerasicolens Fitch. Williams, 1891, p. 7.
Siphocoryne avenae (Fab.) (mali Fitch) (prunifoliae Fitch) (avenae Fitch) (annuae Oestlund) (fitchii Sanderson) (Siphonophora avenae Thos. in part). Pergande, 1904a, p. 8.

P. spinosa L.

Aphis amygdali Boyer. (persicae Boyer). Buckton, 2, p. 105.
Aphis bellula Walker. Walker, 1849c, p. 36.
Aphis cerasina Walker. Kaltenbach, 1874, p. 177.
Aphis consona Walker. Walker, 1849c, p. 36.
Aphis conviva Walker. Walker, 1849c, p. 36.
Aphis humuli Schrank. (A. pruni Scop.). Koch, p. 115.
Aphis impacta Walker. Walker, 1849c, p. 35.
Aphis infuscata Koch. Koch, p. 77.
Aphis nociva Walker. Walker, 1849c, p. 36.
Aphis persicae Boyer. Passerini Flora.
Aphis prunaria Walker. Walker, 1850b, p. 121.
Aphis prunicola Kalt. (A. cerasi Schrank), Passerini, 1863, p. 50.
Aphis prunina Walker. Walker, 1850b, p. 150.
Aphis spinarum Hartig. Hartig, 1841, p. 370.
Aphis transmutata Walker. Walker, 1849c, p. 37.
Brachycaudus amygdali Buckton. (A. persicae Fonsc.) (A. cerasi Schrank) (A. prunicola Kalt.), van der Goot, 1915, p. 253.

Hyalopterus pruni (Fab.) Koch. (Prunifex Amyot). Buckton, 2, p. 111.
Phorodon humuli (Schrank) Pass. (pruni Scop.) (Humulifex Amyot) Buckton, 1, p. 167.
Phorodon humuli var. *mahaleb* Boyer. (A. pruni Boyer) (A. mahaleb Koch) (M. mahaleb Pass.) Buckton, 1, p. 169.
Schizoneura corni Kalt. (S. vagans Koch) "auf Schlehenhecken," Koch, pp. 269 and 330. (September migration).

P. virginiana L. (Cerasus serotina). Choke cherry.
Aphis cerasicolens Fitch. Hunter, 1901, p. 95.
Aphis cerasifoliae Fitch. (Myzus cerasifoliae Thomas). Thomas, 1879, p. 93.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.
Siphocoryne avenae (Fab.) (mali Fitch) (prunifoliae Fitch) (avenae Fitch) (annuae Oestl.) (fitchii Sanderson) (Siphonophora avenae Thos. in part). Pergande, 1904a, p. 8.

P. sp.
Aphis padi Linn. (avenae of European authors). Baker, 1917h.
Aphis prunicolens Ashmead. Hunter, 1901, p. 102.
Aphis prunifoliae Fitch (avenae of American authors, *not* padi) Baker, 1917h.
Aphis pruni-mahaleb Boyer. Lichtenstein Flore Supplement.
Aphis setariae Thomas. Gillette and Taylor, 1908, p. 41.
Chaitophorus populi (Linn.). Pass. (Myzaegirus Amyot) (Arctaphis populi Walker). Buckton, 2, p. 142.
Hyalopterus arundinis (Fab.) (A. pruni Fab.) (A. phragmitidicola Oestlund) (A. prunifoliae Fitch?). Hunter, 1901, p. 92.
Hyalopterus arundinis (Fab.) (pruni). Gillette and Taylor, 1908, p. 39.
Myzus mahaleb Fonsc. Pergande, 1897, Bul. 7, Div. Ent.
Myzus prunifoliae Fitch. Sanborn, 1904, p. 70.
Nectarophora prunicola Ashmead. Hunter, 1901, p. 116.
Phorodon humuli Schrank. Gillette and Taylor, 1908, p. 40.
Rhopalosiphum dubium Curtis. Lichtenstein La Flore.
Rhopalosiphum persicae Sulzer. Lichtenstein La Flore.
Rhopalosiphum persicaecola Boisduval. Lichtenstein La Flore.
Rhopalosiphum vastator Smee. Lichtenstein La Flore.
Rhopalosiphum vulgaris Kyber. Lichtenstein La Flore.

PYRUS. (Cydonia) (Malus) (Mespilus) (Sorbus).

P. americana (Marsh) D. C. (Sorbus americana) American Mountain Ash.
Aphis mali Fab. (A. malifoliae Fitch) Oestlund, 1887, p. 64.
Schizoneura lanigera Hausmann (S. americana in part of authors) Patch, 1912a, p. 395.

P. aucuparia (L.) Ehrh. European Mountain Ash. Rowan Tree.
Aphis aucupariae Buckton. Buckton, 2, p. 76.

Aphis pomi DeGeer. (mali Fab.) (aucupariae Buckton) (crataegi Buckton). van der Goot, 1915, p. 213.

Aphis pomi DeGeer. (mali Fabricius non Oestlund etc.) (oxyacanthae Schrank non Koch) (padi Sanderson non Linnaeus) (pyri Kittel non Boyer, Koch). Theobald, 1916a, p. 176.

Aphis sorbi Kalt. Kaltenbach, 1874, p. 216.

Siphocoryne padi L. (A. avenae Fab.) van der Goot, 1915, p. 244.

P. communis L. (pyraster). Pear.

Aphanostigma (Phylloxera) piri (Chol.) C. B. Borner, 1909b, p. 61. Cholodkovsky, 1910, p. 149.

Aphis crataegi Kalt. (pyri Koch). Passerini, 1863, p. 35.

Aphis crataegi Kaltenbach non Buckton. Theobald, 1916, p. 212.

Aphis gossypii Glover. (citrifolii Ashmead in part) (citrulli Ashmead) (cucumeris Forbes) (forbesi Weed?) Pergande, 1895, p. 314.

Aphis kochii Schouteden (pyri Koch non Boyer) (sorbi Walker, Sanderson etc. non Kaltenbach) (mali Buckton part, non Fabricus) (pyri-mali Fabricius part) (malifoliae Fitch and Thomas) (mali Ferrari part) (pyri Gillette and Taylor). Theobald, 1916b, p. 205.

Aphis lentiginis Buckton. Buckton, 2, p. 60.

Aphis mali Fab. (Puceron du pomier Gotze) (pomi DeGeer). Buckton, 2, p. 46.

Aphis oxyacanthae Koch non Schrank. Bayer, 1909b, p. 35.

Aphis pyri Koch. Bayer, 1909b, p. 35.

Aphis pomi DeGeer. (mali Fab.) (aucupariae Buckton) (crataegi Buckton). van der Goot, 1915, p. 210.

Aphis pomi DeGeer. (mali Fabricius) (pyri Kittel non Boyer, Koch) (padi Sanderson non Linnaeus) (oxyacanthae Schrank). Theobald, 1916a, p. 176.

Aphis pyraria Pass. Buckton, 2, p. 54.

Aphis pyrastri Boisduval. Passerini Flora.

Aphis pyri Goureau. Passerini Flora.

Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli). van der Goot, 1915, p. 225.

Eriosoma lanuginosa Hartig. (pyri Goethe) Baker and Davidson, 1917c, p. 66.

Eriosoma pyricola Baker and Davidson. Baker and Davidson, 1916e, p. 351.

Lachnus pyri Buckton. Buckton, 1899a, p. 274.

Myzoxylus laniger (Hausmann). Bayer, 1909b, p. 34.

Myzus oxyacanthae (Koch) Pass. Passerini, 1863, p. 24.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

Myzus pyrarius Pass. Passerini, 1862, p. 2.

Myzus pyrinus Ferrari. Zoological Record, 1872, p. 418.

Nectarophora tabaci Pergande. Pergande, 1898, p. 300.

Prociphilus corrugatans Sirrine. Quaintance and Baker, 1917, p. 19.

Prociphilus fitchii Baker and Davidson. (pyri Fitch). Baker and Davidson, 1917c, p. 66.
Schizoneura piri Mordwilko. Cholodkovsky, 1910, p. 148.
Siphocoryne avenae (Fab.) (mali Fitch) (avenae Fitch) (prunifoliae Fitch) (annuae Oestl.) (fitchii Sanderson) (Siphonophora avenae Thomas in part). Pergande, 1904a, p. 8.

P. (Malus) coronaria L. American Crab.
Aphis gossypii Glover. Gillette, 1910, p. 404.

P. Cydonia L. (Cydonia vulgaris). Quince-tree.
Aphis brevis Sanderson. Sanderson, 1901b, p. 157.
Aphis crataegifoliae Fitch. Quaintance and Baker, 1917, p. 18.
Aphis cydoniae Boisduval. Zoological Record, 1868, p. 416.
Aphis mali Fab. (A. pomi DeGeer) (A. oxyacanthae Schrank). Passerini, 1863, p. 40.
Aphis pomi DeGeer. (mali Fab.) (aucupariae Buckton) (crataegi Buckton) van der Goot, 1915, p. 210.
Macrosiphum solani (Kalt.) Del Guercio 1909 (1910), Redia VII, p. 297.
Prociphilus corrugatans Sirrine. Quaintance and Baker, 1917, p. 19.
Siphocoryne avenae (Fab.) (mali Fitch) (prunifoliae Fitch) (avenae Fitch) (annuae Oestl.) (fitchii Sanderson) (Siphonophora avenae Thos. in part). Pergande, 1904a, p. 8.
Siphonophora (Aphis) solani Kalt. Passerini, 1863, p. 13.

P. germanica Hook. (Mespilus germanica).
Aphis assidua Walker. Walker, 1849c, p. 40.
Aphis inserta Walker. Walker, 1849c, p. 39.
Aphis insita Walker No. 1. Walker, 1849c, p. 39.
Aphis mactata Walker. Walker, 1849c, p. 39.
Aphis nutricata Walker. Walker, 1849c, p. 39.
Aphis pomi DeGeer. (mali Fabricius non Oestlund) (oxyacanthae Schrank non Koch) (padi Sanderson non Linnaeus) (pyri Kittel non Boyer, Koch etc.). Theobald, 1916a, p. 176.
Aphis pruni Reaum. (prunifoliae Fitch?) (Prunifex Amyot) (Calamaphis Amyot). Buckton, 2, p. 65.
Macrosiphum pelargonii Buckton. Theobald, 1913, p. 54.
Ovatus (Myzus) mespili van der Goot. van der Goot, 1915, p. 138.
Siphonaphis padi L. (avenae Fab.) van der Goot, 1915, p. 244.
Siphonophora pelargonii (Kalt.) Koch (pallida Walker) (fragariae Walker?) (diplanteriae Koch?) (malvae Pass.) Buckton, 1, p. 137.

P. japonica Thunb. (Cydonia japonica).
Aphis mali Fab. (A. pomi DeGeer) (A. oxyacanthae Schrank). Passerini, 1863, p. 40.

P. malus L. (paradisiaca). Apple.
Aphis (Siphocoryne) avenae Fab. Gillette and Taylor, 1908, p. 30.

Aphis bakeri Cowen (cephalicola Cowen). Gillette and Taylor, 1908, p. 28.

Aphis bivincta Fitch (var. of mali). Fitch, 1855, p. 760.

Aphis brevis Sanderson. Sanderson, 1901b, p. 157. ("Accidental?").

Aphis crataegi Kalt. (pyri Koch). Passerini, 1863, p. 35. Lustner 1911.

Aphis crataegi Kaltenbach. (non Buckton). Theobald, 1916a, p. 171.

Aphis devecta Walker. Walker, 1849c, p. 38.

Aphis fulviventris Fitch. (var. of mali). Fitch, 1855, p. 760.

Aphis immaculata Fitch (var. of mali). Fitch, 1855, p. 760.

Aphis kochi Schouteden. (pyri Koch non Boyer) (pyri-mali Fabricius part) (mali Buckton part) (sorbi Walker part Sanderson, Theobald, non Kaltenbach) (Myzus mali Ferrari part) (malifoliae Fitch). Theobald, 1916a, p. 170.

Aphis lanata Salisbury. Hagen, 1863, p. 103.

Aphis mali Fab. (A. pyri Reaum.) Thomas, 1878, p. 11.

Aphis mali Fab. (A. pomi DeGeer) (A. oxyacanthae Schrank). Passerini, 1863, p. 40.

Aphis mali Fab. (Puceron du pomier Gotze) (pomi DeGeer). Buckton, 2, p. 46.

Aphis mali Fab. (A. malifoliae Fitch). Oestlund, 1887, p. 64.

Aphis malifoliae Fitch (the sorbi Kalt. of American authors). Baker and Turner, 1916f, p. 11.

Aphis medicaginis Koch. Gillette and Taylor, 1908, p. 32.

Aphis nigra Theobald. (oxyacanthae Koch non Schrank). Theobald, 1916a, p. 171.

Aphis nigricollis Fitch (var. of mali). Fitch, 1855, p. 760.

Aphis nigriventris Fitch (var. of mali). Fitch, 1855, p. 760.

Aphis obsoleta Fitch (var. of mali). Fitch, 1855, p. 760.

Aphis pallidicornis (var. of mali). Fitch, 1855, p. 759.

Aphis pomi DeGeer. Gillette and Taylor, 1908, p. 23.

Aphis pomi DeGeer. (mali Fab.) (aucupariae Buckton) (crataegi Buckton). van der Goot, 1915, p. 213.

Aphis pomi DeGeer (mali Fabricius) (pyri Kittel non Boyer, Koch) (padi Sanderson, non Linnaeus) (oxyacanthae Schrank). Theobald, 1916a, p. 170.

Aphis pruni Reaum. (prunifoliae Fitch?) (Prunifex Amyot) (Calamaphis Amyot) Buckton, 2, p. 65.

Aphis pyri Boyer (sorbi Sanderson) (malifolii Fitch). Gillette and Taylor, 1908, p. 32.

Aphis pyri Boyer (crataegi Kalt.) (A. discrepans Koch). Koch, p. 109.

Aphis pyri Hartig. Hartig, 1841, p. 369.

Aphis rumicis Linnaeus (papaveris Fabricius) (thlaspeos Schrank) (fabae Scopoli) (atriplicis Fabricius) (aparines Schrank) (ar-

mata Hausmann) (dahliae Mosley) (evonymi Fabricius) (ulicis Fabricius). Theobald, 1916a, p. 171.

Aphis sorbi Kalt. Gillette, 1910, p. 404.

Aphis tergata Fitch (var. of mali). Fitch, 1855, p. 760.

Aphis thoracica Fitch (var. of mali). Fitch, 1855, p. 760.

Aphis triseriata Fitch (var. of mali). Fitch, 1855, p. 760.

Callipterus mucidus Fitch. Hunter, 1901, p. 90. Fitch, 1859, p. 334. "A solitary plant-louse."

Hyalopterus pruni Fab. Del Guercio, 1909 (1910), Redia VII, p. 297.

Macrosiphum solanifolii Ashmead. Patch, 1915e, p. 214.

Myzus mali Ferrari. Zoological Record, 1872, p. 418.

Myzus oxyacanthae (Koch) Pass. Passerini, 1863, p. 24. Theobald, 1911-12.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 32.

Nectarophora tabaci Pergande. Pergande, 1898, p. 300.

Pemphigus americanus Walker.

Phorodon humuli Schrank-Koch. Theobald, 1916a, p. 171.

Schizoneura lanigera (Hausm.) Hartig (A. mali Tougard) (Myzoxylus mali Blot.) Passerini, 1863, p. 69.

Schizoneura lanigera Hausmann. (S. americana Riley in part, of authors). Patch, 1916b.

Schizoneura pyri (Fitch). Hunter, 1901, p. 82.

Siphocoryne avenae (Fab.) (mali Fitch) (prunifoliae Fitch) (avenae Fitch) (annuae Oestl.) (fitchii Sanderson) (Siphonophora avenae Thomas, in part). Pergande, 1904a, p. 8.

Siphocoryne avenae Fabricius (avenae sativae Schrank) (annuae Oestlund) (mali Fitch non Fabricius) (fitchii Sanderson) (crataegifoliae Fitch) Theobald, 1916a, p. 171.

Siphonaphis padi L. (A. avenae Fab.) van der Goot, 1915, p. 244.

P. sinensis.

Aphis pomi DeGeer. Matsumura, 1917a, p. 357.

Nippolachnus piri Matsumura. Matsumura, 1917a, p. 355.

Toxoptera piricola Matsumura. Matsumura, 1917a, p. 363.

P. sitchensis.

Schizoneura lanigera Hausmann. (S. americana in part, of authors). Patch, 1912a, p. 395.

P. torminalis Ehrh. (tormentalis Buck.).

Aphis aucupariae Buckton. Buckton, 2, p. 76.

Aphis sorbi Kalt. Buckton, 2, p. 59. Bayer, 1914a, p. 142.

P. sp.

Aphis crataegi Kalt. (pyri Boyer). Kaltenbach, 1874, p. 202.

Aphis kochi Schouteden. (pyri Koch nec Boyer). Schouteden, 1906a, p. 221.

Aphis pyri Boyer (not pyri Koch). Buckton, 2, p. 98.

ROSA. Rose.

R. californica Schlecht.

Macrosiphum rosae (Linn.) Essig, 1917a, p. 329.
Myzus rosarum Walker. Davidson, 1910, p. 379.

R. canina L. Dog Rose.
Capitophorus tetrarhodus Walker. (Siphonophora rosarum Koch). van der Goot, 1915, p. 131.
Lachnus rosae Cholodkovsky. Cholodkovsky (in Russian).
Macrosiphum dirhodum (Walker). van der Goot, 1915, p. 63.
Myzaphis rosarum Kalt. (not Lichtenstein nor Buckton). van der Goot, 1915, p. 188.
Semiaphis trirhodus Walker. (Hyalopterus aquilegiae Koch). van der Goot, 1915, p. 273.
Siphonophora rosae (Reaumur) Koch. Buckton, 1, p. 109.
Siphonophora rosae var. *glauca* Buckton. Buckton, 1, p. 109.
Siphonophora rosae (Koch) (Aphis rosae L. auct.) (A. dipsaci Schrank). Passerini, 1863, p. 11.
Siphonophora rosarum (Walker) Koch. Buckton, 1, p. 151.

R. centifolia L.
Aphis dirhoda Walker. Walker, 1849a, p. 43.
Aphis rosae Linn. (A. dipsaci Schrank) (Puceron du Rosier Gotz.) Kaltenbach, 1843, p. 4.
Aphis rosarum Kalt. Kaltenbach, 1874, p. 224.
Hyalopterus delineatus Buckton. Buckton, 2, p. 113.
Siphonophora glauca Buckton. Buckton, 1, p. 109.
Siphonophora rosae (Reaumur) Koch. Buckton, 1, p. 109.

R. cinnamomea L. Cinnamon Rose.
Hyalopterus aquilegiae-flavus (Kittel) (Aphis) (flavus Schouteden) (aquilegiae Koch) (trirhoda Walker). Hayhurst, 1909a, p. 108.

R. Eglanteria L.
Aphis dirhoda Walker. Walker, 1849a, p. 43.

R. gallica L.
Aphis rosarum Kalt. Kaltenbach, 1874, p. 224.
Hyalopterus aquilegiae-flavus (Kittel) (Aphis) (flavus Schouteden) (aquilegiae Koch) (trirhoda Walker). Hayhurst, 1909a, p. 112.
Hyalopterus delineatus Buckton. Buckton, 2, p. 113.
Myzus tetrarhoda (Walker) Pass. (S. rosarum Koch). Passerini, 1863, p. 25.
Siphonophora rosaecola Passerini. Passerini Flora.

R. indica L.
Hyalopterus aquilegiae-flavus (Kittel) (Aphis) (flavus Schouteteden) (aquilegiae Koch) (trirhoda Walker). Hayhurst, 1909a, p. 112.
Myzus tetrarhoda (Walker) Pass. (S. rosarum Koch). Passerini, 1863, p. 25.

R. multiflora.
Macrosiphum ibarae Matsumura. Matsumura, 1917a, p. 360.

R. rubiginosa L.

Siphonophora rosae Koch. (Aphis rosae L. auct.) (A. dipsaci Schrank). Passerini, 1863, p. 11.

Siphonophora rosarum (Walk.) Koch. Buckton, 1. p. 151.

R. sempervirens L.

Hyalopterus trirhoda Walker. Macchiati, 1883, p. 237.

Myzus tetrarhoda Walker. Macchiati, 1883, p. 236.

R. sp.

Aphis (Adactynus) diplepha Rafinesque. Rafinesque, 1818.

Aphis (Adactynus) rhodryas Rafinesque. Rafinesque, 1818.

Aphis (Adactynus) rosa-suaveolens Rafinesque. Rafinesque, 1818.

Hyadaphis flavus Kittel (aquilegiae Koch) (trirhodus Walker) Schouteden, 1906a, p. 230.

Hyalopterus trirhoda (Walker) Pass. (H. aquilegiae Koch) Buckton, 2, p. 115.

Lachnus maculatus Lichtenstein. Lichtenstein La Flore.

Lachnus rosae Cholodkovsky. Patch, 1917a, p. 418.

Lachnus rosae Cholodkovsky. (maculatus Licht?) (rosarum van der Goot). van der Goot, 1915a, p. 409.

Macrosiphum rosae Reaumur. (A. dipsaci Schrank) (S. rosae Koch) (S. scabiosae Buckton). van der Goot, 1915, p. 90.

Macrosiphum solanifolii Ashmead. Patch, 1915e, p. 214.

Myzus rosarum (Walker) (potentillae Oestl.) Oestlund, 1887, p. 73.

Myzus roseus Macchiati. Lichtenstein La Flore.

Nectarophora pallida Oestlund. Oestlund, 1887, p. 84.

Rhopalosiphum nervatum Gillette. Gillette, 1908a, p. 63.

Siphonophora rosae var. *floridae* Ashmead. Ashmead, 1882, p. 88.

Siphonophora rosae Reaumur. Theobald, 1911, p. 16.

Siphonophora ulmariae Schrank. (onobrychis Boyer) (pisi Kalt.), (gei Koch). Ferrari, 1872, p. 55.

RUBUS. Bramble.

R. cassius L.

Aphis rubi Kalt. Kaltenbach, 1874, p. 239.

Aphis urticae Fab. (urticaria Kalt.) Passerini, 1863, p. 37.

R. corylifolius Sm. Fl. Brit.

Aphis rubi Kalt. Kaltenbach, 1843, p. 24.

R. dalmaticus D. C.

Hyalopterus trirhoda Walker. Macchiati, 1883, p. 237.

R. discolor.

Aphis rubi Kalt. Kaltenbach, 1874, p. 239.

R. fruticosus L.

Aphis urticae Fab. (urticaria Kalt.) Ferrari, 1872, p. 65.

Aphis urticaria Kalt. Buckton, 2, p. 51.

Macrosiphum chelidonii Kaltenbach? Theobald, 1913, p. 54.

Siphonophora cyparissiae Koch. Buckton, 1, p. 114.

Siphonophora rubi (Kalt.) Koch. Buckton, 1, p. 141.

R. idaeus L. (aculeatissimus. Wild Red Raspberry) (strigosus Michx). Raspberry.

Aphis idaei van der Goot. van der Goot, 1915, p. 204.
Aphis rubicola Oestlund. Oestlund, 1887, p. 60.
Aphis urticae Fab. Passerini, 1874, p. 2.
Aphis urticaria Kalt. Buckton, 2, p. 51.
Macrosiphum rubicola (Oestlund). Oestlund, 1887, p. 78.
Siphonophora chelidonii (Kalt.) Koch. Buckton, 1, p. 122.
Siphonophora funesta Macchiati. Zoological Record, 1885, p. 240.
Siphonophora rubi (Kalt.). Koch. Buckton, 1, p. 141.

R. nutkanus Moc.

Amphorophora rubicola (Oestlund). Davidson, 1914, Jour. Ec. Ent. Vol. 7, p. 136.

R. occidentalis L. Black Raspberry. Thimbleberry.

Amphorophora rubi (Kalt.) Gillette, 1911a, p. 381.
Aphis sp. Sanborn, 1904, p. 62.
Pemphigus rubi Thomas. "Accidental visitant?" Thomas, 1879, p. 148.

R. parviflorus Nutt. Thimbleberry.

Nectarosiphum rubicola (Oestlund). Essig, 1917a, p. 328.

R. saxatilis L.

Nectarosiphum rubi (Kaltenbach). Bayer, 1914a, p. 133.

R. villosus Ait. Dewberry.

Nectarophora rubi (Kalt.). Hunter, 1901, p. 116.
Sipha rubifolii Thomas. Sanborn, 1904, p. 44.
("Undescribed genus?" Davis, 1909b, p. 157.).

R. vitifolius C. & S. Wild Blackberry.

Amphorophora rubi (Kalt.) Essig, 1917a, p. 330.

SANGUISORBA. Burnet.

S. sp.

Aphis sanguisorbae Schrank. Kaltenbach, 1874, p. 245.

SPIRAEA.

S. prunifolia Sieb.

Aphis spiraeella Schouteden. Gillette, 1910, p. 404.

S. salicifolia Linn. Meadow-sweet.

Aphis spiraeae Oestlund. Oestlund, 1887, p. 68.
Aphis spiraeela Schouteden. Essig, 1911a, p. 463.
Macrosiphum ulmariae (Schrank). Bayer, 1914a, p. 135.

S. Thunbergi.

Aphis kogomecola Matsumura. Matsumura, 1917a, p. 357.

S. ulmaria. See Filipendula.

S. sp.

Acyrthosiphon ignotum Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 147.

Acyrthosiphon soldatovi Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 168.
Aphis pisi Kalt. (ulmariae Schrank). Kaltenbach, 1874, p. 242.
Aphis n. sp. Kalt. Kaltenbach, 1874, p. 243.
Macrosiphum cholodkovsky Mordwilko. Zoological Record, 1909, p. 404.
Macrosiphum portschinskyi Mordwilko. Zoological Record, 1909, p. 404.

ULMARIA.

U. ulmaria. See Filipendula.

LEGUMINOSAE. PULSE FAMILY.

ANAGYRIS.

A. sp.
Aphis craccivora Koch. Lichtenstein La Flore.

ASTRAGALUS. Milk Vetch.

A. bisulcatus Hook.
Aphis medicaginis Koch. Cowen, 1895, p. 120.

A. leucopis Torr. Loco Weed.
Aphis medicaginis Koch. Essig, 1912, Host Index II, p. 826.

A. sp.
Rhopalosiphum persicae Sulzer. Matsumura, 1917a, p. 362.

CARAGANA.

C. arborescens Lam.
Acyrthosiphon caraganae (Cholodkovsky) (pisi Bogdanov) (ulmariae part, Cholodkovsky). Mordwilko, 1914, Faune da la Russie, p. 152.
Aphis medicaginis Koch. Hunter, 1901, p. 101.

C. pymaea D. C.
Acyrthosiphon caraganae (Cholodkovsky) Mordwilko, 1914, Faune de la Russie, p. 153.

CERATONIA.

C. sp.
Aphis ceratoniae Licht. (ined.). Lichtenstein La Flore.

CERCIS. Redbud.

C. canadensis L. Redbud.
Lachnus longistigma Monell. Sanborn, 1904, p. 31.

COLUTEA.

C. arborescens L.
Aphis pisi Kalt. Kaltenbach, 1874, p. 134.

Pemphigus coluteae Pass. Passerini, 1863, p. 75.
Siphonophora ulmariae (Schrank and Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

CORONILLA.

C. pusilla.
Aphis coronillae Ferrari. Ferrari, 1872, p. 69.

CYTISUS. Broom.

C. laburnum. See Laburnum vulgare.
C. nigricans L.
Aphis laburni Kalt. Passerini Flora.
C. scoparius (L.) Link. Sarothamnus scoparius L. (Spartum scoparius). Scotch Broom.
Aphis genistae Kaltenbach. Theobald, 1911-12.
Aphis laburni Kalt. (genistae Boyer). Passerini, 1863, p. 45.
Aphis pisi Kalt. Kaltenbach, 1874, p. 107.
Aphis setosa Kalt. Kaltenbach, 1874, p. 107.
Aphis spartii Koch. Kaltenbach, 1874, p. 108.
Siphonophora menthae Buckton. Buckton, 1, p. 121.
Siphonophora rubi (Kalt.) Koch. Buckton, 1, p. 141.
C. (Sarothamnus).
Schizoneura spartanthi Boisduval. Lichtenstein, Flore Supplement.
Siphonophora ulmariae Pass. Passerini Flora.

DESMODIUM. Tick Trefoil.

D. canadense DC.
Microparsus variabilis Patch. (Macrosiphum n. sp. Sanborn Kans. Aphid. p. 71). Patch, 1909b, p. 337.
D. canescens L.
Siphonophora desmodii Williams. Williams, 1910 (1911), p. 76.

DOLICHOS.

D. monacalis.
Aphis medicaginis Koch. Del Guercio, 1909 (1910), Redia VII, p. 297.
D. sp.
Aphis dolichii Signoret. Lichtenstein, Flore Supplement.

ERVUM. See Vicia.

FABA.

F. vulgaris. See Vicia Faba.

GENISTA. Woad-waxen.

G. anglica L.
Aphis genistae Kalt. Kaltenbach, 1874, p. 113.

Aphis rumicis Linn. Walker, 1850a, p. 19.

G. germanica L.

Aphis genistae Scopoli. Passerini, 1863, p. 47.

G. ovata Waldst.

Aphis craccae Schrank. Ferrari, 1872, p. 71.

G. tinctoria L. Dyer's Greenweed.

Acyrthosiphon genistae Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 144.

Aphis genistae Kalt. Kaltenbach, 1874, p. 113.

Aphis laburni Kalt. Pierre, 1905, p. 160.

Aphis rumicis Linn. Walker, 1850a, p. 19.

G. sp.

Aphis genistae Boyer. Lichtenstein, La Flore.

Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) genistae Scopoli. van der Goot, 1915, p. 225.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

GLYCINE.

G. hispida.

Aphis glycines Matsumura. Matsumura, 1917a, p. 531.

G. sp.

Macrosiphum solani Kalt. Matsumura, 1917a, p. 361.

Rhopalosiphum persicae Sulzer. Matsumura, 1917a, p. 362.

GLYCYRRHIZA. Liquorice.

G. lepidota Nutt. Wild Liquorice.

Aphis medicaginis Koch. Gillette and Taylor, 1908, p. 32.

HEDYSARUM.

H. onobrychis. See Onobrychis viciaefolia Scop.

LABURNUM.

L. vulgare Gris. (Cytisus laburnum).

Aphis cytisorum Hartig. Hartig, 1841, p. 370.

Aphis laburni Kalt. Buckton, 2, p. 86. Theobald, 1911-12. van der Goot, 1915, p. 210.

Aphis rumicis Linn. Walker, 1850a, p. 19.

LATHYRUS. Everlasting Pea.

L. angustifolius.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 12.

L. hirsutus Linn. (Orobus lathyroides Habl.).

Acyrthosiphon pisi pisi (Kalt.) Mordwilko, 1914, Faune de la Russie, p. 86.

L. latifolius L. Everlasting or Perennial Pea.

Acyrthosiphon pisi pisi (Kalt.) Mordwilko, 1914, Faune de la Russie, p. 85.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

Siphonophora viciae Kalt. Ferrari, 1872, p. 56.

L. odoratus L.

Aphis bakeri Cowen. Patch, 1913, Bul. 207, p. 448.

Aphis dissita Walker. Walker, 1849c, p. 34.

Macrosiphum pisi (Kaltenbach) (Aphis lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (N. trifolii Pergande). Davis, 1915a, p. 11.

L. pratensis L.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson). (M. trifolii Pergande). Davis, 1915a, p. 11.

Rhopalosiphum viciae (Kaltenbach). van der Goot, 1915, p. 153.

L. sativus. Grass Pea.

Macrosiphum pisi (Kaltenbach) (Aphis lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 11.

L. sylvestris. Flat Pea.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

L. sp.

Acyrthosiphon pisi ussuriensis Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 140.

Megoura viciae Kaltenbach (viciae Buckton). Theobald, 1911-12.

LESPEDEZA.

L. bicolor.

Macrosiphum hagicola Matsumura. Matsumura, 1917a, p. 360.

L. sp.

Macrosiphum solani Kalt. Matsumura, 1917a, p. 361.

LOTUS. Bird's-foot Trefoil.

L. corniculatus L.

Aphis craccae Linn. (A. viciae Fab.). Theobald, 1911-12.

Aphis loti Koch. Del Guercio, 1909 (1910), Redia VII, p. 298.

Aphis loti Kaltenbach. Schouteden, 1906a.

Aphis rumicis Linn. Walker, 1850a, p. 19.

Macrosiphum lathyri Walker? Theobald, 1911-12.

Macrosiphum loti Theobald. Theobald, 1913, Jour, Ec. Biol. Vol. 8, p. 54.

Macrosiphum pisi Kalt. (lathyri Walker) (cyparissiae Koch) (ononis Koch) van der Goot, 1915, p. 85.

L. uliginosus Schkuhr.

Siphonophora pisi (Kalt.) Koch. (ulmariae Schrank) (onobrychis Boyer) (lathyri Walker). Buckton, 1, p. 135.

L. sp.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

LUPINUS. Lupine.

L. albifrons.

Macrosiphum albifrons Essig. Essig, 1911b, p. 546.

L. arboreus Sims. Tree Lupine.

Macrosiphum albifrons Essig. Essig, 1917a, p. 328.

L. latifolius Agarth.

Macrosiphum albifrons Essig. Essig, 1917a, p. 328.

MEDICAGO. Medick.

M. denticulata Willd.

?*Aphis gossypii* Glover. Fullaway, 1909, p. 39.

Aphis medicaginis Koch. Davidson, 1909, p. 302.

M. falcata Linn.

Aphis medicaginis Koch. Kaltenbach, 1874, p. 123.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

Siphonophora ulmariae Schrank (pisi Kalt.) Mordwilko, 1909, p. 103.

M. lupulina L. Black Medick. Nonesuch.

Siphonophora ulmariae Schrank (A. onobrychis Boyer) (A. pisi Kalt.) (S. pisi Koch) (S. gei Koch. Macchiati, 1883, p. 232.

M. orbicularis All.

Aphis medicaginis Koch. Macchiati, 1883, p. 255.

M. sativa L. Lucerne. Alfalfa.

Acyrthosiphon pisi turanicum Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 139.

Aphis medicaginis Koch. Passerini, 1863, p. 42.

Callipterus trifolii Monell. (Chaitophorus maculatus Buckton) (Aphis ononidis Kalt?) Davis, 1914, U. S. D. A., B. E. Tech. Ser. 25, Pt. II.

Chaitophorus maculatus Buckton. Buckton, 1899b, p. 277.

Macrosiphum creelii Davis. Davis, 1914, Can. Ent. 46, p. 47.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

Myzocallis ononidis (Kalt.) Pass. (C. ononidis Koch). Passerini, 1863, p. 54.

Pemphigus betae Doane. Parker, 1914, p. 137. Jour. Ec. Ent. Vol. 7.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

MELILOTUS. Sweet Clover.

M. alba Lam. White Melilot.

Aphis medicaginis Koch. Hunter, 1901, p. 126.

Macrosiphum pisi (Kaltenbach) (Aphis lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

M. italica Lam.

Aphis medicaginis Koch. Hunter, 1901, p. 101.

M. pallida Bess. (macrorhiza).

Pemphigus lactucarius Pass. Passerini, 1863, p. 77.

M. sp.

Aphis papaveris Fab. Lichtenstein, Flore Supplement.

MIMOSA.

M. sp.

Aphis mimosae Ferrari. Lichtenstein, La Flore.

ONOBRYCHIS.

O. viciaefolia Scop. (sativa) (Hedysarum Onobrychis).

Aphis pisi Kalt. (A. ulmariae Schrank) (onobrychis Boyer) Kaltenbach, 1874, pp. 118, 137.

Siphonophora ulmariae Pass. (Aphis ulmariae Boyer). Kaltenbach, 1874, p. 777.

ONONIS.

O. diffusa. See O. serrata.

O. hircina Jacq.

Acyrthosiphon pisi pisi (Kalt.) Mordwilko, 1914, Faune de la Russie, p. 85.

Myzocallis ononidis (Kalt.) Pass. (C. ononidis Koch.). Passerini, 1863, p. 54.

O. Natrix L.

Aphis apocyni Koch. Ferrari, 1872, p. 68.

Aphis brunnea Ferrari. Ferrari, 1872, p. 70.

O. repens L.

Macrosiphum pisi Kalt. (lathyri Walker) (cyparissiae Koch.) (ononidis Koch.) van der Goot, 1915, p. 84.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

Myzocallis ononidis Pass. Passerini Flora.

Pergandeida ononidis Schouteden. Schouteden, 1906a, p. 215.

Siphonophora ulmariae Pass. Passerini Flora.

O. serrata Forsk. (diffusa).

Myzocallis ononidis Kalt. (Chaitophorus ononidis Koch). Macchiati, 1883, p. 260.

Siphonophora ononis Koch. Macchiati, 1883, p. 230.

O. spinosa L.

Aphis incumbens Walker. Walker, 1849c, p. 35.

Aphis inducta Walker. Walker, 1849c, p. 35.

Aphis translata Walker. Walker, 1849c, p. 35.

Chaitophorus ononidis Kalt. (Ch. spinulosus Koch in litt.). Koch, p. 5.

Myzocallis ononidis Kalt. (Aphis). Ferrari, 1872, p. 75.

Siphonophora ononis Koch. Koch, p. 175.

Siphonophora ulmariae Pass. Passerini Flora.

O. sp.

Aphis brunnea Macchiati. Zoological Record, 1885, p. 239.

Aphis rumicis Linn. Walker, 1850a, p. 19.

Therioaphis ononidis (Pass.) Walker. Wilson, 1910, p. 155.

OXYTROPIS. (Aragallus.)

O. lamberti Pursh. (Aragallus lamberti).

Aphis medicaginis Koch. Williams, 1891, p. 20.

PHASEOLUS. Kidney Bean.

P. coccineus L.

Aphis rumicis Linn. Walker, 1850a, p. 19.

Tychea phaseoli Pass. Buckton, 4, p. 90.

P. lunatus L.

?*Aphis gossypii* Glover. Fullaway, 1909, p. 39.

P. multiflorus Willd. Scarlet Runner.

Pemphigus globosus Walker. Walker, 1852, p. 1057.

Siphonophora ulmariae Pass. Passerini Flora.

Tychea phaseoli Pass. Passerini Flora.

P. vulgaris L. (nanus).

Aphis gossypii Glover. (citrifolii Ashm. in part) (citrulli Ashm.) (cucumeris Forbes) (forbesi Weed?). Pergande, 1895, p. 314.

Aphis papaveris Fab. Del Guercio, 1909 (1910), Redia VII, p. 297.

Aphis rumicis Linn. Walker, 1850a, p. 19.

Lachnus longitarsus Ferrari. Zoological Record, 1872, p. 418.

Macrosiphum solanifolii Ashmead. Patch, 1915e, p. 214.

Tullgrenia phaseoli Pass. van der Goot, 1915a, p. 516.

Tychea phaseoli Pass. Hunter, 1901, p. 69.

P. sp.

Aphis pseudobrassicae Davis. Paddock, 1915a, p. 9.

Aphis rumicis (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) genistae Scopoli). van der Goot, 1915, p. 225.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

PISUM.

P. arvense L.

Aphis pisi Kalt. Kaltenbach, 1874, p. 118.

P. sativum L. Garden Pea.

Acyrthosiphon pisi turanicum Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 139.

Aphis crataegifoliae Fitch. Quaintance and Baker, 1917, p. 18.

Aphis rumicis Linn. Walker, 1850a, p. 19.

Macrosiphum pisi Kalt. (lathyri Walker) (cyparissiae Koch) (ononis Koch) van der Goot, 1915, p. 86.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

Macrosiphum solanifolii Ashmead. Patch, 1915e, p. 214.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch). Passerini, 1863, p. 13.

P. sp.

Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) genistae Scopoli). van der Goot, 1915, p. 225.

Macrosiphum solani Kalt. Matsumura, 1917a, p. 361.

Myzus pergandii Sanderson. Sanderson, 1901a, p. 73.

ROBINIA. Locust.

R. Pseudo-Acacia L. Common Locust. False Acacia.

Aphis laburni Kalt. Cholodkovsky, 1910, p. 145.

Aphis robiniae Macchiati. Del Guercio, 1900, p. 133.

Callipterus robiniae Gillette. Gillette, 1907a, p. 395.

Rhopalosiphum dianthi (Schrank). Williams, 1891, p. 7.

R. viscosa Vent. Clammy Locust.

Aphis medicaginis Koch. Hunter, 1901, p. 101.

SAROTHAMNUS. See Cytisus.

SPARTIUM.

S. junceum L.

Siphonophora ulmariae Schrank. (A. onobrychis Boyer) (A. pisi Kalt.) (S. pisi Koch) (S. gei Koch). Macchiati, 1883, p. 232.

S. sp.

Aphis laburni Kalt. Lichtenstein, La Flore.

TEPHROSIA. (Cracca). Hoary Pea.

T. sp.

Aphis rumicis Linn. Walker, 1850a, p. 19.

Aphis viciae Kalt. Kaltenbach, 1874, p. 143.

TRIFOLIUM.

T. filiforme.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

T. hybridum. Alsike Clover.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 12.

T. incarnatum L. Crimson or Italian Clover.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 11.

Nectarophora pisi Kalt. (ulmariae Schrank) (onobrychis Boyer) (lathyri Mosley) (gei Koch) (viciae Curtis not Fab.) (destructor Johnson). Sanderson, 1900, p. 171.

T. medium perenne. Mammoth Clover.

Callipterus trifolii Monell. (Chaitophorus maculatus Buckton) (Aphis ononidis Kalt?) Davis, 1914, U. S. D. A. Bur. Ent., Ser. 25, Pt. II.

T. pratense L. Red Clover.

Aphis bakeri Cowen. Davis, 1908, p. 259.

Aphis gossypii Glover (citrifolii Ashm. in part) (citrulli Ashm.) (cucumeris Forbes) (forbesi Weed?) Pergande, 1895, p. 314.

Aphis pisi Kalt. Kaltenbach, 1874, p. 118.

Callipterus trifolii Monell. (Chaitophorus maculatus Buckton) (Aphis ononidis Kalt?). Davis, 1914, U. S. D. A. Bur. Ent. Tech. Ser. 25, Pt. II.

Macrosiphum cerealis (Kalt.) Pergande, 1904a, p. 20.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 11.

Macrosiphum pisi Kalt. (lathyri Walker) (cyparissiae Koch) (ononis Koch). van der Goot, 1915, p. 86.

Myzocallis trifolii (Monell). Gillette, 1910, p. 369. (genevii Sanborn). Baker, 1917f, p. 424.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 35.

T. procumbens L. Low Hop Clover.

Macrosiphum trifolii Theobald. Theobald, 1913, Jour. Ec. Biol. Vol. 8, p. 55.

Myzocallis ononidis (Kalt.) Pass. (C. ononidis Koch). Passerini, 1863, p. 54.

T. repens L. White Clover

Aphis cephalicola Cowen. Cowen, 1895, p. 118.

Aphis trifolii Oestlund. Oestlund, 1887, p. 55.

Callipterus trifolii Monell. (Chaitophorus maculatus Buckton) (Aphis ononidis Kalt?) Davis, 1914, U. S. D. A. Bur. Ent., Tech. Ser. 25, Pt. II.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmicariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 11.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 35.

T. sp.
Aphis bakeri Cowen. Patch, 1915b, p. 433.
Aphis brevis Sanderson. Patch, 1915b, p. 431.
Aphis crataegifoliae Fitch. Quaintance and Baker, 1917, p. 18.
Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli). van der Goot, 1915, p. 225.
Aphis scaliae Del Guercio. Del Guercio, 1914.
Geoica squamosa Hart. Hart, 1891 and 1892, p. 99.
Rizoberlesia trifolii Del Guercio. Del Guercio, 1914.

ULEX. Furze.

U. europaeus L.
Aphis rumicis Linn. Walker, 1850a, p. 19.

U. sp.
Aphis papaveris Fab. Lichtenstein, Flore Supplement.
Aphis rumicis Linn. (fabae Kirby) (genistae Scop.) (ulicis Fab?) (euphorbiae Kalt?) (dahliae Mosley) (Cinara rumicis Mosley) (Rumicifex Amyot) (Genistifex Amyot). Buckton, 2, p. 84.

VICIA. Ervum. Vetch. Tare.

V. amoena.
Acyrthosiphon pisi pisi (Kalt.) Mordwilko, 1914, Faune de la Russie, p. 86.

V. cracca L.
Aphis craccae Linn. Kaltenbach, 1874, p. 144.
Aphis craccae Schrank. (A. viciae craccae L.). Passerini, 1863, p. 46.
Aphis craccivora Koch. Kaltenbach, 1874, p. 144.
Aphis rumicis Linn. Thomas, 1879, p. 88.
Aphis viciae Kalt. Kaltenbach, 1874, p. 143.
Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 12.

V. Faba L. (Faba vulgaris).
Aphis papaveris Fab. (thlaspeos Schrank) (aparines) (fabae Scopoli). Ferrari, 1872, p. 71.
Aphis rumicis Linn. Walker, 1850a, p. 19.
Aphis viciae Kalt. Kaltenbach, 1874, p. 143.

V. gigantea Hook.
Macrosiphum pisi (Kaltenbach) (A. onobrychis B. de Fonsc?) (A. lathyri Mosley) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 11.

V. ludoviciana Nutt.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 11.

V. narbonensis L.

Aphis medicaginis Koch. Passerini, 1863, p. 42.

V. pseudo-cracca Bert.

Aphis craccae Schrank. Macchiati, 1883, p. 240.

V. pulchella H. B.

Aphis atronitens Cockerell. Cockerell, 1903b, p. 115. "Vicia aff. pulchella."

V. sativa L. (angustifolia). Spring Vetch.

Aphis craccae L. Kaltenbach, 1874, p. 144.

Aphis papaveris Fab. (fabae Scop.) (aparines Schrank). Passerini, 1863, p. 46.

Aphis viciae Kalt. Kaltenbach, 1874, p. 143.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 12.

V. sepium L.

Aphis tribulis Walker. Walker, 1849c, p. 34.

Aphis viciae Kalt. Kaltenbach, 1874, p. 143.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande) Davis, 1915a, p. 12.

V. villosa Roth...Hairy or Winter Vetch.

Macrosiphum pisi (Kaltenbach) (A. lathyri Mosley) (A. onobrychis B. de Fonsc?) (S. ulmariae Pass. nec Schrank) (N. destructor Johnson) (M. trifolii Pergande). Davis, 1915a, p. 11.

V. sp.

Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli). van der Goot, 1915, p. 225.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

VIGNA.

V. catjang Walpers.

Aphis medicaginis Koch. Essig, 1917a, p. 340.

V. sinensis.

Melanoxanthus sinensis Matsumura. Matsumura, 1917a, p. 359.

LEGUMINOSAE.

L. sp.

Acyrthosiphon dubium Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 180. "in quadam Papilionacearum."

LINACEAE. FLAX FAMILY.

LINUM. Flax.

L. sp.

Pemphigus betae Doane. Parker, 1914, p. 137. Jour. Ec. Ent., Vol. 7.

OXALIDACEAE. WOOD SORREL FAMILY.

OXALIS. Wood Sorrel.

O. corniculata L. Lady's Sorrel.
Aphis oxalis Macchiati. Macchiati, 1883, p. 256.

O. stricta L.
Aphis maidi-radicis Forbes. Davis, 1909b, p.124.

O. sp.
Aphis maidis Fitch. Davis, 1909b, p. 145.
Rhopalosiphum dianthi (Schrank). Williams, 1891, p. 19.

GERANIACEAE. GERANIUM FAMILY.

ERODIUM. Storksbill.

E. Botrys Bert.
Siphonophora malvae Mosley. (A. pelargonii Kalt.) (A. pallida Walker) (S. pelargonii Koch) (S. diplantherae Koch). Macchiati, 1883, p. 230.

E. cicutarium L'Herit. ex Ait.
Aphis rumicis Linn. Walker, 1850a, p. 19.

GERANIUM. Cranesbill.

G. maculatum L. Wild Cranesbill.
Nectarophora geranii Oestlund. Oestlund, 1887, p. 81.

G. molle L.
Aphis geranii Kalt. Kaltenbach, 1874, pp. 81-82.
Siphonophora malvae (Mosley) Pass. (A. pelargonii Kalt.) (A. pallidaWalker) (S. pelargonii Koch) (S. diplantherae Koch). Passerini, 1863, p. 14.

G. pusillum Burm.
Aphis geranii Kalt. Kaltenbach, 1874, p. 81.

G. Robertianum L. Herb Robert.
Aphis dianthi Schrank. Walker, 1850a, p. 394.
Aphis urticae Schrank. Kaltenbach, 1874, p. 81.
Siphonophora pelargonii Kalt. Koch, pp. 193, 194.
Siphonophora urticae (Kalt.). Koch. Buckton, 1, p. 144.

G. sp.
Siphonophora circumflexa Buckton. Theobald, 1911, p. 17.
Siphonophora pelargonii (Kalt.) Koch. (pallida Walker) (fragaria Walker?) (diplanterae Koch?) (malvae Pass.) Buckton, 1, p. 137.

PELARGONIUM.

P. sp.
Aphis extranea Walker. Walker, 1849c, p. 2251.

Myzus ribis Linn. et auct. (Aphis) Ferrari, 1872, p. 62.
Myzus targionii Del Guercio. (Myzus ribis? Linn. Ferrari). Del Guercio, 1900, p. 152.
Siphonophora malvae (Mosley) Pass. (A. pelargonii Kalt.) (A. pallida Walker) (S. pelargonii Koch) (S. diplantherae Koch). Passerini, 1863, p. 14.

TROPAEOLUM.

T. majus L.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 35.
T. tricolorum Sweet. (tricolor).
Aphis dianthi Schrank. Walker, 1850a, p. 122.
T. sp.
Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli. van der Goot, 1915, p. 225.

RUTACEAE. RUE FAMILY.

CITRUS.

C. Aurantium L. (vulgaris). Orange.
Aphis citri Ashmead. Essig, 1909, p. 49.
Aphis gossypii Glover. (citrifolii Ashmead, in part) (citrulli Ashmead) (cucumeris Forbes) (forbesi Weed?) Pergande, 1895, p. 314. Essig, 1911c, p. 590.
Aphis tavaresi Del Guercio. Tavares, 1908, pp. 142-144.
Myzus asclepiadis Pass. Ferrari, 1872, p. 62.
Myzus citricidus Kirkaldy. Fullaway, 1909, p. 28.
Myzus persicae (Sulzer). Essig, 1911c, p. 600.
Siphonophora citrifolii Ashmead. Ashmead, 1882, p. 91. Essig, 1911c, p. 592.
Toxoptera aurantii Boyer. (Aphis) (Aphis camelliae Kalt.) (Ceylonia theaecola Buckton). Phillips and Davis, 1912, p. 8.
Toxoptera aurantii Koch. Buckton, 3, p. 135. Essig, 1911c, p. 601.
C. Medica L. (limonum) (limetta).
Aphis tavaresi Del Guercio.
Myzus persicae (Sulzer). Essig, 1911c, p. 600.
Toxoptera aurantii Boyer. (Aphis) (A. camelliae Kalt.). Ferrari, 1872, p. 62.
C. sp.
Aphis citricola van der Goot. van der Goot, 1912, "Uber einige wahrscheinlich neue Blattlausarten," p. 275.
Aphis cookii Essig. (gossypii Essig 1910a). Essig, 1911c, p. 587.
Aphis dianthi Schrank. Walker, 1850a, p. 394.
Aphis medicaginis Koch. Essig, 1917a, p. 340.

MELICOPE. (Pelea).

M. sp.
Toxoptera aurantiae Koch. Fullaway, 1909, p. 32.

RUTA. Rue.

R. graveolens L. Common Rue.

Siphonophora jaceae Linn. Ferrari, 1872, p. 58. Theobald, **1913,** p. 54.

SIMARUBACEAE. QUASSIA FAMILY.

AILANTHUS. Tree of Heaven.

A. glandulosa L.

Aphis mali Fab. (A. pomi DeGeer) (A. oxyacanthae Schrank). Macchiati, 1883, p. 255.

A. sp.

Aphis mali Macchiati. Lichtenstein, Flore Supplement.

POLYGALACEAE. MILKWORT FAMILY.

POLYGALA. Milkwort.

P. Senega L. Seneca Snakeroot

Aphis (Adactynus) polygala-senega Raf. Rafinesque, 1818.

EUPHORBIACEAE. SPURGE FAMILY.

AND

BUXACEAE. BOX FAMILY.

ACALYPHA. Three-seeded Mercury.

A. virginica L.

Aphis gossypii Glover. (citrifolii Ashm. in part) (citrulli Ashm.) (cucumeris Forbes) (forbesi Weed?) Pergande, 1895, p. 314.

BUXUS.

B. sempervirens L.

Aphis papaveris var. *buxi* Del Guercio. Del Guercio, 1909 **(1910)** p. 297. Redia VII.

Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli). van der Goot, 1915, p. 225.

EUPHORBIA. Spurge.

E. biglandulosa Desf.

Aphis euphorbiae Kalt. Macchiati, 1883, p. 239.

E. corollata L. Flowering Spurge.

Aphis euphorbia Kalt. Williams, 1891, p. 18.

E. Cyparissias L. Cypress Spurge.

Aphis euphorbiae Kalt. Passerini, 1863, p. 47.

Siphonophora cyparissiae Koch. Buckton, 1, p. 114.

E. Esula L.

Aphis euphorbiae Kalt. Passerini, 1863, p. 47.

E. gerardiana Facq.

Acyrthosiphon cyparissiae propinquum Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 193.

E. hirsuta (Torr.) Wiegand. (Euphorbia hypericifolia).

Siphonophora euphorbicola Thomas. Williams, 1891, p. 24.

E. lathyris L. Caper Spurge. Mole Cricket.

Tychea phaseoli Pass. Karsch, 1886, p. 1.

E. maculata L. Milk Purslane.

Siphonophora euphorbiae Thomas. Thomas, 1879, p. 57.

E. marginata Pursh. Snow-on-the-Mountain.

Siphonophora euphorbiae Thomas. Thomas, 1879, p. 57.

E. Paralias L.

Aphis rumicis Linn. Walker, 1850a, p. 18.

E. Peplus L. Petty Spurge.

Acyrthosiphon cyparissiae cyparissiae (Koch). Mordwilko, 1914, Faune de la Russie, p. 192.

Aphis dianthi Schrank. Walker, 1850a, p. 394.

Aphis euphorbia Kalt. Macchiati, 1883, p. 239.

E. Terracina L.

Aphis euphorbiae Kalt. Macchiati, 1883, p. 239.

E. sp.

Aphis asclepiadis Fitch. Oestlund, 1887, p. 60.

Aphis cyparissiae Koch. Kaltenbach, 1874, p. 525.

Forda occidentalis Hart. Davis, 1910b, p. 408.

Tychea brevicornis Hart. Davis, 1910b, p. 408.

RICINUS. Castor-oil Plant.

R. communis L.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 35.

CALLITRICHACEAE. WATER STARWORT FAMILY.

CALLITRICHE. Water Starwort.

C. stagnalis Scop.

Rhopalosiphum nymphaeae Koch. Passerini, Flora.

ANACARDIACEAE. CASHEW FAMILY.

PISTACIA.

P. atlantica Desf.

Pemphigus riccobonii Stefani. Stefani, 1899, p. 1.

P. Lentiscus L.

Aphis (?) *pistaciae* Linn. Kaltenbach, 1843, p. 140.

Aploneura lentisci Pass. Ferrari, 1872, p. 84.

P. Terebinthus L.

Aphis therebinthinae Virey. Hagen, p. 449.

Pemphigus cornicularius Pass. Lichtenstein, 1880a.
Pemphigus cornicularius Pass. (A. pistaciae L. auct. partim). Passerini, 1863, p. 72.
Pemphigus corniculoides Licht. Lichtenstein, 1880a.
Pemphigus derbesi Licht. (P. pallidus Derbes). Buckton, 3, p. 128.
Pemphigus follicularius Pass. Lichtenstein, 1880a.
Pemphigus folliculoides Licht. Lichtenstein, 1880a.
Pemphigus pallidoides Licht. Lichtenstein, 1880a.
Pemphigus retroflexus Courchet. Lichtenstein, 1880a.
Pemphigus semilunarius Pass. Lichtenstein, 1880a.
Pemphigus semilunoides Licht. Lichtenstein, 1880a.
Pemphigus utricularius Pass. Lichtenstein, 1880a.
Pemphigus utriculoides Licht. Lichtenstein, 1880a.

P. vera L.

Pemphigus coccus Buckton, 1889, p. 141.

P. sp.

Ceratopemphigus zehntneri Schouteden. Schouteden, 1905, p. 188. "on undetermined shrub, possibly a Pistacia."
Pemphigus edificator Buckton. Buckton, 1893, p. 71. "found on what was thought to be a variety of Pistacia terebinthae."
Pemphigus minus Derbes. Zoological Record, 1869, p. 501.

RHUS.

R. diversiloba T. and G.

Rholaposiphum rhois Monell (howardii Wilson?). Essig, 1917a, p. 334.

R. glabra L. Smooth Sumach

Pemphigus rhois (Fitch). Jackson, 1908, p. 203.
Rholaposiphum rhois Monell. Sanborn, 1904, p. 65.

R. semilata Murray.

Melaphis (Schlechtendalia) chinensis (Bell). Baker, 1917j, p. 385

R. trilobata.

Rholaposiphum rhois Monell. Gillette and Bragg; 1915, Jour. Ec. Ent. p. 100.

R. typhina L. Staghorn Sumach.

Pemphigus rhois (Fitch). Jackson, 1908, p. 203.

R. vernicifera.

Arimakia araliae Matsumura. Matsumura, 1917a, p. 363.

R. sp.

Pemphigus cornicularius Pass. (pistaciae L. and Boyer). Kaltenbach, 1874, p. 96.
Pemphigus semilunarius Pass. Kaltenbach, 1874, p. 96.
Pemphigus utricularius Pass. Kaltenbach, 1874, p. 96.
Schlechtendalia sinensis Doubleday. Lichtenstein, La Flore.
Tetraneura (Aploneura) lentisci Pass. Kaltenbach, 1874, p. 97.

CYRILLACEAE. CYRILLA FAMILY.

CYRILLA.

C. racemiflora L.
Pergandeida nigra Wilson. Wilson, 1911, p. 63.

AQUIFOLIACEAE. HOLLY FAMILY.

ILEX. Holly.

I. Aquifolium L.
Aphis ilicis Kalt. Kaltenbach, 1843, p. 88.
Aphis rumicis (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli). van der Goot, 1915, p. 225.

L. sp.
Aphis ilicicola Boisduval. Zoological Record, 1868, p. 416.
Aphis ilicis Kaltenbach. Theobald, 1911-12.
Aphis rumicis Linn. (fabae Kirby) (genistae Scop.) (ulicis Fab?) (euphorbiae Kalt?) (dahliae Mosley) (Cinara rumicis Mosley) (Rumicifex Amyot) (Genistifex Amyot). Buckton, 2, p. 84.

CELASTRACEAE. STAFF TREE FAMILY.

CELASTRUS. Staff Tree.

C. articulatus Thunb.
Aphis celastrii Matsumura. Matsumura, 1917a, p. 356.

C. scandens L. Waxwork. Climbing Bitter-sweet.
Nectarophora sp. Lintner, 1894, p. 512.

EVONYMUS. (Evonymus). Spindle Tree.

E. atropurpureus Jacq. (Waahoo). Burning Bush.
Aphis euonymi Fab. Weed, 1893, p. 298.
Aphis rumicis L. Thomas, 1879, p. 88.
Aphis rumicis L? (euonymi Fab.). Hayhurst, 1909b, p. 98.
Aphis sp. Sanborn, 1904, p. 58.

E. bungeana.
Aphis evonymi Fab. Lingelsheim, 1916a.

E. Europaeus L. European Spindle Tree.
Aphis euonymi Fab. Buckton, 2, p. 72.

E. Maaki.
Aphis rumicis Linn. (?aquilegiae nigra Kittel) (atriplicis Fabricius) (armata Hausmann) (aparines Schrank) (dahliae Mosley) (evonymi Fabricius) (papaveris Fabricius) (?solani Kittel) (thlaspeos Schrank). Schouteden, 1906a, p. 227.

E. verrucosa.
Aphis evonymi Fab. Lingelsheim, 1916a.

STAPHYLEACEAE. BLADDER NUT FAMILY.

STAPHYLEA. Bladder Nut.

S. pinnata L.

Amphorophora ampullata Buckton. (Rhopalosiphum staphyleae Koch?) Buckton, 1, p. 187.

Rhopalosiphum staphyleae Koch. Koch, p. 33. van der Goot, 1915, p. 151.

ACERACEAE. MAPLE FAMILY.

ACER. (Negundo.) Maple.

A. campestris L.

Chaitophorinella lyropicta Kessler. van der Goot, 1915a, p. 373.

Chaitophorus aceris (Linn.) Koch. (Puceron de l'Erable Reaum.) Buckton, 2, p. 126. Passerini, 1863, p. 59.

Chaitophorus granulatus Koch. Buckton, 2, p. 140.

Drepanosiphum acerinum Walker. (aceris Koch). van der Goot, 1915, p. 282.

Drepanosiphum (Aphis) platanoides Schrank. van der Goot, 1915a, p. 285.

Lachnus longirostris Fab? Passerini, 1860, p. 38.

Lachnus longirostris Fab. Kaltenbach, 1874, p. 92.

Lachnus longirostris Pass. Kaltenbach, 1874, p. 562.

Phyllophora testudinacea Fernie. Fernie, 1852, p. 265.

Siphonophora (Drepanosiphum) aceris Koch. Ferrari, 1872, p. 53.

Stomaphis macroryncha Cholodkovsky. Mordwilko, 1899, p. 411.

A. circinnatum Pursh.

Chaitophorus americanus Baker. Baker, 1917f, p. 428.

Chaitophorus sp. (not negundinis and not aceris). Gillette, 1909a, p. 388.

A. japonicum.

Chaitophorus aceris L. Matsumura, 1917a, p. 354.

A. miyabei.

Chaitophorus aceris L. Matsumura, 1917a, p. 354.

A. Negundo (Moench) Koehne. (Negundo aceroides) (Rulac negundo). Box Elder.

Chaitophorus negundinis Thomas. Bragg, 1907, p. 431. Gillette, 1909a, p. 387.

Drepanosiphum braggii Gillette. Gillette, 1907a, p. 393.

Macrosiphum n. sp. Sanborn. Sanborn, 1904, p. 73.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 35.

A. palmatum.

Chaitophorus aceris L. Matsumura, 1917a, p. 354.

Siphocoryne acericola Matsumura. Matsumura, 1917a, p. 359.

A. pennsylvanicum L. Striped Maple. Moosewood.

Chaitophorus aceris (Linn.) Hunter, 1901, p. 86.

A. platanoides L. Norway Maple.

Chaithophorinella lyropicta Kessler. van der Goot, 1915a, p. 373.
Chaitophorus aceris (Fab.) Koch. Passerini, 1863, p. 59.
Chaitophorus aceris (Linn.) Koch (Puceron de l'Erable Reaum.). Buckton, 2, p. 126.
Chaitophorus coracinus Koch. Koch, p. 2.
Chaitophorus lyropicta Kessler (aceris of most American authors) Baker, 1917f, p. 428.
Drepanaphis acerifolii (Thomas). Essig, 1917a, p. 322.
Drepanosiphum platanoides Schrank (Siphonophora platanoides Pass.) van der Goot, 1915, p. 283.

A. Pseudo-Platanus L.

Aphis acericola Walker. Kaltenbach, 1874, p. 91.
Aphis acerina Walker. Kaltenbach, 1874, p. 91.
Aphis platanoides Schrank. Kaltenbach, 1874, p. 91.
Chaithophorinella aceris Koch. (Aphis aceris Linn. pr. p.). van der Goot, 1915a, p. 371.
Chaitophorus coracinus Koch. Schouteden, 1906a, p. 213.
Drepanosiphum acerina (Walker). (D. aceris Koch). Buckton, 1, p. 186.
Drepanosiphum platanoides (Schrank) Koch. Buckton, 1, p. 183.
Myzus gracilis Buckton. Buckton, 1, p. 177.
Phyllophora testudinacea Fernie. Fernie, 1852, p. 265.
Siphonophora aceris Koch. (S. aceris Ferrari). Macchiati, 1883.

A. saccharinum L. Acer dasycarpum Ehrh. (eriocarpum). White or Silver Maple.

Drepanosiphum (Siphonophora) acerifoliae Thomas. Thomas, 1879, p. 47.
Lachnus longistigma Monell. Sanborn, 1904, p. 31.
Longistigma (Lachnus) caryae (Harris). Wilson, 1909c, p. 385.
Melanoxanthus salicti Harris. Williams, 1891, p. 17.
Pemphigus aceris Monell. Hunter, 1901, p. 77.
Pemphigus stamineus Haldeman. Hunter, 1901, p. 79.
Pemphigus tessellata (*acerifolii* Riley). Patch, 1908, p. 484.

A. saccharum Marsh. Sugar or Rock Maple.

Chaitophorus americanus Baker. Baker, 1917f, p. 429.
Drepanaphis? minutus Davis. Davis, 1910a, p. 195.
Pemphigus aceris Monell. Williams, 1891, p. 17.

A. sp.

Aphis perforata Signoret. Lichtenstein, La Flore.
Aphis platanoides Hartig. Hartig, 1841, p. 369.
Aphis villosus Hartig. Hartig, 1841, p. 369.
Chaithophorinella testudinata Thornton. (Aphis aceris Linn. pr. p.) (Chaitophorus aceris Koch pr. p.) (Periphyllus testudo Thornton). van der Goot, 1915, p. 377.
Chaitophorus aceris L. (Chelymorpha phyllophora Clark). Kirkaldy, 1905, p. 417.

Chaitophorus lyropictus Kessler. Mordwilko, 1899, p. 414.
Chaitophorus testudinatus (Thorn.). Oestlund, 1908, p. 131.
Chaitophorus versicolor Koch. Theobald, 1911-12.
Drepanosiphum platanoides Schrank. Wilson, 1909b, p. 349.
Euceraphis betulae (Koch). (Aphis cerasicolens Fitch?). Baker, 1917f, p. 425.
Pemphigus aceris Monell. Jackson, 1908, p. 214.
Periphyllus testudo van der Hoeven. Zoological Record, 1870, p. 472.
Stomaphis graffii Chol. Cholodkovsky, 1894 (1895), p. 405. "Auf ahornwurzeln."

RULAC.

R. negundo. See Acer negundo L.

SAPINDACEAE. SOAPBERRY FAMILY.

AESCULUS. Horse-chestnut.

A. glabra Willd. Fetid or Ohio Buckeye.
Drepanaphis monelli (Davis). Gillette, 1910, p. 371.
Phymatosiphum monelli Davis. Davis, 1909c, p. 197.

A. parviflora Walt.
Chaitophorus aceris (Linn.) Koch. Buckton, 2, p. 126.

MELIANTHUS.

M. major (L).
Rhopalosiphum persicae (Sulzer). Essig, 1917a, p. 332.

BALSAMINACEAE. TOUCH-ME-NOT FAMILY.

IMPATIENS. Balsam.

I. biflora Walt. (fulva). Spotted Touch-me-not.
Aphis impatientis Thomas. Thomas, 1879, p. 98.
Nectarophora fulvae Oestlund. Oestlund, 1887, p. 80.
Siphonophora carnosa var. *impatientis* Williams. Williams, 1910 (1911), p. 74.

I. noli-tangere L.
Aphis balsamines Kalt. Kaltenbach, 1874, p. 84.

I. pallida Nutt. (aurea Muhl.) Pale Touch-me-not.
Aphis impatientis Thomas. Williams, 1891, p. 25.
Siphonophora carnosa var. *impatientis* Williams. Williams, 1910 (1911), p. 74.
Siphonophora fulvae Oestlund. Williams, 1891, p. 25.

RHAMNACEAE. BUCKTHORN FAMILY.

CEANOTHUS. Red-root.

C. cuneatus Nutt.
Aphis ceanothi Clarke. Davidson, 1909, p. 302.

C. hirsutus Nutt.
Aphis ceanothi-hirsuti Essig. Essig, 1911b.

C. integerrimus Hook.
Aphis ceanothi Clarke. Clarke, 1903, p. 251.

C. thrysiflorus Esch.
Aphis ceanothi Clarke. (A. ceanothi-hirsuti Essig). Essig, 1917a, p. 338.

NOLTEA.

N. africana Reichb. Soapbush.
Aphis ceanothi Clarke. (A. ceanothi-hirsuti Essig). Essig, 1917a, p. 338.

PALIURUS.

P. sp.
Aphis paliuri Licht. (ined.) Lichtenstein, La Flore.

RHAMNUS. Buckthorn.

R. Alaternus L.
Aphis frangulae Koch. (rhamni Kalt.) Macchiati, 1883, p. 240.
Myzus rhamni Koyer. Macchiati, 1883, p. 236.
Toxoptera alaterna Del Guercio. Phillips and Davis, 1912, p. 8.
Toxoptera variegata Del Guercio. Phillips and Davis, 1912, p. 8.

R. alpina L.
Aphis frangulae Kalt. (rhamni Kalt.). Kaltenbach, 1874, p. 101.

R. californica Esch. Coffee Berry.
Nectarophora rhamni Clarke. Clarke, 1903, p. 254.

R. Frangula L.
Aphis frangulae Kalt. (rhamni Kalt.). Kaltenbach, 1874, p. 101. Koch, pp. 120, 142.
Aphis frangulae Koch. (rhamni Kalt.). Macchiati, 1883, p. 240.

R. lanceolata Pursh.
Aphis frangulae Kalt. Williams, 1891, p. 7.

R. Purshiana. Cascara sagrada.
Aphis gossypii Glover. Essig, 1917a, p. 338.
Myzus rhamni Boyer. (Macrosiphum rhamni Clarke). Wilson, 1912a, p. 156.

R. sp.
Aphis rhamni Schrank. Lichtenstein, La Flore.
Myzus rhamni Boyer. Lichtenstein, La Flore.

ZIZYPHUS.

Z. Jujuba Lam.

Rhizobius jujubae Buckton. Buckton, 1899b, p. 278. Kirkaldy, 1906, p. 16. "is a Coccid."

VITACEAE. VINE FAMILY.

AMPELOPSIS.

A. quinquefolia. See Psedera.

PARTHENOCISSA.

P. quinquefolia. See Psedera.

PSEDERA. Virginia Creeper. Woodbine.

P. quinquefolia (L.) Greene. (Ampelopsis quinquefolia) (Parthenocissa quinquefolia).

Aphis folsomii Davis. (parthenocissa Williams). Davis, 1911, p. 17.

Aphis setariae Thomas. Gillette and Taylor, 1908, p. 42.

VITIS. Grape.

V. californica Benth.

Phylloxera pemphigoides Donnadieu. Rathay, 1889, p. 67.

V. cordifolia Michx. Frost or Chicken Grape.

Aphis ripariae Oestlund. Williams, 1891, p. 12.

Phylloxera vastatrix Planchon. Williams, 1891, p. 12.

Siphonophora viticola Thomas. Williams, 1891, p. 12.

V. vinifera L.

Aphis vitis Scopoli. Kaltenbach, 1874, p. 95.

Hyalopterus pruni (Fab.) Koch (Prunifex Amyot). Buckton, 2, p. 111.

Hyalopterus pruni (Fab.) Koch (Walker partim). Passerini, 1863, p. 27.

Peritymbia (Phylloxera) vitifolii (Fitch-Riley) (vastatrix Planchon). Borner, 1909b, p. 61.

Phylloxera vastatrix Planchon. Kaltenbach, 1874, p. 775.

Rhizoctonus ampelinus Mokrzecky. Mordwilko, 1909, p. 159. Mokrzecky, 1895-96 (1897), p. 438.

Schizoneura ampelorhiza Del Guercio. Del Guercio, 1900, p. 104.

V. vulpina L. (riparia Michx.). River-bank or Frost Grape.

Aphis ripariae Oestlund. Oestlund, 1887, p. 63.

Phylloxera pemphigoides Donnadieu. Rathay, 1889, p. 66.

V. sp.

Aphis ripariae Oestlund? (?vitis Scopoli). Gillette, 1910, p. 404.

Aphis vitis Scopoli. Sanborn, 1904, p. 56.

Macrosiphum illinoiensis (Shimer) (Aphis) (viticola Thomas). Davis, 1910, Jour. Ec. Ent., p. 486.

Phylloxera vastatrix Planch. (Peritymbia vitisana Westwood). Lichtenstein, La Flore.
Xerampelus vastator Del Guercio. (Rhizaphis vastatrix Planchon). Del Guercio, 1909, p. 80.

TILIACEAE. LINDEN FAMILY.

TILIA. Linden.

T. americana L. Basswood.
Eucallipterus tiliae (Linn.). Gillette, 1910, p. 367.
Longistigma caryae (Harris) Wilson (Lachnus longistigma Monell). (L. platanicola Riley). Wilson, 1909a, p. 385.
Macrosiphum tiliae (Monell). Davis, 1914, Can. Ent. Vol. 46, p. 83.
Pterocallis tiliae (Linn.). Pass. Buckton, 3, p. 36.

T. grandifolia.
Drepanosiphum tiliae Koch. Koch, p. 204.
Pterocallis tiliae (Linn.) Pass. Buckton, 3, p. 36.

T. Europea L.
Pterocallis tiliae Auct. (Aphis) Kalt. Ferrari, 1872, p. 77.
Schizoneura reaumuri Kalt. Kaltenbach, 1843, p. 176.

T. platyphyllos Scop.
Drepanosiphum (Aphis) tiliae Koch. Kaltenbach, 1874, pp. 79, 561.
Pterocallis tiliae (Linn.) Pass. Buckton, 3, p. 36.

T. rubra D. C.
Aphis adducta Walker. Walker, 1849c, p. 34.
Pterocallis tiliae (Linn.) Pass. Buckton, 3, p. 36.

T. tomentosa Moench. Silver Linden.
Eucallipterus tiliae (Linn.). Essig, 1917a, p. 323.

T. sp.
Callipterus (Eucallipterus) tiliae (Linn.). Davis, 1909a, p. 33.
Pachypappa reaumuri Kaltenbach. Theobald, 1915a. "on lime."
Siphonophora tiliae Monell. (Drepanosiphum tiliae Koch?). Thomas, 1879, p. 188.

MALVACEAE. MALLOW FAMILY.

ALTHAEA. Marsh Mallow.

A. narbonnensis Pourr.
Aphis malvae Koch. Passerini, 1863, p. 36.
Siphonophora malvae (Mosley) Pass. (A. pelargonii Kalt.) (A. pallida Walker) (S. pelargonii Koch) (S. diplantherae Koch). Passerini, 1863, p. 14.

A. officinalis L. Marsh Mallow.
Aphis malvae Koch. Passerini, 1863, p. 36.
Aphis urticaria Kalt. Kaltenbach, 1874, p. 70.
Siphonophora artemisiae Boyer.

Siphonophora kochii Ferrari. (S. artemisiae Koch, p. 165). Del Guercio, 1900, p. 168.

A. rosea Cav. Hollyhock.

Aphis malvae Koch. Passerini, 1863, p. 36.

Macrosiphum solanifolii (Ashmead). Houser, 1917a, p. 69.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

Siphonophora malvae (Mosley) Pass. (A. pelargonii Kalt.) (A. pallida Walker) (S. diplantherae Koch). Passerini, 1863, p. 14.

A. sp.

Aphis cucumeris Forbes. Williams, 1891, p. 15.

GOSSYPIUM.

G. herbaceum L. Cotton.

Acyrthosiphon gossypii gossypii Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 173.

Aphis gossypii Glover. (citrifolii Ashmead, in part) (citrulli Ashmead) (cucumeris Forbes) (forbesi Weed?). Pergande, 1895, p. 314.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 35.

G. sp.

Acyrthosiphon gossypii gossypii Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 173.

Aphis malvae Koch. Lichtenstein, La Flore.

Aphis medicaginis Koch. Lichtenstein, La Flore.

Aphis plantaginis Schrank. Lichtenstein, La Flore.

HIBISCUS. Rose Mallow.

H. rosasinensis L.

Aphis gossypii Glover. Fullaway, 1909, p. 40.

H. sp.

Aphis malvae Walker. Williams, 1891, p. 14.

Aphis medicaginis Koch. Macchiati, 1883, p. 255.

Rhopalosiphum dianthi (Schrank). Williams, 1891, p. 14.

LAVATERA.

L. arborea L.

Aphis malvae Koch. Ferrari, 1872, p. 64.

L. assurgentiflora Kellogg.

Rhopalosiphum persicae (Sulzer). Essig, 1917a, p. 331.

L. trimestris L.

Aphis malvae Koch. Passerini, Flora.

MALOPE.

M. trimestri.

Aphis malvae Koch. Passerini, 1863, p. 36.

MALVA. Mallow.

M. moschata L. Musk Mallow.

Siphonophora urtica Koch. (Aphis Schrank). Passerini, 1863, p. 14.

M. parviflora L.

Aphis malvae Koch. Del Guercio, 1909 (1910), Redia VII, p. 298.

Myzus achyrantes Monell. Davidson, 1909, p. 303.

Myzus persicae (Sulzer). Essig, 1911c, p. 600.

M. rotundifolia L. Common Mallow. Cheeses. (neglecta).

Acyrthosiphon skrjabini Mordwilko. Mordwilko, 1914, Faune de la Russie, p. 181.

Aphis cardui Linn. Kaltenbach, 1874, p. 381.

Aphis gossypii Glover. (citrifolii Ashm., in part) (citrulli Ashm.) (cucumeris Forbes) (forbesi Weed?). Pergande, 1895, p. 314.

Aphis malvae Koch. Theobald, 1911-12.

Aphis urticae Fab. Bayer, 1914a, p. 111.

Aphis urticaria Kalt. Kaltenbach, 1874, p. 69.

Chaitophorus sp. Gillette, 1909a, p. 388.

Myzus achyrantes (Monell). Williams, 1891, p. 17.

M. sylvestris L. High Mallow.

Aphis addita Walker. Walker, 1849c, p. 33.

Aphis cardui Linn. (A. onopordi Schrank). Kaltenbach, 1843, p 115.

Aphis malvae Koch. Passerini, 1863, p. 36.

Aphis urticae Fab. Bayer, 1914a, p. 111.

Siphonophora pelargonii (Kalt.) Koch (pallida Walker) (fragariae Walker?) (diplantherae Koch?) (malvae Pass.). Buckton, 1, p. 137.

Siphonophora urticae (Kalt.) Koch. Buckton, 1, p. 144.

M. sp.

Aphis eupatorii Passerini. Del Guercio, 1909 (1910), Redia VII, p. 297.

Aphis gossypii Glover. (malvae Koch) (cucubiti Buckton). van der Goot, 1915, p. 198.

Aphis malvae Mosley. Lichtenstein, La Flore.

Aphis malvae Koch. Ferrari, 1872, p. 64.

Aphis malvae Walker. Buckton, 2, p. 43.

Macrosiphum diplantherae Koch. Theobald, 1913, p. 54.

Macrosiphum malvae (Mosley). Theobald, 1913, p. 150.

Macrosiphum malvicola Matsumura. Matsumura, 1917a, p. 359.

Macrosiphum pelargonii Buckton. Theobald, 1913, p. 54.

Myzus persicae Sulzer. (achyrantes Monell?) (malvae Oestlund?). Gillette and Taylor, 1908, p. 137.

Siphocoryne alboapicalis Theobald. Theobald, 1916f, p. 183.

MALVASTRUM. False Mallow.

M. coccineum. A. Gray. Red False Mallow.

Myzus circumflexum (Buckton) (vincae Gillette). Davis, 1914, p. 122. Can. Ent.

Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

STERCULIACEAE.

THEROBROMA.

T. Cacao L.
Toxoptera theobromae Schouteden. Schouteden, 1906b, p. 38 (2).

TERNSTROEMIACEAE. TEA OR CAMELLIA FAMILY.

CAMELLIA.

C. drupifera (oleifera).
Toxoptera aurantii Boyer. (Aphis) (A. camelliae Kalt.). Ferrari, 1872, p. 62.

C. japonica.
Toxoptera aurantii Boyer. (Aphis) (A. camelliae Kalt.). Ferrari, 1872, p. 62. Essig, 1917a, p. 330.

C. Thea Link.
Ceylonia theaecola Buckton. Experiment Station Record, 1903-4, (1904), p. 277.

C. sp.
Toxoptera aurantii Boyer. (T. camelliae Kaltenbach) (Ceylonia theaecola Buckton). Phillips and Davis, 1912, p. 8.

HYPERICACEAE. SAINT JOHN'S-WORT FAMILY.

HYPERICUM. Saint John's-wort.

H. crispum L.
Aphis chloris Koch. Macchiati, 1883, p. 239.

H. hirsutum L.
Aphis papaveris Fab. Kaltenbach, 1874, p. 269.
Aphis rumicis Linn. Walker, 1850a, p. 19.

H. kalmianum L. Kalm's Saint John's-wort.
Aphis hyperici Monell. Monell, 1879, p. 25.

H. perforatum L. Common Saint John's-wort.
Aphis chloris Koch. Ferrari, 1872, p. 65.
Aphis papaveris Fab. Kaltenbach, 1874, p. 269.
Aphis rumicis Linn. Walker, 1850a, p. 19.

H. prolificum L. Shrubby Saint John's-wort.
Myzocallis hyperici Thomas. Thomas, 1879, p. 109.

H. quadrangulum L.
Aphis papaveris Fab. Kaltenbach, 1874, p. 269.
Aphis rumicis Linn. Walker, 1850a, p. 19.

H. Sarothra Michx. (gentianoides).
Aphis maidi-radicis Forbes. Vickery, 1910, p. 103.

TAMARICACEAE.

TAMARIX.

T. sp.
Aphis rumicis L. (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli). van der Goot, 1915, p. 225.

Aphis tamaricis Licht. Lichtenstein, 1885a, p. CLXXIX.

CISTACEAE. ROCKROSE FAMILY.

CISTUS.

C. crispus L.
Aphis cisti Lichtenstein. Del Guercio, 1909 (1910), Redia VII, p. 297.

C. hirsutus.
Aphis cisti Lichtenstein. Del Guercio, 1909 (1910), Redia VII, p. 297.

C. sp.
Aphis cisti Licht. (ined.). Lichtenstein, La Flore.
Myzus targonii Del Guercio. (M. ribis? Linn., Ferrari). Del Guercio, 1900, p. 152.

HELIANTHEMUM. Rockrose.

H. vulgare Gaertn. Fruct.
Aphis helianthemi Ferrari. Ferrari, 1872, p. 65.

VIOLACEAE. VIOLET FAMILY.

VIOLA. Violet.

V. nuttallii.
Myzus circumflexum (Buckton) (vincae Gillette). Davis, 1914, p. 122. Can. Ent.

V. odorata L. English or Sweet Violet.
Siphonophora malvae (Mosley) Pass. (A. pelargonii Kalt.) (A. pallida Walker) (S. pelargonii Koch) (S. diplantherae Koch). Passerini, 1863, p. 14.

V. tricolor L. Pansy. Heart's-ease.
Aphis certa Walker. Walker, 1849c, p. 32.
Aphis insessa Walker. Walker, 1849c, p. 32.
Aphis violae Scouteden. Schouteden, 1906a, p. 229.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.
Siphonophora malvae Mosley. (A. pelargonii Koch) (A. pallida Walker) (S. pelargonii Koch) (S. diplantherae). Macchiati, 1883, p. 230.

V. sp.
Idiopterus nephrelepidis Davis. Essig, 1911b, p. 541.
Rhopalosiphum tulipaella Theobald. Theobald, 1916f, p. 148.
Rhopalosiphum violae Pergande. Pergande, 1900b, p. 29. Sanborn, 1904, p. 65.

LOASACEAE. LOASA FAMILY.

MENTZELIA.

M. nuda Pursh.
Nectarophora sp. Cowen. Cowen, 1895, p. 125.

M. sp.
Macrosiphum mentzeliae Wilson. Wilson, 1915b, p. 99.

BEGONIACEAE.

BEGONIA.

B. sp.
Aphis gossypii Glover. (citrifolii Ashm., in part) (citrulli Ashm.) (cucumeris Forbes) (forbesi Weed?). Pergande, 1895, p. 314.
Aphis opima Buckton. Theobald, 1911-12.
Macrosiphum begoniae Schouteden. Schouteden, 1901, p. 117. 1906a, p. 238.

CACTACEAE. CACTUS FAMILY.

CACTUS.

C. sp.
Aphis dianthi Schrank. Walker, 1850a, p. 394.

OPUNTIA. Prickly Pear.

O. vulgaris Mill.
Aphis papaveris Fab. Macchiati, 1883, p. 256.
O. sp.
Myzus persicae Sulzer. Gillette and Taylor, 1908, p. 36.

THYMELAEACEAE. MEZEREUM FAMILY.

DAPHNE. Mezereum.

D. sp.
Macrosiphum hibernaculorum (Boyer). Theobald, 1916f.
Siphonophora gnidii Licht. (ined.). Lichtenstein, La Flore.

PIMILEA.

P. sylvatica.
Aphis dianthi Schrank. Walker, 1850a, p. 394.

ELAEAGNACEAE. OLEASTER FAMILY.

ELAEAGNUS.

E. angustifolia L.
Rhopalosiphum hippophaes (Myzus elaeagni Del Guercio, Davis, 1908) Gillette, 1915, Jour. Ec. Ent. Vol. 8, p. 376.
E. argentea Pursh. Silver-berry.
Capitophorus (Myzus) braggii Gillette. van der Goot, 1915, p. 120.
E. sp.
Myzus braggii Gillette. Gillette, 1915, Jour. Ec. Ent. Vol. 8, p. 376.

HIPPOPHAE.

H. rhamnoides L.
Myzus braggii Gillette. Gillette, 1915, Jour, Ec. Ent. Vol. 8, p. 376.

Rhopalosiphum hippophaes Koch. Gillette, 1915, Jour. Ec. Ent. Vol. 8, p. 376.

SHEPHERDIA.

S. argentea Nutt.
Capitophorus shepherdiae G. and B. Gillette and Bragg, 1916, p. 445.

S. arvensis.
Myzus braggii Gillette. Gillette, 1915, Jour, Ec. Ent. Vol. 8, p. 376.

LYTHRACEAE. LOOSESTRIFE FAMILY.

AMMANNIA.

A. sp.
Rhopalosiphum nymphaeae (Linn.). Williams, 1891, p. 5.

CUPHEA. (Parsonsia).

C. Bustamanta Lex. (platycentra).
Aphis malvae Walker. Williams, 1891, p. 8.

C. ignea DC. (Parsonia platycentra).
Aphis malvae Walker. Hunter, 1901, p. 127.

C. sp.
Aphis gossypii Glover. Fullaway, 1909, p. 40.
Siphonophora malvae (Mosley) Pass. (A. pelargonii Kalt.) (A. pallida Walker) (S. pelargonii Koch) (S. diplantherae Koch). Passerini, 1863, p. 14.

LAGERSTROEMIA.

L. indica L.
Myzocallis kahawaluokalani Kirkaldy. Fullaway, 1909, p. 43.

L. sp.
Aphis lagerstroemiae Licht. (ined.). Lichtenstein, La Flore.

LYTHRUM. Loosestrife.

L. Salicaria L. Spiked Loosestrife.
Aphis lythri Schrank. Kaltenbach, 1874, p. 254. Theobald, 1911-12.
Aphis salicariae Koch. Kaltenbach, 1874, p. 254.
Myzaphis lythri Schrank. van der Goot, 1915, p. 185.

PUMICA.

P. Granatum L.
Aphis punicae Pass. Ferrari, 1872, p. 69.

MYRTACEAE.

MYRTUS.

M. sp.
Aphis dianthi Schrank. Walker, 1850a, p. 394.
Rhopalosiphum persicae Sulzer. Lichtenstein, Flore Supplement.

ONAGRACEAE. EVENING PRIMROSE FAMILY.

CLARKIA.

C. elegans Dougl.
Rhopalosiphum persicae (Sulzer). Essig, 1917a, p. 331.

EPILOBIUM. Willow-herb.

E. adenocaulon occidentale Trelease.
Aphis oenotherae Oestlund. Essig, 1917a, p. 341.

E. angustifolium L. (spicatum Lam.) Great Willow-herb. Fireweed.
Aphis epilobii Kalt. Cockerell, 1903b, p. 114.
Nectarophora sp. Cowen. Cowen, 1895, p. 124.

E. Dodonaei.
Aphis plantaginis Schrank. (A. dauci Fab.). Passerini, 1863, p. 40.

E. hirsutum L.
Aphis epilobii Koch. Theobald, 1911-12.

E. montanum L. (pubescens).
Aphis epilobii Kalt. Buckton, 2, p. 71.
Aphis instabilis Buckton. Buckton, 2, p. 95.
Aphis penicillata Buckton, 2, p. 52.
Macrosiphum ulmariae (Schrank) (gei Koch) (urticae Kalt?) van der Goot, 1915, p. 104.
Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

E. parviflorum Schreb.
Aphis epilobii Koch. Theobald, 1911-12.
Aphis instabilis Buckton. Buckton, 2, p. 95.

E. virgatum Cunn.
Aphis virgata Del Guercio. Del Guercio, 1909 (1910), Redia VII, p. 297.

E. sp.
Anuraphis myosotidis Koch. Del Guercio, 1909 (1910), Redia VII, p. 297.
Aphis despecta Walker. Walker, 1849c, p. 53.
Aphis diphaga Walker. Walker, 1852, p. 1042.
Aphis epilobiina Walker. Walker, 1849c, p. 53.
Aphis malvae Walker. Buckton, 2, p. 43.
Aphis oenotherae Oestlund. Clarke, 1903, p. 252.
Aphis pollinosa Walker. Walker, 1849c, p. 52.
Aphis praeterita Walker. Walker, 1849c ,p. 52.
Aphis tincta Walker. Walker, 1849c, p. 51.
Aphis triphaga Walker. Walker, 1852, p. 1041.
Nectarophora epilobii Pergande. Pergande, 1900a, p. 516.

FUCHSIA.

F. coccinea Ait.
Aphis dianthi Schrank. Kaltenbach, 1874, p. 48.

F. globosa Lindl.
Aphis dianthi Schrank. Kaltenbach, 1874, p. 48.

F. gracilis.
Rhopalosiphum dianthi (Schrank) Koch (persicae, Puceron du pecher Morren) (rapae Curtis) (floris-rapae Curtis) (dubia? Curtis) (vastator Smee) (A. persicaecola Boisduval) (Rh. persicae Pass.). Buckton, 2, p. 17.

F. macrantha Hook.
Aphis dianthi Schrank. Kaltenbach, 1874, p. 48.

GUARA.

G. parviflora Doughl.
Nectarophora sp. Cowen. Cowen, 1895, p. 124.
Siphonophora gaurae Williams. Williams, 1910 (1911), p. 80.
Siphonophora gaurina Williams. Williams, 1910 (1911), p. 80.

OENOTHERA. Evening Primrose.

O. bectiana.
Aphis oenotherae Oestlund. Clarke, 1903, p. 252.

O. biennis L.
Aphis gossypii Glover. Sanborn, 1904, p. 57.
Aphis oenotherae Oestlund. Cowen, 1895, p. 121.
Myzus biennis Sanborn. Sanborn, 1904, p. 78.
Myzus oenotherae Williams. Williams, 1910 (1911), p. 65.
Pemphigus oenotherae Williams. Williams, 1891, p. 11.
Siphonophora sp. Williams, 1891, p. 11.

O. caespitosa Nutt.
Aphis oenotherae Oestlund. Cowen, 1895, p. 121.

O. grandiflora Ait.
Aphis oenotherae Oestlund. Essig, 1917a, p. 341.

O. serrulata Nutt.
Aphis oenotherae Oestlund. Williams, 1891, p. 11.

O. sp.
Anoecia oenotherae Wilson. Wilson, 1911, p. 64.
Anoecia querci (Fitch) (Eriosoma querci Fitch) (Rhizobius eleusinis Thos.) (Schizoneura panicola Thos.) (Anoecia corni American authors) (?Anoecia oenotherae Wilson). Baker, 1916, p. 363.

TRAPA. Water Nut.

T. natans L. Water Chestnut.
Rhopalosiphum nymphaeae Koch. Passerini, Flora.

HALORAGIDACEAE. WATER MILFOIL FAMILY.

MYRIOPHYLLUM. Water Milfoil.

M. verticillatum L.
Rhopalosiphum nymphaeae Linn. (Aphis aquaticus Jackson). Davis, 1910a, p. 245.

ARALIACEAE. GINSENG FAMILY.

ACANTHOPANAX.

A. ricinifolium.
Aphis acanthopanaci Matsumura. Matsumura, 1917a, p. 356.

ARALIA.

A. cordata.
Arimakia araliae Matsumura. Matsumura, 1917a, p. 363.

A. hispida Vent. Bristly Sarsaparilla. Wild Elder.
Aphis (Adactynus) aralia-hispida Raf. Rafinesque, 1817.

A. sinensis.
Arimakia araliae Matsumura. Matsumura, 1917a, p. 363.
Arimakia taranbonis Matsumura. Matsumura, 1917a, p. 363.

HEDERA.

H. Helix L. English Ivy.
Aphis hederae Kalt? Essig, 1917a, p. 339.
Aphis hederae Kalt. Buckton, 2, p. 75.
?*Aphis lychnidis* Linn. Buckton, 2, p. 74.
Aphis rumicis Linn. (fabae Kirby) (genistae Scop.) (ulicis Fab?) (euphorbiae Kalt?) (dahliae Mosley) (Cinara rumicis Mosley) (Rumicifex Amyot) (Genistifex Amyot). Buckton, 2, p. 84.
Myzus persicae (Sulzer). Essig, 1911c, p. 600.
Pemphigus hederae Horvath.

UMBELLIFERAE. PARSLEY FAMILY.

AEGOPODIUM. Goutweed.

A. Podagraria L.
Aphis capreae Fab. (A. aegopodii Scopoli). Kaltenbach, 1843, p. 110.
Aphis papaveris Fab. Kaltenbach, 1874, p. 269.
Siphocoryne capreae (Fab.) Theobald, 1912. Rept. Ec. Zool. p. 88.

A. sp.
Aphis rumicis Linn. Walker, 1850a, p. 19.

AETHUSA. Fool's Parsley.

A. Cynapium L.
Aphis papaveris Fab. Kaltenbach, 1874, p. 269.

A. sp.
Aphis rumicis Linn. Walker, 1850a, p. 19.

ANGELICA.

A. sylvestris L.
Aphis angelicae Koch. Koch, p. 52.

Aphis capreae Fab. (A. aegopodii Scopoli). Kaltenbach, 1843, p. 110.
Aphis rumicis Linn. Walker, 1850a, p. 19.
Cavariella gigliolii Del Guercio. Del Guercio, 1909 (1910), Redia VII, p. 298.
Siphocoryne angelicae Del Guercio. Del Guercio, 1909 (1910), Redia VII, p. 298.

A. tomentosa Wats.
Aphis cari Essig. Essig, 1917a, p. 320.

A. sp.
Aphis angelicae Koch. Wilson, 1909b, p. 348.

ANTHRISCUS. Chervil.

A. sylvestris Hoffm. (Chaerophyllum sylvestre).
Aphis pisi Kalt. Kaltenbach, 1874, p. 118.
Macrosiphum ulmariae Schrank (gei Koch) (urticae Kalt?). van der Goot, 1915, p. 104.

A. vulgaris Bernh.
Aphis anthrisci Kalt. Kaltenbach, 1843, p. 112.

A. sp.
Aphis papaveris Fab. Kaltenbach, 1874, p. 288.
Aphis rumicis (evonymi Fab.) (papaveris Fab.) (atriplicis Fab.) (genistae Scopoli). van der Goot, 1915, p. 225.
Siphonophora ulmariae Schrank. Lichtenstein, Flore Supplement.

APIUM.

A. graveolens L. Garden Celery.
Aphis inculta Walker. Walker, 1849c, p. 43.
Aphis lappae Koch. Passerini, 1863, p. 51. Theobald, 1911-12.
Myzus lycopersici Clarke. Davis, 1914, p. 134. Can. Ent.
Rhopalosiphum dianthi Schrank. G. C. Davis, 1893, p. 40.
Siphocoryne avenae (Fab.) (mali Fitch) (prunifoliae Fitch) (avenae Fitch) (annuae Oestlund) (fitchii Sanderson) (Siphonophora avenae Thos. in part). Pergande, 1904a, p. 8.
Siphocoryne pastinaceae Linn. Buckton, 2, p. 24.
Siphocoryne pastinaceae Linn. Cockerell, 1903b, p. 114.

ARCHANGELICA.

A. atropurpurea Hoffm.
Siphocoryne archangelicae Oestlund. Oestlund, 1887, p. 70.

A. sp.
Aphis archangelicae Scop. Lichtenstein, Flore Supplement.

CARUM. Caraway.

C. kelloggii Gray. Wild or Sweet Anise.
Aphis cari Essig. Essig, 1917a, p. 320.
Siphocoryne capreae (Fab.). Essig, 1917a, p. 342.

C. sp.

Siphocoryne capreae Fab. (aegopodii Scopoli) (umbellatorum Koch) (cicutae Koch). van der Goot, 1915, p. 163.

CAUCALIS. (Turgenia).

C. latifolia L. (Turgenia latifolia L.).

Aphis papaveris Fab. (A. fabae Scop.) (A. aparines Schrank). Passerini, 1863, p. 46.

CHAEROPHYLLUM.

C. temulum L.

Aphis capreae Fab. (aegopodii Scopoli). Kaltenbach, 1843, p. 110.

Aphis chaerophilli Koch. Koch, p. 80.

Aphis pisi Kalt. Kaltenbach, 1874, p. 118.

C. tuberosum.

Aphis chaerophylii Koch. Theobald, 1915b.

C. sp.

Siphocoryne capreae Fab. Lichtenstein, La Flore.

Siphonophora ulmariae (Schrank, Walker) (onobrychis Boyer) (pisi Kalt.) (pisi Koch) (gei Koch). Passerini, 1863, p. 13.

CICUTA. Water Hemlock.

C. maculata L. Spotted Cowbane. Musquash Root. Beaver Poison.

Nectarophora sp. Osborn-Sirrine. Hunter, 1901, p. 123.

C. virosa L.

Rhopalosiphum cicutae Koch. Koch, p. 24.

Rhopalosiphum nymphaeae (Linn.) Koch (A. butomi Schrank) (R. najadum Koch). Passerini, 1863, p. 21.

CONIUM. Poison Hemlock.

C. maculatum L.

Aphis capreae Fab. (cicutae Koch). Kaltenbach, 1874, pp. 291, 266.

Aphis capreae Fab. (A. aegopodii Scopoli). Kaltenbach, 1843, p. 110.

Aphis xylostei Schrank (lonicerae Boyer). Kaltenbach, 1874, p. 307.

Hyadaphis xylostei Schrank. (Siphocoryne conii Davidson). Davidson, 1914, Jour. Ec. Ent., Vol. 7, p. 134.

C. sp.

Siphocoryne foeniculi Pass. Lichtenstein, La Flore.

CRITHMUM.

C. maritimum L.

Aphis crithmi Buckton. Buckton, 1886, p. 324.

CRYPTOTAENIA. Honewort.

C. Canadensis DC. (Chaerophyllum canadense).

Aphis chenophyllum-canadense Raf. Rafinesque, 1817.

DAUCUS. (Orlaya). Carrot.

D. Carota L.

Aphis assueta Walker. Walker, 1849c, p. 49.
Aphis carotae Koch. Graells, 1887, p. 11.
Aphis dauci Fab. Graells, 1887, p. 11.
Aphis lappae Koch. Graells, 1887, p. 11.
Aphis papaveris Fab. Graells, 1887, p. 11.
Aphis papaveris Fab. (A. fabae Scop.) (A. aparines Schrank). Passerini, 1863, p. 46.
Aphis plantaginis Fab. Kaltenbach, 1874, p. 56.
Aphis plantaginis Schrank. (dauci Fab.). Ferrari, 1872, p. 66. Theobald, 1916f, p. 183.
Aphis plantaginis Schrank. Graells, 1887, p. 11.
Aphis rumicis Linn. Walker, 1850a, p. 19.
Aphis subterranea Walker. (A. carotae Koch). Buckton, 2, p. 38.
Aphis umbellatarum Kalt. Graells, 1887, p. 11.
Forda dauci Gureau. Graells, 1887, p. 11.
Siphocoryne capreae (Fab.) (not pastinaceae Koch). Theobald, 1912, Rept. Ec. Zool., p. 88.
Siphocoryne foeniculi Pass. Graells, 1887, p. 11.
Siphocoryne pastinaceae Linn. Buckton, 2, p. 24.

D. foliosus Guss.

Aphis carotae Koch. Macchiati, 1883, p. 239.

D. sp.

Aphis umbellatorum Koch. Lichtenstein, La Flore.
Siphocoryne capreae Fab. (aegopodii Scop.) (umbellatorum Koch) (cicutae Koch). van der Goot, 1915, p. 163.

ERYNGIUM. Eryngo.

E. campestre L.

Aphis dispar Walker. Walker, 1848c, p. 2251.
Aphis diversa Walker. Walker, 1848c, p. 2251.
Aphis papaveris Fab. Macchiati, 1883, p. 256.
Aphis rumicis Linn. Walker, 1850a, p. 19.

FALCARIA.

F. vulgaris Bernh. (Sium falcatum).

Aphis sii Koch. Kaltenbach, 1874, p. 271.

FERULA.

F. sp.

Myzus ferulaginis Macchiati. Lichtenstein, Flore Supplement.
Vacuna ferulae Macchiati. Lichtenstein, Flore Supplement.

FOENICULUM. Fennel.

F. vulgare Mill. (officinale ALL.).

Aphis saliceti Kaltenbach. Patch, 1917a, p. 417.
Siphocoryne foeniculi Pass. Clarke, 1903, p. 252.

F. sp.
Aphis capreae Fab. (foeniculi Pass.) (cicutae Koch). Kaltenbach, 1874; p. 275.

HERACLEUM. Cow Parsnip.

H. lanatum Michx.
Aphis heraclii Cowen. Cowen, 1895, p. 120.
Aphis saliceti Kaltenbach. Patch, 1917a, p. 417.

H. mantegazzianum S&L.
Aphis heraclei Cowen. (not Koch). Essig, 1917a, p. 339.

H. Sphondylium L.
Aphis heraclei Koch. Koch, p. 51.
Aphis umbellatorum Koch. Theobald, 1911-12.
Hyalopterus spondylii Koch. Koch, p. 18.
Phorodon galeopsidis (Kalt.) Pass. (Walker ex parte). Passerini, 1863, p. 19.
Siphocoryne capreae (Fab.). Theobald, 1912, Rept. Ec. Zool., p. 88.

H. sp.
Siphocoryne capreae Fab. (aegopodii Scopoli) (umbellatorum Koch) (cicutae Koch). van der Goot, 1915, p. 163.

HYDROCOTYLE. Water Pennywort.

H. sp.
Aphis nymphaeae L. Kaltenbach, 1874, p. 20.

LEVISTICUM. Lovage.

L. sp.
Aphis ligustici Fab. Kaltenbach, 1874, p. 278.

LIGUSTICUM. Lovage.

L. scoticum L. Scotch Lovage.
Aphis ligustici Fab. Kaltenbach, 1843, p. 140.

L. sp.
Nectarophora martini Cockerell. Cockerell, 1903a, p. 171.

MUSENIUM.

M. tenuifolium Nutt.
Aphis penstemonis Williams. Williams, 1910 (1911), p. 54. "Evidently this species."

OENANTHE. Phellandrium.

O. crocata L.
Aphis umbellatorum Koch. Theobald, 1911-12.

O. sp.
Aphis oenanthis Licht. (ined.). Lichtenstein, La Flore.
Aphis papaveris Fab. Kaltenbach, 1874, p. 275.

PASTINACA. Parsnip.

P. sativa L.

Aphis capreae Fab. (A. aegopodii Scopoli). Kaltenbach, 1843, p. 110.

Aphis carotae Koch. Ferrari, 1872, p. 72.

Aphis cicutae Koch. (capreae Fab.). Kaltenbach, 1874, p. 266.

Aphis heraclii Cowen. Cowen, 1895, p. 120.

Aphis robusta Walker. Walker, 1849c, p. 43.

Aphis rumicis Linn. Walker, 1850a, p. 19.

Aphis saliceti Kaltenbach. Patch, 1917a, p. 417.

Rhopalosiphum pastinaceae (L). Koch. (A. capreae Fab.) (R. cicutae Koch). Koch, pp. 41-42.

Siphocoryne capreae (Fab.) (not pastinaceae Koch). Theobald, 1912, Rept. Ec. Zool., p. 88.

Siphocoryne foeniculi Pass. Passerini, 1860, p. 37.

P. sp.

Siphocoryne capreae Fab. (aegopodii Scopoli) (umbellatorum Koch) (cicutae Koch). van der Goot, 1915, p. 163.

PETROSELINUM. Parsley.

P. hortense Hoffm. Common Parsley.

Rhopalosiphum capreae (Fab.) Gillette, 1911, p. 323.

PEUCEDANUM. (Anethum).

P. alsaticum L. (Anethum.).

Aphis papaveris Fab. (A. fabae Scop.) (A. aparines Schrank). Passerini, 1863, p. 46.

P. palustre Moench.

Aphis rumicis Linn. (fabae Kirby) (genistae Scop.) (ulicis Fab?) Euphorbiae Kalt?) (dahliae Mosley) (Cinara rumicis Mosley) (Rumicifex Amyot) (Genistifex Amyot). Buckton, 2, p. 84.

P. sp.

Siphonophora capreae Fab. Lichtenstein, Flore Supplement.

PIMPINELLA.

P. magna L.

Aphis anthrisci Kalt. Kaltenbach, 1874, p. 273.

Aphis pimpinellae Kalt. Kaltenbach, 1874, p. 273.

P. Saxifraga L.

Aphis anthrisci Kalt. Kaltenbach, 1874, p. 273.

Aphis pimpinellae Kalt. Kaltenbach, 1874, p. 273.

SANICULA. Sanicle.

S. canadensis L.

Aphis saniculae Williams. Williams, 1910 (1911), p. 56.

SCANDIX. Venus' Comb.

S. Pecten-Veneris L.
Aphis papaveris Fab. Kaltenbach, 1874, p. 269.

SESELI.

S. sp.
Aphis seselii Licht. (ined.). Lichtenstein, La Flore.

SIUM.

S. falcatum. See Falcaria vulgaris.
S. latifolium L.
Aphis rumicis Linn. Walker, 1850a, p. 19.

THASPIUM. Meadow Parsnip.

T. aurem Nutt.
Aphis thaspii Oestlund. Oestlund, 1887, p. 58.

TORDYLIUM.

T. apulum L.
Aphis carotae Koch. Macchiati, 1883, p. 239.

TORILIS.

T. Anthriscus (L). Bernh. (Caucalis Anthriscus).
Aphis anthrisci Kalt. Kaltenbach, 1874, p. 273.
Aphis papaveris Fab. Kaltenbach, 1874, p. 269.

UMBELLIFERAE.

U. sp.
Acyrthosiphon navozovi Mordwilko, 1914, Faune de la Russie, p. 196.
Siphocoryne pastinaceae Koch (not capreae Fab.). Theobald, 1912, Rept. Ec. Zool., p. 89.

EXPLANATION OF FIGURES

Figure 4. Showing antennae, thoracic wax-plates and hind tarsi, all drawn to same scale.

Prociphilus corrugatans? Spring migrant from *Crataegus* (67-12, 50-04) : *P. alnifoliae?* Spring migrant from *Amelanchier* (27-06, 40-06, 29-10, 16-11) : *P. (Trama) erigeronensis.* Fall migrant from *Solidago* (78-06) ; Apterous female from cultivated aster. *P.* sp. Fall migrants found alighting at base of trunk of Mountain Ash, *Pyrus* sp. (164-12).

Figure 5. Showing antennae, thoracic wax-plates and hind tarsi, all drawn to same scale.

Prociphilus tessellata. Spring migrant from *Acer* (24-11) ; fall migrant from *Alnus* (120-16) : *P. xylostei,* spring migrant from *Lonicera* (53-14, 96-16) : *P. approximatus,* spring migrant from *Fraxinus* (1-16-21) : *P. fraxinifolii,* spring migrant from *Fraxinus* (62-09) : *P. venafuscus,* spring migrant from *Fraxinus* (55-06, 85-11) ; fall migrant (100-08).

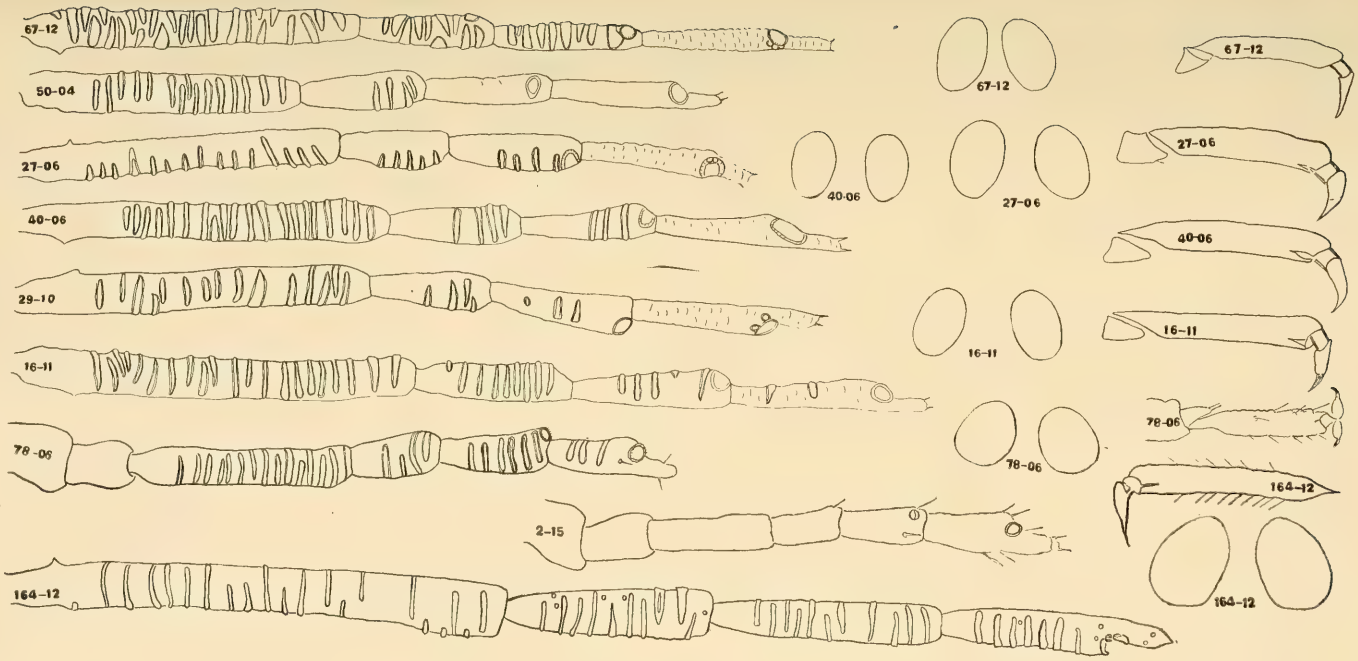
67-12
50-04
27-06
40-06
29-10
16-11
78-06
2-15
164-12
67-12
40-06
27-06
16-11
78-06
164-12
67-12
27-06
40-06
16-11
78-06
164-12

FIGURE 4.

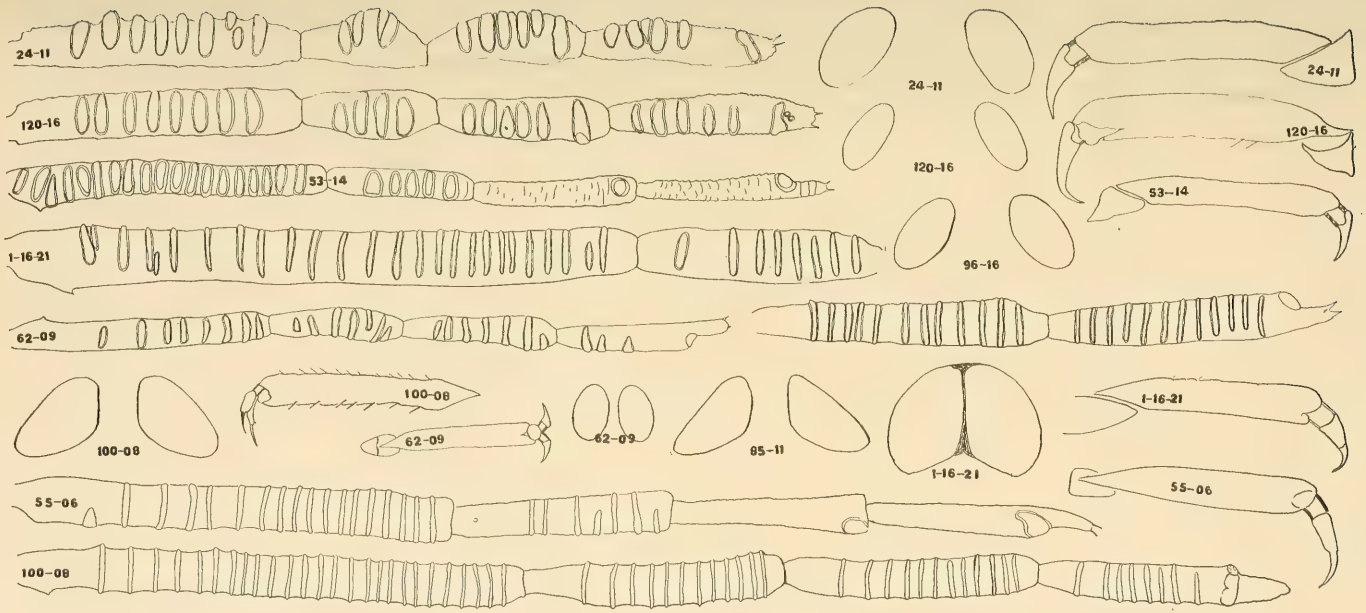
24-11
120-16
53-14
1-16-21
62-09
100-08
55-06
100-08
62-09
62-09
85-11
1-16-21
55-06
24-11
120-16
96-16
24-11
120-16
53-14
1-16-21

FIGURE 5.

BULLETIN 271

APPLE SPRAYING EXPERIMENTS IN 1916 AND 1917*

W. J. MORSE.

This publication constitutes the seventh and eighth annual reports of progress with the apple spraying experiments which are being conducted at Highmoor Farm, Monmouth. In 1916 9 and in 1917 10 different plots were used. Each of these plots consisted of 24 trees, or 4 rows of 6 trees to the row, except plot 1 in 1917 had only 23 trees. All were of the Ben Davis variety.

The above mentioned plots were located in the orchard known as "Ben Davis No. 2", which consists of a solid block of 555 trees. Somewhat less than two-fifths or 216 trees in 1916 and nearly three-sevenths or 239 trees in 1917 were included in the experiments.

The very evident value of arsenate of lead as a preventive of apple scab when used alone, as shown in the results obtained in the 4 previous, consecutive seasons seemed to warrant the testing of this material on a larger scale in 1916. Accordingly one-half of the orchard known as "Ben Davis No. 1" was sprayed with lime-sulphur 20 per cent stronger than standard, plus one pound of dry arsenate of lead to 50 gallons for the blossom bud application.† The two remaining applications consisted of double strength arsenate of lead alone. This duplicates

*A general discussion of the nature and extent of the previously conducted experiments with a summary of the results obtained is given in Bulletin 249 entitled, "Six Years of Experimental Apple Spraying at Highmoor Farm." The results for 1915 are given in Bulletin 252 of this Station.

†By standard dilution lime-sulphur is meant the equivalent of 1 gallon of 33° B. lime-sulphur concentrate to 40 gallons of water. To make the so-called 20 per cent stronger dilution one-fifth more of the concentrate is added to a given amount of water than is used to make the standard dilution.

on a large scale plot 5 of 1916 and plot 3 of 1917. The remainder of the orchard was sprayed with standard dilution lime-sulphur containing one pound of dry arsenate of lead in 50 gallons, thus duplicating plot 1 of 1916 and plot 5 of 1917. This orchard, consisting of over 1200 Ben Davis trees, lies directly across the road from the experimental plots in Ben Davis No. 2.

SPRAYING PROGRAM.

No sprays were used when the trees were dormant. Unless otherwise specified 3 applications were made, the aim being to make the first when the blossom buds were showing pink, the second just after the petals fell, and the third application between two and three weeks after the second. The dates of application each season are given later.

TREATMENT OF PLOTS IN 1916.

Plot 1. Standard dilution lime-sulphur, plus one pound of dry, acid arsenate of lead to 50 gallons.

Plot 2. Same spray treatment as plot 1, but using Friend calyx nozzle.

Plot 3. Standard dilution lime-sulphur plus one pound of arsenate of lime to 50 gallons.

Plot 4. First application omitted, otherwise like plot 1.

Plot 5. Blossom bud application, lime-sulphur 20 per cent stronger than standard dilution, plus one pound of dry, acid arsenate of lead to 50 gallons. Later applications two pounds of dry, acid arsenate of lead alone in 50 gallons.

Plot 6. Dry, acid arsenate of lead alone, two pounds in 50 gallons of water.

Plot 7. Bordeaux mixture, 3-3-50, plus one pound of dry, acid arsenate of lead in 50 gallons.

Plot 8. Sherwin-Williams dry lime sulphur, using for dilution in water 3 pounds of the powder as an equivalent of one gallon of a 33° B. concentrate and adding one pound of dry acid arsenate of lead to each 50 gallons of diluted spray.

Plot 9. Unsprayed check.

Time and Manner of Spray Applications in 1916.

The first spray application was made on the experimental plots on May 20, the second June 5, and the third June 23. Ben Davis orchard No. 1 was sprayed the first time immediately following the experimental plots. On account of weather conditions, which are discussed later in some detail, the completion of the second application was not accomplished till June 13. However, to make conditions uniform, a separate machine and spraying crew were employed in each half of the orchard at the same time. Therefore approximately an equal number of trees were covered with each kind of spray on each day that the work was done. The third application to each half of Ben Davis No. 1 was made on June 26 and 27.

An attempt was made to apply the sprays on the experimental plots with a pressure of 200 pounds, but on account of the failure of the pump to maintain this pressure constantly, 150 to 175 pounds per square inch was used. A type of nozzle which throws a fine mist was used on all but plot 2 where the Friend calyx nozzle was substituted. With this distinctly more spray was applied than with the other type, and some difficulty was experienced when changing from the other form to this in getting the men who handled the spray rods to adjust their movements so as to avoid waste of material, and at the same time do thorough work.

Conditions During and Following the Spraying Season of 1916.

The early part of May was favorable for growth, but cold, rainy weather prevailed for some time previous to the first application. The blossom buds were nearly in condition to spray for 10 days previous to the first application but their development was extremely slow. On the date of application, May 20, all of the buds in each cluster were showing distinctly pink.

The total rainfall recorded at the farm for the month of May was 5.77 inches. The 5 days preceding May 17 were very cloudy and rainy, and 4.09 inches of the total rainfall for the month came during that day and the night following. Some

rain fell on the 18th, and the 19th also was cloudy. Between May 20 and June 5, the date of the second application, there were 7 wholly fair days. Rain fell on 5 different days but this was slight, except on May 30 when .95 of an inch was recorded.

At the time of the second application the petals had not entirely fallen but weather conditions indicated that it was unsafe to delay farther. On this date, June 5, the forenoon was clear but the afternoon was cloudy. Late in the afternoon .05 of an inch of rain fell but this occurred after the plots had been sprayed and the material applied had become dry.

Of the 17 days that intervened between the second and third applications only 3 were recorded as entirely fair. Rain fell on 9 of these days. The total rainfall for June was 4.20 inches, making the combined total for May and June nearly 10 inches. It would seem that the weather conditions just prior to the first application of the sprays and from then on till the third application had been made were extremely favorable for scab infection and development. As will be shown later nearly 39 per cent of the fruit on the unsprayed plot was scabby. Undoubtedly this would have been greatly increased were it not for the fact that the experimental plots were all plowed prior to May 8, thus turning under the diseased leaves of the season before, except those near the bases of the trees, previous to the complete development of the ascospores of the scab fungus upon the leaves, under local climatic conditions.

EFFECT OF THE DIFFERENT SPRAYS ON THE FOLIAGE AND FRUIT DURING THE SUMMER OF 1916.

Plot 1. Standard dilution lime-sulphur and acid arsenate of lead.

A very slight amount of injury to the tips of the leaves was noted on June 22. By the middle of July some burning of the margins was apparent but this was not bad. Russeting of the fruit was quite evident at this time and was plainly greater than on the unsprayed check. These effects did not materially increase during the remainder of the season. After the middle of July a small amount of scab was noted on the leaves but none on the fruit before harvesting.

Plot 2. Same as plot 1, using Friend calyx nozzle.

The record for this plot throughout the season was identical with that for plot 1.

Plot 3. Standard dilution lime-sulphur and arsenate of lime.

The amount of scab and leaf injury was also essentially the same on plot 3 as on plot 1, except that after the first of August the amount of foliage injury on 3 where arsenate of lime had been used with lime-sulphur was considerably more common. This observation was carefully checked since it was unexpected. On the other hand, fruit russeting was less apparent on plot 3 than on plot 1.

Plot 4. Standard dilution lime-sulphur and acid arsenate of lead, first application omitted.

On plot 4, scab on the foliage was as well controlled as on plot 1 where all 3 applications of lime-sulphur and arsenate of lead were made. In comparison with plot 1, plot 4 in the early part of the season showed somewhat less leaf injury.

Plot 5. First application stronger lime-sulphur and acid arsenate of lead; last two, double strength acid arsenate of lead alone.

No leaf injury was recorded. The general condition of the foliage was better than on plot 1 throughout the season, although a slight amount of scab was noted at about the same time that it was observed on the latter.

Plot 6. Acid arsenate of lead alone, double strength.

Scab appeared on the leaves at the same time as on plots 1 and 5 and was evidently somewhat more common. A careful comparison of plot 6 with plot 9, the unsprayed check, showed that on July 18 the number of scabby leaves and fruit were much greater on the latter. It was estimated at that time that the use of arsenate of lead alone as a spray had reduced the amount of scab on the foliage from 90 to 95 per cent.

Plot 7. Bordeaux mixture, 3-3-50, and acid arsenate of lead.

With bordeaux mixture, as in the past, a large amount of leaf injury and defoliation appeared early in the season and much leaf spotting was apparent even up to harvest time. No scab was observed on this plot previous to harvesting.

Plot 8. Sherwin-Williams Co. dry lime-sulphur and acid arsenate of lead.

The appearance of the foliage on this plot did not differ materially from that recorded for conditions on plot 1.

Plot 9. Unsprayed check.

Scab began to appear on the leaves on the unsprayed check before the third spray application and developed rapidly during the first part of July. By the middle of the month there was a large amount on the leaves and it was very common on the fruit. A certain amount of fungous leaf-spot also appeared. Russeting of the fruit, apparently resulting from weather conditions, was evident early in the season. It was noted that this russeted condition was confined to the upper sides of the fruits as they hung on the trees.

THE EFFECT OF THE DIFFERENT SPRAYS ON THE FRUIT IN 1916.

The fruit was harvested and sorted the first week of October. From the experimental plots in orchard No. 2 only the crop from the two central rows or 12 trees was saved for sorting. This was limited to a random sample of 20 barrels where the total crop of these central rows exceeded this amount. The following, Table I, gives the results obtained. The record for orchard No. 1, where plots 1 and 5 were repeated on a large scale was obtained by selecting a random sample of 20 barrels from each half in such a manner that it would represent as nearly as possible the average conditions throughout each part treated in a different manner. These results are given in Table II.

Summary of Results Obtained from Sorting Fruits on Experimental Plots in Orchard No. 2 in 1916.

Plot.	TREATMENT.	Total number of apples.*	Number smooth.	Number scabby.	Number russeted.	Per cent of perfect apples.	Per cent of scabby apples.	Per cent of russeted apples.	Difference in per cent of russeting as compared with check.	Average yield per tree in pounds.
1	Standard dilution lime-sulphur plus 1 pound of dry, acid arsenate of lead to 50 gallons	8197	2678	61	5467	32.67	.74	66.69	46.12	215
2	Friend Calyx nozzle used. Otherwise like Plot 1	8434	3934	159	4359	46.64	1.88	51.68	31.11	265
3	Standard dilution lime-sulphur plus 1 pound dry arsenate of lime to 50 gallons	7417	5351	398	1688	72.14	5.36	22.75	2.18	276
4	Blossom bud application omitted, otherwise like Plot 1	8256	3804	111	4358	46.07	1.34	52.78	32.21	283
5	Blossom bud application, lime-sulphur 20 per cent stronger than standard, plus 1 lb. of dry, acid arsenate of lead in 50 gallons. Calyx and one later application 2 lbs. of dry, acid arsenate of lead in 50 gallons of water	8174	4876	130	3188	59.65	1.59	39.00	18.43	324
6	Dry, acid arsenate of lead alone, 2 lbs. to 50 gallons of water	8548	5302	138	3144	62.02	1.61	36.78	16.21	357
7	Bordeaux mixture 3-3-50 plus 1 lb. of dry, acid arsenate of lead to 50 gallons	4338	1136	19	3183	26.18	.43	73.37	52.80	90
8	Sherwin-Williams Co. dry lime-sulphur, 3 pounds, 11 ounces plus 1 pound dry, acid arsenate of lead to 50 gallons	8469	3664	111	4709	43.26	1.31	55.6	35.03	191
9	Unsprayed check	6091	2931	2363	1253	48.12	38.81	20.57	0	122.5

*Omitting those apples counted twice as both scabby and russeted.

TABLE II.

*Summary of Results Obtained in 1916 from Sorting Fruits in Orchard No. 1.**

TREATMENT	Per cent of perfect apples.	Per cent of scabby apples.	Per cent of russeted apples.
East half. Sprayed like plot 1 of 1916	45.96	0.17	53.86
West half. Sprayed like plot 5 of 1916	56.68	1.24	42.11
Unsprayed Check. Plot 9 in orchard No. 2, 1916	48.12	38.81	20.57

*The per cents for each plot do not always total 100, since certain apples were counted twice as both scabby and russeted.

TREATMENT OF PLOTS IN 1917.

Plot 1. Thomsen's "T. P." arsenate of lead paste alone, 4 pounds in 50 gallons of water.

Plot 2. Corona dry, acid arsenate of lead alone, two pounds in 50 gallons of water.

Plot 3. Blossom bud application lime-sulphur 20 per cent stronger than standard, plus one pound of Corona dry, acid arsenate of lead in 50 gallons. Later applications two pounds of the same arsenate in 50 gallons of water.

Plot 4. Blossom bud application omitted, otherwise like plot 5.

Plot 5. Standard dilution lime-sulphur, plus one pound of Corona dry, acid arsenate of lead in 50 gallons.

Plot 6. Standard dilution lime-sulphur, plus one pound of Thomsen's dry arsenate of lime in 50 gallons.

Plot 7. Standard dilution lime-sulphur, plus two pounds of Thomsen's "T. P." arsenate of lead paste in 50 gallons.

Plot 8. Standard dilution lime-sulphur alone, no arsenical added.

Plot 9. Unsprayed check.

Plot 10. Sherwin-Williams Co. dry lime-sulphur 3 pounds, 11 ounces, and 1 pound of S-W Co., dry, acid arsenate of lead in 50 gallons of water.

The spray combinations used on plots 2, 3, 4, 5, 6, 9 and

10 in 1917 were the same as those used on plots 6, 5, 4, 1, 3, 9 and 8 respectively in 1916.

Two new features were included in the 1917 experiments in order to obtain farther light on the question of the fungicidal action of arsenate of lead in controlling apple scab. Plot 8 was sprayed with standard dilution lime-sulphur alone with no arsenical added, in order to secure a check on this point from another angle. On plots 1 and 7 a different form of arsenate of lead was used than that previously employed.

The writer's first observations indicating the possible value of arsenate of lead in controlling apple scab were made quite unexpectedly in 1912 in connection with this series of experiments. For the most part it has been the custom to utilize for experimental work the same supply as that bought for general use as an insecticide on the farm orchards. In the earlier work no attention was paid to the character of the material used, whether it was acid, neutral, or basic, or a mixture of two or more of these different forms. Samples were saved from the lots used in 1915 and 1916 and analyses of these samples by the Chemical Department of this Station showed that each, although purchased from different manufacturers, was practically of the same composition as a pure acid, or lead hydrogen arsenate. No accurate data is obtainable as to the composition of the materials used in former years. However, a study of the reports of analyses of the same brands as were used in these years, based upon samples taken by the inspection service from goods on sale in the State, shows that in all probability these results showing a fungicidal action on apple scab have been obtained throughout the series of experiments with an acid arsenate of lead, previous to 1917.

"Taken as a whole, the literature indicates that there are at least two common lead arsenates, lead hydrogen arsenate and lead orthoarsenate; that these two compounds are the main components present in ordinary commercial lead arsenate....."*

The authors of the publication just quoted made a very thorough chemical study of the subject of the arsenates of lead used in spraying. Among other things, they attempted to pre-

*Robinson, R. H. and Tartar, H. V. The Arsenates of Lead. Bul. Ore. Agl. Exp. Sta. 128, p. 6, 1915.

pare the orthoarsenate according to the methods recommended by certain other writers. What they obtained, as shown by analysis, did not correspond to a pure orthoarsenate of lead, since it contained more lead and less arsenic than the theoretical figures. Their tests led them to conclude that what they obtained was a distinctly different chemical compound, a new basic lead arsenate of which there was no previous mention in the literature. Furthermore, to quote farther, they state, p. 9: "Without going into any lengthy discussion of the reactions used, the authors will state that *lead orthoarsenate is not formed under the ordinary aqueous conditions employed in the manufacture of commercial lead arsenate, and that it is not a component of the commercial material as has been formerly supposed.* The compound present, which has been represented to be the orthoarsenate, is in reality the basic lead arsenic mentioned above." In a letter to the writer, under date of February 12, 1917, one of the authors (R) just quoted, stated that there are now on the market two brands of arsenate of lead which their analyses show to be of a neutral type and mentioned another which the manufacturers claim to be a neutral arsenate of lead.

Orthoarsenate of lead has been recommended as a safer material for use with lime-sulphur on peaches and has also been advocated for apple spraying. In view of the evidence cited above it would not be strange if some confusion should exist in the minds of those who are conducting spraying experiments as to what form of arsenate of lead they were using. In fact letters from 3 different horticulturists to the writer, two from Canada and one from another state, specifically stated that a certain brand put out by one concern is a neutral of orthoarsenate of lead. The chemists of this Station examined two samples of this brand in 1914 and 3 samples in 1915, taken in the open market in Maine. The arsenic content of these samples was such that they could have been by no possibility a neutral arsenate. The analyses do indicate that they were, in reality, fairly pure and consequently high grade acid arsenates. It is significant to note that the records indicate that the word "neutral" appeared on the label in 1914 and not in 1915. Moreover when asked in the winter of 1917 if they could furnish us with another form for experimental work this firm replied that

they could supply us only with what they claimed to be, and the Station's analysis showed to be, a very high grade acid arsenate.

COMPOSITION OF MATERIALS USED IN 1917.

Through the cooperation of the Chemical Department of this Station analyses were made of certain materials, particularly the arsenicals used in the 1917 experiments. The dry arsenate of lead furnished by the Corona Chemical Company and the Sherwin-Williams Company showed a chemical composition of very closely the right proportions to conform to and but slightly lower in As_2O_5 and PbO than is the theoretical requirement for pure acid arsenate of lead.

The "T. P." arsenate of lead obtained from the Thomsen Chemical Company was in a paste form but since this discussion is concerned entirely with the type of the arsenate of lead used in the experiments the material, for convenience in making comparisons, was reduced to nearly a water-free basis before the analysis was made. The moisture content of the final or dry sample used was 0.22 per cent. On this basis 22.43 per cent As_2O_5 and 74.01 per cent PbO were found, the ratio being 1:3.299. Robinson and Tartar* point out that the theoretical ratio between As_2O_5 and PbO in an acid arsenate is 1:1.945 and in a neutral arsenate is 1:2.911. In their attempts to prepare a neutral or orthoarsenate of lead, an analysis of the samples obtained gave a ratio between the two compounds mentioned varying from 1:3 180 to 1:3.196. As has already been stated they expressed the opinion that arsenate of this composition is a basic and not an orthoarsenate. It will be noted that the ratio given by the analysis of the "T. P." arsenate shows even a greater deviation from the theoretical composition of an orthoarsenate.†

**l. c.* p. 9.

†No attempt has been made to look up the analyses of this brand of arsenate of lead which have been made by the inspection service maintained by different states but one analysis of a sample in 1917 has come to the writer's attention. This is reported on p. 9 of Bulletin 315 of the New Jersey Agricultural Experiment Station. A sample of "Orchard Brand Powdered Arsenate of Lead—T. P." is reported as carrying 24.26 per cent of arsenic oxide and 71.72 per cent lead oxide. The ratio here corresponds fairly closely to the theoretical for a neutral or orthoarsenate.

In order to obtain as much light as possible upon the composition of this material certain definite questions regarding this point were asked of the manufacturers. The following is quoted from a statement made by their chemist:

"The T. P. product will contain about 3% to 5% $PbHAsO_4$. The remaining As_2O_5 and PbO are combined as either a mixture of $Pb_3(AsO_4)_2$ and some new basic arsenate, or entirely as the new basic arsenate, the composition of which, as far as the writer knows, has not been definitely determined."

The writer farther stated that while he was not familiar with the article of Robinson and Tartar that this new basic arsenate probably corresponds with the one they described.

TIME AND MANNER OF SPRAY APPLICATIONS IN 1917.

The dates of application in 1917 were May 30, June 20 and July 9, which shows a very abnormal situation. Previous to this the latest date for making the so-called "pink-bud" application, during 7 consecutive seasons, was May 24, and the earliest May 8. In the same period the second date, as determined by the fall of the petals, has been quite constant, usually not earlier than the third and not later than the sixth of June.

The method of application was the same as in 1916 except that a pressure of 200 pounds was constantly maintained by the spray pump.

CONDITIONS DURING AND FOLLOWING THE SPRAYING SEASON OF 1917.

The entire growing season, on the whole, was uncommonly cold, cloudy and wet. The very slow development of the flowers, and consequent delayed spray applications, was due to unseasonably cold, wet weather. Between the first and second applications of spray something over 9 inches of rainfall was recorded at the farm. On account of a leak which developed in the rain gage it was impossible to get an accurate record of the rainfall for June, but as near as could be determined it was over 10 inches. The observer estimates that over 4 inches fell in a single storm, June 10-12. The combined rainfall for May and June was about 12 inches. These conditions made it extremely difficult to control scab effectively.

EFFECT OF THE DIFFERENT SPRAYS ON THE FOLIAGE AND FRUIT DURING THE SUMMER OF 1917.

No evidence of scab could be observed on the foliage and fruit on any of the plots at the time of the second application, June 20. The orchard was not visited again till July 9 when the disease was present on the leaves in varying amounts on all plots. The following is a summary of the record on each for the season.

Plot 1. "T. P." arsenate of lead alone, double strength.

Scab became common on the leaves and fruit as the season advanced, but was very plainly less prevalent than on the unsprayed check. Relatively light leaf-spotting appeared about August 1 and a month later this was fairly common but there was little evidence of burning of the margins of the leaves.

Plot 2. Corona acid arsenate of lead alone, double strength.

The amount of scab was similar to the preceding, but leaf injury was somewhat more common.

Plot 3. First application stronger lime-sulphur and acid arsenate of lead; last two, double strength Corona acid arsenate of lead alone.

Throughout the season it was plainly evident that scab was more efficiently controlled on this plot than on the two preceding, which were sprayed with the two different forms of arsenate of lead alone. There was also less scab here than on plot 5, which received the standard treatment with combined lime-sulphur and arsenate of lead. Leaf injury was relatively somewhat more common than on the other two plots mentioned.

Plot 4. Standard dilution lime-sulphur and acid arsenate of lead; first application omitted.

Somewhat more scab was recorded for this plot during the summer than for plot 5. The most striking thing about it was the small set of fruit. As the fruit neared maturity the contrast shown by the number of apples on the trees on plot 4 as compared with those on plots 3 and 5 on either side was very evident. Unexpectedly, leaf injury was more common than on plot 5.

Plot 5. Standard dilution lime-sulphur and acid arsenate of lead.

The conditions observed on this plot throughout the season did not differ materially from those on plot 2.

Plot 6. Standard dilution lime-sulphur and arsenate of lime.

The records here were practically identical with those for plots 2 and 5.

Plot 7. Standard dilution lime-sulphur and "T. P." arsenate of lead.

The general condition of the foliage on plot 7 was decidedly better than was the case on any other in the series. At the close of the season only relatively small amounts of scab could be seen on the foliage and fruit and very little leaf injury was present.

Plot 8. Standard dilution lime-sulphur; no arsenical added.

The amount of scab on the leaves appeared about the same as on plots 2, 5 and 6. Only a very little leaf spotting and burning was observed and this was not apparent at the close of the season.

Plot 9. Unsprayed check.

Scab was very prevalent on the unsprayed plot from the time it first appeared. Injury to the margins of the leaves was also noted.

Plot 10. Sherwin-Williams Co. dry lime-sulphur, plus acid arsenate of lead.

Except for possibly slightly more leaf injury, very little difference could be detected between the condition of the foliage on the trees on this plot and on plot 5 where, on the last named, ordinary home-prepared lime-sulphur and a similar amount of arsenate of lead were used.

EFFECT OF THE DIFFERENT SPRAYS ON THE FRUIT IN 1917.

On account of the small crop, the sample taken for sorting included the fruit produced on the inside of the two outside rows as well as the middle two rows of each plot. Except on plots 4, 8, 9, and 10 from which 2, 8½, 5¼, and 5½ barrels respectively were obtained the sample varied from 12 to 20 barrels. The following Table III gives the results obtained from sorting.

Summary of Results Obtained from Sorting Fruits. 1917.

Plot.	TREATMENT.	Total number of apples.*	Number smooth.	Number scabby.	Number russeted.	Per cent of perfect apples.	Per cent of scabby apples.	Per cent of russeted apples.	Difference in per cent of russeting as compared with check.	Average yield per tree in pounds.
1	Thomsen's "T. P." arsenate of lead paste alone, 4 lbs. in 50 gallons of water	9651	2535	7031	255	26.26	72.85	2.64	−4.72	111
2	Corona dry, acid arsenate of lead, 2 lbs. in 50 gallons of water	6835	1186	5605	135	17.35	82.00	1.97	−5.39	79
3	Blossom bud application lime-sulphur 20 per cent stronger than standard, plus 1 lb. Corona dry, acid arsenate of lead in 50 gallons. Later applications 2 lbs. of the same arsenate of lead alone in 50 gallons of water	9704	4032	5503	258	41.54	56.70	2.65	−4.71	125
4	Blossom bud application omitted, otherwise like plot 5	1163	134	1012	69	11.52	87.01	5.93	−1.43	15
5	Standard dilution lime-sulphur, plus 1 lb. Corona dry, acid arsenate of lead in 50 gallons	7240	2162	4893	380	29.86	67.58	5.24	−2.12	95
6	Standard dilution lime-sulphur, plus 1 lb. Thomsen's dry arsenate of lime in 50 gallons	7595	3731	3660	325	49.12	48.18	4.27	−3.09	124
7	Standard dilution lime-sulphur, plus 2 lbs. Thomsen's "T. P." arsenate of lead paste in 50 gallons	8703	4308	3877	713	49.50	44.54	8.19	0.83	142
8	Standard dilution lime-sulphur alone, no arsenical added	4168	1600	2188	607	38.38	52.49	14.56	7.20	59
9	Unsprayed check	4061	36	3995	299	.89	98.37	7.36	0.00	39
10	Sherwin-Williams Co. dry lime-sulphur, 3 lbs. 11 oz., and 1 lb. S-W Co. dry, acid arsenate of lead in 50 gallons of water	3509	1158	1950	673	33.00	55.57	19.17	11.81	40

*Omitting those apples counted twice as both scabby and russeted.

DISCUSSION OF RESULTS.

As has already been pointed out, the weather conditions both years, particularly during the early part of the season when infection occurs and the distribution of scab is most rapid, were exceedingly favorable for the development of the disease. The fact that nearly 39 per cent of the fruit on the unsprayed check plot in 1916 and over 98 per cent in 1917 were classed as scabby indicates that both seasons, particularly the last, provided conditions for a rigorous test of the spray mixtures used. The orchards were plowed early in May 1916, thus turning under the leaves of the previous season, except those that lay near the bases of the trees, before the ascospores of the fungus had developed. This undoubtedly materially reduced the possibilities of primary scab infection that spring. General observations indicated that scab developed with greater severity on unplowed and unsprayed orchards near by than it did on the unsprayed check plot, but no accurate data were obtained on this point.

It will be noted that during the first season under discussion every spray material used showed marked and some of them excellent scab control. On the other hand, the efficiency of the same materials in 1917 was exceedingly low. In the light of past experimental spraying work in the same orchard it is believed that the very abnormal weather conditions during the early part of the season, which materially delayed the first two applications, are primarily responsible for the poor results obtained the second season. Undoubtedly in practical work an additional, earlier application of a fungicidal spray when the leaves are about one-fourth inch in diameter, such as has been recommended by Brittain and Sanders as the result of their work in Nova Scotia, would be very effective in Maine under such conditions as these. This will be discussed farther under the topic, "The importance of the blossom bud application."

FRUIT RUSSETING ON THE PLOTS AS A WHOLE.

Much of the following discussion with reference to the desirable and undesirable qualities of certain spray combinations with regard to russeting would not apply in the same degree to a number of commercial varieties of apples. Attention is again called to the fact that the skin of the fruit used

in these experiments is particularly sensitive to any irritating influence, especially when the apples are small. This has been demonstrated repeatedly for the climatic conditions which prevail where the experimental orchard is located. In normal seasons a slight amount of russeting has always appeared on the unsprayed check plot and in the past this has been increased in varying degree by the different spray mixtures used. A comparison of the results obtained with reference to russeting, during the two seasons present some interesting and unexpected contrasts.

One of the most prominent facts shown by the tabulated results for 1916 is the relatively high per cent of russeted fruit on each plot, even on the unsprayed check which showed 20.57 per cent. This duplicated a condition which prevailed in 1913 when over 31 per cent of russeted fruit was obtained on the plot upon which no insecticide or fungicide was applied, and the different sprays produced a corresponding increase in amount. Although this russeting was materially increased by different sprays it is evident that much of it must be attributed to natural causes. The weather conditions of 1913 and 1916 were remarkably similar in many ways, and differed from *previous* seasons in which abnormal fruit russeting did not occur. In 1913 the first spray application was followed by a month of unseasonably, cold weather, with frosts and cold, north-west winds, associated with much cloudiness and heavy rainfall. In 1916 similar conditions prevailed previous to and following the first application. This was also followed in 1916 by heavy rains and continuous cloudy weather in June after the second application, which was not the case in 1913.

The amounts of russeting obtained in 1917 are contrary, in two respects, to what might be expected as the result of previous experience. While the weather conditions during the early part of the season were similar to those in two years mentioned above the amount of russeting was relatively slight as compared with that obtained then. What is still more remarkable, it will be seen that on 6 sprayed plots out of 9 there was actually less russeted fruit than on the unsprayed check. Only twice in the 4 preceding seasons, during which an unsprayed check plot had been kept for comparison, did anything like this occur. Each time it was recorded on a single plot and the dif-

ferences were slight, or within the limits of experimental error. The writer has no explanation to offer as to cause of these unexpected results. It is true that the dates of application in 1917 were much later than in 1913 and 1916, but they were made at a corresponding stage of the development of the flowers and fruit.

LIME-SULPHUR VS. BORDEAUX MIXTURE.

There has been, perhaps, little excuse to continue to include a plot sprayed with bordeaux mixture in these series of experiments. It was omitted in 1917. In the past it was retained solely for the purpose of serving as a check, along with the one sprayed with lime-sulphur and the unsprayed plot, for a standard of comparison with the other spray combinations. Regardless of seasonal conditions bordeaux mixture has invariably caused much damage to the Ben Davis variety on this farm, both by leaf injury and fruit russeting. Although almost perfect scab control has been secured, the per cent of perfect apples has been so reduced on account of russeting that spraying with bordeaux mixture has actually resulted in a loss rather than a gain. This is well illustrated when the record of plots 7 and 9 in 1916, Table I, are compared. Only a little more than half as many merchantable apples were obtained on plot 7 as on the one where no spray whatever was used.

In 1916, as in the past, lime-sulphur combined with arsenate of lead gave efficient scab control, as is shown by comparison of plots 9 and 1 where the amount of scab was reduced from nearly 39 per cent to less than 1 per cent. On the other hand the large amount of russeting which occurred where the lime-sulphur and arsenate of lead was used reduced the percentage of merchantable apples to less than was obtained on the check plot. In 1917, while scab control was far from efficient, the percentage of merchantable apples, as shown by comparing plots 5, 7 and 9, Table III, was increased approximately 29 and 49 per cent respectively by the lime-sulphur and arsenate of lead treatment.

The records over a series of years indicate that in most seasons, even on a variety like the Ben Davis where the skin of the fruit is easily injured, spraying with lime-sulphur combined with moderate amounts of acid arsenate of lead is profit-

able. It is only in exceptional seasons where a large amount of russeting occurs as in 1916, that there is little real gain, and actual loss of merchantable fruit may occur. These observations apply only to the value of the fruit as influenced by the use of lime-sulphur and do not take into account the effects of the spray in improving the general health of the tree, which cannot be overlooked in practical work.

It should be understood also that the above statements with reference to both bordeaux mixture and lime-sulphur refer only to the selling value of the fruit of the variety under consideration. With any variety equally subject to scab and less susceptible to spray injury there is plenty of evidence that spraying with either fungicide combined with acid arsenate of lead is, as a rule, exceedingly profitable. As a matter of fact if apples were sold on the basis of quality and not on the appearance of the skin, those obtained on the plots sprayed in 1916 with lime-sulphur and bordeaux mixture were nearly 100 per cent perfect. The only imperfections were the russeting of the skin. The fruit on these sprayed plots was larger and in every way more healthy than on the unsprayed check.

The single trial in 1917 of the "T. P." arsenate of lead combined with lime-sulphur indicates that as good or even better results may be obtained with this material than with the acid arsenate used in like manner. It will be seen on comparing plots 7 and 5, Table III, that on account of more efficient scab control approximately 20 per cent more merchantable apples were obtained where the "T. P." arsenate was substituted for the acid arsenate. It is interesting to note, however, that while the difference was slight, less russeting was obtained by the use of the acid arsenate. Compare also plots 1 and 2, Table III, where these two forms of arsenate of lead were used alone, double strength.

THE EFFICIENCY OF THE FIRST SPRAY APPLICATION.

The results here reported are for the fifth and sixth seasons in which a plot has been included in these spraying experiments where the application of lime-sulphur when the blossom buds were showing pink was omitted. It will be noted on comparing the figures obtained in 1916 on plot 4 with those for plot 1, Table I, that scab control was only slightly better

on the latter plot where all 3 applications were made. A more striking fact is that where the pink bud spray was omitted nearly 13.5 per cent more merchantable apples were obtained, due to the greater freedom from russeting.

The experience of the season of 1916 tends to confirm the opinion expressed by the writer in Bulletin 249 that it is not necessarily a foregone conclusion, under Maine conditions, that the spraying operations of the year are doomed to utter failure if no spray is applied till after the petals fall. Previous to 1917 in only one year out of 5 has anything approaching this been the case on these experimental plots. Three years out of 5 very little difference in scab control was obtained on the plots with and without the first application. The remaining season there was a little over 3 per cent increase in scab as a result of omitting the pink bud spray. On account of increased russeting, less merchantable apples were obtained 3 years out of 5 where all 3 applications of lime-sulphur were made. Doubtless this would not have been the case with a variety of apples where the skin of the fruit is less tender than that of the Ben Davis.

It will be seen on comparing the per cents of scabby apples obtained on plots 4 and 5 in 1917, Table III, that this was a season where the omission of the pink-bud application was a matter of much importance for over 19 per cent more scab was obtained by so doing. It strongly emphasized the fact, not always recognized by growers, that spraying is really a form of insurance and that even though the records obtained in this series of experiments so far, indicate that the pink-bud application may be omitted in certain seasons with little or no increase in the amount of scab resulting, such an omission may be a matter of considerable importance in controlling the disease.

It is not the writer's intention to imply by any of the above discussion that the results secured indicate that the pink-bud spray is ever unnecessary in Maine and that it ever should be omitted from the spraying program. It is intended to emphasize the fact that, if for any good reason no spray is applied till the petals fall, the chances of preventing infection, as shown by the results obtained over a series of years, are still good if the remaining applications of spray material are made as usual. Such would not have been the case in 1917 and undoubtedly still another fungicidal spray applied about the middle of May,

some days before the blossom buds showed pink, would have been advantageous. However, throughout this series of experiments, covering 8 successive seasons, no evidence has been obtained to indicate that under Maine conditions the period for making any single applicaton of spray for the successful control of apple scab is limited to a single day, or even two or three days, although the pink-bud and calyx applications should be made as closely to the specified times as possible.

ARSENATE OF LEAD AS A FUNGICIDE.

While previous results seemed to furnish fairly conclusive data relative to the fungicidal value of acid arsenate of lead in preventing apple scab, these here reported represent much more severe tests. In comparing plots 6 and 9 in 1916, Table I, it will be seen that by the use of arsenate of lead alone the amount of scab on the fruit was reduced from nearly 39 to a little over one and one-half per cent. This was the fifth consecutive season that the figures obtained from experimental tests in this orchard have shown that arsenate of lead alone has materially reduced the amount of scab on the fruit. Scab control on plot 6 in 1916 was nearly as efficient as was obtained on plot 1 where the standard lime-sulphur and arsenate of lead treatment was used. A more important fact which should not be overlooked is that with the arsenate of lead used alone nearly twice as many merchantable apples were obtained, due to the greater freedom from russeting.

A comparison of the results obtained on plots 2, 5 and 9 in 1917, Table III, also indicated that arsenate of lead showed considerable fungicidal value, even under the severe conditions of that season. However, the results were plainly much inferior to those obtained with the combined lime-sulphur and arsenate of lead spray.

ACID ARSENATE VS. "T. P." ARSENATE OF LEAD.

No definite conclusions can be drawn from the work of a single season but the records obtained in 1917 on plots 1 and 2, Table III, indicate that the "T. P." arsenate of lead possesses fully as great if not greater fungicidal properties than the acid arsenate since about 9 per cent less scab was obtained with it.

This view is strengthened by the fact that on plot 5 where the acid arsenate was used with lime-sulphur about 23 per cent more scab was obtained than there was on plot 7 where the "T. P." arsenate was used in like manner.

LIME-SULPHUR WITH NO ARSENICAL ADDED.

The marked fungicidal value of arsenate of lead when used alone suggested that it might contribute materially to the fungicidal qualities exhibited by the combined lime-sulphur and arsenate of lead spray. To secure data on this point in 1917 plot 8, Table III, was included in the experiments. The fact that about 52.5 per cent of scabby apples were obtained on this plot and only about 44.5 on plot 7 where the "T. P." arsenate was added to the same strength lime-sulphur might indicate that there is something in this hypothesis were it not for the fact that over 67.5 of scabby fruit was obtained on plot 5 where the acid arsenate was used in like manner. It will also be seen on comparing the figures obtained on plots 1 and 2 with those for plot 8 that lime-sulphur, standard strength used alone was decidedly more efficient than double strength arsenate of lead, both forms, used alone. No definite conclusions shou'd be drawn from this single trial, however.

MODIFIED SPRAYING PROGRAM.

The modified spraying program such as was carried out on plot 5 in 1916, Table I, and plot 3 in 1917, Table III, in which lime-sulphur 20 per cent stronger than standard is used for the pink-bud spray, followed by double strength arsenate of lead for the two later applications, has now been tested for 4 consecutive seasons, in comparison with plots sprayed all 3 times with standard lime-sulphur and arsenate of lead, and double strength arsenate of lead alone, respectively. In addition plots 1 and 5 of 1916 were duplicated on a large scale in the orchard known as Ben Davis No. 1, see Table II.

The results obtained in scab control in 1916 on the experimental plots and in the large orchard were very uniform for each kind of treatment. Plot 1 and the east half of Ben Davis No. 1, sprayed according to the standard program, produced

.74 and .17 per cent of scabby apples respectively. Plot 5 and the west half of Ben Davis No. 1, sprayed according to the modified program, produced 1.59 and 1.24 per cent of scabby apples respectively. The slightly better results obtained with both methods of treatment in No. 1 may be due to the fact that the trees are smaller here with more open spaces. allowing better ventilation and better penetration of sunlight. In each instance a greater per cent of merchantable apples was obtained with the modified spraying program, than from 3 applications of the standard lime-sulphur and arsenate of lead combination . This was directly due to the smaller amount of fruit russeting with the former.

It has already been shown by comparison of the results obtained on plots 1 and 4 in 1916 that omission of the pink bud spray entirely, did not lead to a material increase of scab. Therefore it is not surprising that the amount of scabby fruit, obtained with the modified spraying program on plot 5, or 1.59 per cent, should be practically the same as where double strength arsenate of lead was used alone throughout the season on plot 6, which was 1.61 per cent.

These results and those previously secured which have to do with the same subject, taken together with those obtained in 1917, illustrate very well the difficulties which may arise if in apple spraying experiments one attempts to draw definite conclusions from work covering only a few seasons. It might seem that the necessity for using the stronger lime-sulphur for the pink-bud spray is not indicated by the results secured in 1916 or in the 4 or 5 previous seasons. During this period plots sprayed with the standard combinations of lime-sulphur and arsenate of lead showed but little better scab control than where the pink-bud application was omitted entirely. It is also true that 3 applications of double strength arsenate of lead alone produced during successive seasons very efficient scab control when compared with standard dilution lime-sulphur containing one pound of dry arsenate of lead in 50 gallons. In spite of all of this the writer has not felt ready to advocate that two or even three applications of double strength arsenate of lead alone should be depended upon for the control of apple scab in commercial orchards in Maine. In view of the fact that in *some* seasons in Maine, and in all seasons according to the expressed

opinions of observers in some other parts of the country, the period just before blossoming is especially favorable for primary scab infection, it seems wise to advocate the use of combined lime-sulphur and arsenate of lead at this time. We have shown that a lime-sulphur spray containing 20 per cent more than the standard dilution is more efficient in scab control and causes practically no more fruit russeting than the latter. Also it is evident from experiments made in past years that the majority of the fruit russeting produced by lime-sulphur comes from the calyx and later applications.

Except for the first sentence the above paragraph stands essentially as it was written before the results of the 1917 experiments, here included, were obtained. A comparison of the per cents of scabby apples and merchantable fruit produced on the various experimental plots in 1917, Table III, seems to justify the position taken.

It is interesting to note, also, that the modified spraying program used on plot 3, Table III, when compared with the standard lime-sulphur and arsenate of lead treatment used on plot 5 shows a decrease of almost 11 per cent in the amount of scab produced and an increase of over 11.5 per cent in the amount of merchantable fruit obtained. In fact it was only where arsenate of lime and the "T. P." arsenate of lead were used, plots 6 and 7, that a greater percentage of merchantable apples were produced in 1917, than was obtained on the plot where the modified spraying program was used. In view of the fact that on the unsprayed check over 98 per cent of the fruit was scabby and less than one per cent was merchantable, a more severe test of the modified spraying program could hardly be imagined.

The Ben Davis and the Baldwin varieties predominate in the orchards at Highmoor Farm. Fruit russeting on both of these varieties, when sprayed in the ordinary manner, as a rule materially reduces the value of the crop produced each season. For this and the following reasons the modified spraying program has been adopted there for the present for the commercial orchards. Its relative efficiency in controlling scab has been shown by the results obtained on the half of Ben Davis No. 1 so sprayed in 1916, and upon the experimental plots in repeated seasons. A more important consideration is that with this modi-

fied spraying program fruit russeting has been materially reduced and the percentage of merchantable fruit consequently increased. Similar results were reported to the writer by a few of the leading apple growers of the State who sprayed parts of their orchards in this manner in 1916.

CALYX NOZZLE.

It has been the aim in these series of experiments to develop more efficient spraying methods as applied to local conditions and not primarily to make comparative tests of materials and appliances. Nearly every year, however, it has seemed wise for one reason or another to include something of this kind, usually limited to a single plot. The Friend calyx nozzle was used on plot 2 on account of the fact that instances had been called to the writer's attention where it was stated that better control of scab was obtained from lime-sulphur applied with it than with the ordinary mist type of nozzle.

In comparing the results secured in 1916 on plots 1 and 2, Table I, it will be seen that slightly better scab control was obtained with the mist type of nozzle than with the semi-drive type. On the other hand, there was a difference of some 15 per cent in the amount of russeting, in favor of the latter. Whether this has any special significance it is impossible to say at present.

DRY LIME-SULPHUR.

There was nothing in the action of this material either season to indicate that it is anything different from what the manufacturers claim it to be. In fact the results secured with it, at the strength used, were quite similar to those secured with dilutions of home-made, liquid concentrates of lime-sulphur. In 1916 it was slightly less efficient in scab control, but in 1917 it was plainly more efficient. Compare plots 1 and 8, Table I, and plots 5 and 10, Table III. It will be seen also that the first season the spray made from dry lime-sulphur produced less fruit russeting, but the second year it caused considerably more. The per cents of merchantable apples were in favor of the dry lime-sulphur both seasons.

ARSENATE OF LIME VS. ARSENATE OF LEAD.

Arsenate of lime was used with the idea that when combined with lime-sulphur less injury to the foliage and fruit would result than is the case where arsenate of lead is employed in the same way. As has already been stated the reverse seemed to be the case with regard to foliage injury in 1916, and no differences could be noted between the effects of the two in 1917.

In 1916 a difference of only two per cent in russeting was obtained when the results from the plot where the arsenate of lime and lime-sulphur were compared with those from the check plot, while this difference where arsenate of lead was used was over 46 per cent. In 1917 the plots where these two treatments were applied produced less russeted fruit than the unsprayed check and the differences, although in favor of arsenate of lime, were within the limits of experimental error.

It will be seen that scab control was better on the arsenate of lead plot in 1916 but in 1917 the results were quite the reverse of this Each season the percentage of merchantable apples obtained was decidedly in favor of the arsenate of lime. No data has been obtained relative to the fungicidal value of arsenate of lime used alone.

SPRAY TREATMENT AS INFLUENCING THE SET OF FRUIT.

Attention has already been called to the fact that the final set of fruit on plot 4 in 1917 was far below that of the plots on either side of it. There is nothing in the condition of the trees on these plots which could in any way account for this difference. In the writer's opinion the only explanation for the small crop on this plot is that it was in some way, directly or indirectly, concerned with the failure to make a spray application at the time the blossom buds were showing pink. This was the fifth season that a plot treated in this way had been included in this series of experiments and, with the possible exception of 1913, nothing of the kind had occurred previously.

A number of different observers have stated that loss of fruit set may often be traced directly to the fact that the scab disease may occur abundantly on the pedicels and that this causes the blossoms and young fruit to fall. Wallace in 1913

summarized the literature on this point.* While no direct observations were made it is a logical conclusion that infection of the pedicels of the blossoms and young fruits by the scab fungus was responsible for the poor set of fruit on plot 4 in 1917. However a careful analysis of the facts do not commit one to this conclusion without reservations.

The Department of Biology of the Station, for other purposes, is now making an annual record of the yield of fruit in pounds for each tree in all of the orchards. These figures for the past two seasons have been turned over to the writer and the average yield per tree of each plot in 1916 and 1917 are given in the last column to the right of Tables I and III. Plots 7, 8 and 9 of 1916 and 8, 9 and 10 of 1917 are made up of less vigorous trees and allowances should be made in comparing them with 1 to 6 in 1916, and 1 to 7 in 1917. Also the trees on 5 and 6 in 1916 and 6 and 7 in 1917 are somewhat larger and more vigorous, thus partially explaining the averge larger yields on these plots in both seasons. There seems to be no reason, however, why plot 4 in Table III should produce only 15 pounds per tree while plots 3 and 5 on either side of it should yield 125 and 95 pounds per tree, respectively, except the probable one that the fruit set on plot 4 was injured from infection of the pedicels of the flowers and young fruit by the scab fungus. On the other hand, the unsprayed check, plot 9, composed of much less vigorous trees, lying west of plot 4 with the corners joining, yielded an average of 39 pounds per tree. While it is true that the relatively low yield on plot 9 may also be due partially to pedicel infection by the scab fungus it is difficult to explain why two and a half times as much fruit was produced here, where no fungicidal spray was applied, than was the case where one out of three applications was omitted, even granting that the application omitted was the all important one. Moreover only 40 pounds per tree were obtained on plot 10 where the records show that scab was as well controlled as on plot 3 and much better controlled than on plot 5.

It will be seen on reference to Table I that in 1916 the average yield per tree on plot 4 on which the blossom bud application of lime-sulphur and arsenate of lead was omitted was even

*Wallace, Errett. Scab disease of apples, Bull. Cornell Agl. Exp. Sta. 335:552-553. Sept., 1913.

better than on plot 1 where all 3 applications were made. It was also slightly better than on the adjoining plot 3 where lime-sulphur and arsenate of lime was used for all 3 applications. As has already been stated the larger yield on the other adjoining plot, number 5, is partly due to greater vigor of the trees which compose it.

BULLETIN 272

INHERITANCE STUDIES OF CERTAIN COLOR AND HORN CHARACTERISTICS IN FIRST GENERATION CROSSES OF DAIRY AND BEEF BREEDS.*

JOHN W. GOWEN.

SUMMARY

This constitutes a preliminary paper on the crossbred herd now being brought together by the Maine Agricultural Experiment Station for the purpose of studying some of the outstanding problems of Dairy Husbandry.

No influence on the vigor of the offspring would be expected from the width of the outcrosses as inbreeding studies showed the inbreeding low in amount.

Black body color is dominant to the other colors in the first generation. In the second generation there occurred an orange coated bull and a dark Jersey heifer. This is to be explained on the grounds of a recessive dilution factor in the Guernsey breed. This factor is not normally present in the Jersey breed.

It has been shown that white marking of the body taken as a whole appears as a dominant. Study of the individual white areas, however, indicate that this is due to white in the inguinal region only for this alone appears as such a dominant. The white spots on the face (star, star snip and blaze) neck, shoulders, rump, flanks and legs are, in general, suppressed in the offspring when animals with these markings are mated to solid colored animals.

As has been suggested but as has never been tested before, the pigmented muzzle is dominant to the unpigmented muzzle.

---

*Papers from the Biological Laboratory, Maine Agricultural Experiment Station No. 122. This is an abstract of paper No. 120 from the Biological Laboratory of the Maine Agricultural Experiment Station published in the Journal of Agricultural Research. Vol. 15. No. 1.

Agreeing with the previous work of this laboratory it is shown that a pigmented tongue is dominant to a non-pigmented one.

A black switch appears to cause the suppression of the other switch colors in the offspring. Because of this suppression and because all of the matings had at least one animal with a black switch as parent, it was impossible to study the behavior of the other colors. There was one case of segregation of a deep red orange switch from a back cross of a black animal carrying an orange coat and white switch, genetically. This case showed the separation of the factor for this red from that for both white and black.

The character of polledness has been studied. Two horned animals resulting from crosses of polled x horned appeared. On the basis of the other results these could not have resulted from a heterozygous polled condition. One of these cases had the horns tight on the head and the other loose. These cases then form exceptions to the previously accepted hypothesis of simple dominence for the polled character and require a subsidiary hypothesis. The hypothesis suggested is that the male sex organs have some action on the presence or absence of horns. Partial proof of this hypothesis is given by the fact that of the polled animals 10 were females, two males one of which was doubtfully polled. Of those with scurs one female and 7 males had loose scurs; of those with tight scurs all (3) were males; of those with horns, all (2) were males. This would seem like a clear case where the male has some influence. The explanation of this difference appears to be due to a substance secreted by the germ cells. Should this prove true this forms an interesting parallel between cattle and sheep where the sex glands are known to produce such changes.

The inherited characters of the beef type are shown to effect the 4 general regions of the body, head, fore quarters, body and hind quarters differentially. The type of head and heavy, deep fleshed fore quarters are transmitted to the offspring when either parent is of Aberdeen-Angus breed. The body and hind quarters appear intermediate but in most cases resemble the dairy parents.

Data are given on the milk and fat production of some of the crossbreds. The results indicate that milk and fat production are inherited separately. High milk production is dominant to low, high fat per cent is recessive to a low fat per cent in the milk. Put in less technical language the results of this cross indicate that in a cross between an animal from a high milking strain mated to one of a low milking strain, the resulting female offspring will have the milk production of the high strain. In a cross between animals one of which is from a high test line and the other from a low test line the resulting offspring will have a butter fat test of the low test line. The number of these milking first generation females is not great enough to make this statement an absolutely sure conclusion.

INTRODUCTION

The investigation reported in the present paper† deals with the results of 4 years' crosses for certain characters found in the different breeds of domestic cattle. The original plan and three years' direction of the work were carried on by Dr. Raymond Pearl. The present analysis of the material and the further continuance of the studies have, through the exigencies of the war, fallen to the present author. The conclusion expressed as the results of these studies are the author's own and he is alone responsible for them.

This paper is the first of a series which will deal with the inheritance in cattle. The chief objects in undertaking the work have been to learn the mode of inheritance of milk production. Results from such studies are obtained very slowly and are not yet available in sufficient quantity to justify any conclusions.

---

†The cattle breeding work has been made possible by the use of the University of Maine herd. In all of this work it has been necessary to to use pure bred animals. By placing their herd at our disposal it has been impossible for the College of Agriculture to build up their pure bred herd. To date more than 50 pure bred matings have been sacrificed for this work. From this time on it will not be necessary to use many of the pure bred females for experimental purposes and will allow the college the opportunity to develop their herd. The Experiment Station desires to express its appreciation of the services rendered in this work by the College and in particular by the Department of Animal Husbandry,—C. D. Woods Director.

There are, however, certain results available relating to the inheritance of external characters, chiefly color markings. It is well known that in other animals certain economic characters are frequently associated in inheritance with similar external features. It is the purpose of this paper to present the available data on the inheritance of these external characters. In later studies the question of the association of these with the character of milk and fat production will be considered.

The breeds used in the crosses are the Jersey, Guernsey, Ayrshire and Holstein-Friesian for the dairy cattle and the Aberdeen-Angus for the beef breed.

THE DETAILED ANALYSIS OF THE INHERITANCE OF THE CHARACTERS IN THE FIRST GENERATION CROSSES.

All of the animals which were used as parents in the formation of this first generation mendelian herd have long been pedigreed.

Inbreeding studies by one of the methods devised in this laboratory of the pedigrees of these parental pure bred animals for four generations, showed the total number of repeated ancestors to be 36 and the total coefficient of inbreeding to be 225.00 percent. The average inbreeding per individual parent of this herd up to the 4th generation, is then, only 9.00 percent. In a previous study from this laboratory of the amount of inbreeding found in pure bred Jersey cattle* it was shown that the average minimum inbreeding coefficient of a sample of Jersey bulls taken at random was 11.01 percent and for the random sample of the Jersey cows was 12.50 percent. For the advanced registry Jersey bulls the minimum inbreeding was 14.88 percent and the advanced registry Jersey cows was 9.23 percent. In each case the inbreeding coefficient is higher than is that of the foundation stock used to form the mendelian herd described in this paper. Again the inbreeding coefficients of 14.50 and 9.23 represent the inbreeding coefficients of the highest producing animals in the breed from which they were selected. Consequently, it is held that since this percentage of inbreeding has not

*Patterson, S. W., Investigation on the degree of inbreeding which exists in American Jersey Cattle. Thesis publications of the University of Maine, Orono.

affected the constitution or vitality of the best animals of a high producing breed, the width of the crosses will not influence the vigor of the hybrids described in the succeeding pages.

The parents used in the crosses possess the following contrasting characters seen in Table I.

TABLE I.

Contrasting Characters of the Parental Breeds of the Crossbred Herd.

Character	Jersey	Guernsey	Ayrshire	Holstein-Friesian	Aberdeen-Angus
Body Color	Fawn or Dun	Light Fawn or Dun	Red	Black	Black
White markings	Often absent	Present	Present	Present	Often absent
Switch color	Black or white	Light fawn or white	Red or white	Black or white	Black
Muzzle pigment	Black	White	Black	Black or white	Black
Tongue pigment	Black	White	Black	Black or white	Black
Horns	Horns	Horns	Horns	Horns	Polled
Conformation	Dairy	Dairy	Dairy	Dairy	Beef
Milk quantity	Medium	Medium	Medium	Large	Low
Milk quality	High	High	Medium	Low	High

THE INHERITANCE OF BODY COLOR.

The data for the study of the body color are given in the table below.

TABLE II.

Inheritance of Ground Color in the Cattle Coat.[2]

Mating.			Character of resulting offspring.
Sire		Dam	
Black	×	Black	10 Black
Black	×	Fawn	23 Black
Black	×	Red	4 Black 8 Black
Black	×	$F_1 \frac{\text{Black}}{\text{Fawn}}$	2 Black
$F_1 \frac{\text{Black}}{\text{Fawn}}$	×	Fawn	1 Black, 1 Dark Dun, 1 Deep Orange
$F_1 \frac{\text{Black}}{\text{Fawn}}$	×	$F_1 \frac{\text{Black}}{\text{Fawn}}$	3 Black

The data in this table reaffirm the conclusion of Spillman,[3] Wilson,[4] and others that black is dominant to the red and yellow coats (so called fawns). The number in the second generation from the cross are not large enough, as yet, to establish any facts regarding the proportions between the animals of the different kinds of coats resulting from breeding these first generation animals together. The apearance of the dark fawn and deep orange offspring from Black F_1, parents indicate that such reappearance of the parental types of coat color does occur.

CROSSBRED No. 38.

This second generation bull comes from the cross of a black first cross bull Aberdeen-Angus-Guernsey x Guernsey. He is solid orange in color, carries horns, and has the light eye ring and muzzle color of the Guernsey breed. The conformation resembles the Guernsey especially in the region of the loin, chine and tail set.

Crossbred Number 38, the deep orange coated bull shown in the photograph, is of special interest as the coat of the Guernsey parent has reappeared in a much deeper shade. This deepening of the shade seems to be confirmatory evidence for the hypothesis advanced by Wright[5] that Guernsey cattle differ from

the other dun colored breeds by a hereditary unit which dilutes the dun color. This hereditary unit must be recessive as the cross was made as a backcross of the first hybrid male $\frac{\text{Aberdeen-Angus}}{\text{Guernsey}}$ onto a Guernsey cow. Furthermore, this factor cannot follow sex (be sex-linked) for the way the cross was made eliminates this possibility, as the Guernsey mother would have to transmit all of her recessive factors to her male offspring. Consequently, this factor cannot be considered in the class with that for the brown of the Ayrshire coat which Wentworth says is dependent for its shade on a recessive sex-linked dilution factor. The almost identical appearance of the dark dun second generation heifer and her Jersey parent indicate that in the Jerseys any such dilution factor as that in the Guernsey is not normally present.

CREUSA'S LADY. 53234.

This Guernsey cow shows the typical white marking of the breed. The presence of the star is quite characteristic. It is this marking which we have studied in our crosses for the inheritance of white on the head.

DIFFERENCE IN INHERITANCE OF THE WHITE SPOTS IN CATTLE COATS.

A preliminary study of the white markings found in the coats of dairy cattle satisfied the author that the areas, (star, star strip and blaze; neck; shoulders; rump; flanks; legs and belly) designated by Allen as the principal divisions of this white were correct. Creusa's Lady shows the typical white spotting of an animal bearing a number of these areas.

The exact descriptions, including photographs of both sides of all the animals made it possible to study the inheritance of these areas considered separately, as well as present or absent for the animal's whole coat. Table III treats the inheritance of two of the white areas for white markings into which the coats have been found to be divisible.

TABLE III.

Inheritance of White Markings.

Mating.			Character of resulting offspring.
Sire		**Dam**	
Piebald	×	Solid Color	5 Solid Color, 10 Piebald
Solid Color	×	Piebald	2 Solid Color, 3 Piebald
Piebald	×	Piebald	6 Solid Color, 22 Piebald
Solid Color	×	Solid Color	1 Solid Color
F_1 Piebald / Solid Color	×	Solid Color	2 Solid Color
F_1 Piebald / Solid Color	×	Piebald / Solid Color	3 Piebald

The breeding tests made it clear that the bulls were all heterozygous for the piebald factor on the single factor hypothesis. Such being the case piebald x solid color gave more piebalds than would be expected of a good back cross ratio (5 to 10) and the mating of piebald by piebald (6 solid colored to 22 piebald) slightly more than a good F_2 ratio. These ratios always favor the piebald and taken in consideration with other investigations make it doubtful if any such simple hypothesis of a single mendelian factor explains the facts. Furthermore, the results set forth in the above table could equally well be explained by the

presence of a dominant factor for a white spot in the coat together with several recessive factors. This is in truth the explanation indicated from the results of Table IV and V, inserted to show the typical behavior in inheritance for white spots of two of the above mentioned areas.

TABLE IV.

Inheritance of the White Markings on the Face (star).

Mating.			Character of resulting offspring.
Sire		Dam	
Star	×	Star	1 Solid Color, 3 Star
Star	×	Solid Color	10 Solid Color, 3 Star
Solid Color	×	Star	15 Solid Color, 1 Star
Solid Color	×	Solid Color	13 Solid Color
F_1 Star	×	Star / Solid Color	1 Star
F_1 Star / Solid Color	×	Solid Color	2 Solid Color
F_1 Star / Solid Color	×	Star	1 Solid Color
F_1 Star / Solid Color	×	Star / Solid Color	2 Star, 1 Solid Color

TABLE V.

Inheritance of the White Markings of the Inguinal Region.

Mating.			Character of resulting offspring.
Sire		Dam	
Inguinal Spot	×	Inguinal Spot	19 Inguinal Spot, 5 Solid Color
Inguinal Spot	×	Solid Color	10 Inguinal Spot, 6 Solid Color
Solid Color	×	Inguinal Spot	4 Inguinal Spot
Solid Color	×	Solid Color	1 Inguinal Spot, 2 Solid Color
F_1 Inguinal Spot / Solid Color	×	Solid Color	2 Solid Color
F_1 Inguinal Spot / Solid Color	×	Inguinal Spot	2 Inguinal Spot, 1 Solid Color

The difference in the inheritance of these two white areas is evident even with a casual glance. White on the forehead is in general recessive to solid color for solid color mated to star

gives 15 solid color to 1 star. The case is not strictly mendelian for in the mating of star by star one solid colored animal resulted. This animal was out of a Guernsey cow with a very small star, in fact only a few hairs, and by a bull with a large star. The matings of Table V point strongly to the conclusion that white in the region of the udder is dominant. This dominance is not strict for one solid colored bull mated to a solid colored cow produced an animal with an inguinal spot.

Table IV is typical of the behavior in inheritance of the other white areas found on the neck, shoulders, rump, flanks and legs. Individually considered, they all are suppressed when the cross includes one pure solid colored animal (that is, the above areas are recessive to solid color) for the given region. This recessive quality of the hereditary units for this white is not strict in any of the regions as one or two exceptions occur in each case. It is conceivable that there would be an association between the inheritance of the different individual spots. No such correlation has, as yet, been made out. In fact, the data are too limited to make any such correlations which might be established, significant.

The difficulties experienced in the explanation of the inheritance of the Shorthorn coat color, red, white and red and white are familiar to all breeders of cattle. In the study of the Roan coat of this breed about the only thing which the results of Wilson, Laughlin, Wentworth, Pearson and Walthers have in common are exceptions which each found to the interpretations offered by the other writers. A beginning at a solution of these exceptions has been made by the excellent review of the writings of Storer, Wilsdorf and others on white body color by Lloyd-Jones and Evvard. In this review they show that two types of identical white body with colored ears exist. In the Chillingham cattle this white is dominant. In the Highland cattle it is recessive.

The demonstration of such a difference in inheritance of white as that in the above mentioned breed does not quite hit the case of the Roan Shorthorn for, while the presence of these two genetically different whites would complicate the results, it is likely that their presence would be noted because the pattern of each is so striking. It does remain to be shown rather that the piebald cattle, like the Shorthorn, have a difference in

behavior of the separate spots which compose this piebald. A beginning of this kind of analysis has been made by Kiesel according to a review by Lang. In these experiments a solid colored Limburger race was crossed to a piebald race. The first generation hybrids were intermediate piebald. The back cross gave 22 solid colored and 29 piebald. The cross to the piebald first generation hybrids gave out of 90 offspring, 84 piebald. Unfortunately, no record of the exact spotting has been given, consequently, we are left in the dark concerning any difference in behavior throughout the coat. It would seem, however, that his results, would fall in line with the results obtained here, where each individual area is treated separately.

Analyzed by this method, there has been shown to be a marked difference in the inheritance of the individual white spots throughout the animal's coat. This is, perhaps, as far as we should go and is the only conclusion it is intended to emphasize, but realizing that there are exceptions not yet accounted for we may say white spotting in the inguinal region is, broadly speaking, dominant. The spots of the rest of the piebald pattern are, individually considered, recessive. These enumerated individually, according to the region in which they occur, are white on the face (star, star snip or blaze); on the throat; as a band across the shoulders; as a white area on the rump at the base of the tail set; on the flanks as irregular spots; white on the tail above the switch and the white stockings on the fore feet.

The bearing of this difference in inherited behavior on the general problem is at once evident. If a red coated Shorthorn should carry one of these recessive white spots we should expect a small proportion of cattle produced from the random mating of such an animal in the Shorthorn population would be white spotted. This is what has actually been obtained in point of fact. The reverse is also true that if these dominant whites are mated together, we should expect that a heterozygous mating would now and then take place giving a red. The evidence brought forward offers a straightforward, clear explanation of the anomolous behavior of the Shorthorn coat.

ON THE INHERITANCE OF SWITCH COLOR.

Since all of our parental generations had at least one member of the mated pair with a black switch, it was only possible to determine that this black suppressed (was dominant to) the other colors, red, cream and white in the first hybrid generation. In the second hybrid generation a bull with a deep orange switch was produced from a black first hybrid gereration bull, $\frac{\text{black}}{\text{white}}$ Guernsey, bred back to white (Guernsey). To produce this switch color a double separation of the hereditary units must have taken place in the germ cells of the black first generation parent bull. The black of the Aberdeen Angus and the white of the Guernsey were segregated out from the fawn of the Guernsey coat. This fawn must have been further separated from the dilution factor for the fawn normally present in the Guernsey coat. The data for these crosses are shown in the Table VI below.

TABLE VI.

Inheritance of Switch Color.

Mating.			Character of resulting offspring.
Sire		Dam	
White	×	Black	3 Black, 5 White, 2 Black and White
White	×	Brown	1 Black and White
Black	×	White	12 Black, 2 Black and White
White	×	White	4 White, 1 White, few black hairs
Black	×	Black	9 Black
Black	×	Black, red and gray	3 Black
$F_1 \frac{\text{Black}}{\text{White}}$	×	Black	2 Black
$F_1 \frac{\text{Black}}{\text{White}}$	×	$F_1 \frac{\text{Black}}{\text{White}}$	1 White
$F_1 \frac{\text{Black}}{\text{White}}$	×	$F_1 \frac{\text{Black and White}}{\text{White}}$	1 White
$F_1 \frac{\text{Black}}{\text{White}}$	×	White	1 Black, 1 Orange

The dominance of black is easily seen from the table. Black by black gave all black. White by black gave 3 black, 5 white and 2 black and white, showing that many animals with a black switch carry the recessive white factor suppressed. In

the second generation a number of cases of segregation of the white from the black and of solid colored red from the white and black appeared lending further evidence toward the single unit nature of the inherited factors behind these colors.

ON THE INHERITANCE OF MUZZLE PIGMENT.

The evidence gathered together in Table VII shows that the suggestion made by Spillman without the presentation of evidence that the pigmented muzzle was dominant to the unpigmented condition was a correct interpretation of the facts of the case.

TABLE VII.

Inheritance of Muzzle Pigment.

Mating.			Character of resulting offspring.
Sire		Dam	
White	×	Pigmented	14 Pigmented
Pigmented	×	Pigmented	23 Pigmented
Pigmented	×	White	3 Pigmented
White	×	$F_1 \frac{\text{Pigmented}}{\text{White}}$	1 White with small black spots
$F_1 \frac{\text{Pigmented}}{\text{White}}$	×	Pigmented	3 Pigmented
$F_1 \frac{\text{Pigmented}}{\text{White}}$	×	$\frac{\text{Pigmented}}{\text{White}}$	3 Pigmented

This table shows that in the first generation of crosses of pigmented x pigmented there were 23 animals produced with pigmented muzzles. One case where a modified form of separation of the pigmented from the white condition is seen in one of the second generation animals where the muzzle was white with small black spots scattered over it. These results easily prove the pigmented condition dominant to the unpigmented.

ON THE INHERITANCE OF TONGUE PIGMENT.

In a previous paper from this laboratory[6] the pigmented condition of the tongue in Jersey cattle was shown to be dominant to the unpigmented condition. The table given below extends

this conclusion to the other breeds which have been used in the crosses for our crossbred herd.

TABLE VIII.

Inheritance of Tongue Pigment.

Mating.			Character of resulting offspring.
Sire		Dam	
White	×	White	3 White
White	×	Pigmented	7 Pigmented, 1 Pigmented and White
Pigmented	×	White	11 Pigmented, 2 White, 3 Pigmented and White
Pigmented	×	Pigmented	10 Pigmented
Pigmented / White	×	Pigmented	2 Pigmented
Pigmented / White	×	Pigmented / White	2 White
Pigmented / White	×	White	1 White

In these crosses pigmented x pigmented gave all pigmented, white x white gave all white, and crosses of pigmented x white produced largely pigmented offspring. The second generation offspring from pigmented tongued hybrids both came white tongues showing the separation of the factors for the pigmented and unpigment condition in the first generation parents. These facts strengthen the hypothesis that the pigmented condition of the tongue is inherited through a dominant factor.

THE INHERITANCE OF THE HORNED CONDITION.

The inheritance of the polled condition as a simple mendelian dominant was first suggested by Bateson and Saunders[7] through their studies on show cattle. Spillman in further studies during the year 1905 confirms this view and makes the interesting suggestion without support of numerical evidence, that the horned condition is dependent to some extent on sex. This suggestion, although denied by later investigators, has proved helpful in explaining certain exceptions to the strict mendelian explanation which occurred in our data. The table shown below records the data of these crosses according to sex.

TABLE IX.

Relation of Sex to the Horned Condition in Cattle.

Mating.		Character of resulting offspring.							
Sire	Dam	Polled		Scurred					
				Solidly attached		Loosely attached		Horned	
		Male	Female	Male	Female	Male	Female	Male	Female
Horned	Polled	1	3			1	1	1	
Polled	Horned	1	(?) 7	3		6		1	

CROSSBRED No. 21.

This bull is the progeny of Kayan (Aberdeen-Angus clean polled bull) mated with Dot Alaska (Ayrshire). Note the heavy solidly attached horns grown while only a year and four months old. The Aberdeen-Angus blood is plainly seen in the heavy beefy conformation of this bull. The other horned animal had horns even longer than these at this age.

The polled character in the offspring of these crosses occurs most frequently in the females. In 7 offspring from matings of horned males with polled females, 3 polled females were produced to 1 polled male. One male and 1 female had scurs and 1 male had heavy horns. In the reciprocal cross of polled male bred with horned female, 1 male was doubtfully recorded as loose scurs under the skin. He died before this could be checked. Of the others 7 females were polled, 3 males had solidly attached scurs, 6 had loose scurs and 1 was horned. Crossbred No. 21 shows this horned condition.

These data make it probable that sex has some influence on the horned condition. The parallel with the case of sheep is of special interest for castration experiments have established the presence of a secretion by the testis which materially aids the production of horns with this species. On the basis of this the testis in the bull would be expected to secrete a hormone which would allow him to grow horns with one dose of the horned genes where two doses of the horned gene would be required by the female. The parallel is still further emphasized by the variability, both intra and interracially and in the length of time necessary for its action in producing horns, as this work has shown for cattle and as the work of Arkell[8] has shown for sheep. This may be the explanation of the results obtained by Lloyd-Jones and Evvard[9] where out of 78 offspring of a Shorthorn bull to Galloway cows they obtained only 6 scurred and two horned animals. Here it is conceivable that in this cross the secretion may be lacking or very small in amount as in some of the Merinos that Arkell bred. That is, the concentration or amount of the secretion may be lower in Galloway crosses than it is in Aberdeen-Angus crosses. In all events the secretion in cattle seems intermediate in its action between the reindeer and the sheep since castration of horned breeds does not retard the horn growth although it does tend to make the horn longer and more slender.

THE INHERITANCE OF BEEF AND DAIRY CONFORMATION.

The component elements which go to make up conformation or type are obviously complex. In the crosses of the two types, dairy and beef, the offspring break up more or less strictly into

the two types for four quite definite regions. These may be designated the head, fore quarters, barrel and hind quarters. These crossbreds have been divided into 4 catagories, beef, beef and milk, milk and beef and milk as they approach the ideal beef or dairy type in any of the above named regions. Hearthbloom, one of the parental animals of the distinctly beef type is shown in the photograph below.

HEARTHBLOOM 147141.

This animal illustrates the rounded blocky conformation typical of the Aberdeen-Angus breed. She is of a very good beef type. Her offspring are some of the best animals in this study of the inheritance of the beef and dairy conformation. In connection with the section devoted to the inheritance of the horned condition notice that this animal is cleanly polled.

To save space I will tabulate only two of the regions as these are typical of the rest.

TABLE X.

Inheritance of Conformation.

Fore Quarters.

Mating.			Character of resulting offspring.
Sire		Dam	
Beef	×	Milk	6 Beef, 14 Beef and Milk
Milk	×	Beef	8 Beef and Milk, 1 Milk and Beef
Milk	×	Milk	14 Milk
Milk	×	Milk and Beef	3 Milk and Beef, 1 Milk
F_1 Beef/Milk	×	Milk	1 Milk and Beef

Hind Quarters.

Mating.			Character of resulting offspring.
Sire		Dam	
Beef	×	Milk	1 Beef, 6 Beef and Milk, 11 Milk and Beef
Beef	×	Milk and Beef	1 Beef and Milk, 1 Milk and Beef
Milk	×	Beef	1 Beef and Milk, 8 Milk and Beef
Milk	×	Milk	14 Milk
Milk	×	Milk and Beef	3 Milk, 1 Milk and Beef
F_1 Beef/Milk	×	Milk	1 Milk

Most of the F_1 offspring are intermediate in type. The proportion of animals with the beef conformation is quite different for the two regions. In general it would seem that in the head and shoulder the conformation of these F_1 crosses tended toward the beef type, while in the region of the barrel and hind quarters the conformation was more like the dairy type.

ON THE INHERITANCE OF MILK AND BUTTER FAT PRODUCTION.

Since the results of any study of milk production is of so much economic and scientific interest the data on the results for the comparison of the milk production of 4 F_1 crossbred heifers are presented. The production of these animals is corrected to its expected maximum by the method previously devised in this laboratory.

TABLE XI.

Inheritance of Milk Production.

Daughter's Production.

No.	Breed of Sire	Age	Days in Milk	Production	Corrected Maximum for 100 Days	Difference Daughter Dam Production
1	Jersey	2-0-5	110	2016	2666	
2	Holstein-Friesian	2-8-26	105	3035	3722	
11	Jersey	2-3-22	110	2234	2791	
12	Holstein-Friesian	2-4-7	93	2314	3405	

Dam's Production.

Breed of Dam	Age	Days in Milk	Production	Corrected Maximum for 100 Days	Difference Daughter Dam Production
Holstein-Friesian	10-8-14	104	3579	3600	—934
Guernsey	3-9-2	96	2243	2718	+1004
Holstein-Friesian	5-4-20	123	3168	2686	+105
Guernsey	4-4-5	109	1830	1881	+1524

TABLE XII.

Inheritance of Fat Content.

Daughter's Production.

No.	Breed of Sire	Age	Days in Milk	Production Fat Per cent	Corrected Maximum Fat Per cent	Difference Daughter Dam Production
1	Jersey	2-0-5	110	4.4	4.4	
2	Holstein-Friesian	2-8-26	105	3.2	3.2	
11	Jersey	2-3-22	110	3.2	3.2	
12	Holstein-Friesian	2-4-7	93	3.5	3.5	

Dam's Production.

Breed of Dam	Age	Days in Milk	Production Fat Per cent	Corrected Maximum Fat Per cent	Difference Daughter Dam Production
Holstein-Friesian	10-8-14	104	2.5	2.7	+1.7
Guernsey	3-9-2	96	3.4	3.5	—0.3
Holstein-Friesian	5-4-20	123	3.6	3.8	—0.6
Guernsey	4-4-5	109	5.4	5.6	—2.1

All 4 heifers are from one parent of a high producing strain at the expense of quality and the other parent a low producing strain but high in quality. The corrected maximum production is the amount expected of the cows when they reach their maximum production at mature form. The production of Number 1 seems abnormal due probably to her growth being poor as a calf. Her second lactation approaches more nearly the normal of her capacity with proper nutrition. In this lactation she produced an expected maximum for the 100 day period of 3246 pounds of milk and 3.6 for the fat percent.

The difference between the production of these heifers and that of their dams show, in general, that they produce the quantity of milk expected of the high producing strains and the quality of the low quality breed. Or put in another way, these facts support the hypothesis that in a cross of high producing lines to low producing lines the offspring tend to have the high production of the high lines. Further, the offspring of a parent producing a milk of low fat content tends to have the low content of the low parent even though the other parent may be from a high fat content line.

REFERENCES TO LITERATURE CITED IN TEXT.

1. Pearl, R., A Contribution toward an analysis of the Problem of Inbreeding. Amer. Nat. Vol. XLVII, pp. 577-614.

2. The tables included will not be found to check exactly. This is due generally to the animals being too young to determine the particular point studied.

3. Spillman, W. J. 1905. Mendel's Law in relation to Animal Breeding. Rpt. Am. Breeder's Ass., 1 pp. 171-177.

4. Wilson, J. The Colors of Highland Cattle. Soc. Proc. Dub. Soc. Vol. XII, No. 8.

5. Wright, S., Color Inheritance in Mammals. Jour. Her. Vol. XIII, No. 11, pp. 521-527.

6. Pearl, R., Variations in the Tongue Color of Jersey Cattle. 1913. Proc. Soc. Prom. Agric. Sci.

7. Bateson, W., Saunders, E. R., Rpt. I to the Evolution Committee, London, pp. 1-160.

8. Arkell, T. R., 1912. Some data on the Inheritance of Horns in Sheep. Bull. 160, New Hampshire Station.

9. Lloyd-Jones and Evvard, O. G. 1916. Res. Bull. No. 30. Agr. Exp. Sta., Iowa Station, College of Agriculture.

10. Pearl, R. 1915. Rpt. of Progress of Animal Husbandry Investigations. Bull. 519. Maine Agr. Expt. Station.

BULLETIN 273

THE BIOLOGY OF MAINE SPECIES OF ALTICA.*

WILLIAM COLCORD WOODS.†

SUMMARY

The flea-beetles commonly classed as *Altica ignita* Ill. form a composite group of closely related species. Three species of the group are named and described in this bulletin: *A. corni,* a black species occurring on dogwood, *A. rosae,* a cupreous species occurring on the wild rose, and *A. ulmi,* a greenish or bluish form found on the elm. The life histories of all three are very similar. They hibernate as adults which, coming out from their winter quarters in late spring, pair and deposit eggs on the leaves of their respective host plants in June and July. The larvae which hatch from these eggs feed on the leaves, skeletonizing them. In all cases there are 3 larval instars averaging about 4 days each. When full grown, the larvae enter the ground where they transform, spending about 5 days as prepupae and 9 days more as pupae before emerging as adults. There is but one generation each year.

The blueberry flea-beetle, *A. torquata* LeC., belongs to the *carinata* group. At least in this species the winter is passed in the egg stage. The larvae hatch in late May, and feed on the opening buds of the blueberry and later on the flowers and foliage. They do great damage when they are abundant. As in the *ignita* group, there are 3 larval instars, and the larval life lasts about 12 days. The larvae when full fed enter the soil to pupate, spending about 6 days as prepupae, and 10 or 11 days as pupae, before the adult beetles emerge. The adults feed freely all summer on the leaves of the blueberry, but do not survive the winter. In July they deposit their eggs, probably

---

*Papers from the Maine Agricultural Experiment Station: Entomology No. 100.

†Member of the Station Summer Staff.

on the ground at the base of the bushes, and these eggs pass the winter, hatching the following spring. There is only one generation each year.

All of these flea-beetles can be controlled by spraying with arsenate of lead. Parasitic flies were bred from the adults of 2 species and a predaceous bug was found attacking the larva of one species. All are susceptible to fungous and bacterial diseases which doubtless play a large role in holding them in check.

SPECIES DISCUSSED.

So far as the records of this Experiment Station show, 6 species of *Altica,* the typical genus of jumping chrysomelids or flea-beetles, occur in the State of Maine. Since all of them feed on plants of greater or less economic importance, and as these very prolific beetles under favorable conditions may appear quite suddenly in enormous numbers, an acquaintance with their various life histories is important, so that we may know at what period remedial measures may be most effectively applied. Moreover in entomological literature there is great confusion regarding the structural and biological limits of the different species of *Altica,* and in many cases the host plant records are hopelessly mixed up. It is hoped that some light may be thrown upon the specific limits and the biological habits of the insects described in this bulletin.

Four of the 6 recorded species are discussed in this bulletin. These are the dogwood flea-beetle *A. corni* sp. n., the rose flea-beetle, *A. rosae* sp. n., the elm flea-beetle, *A. ulmi* sp. n., and the blueberry flea-beetle, *A. torquata* LeC. A fifth, the alder flea-beetle, *A. bimarginata* Say, has already been treated in bulletin 265 of this Experiment Station, in which is also given a statement of the facts which make it seem proper to drop the "H" and revert to Geoffroy's original spelling of the generic name. The sixth is listed provisionally as identical with what Lugger

(1899 5th Minn. Rept., p. 159) called the lesser grape vine flea-beetle, although it certainly is not *A. ignita* Ill. as he stated.*

Three beetles described in this bulletin as new, *A. corni, A. rosae* and *A. ulmi,* are all forms that in Horn's monograph (1889. A synopsis of the Halticini of Boreal America. Tran. Am. Ent. Soc. v. 16:163-320, pl. 5-6) would fall under the single species *ignita* Ill. It has been stated almost universally that *ignita* Ill. is a very variable species but *ignita* Ill., as it has been commonly interpreted by the best authorities is undoubtedly a composite species which when it has been carefully studied throughout the country will be found to consist of a greater or less number of closely related but distinct species where the characters remain constant and the range of variation is slight. Such indeed is the opinion of Fall (1910. Trans. Am. Ent. Soc. v. 36:153) who states: "In the case of *ignita* this variation is assumed to be very great, but I think it probable that this complex will ultimately be broken up. The opening wedge is here inserted by giving names to three forms.....which by the latest paper on the genus would pass as *ignita.*" Certainly the 3 species of the *ignita* group discussed in this present paper are distinct both structually and biologically, and such characters as color, size, and proportionate length of antennae are constant, as well as the food-habits and immature characteristics which are definite and various.

The writer has grave doubts whether it be permissible to call any of our known American flea-beetles *ignita* Ill., at least until Illiger's type specimen—if it be in existence—has been carefully compared with his description, and the latter proven incorrect. It would not appear scientifically sound to set aside a portion of an author's description arbitrarily merely because

---

*This is a small green species which the writer has taken only twice in the State, August 1917 and June 1918, both times on woodbine at Orono. Unfortunately the writer has not been able to study this species except very superficially since at present he is in the military service of the United States. This species evidently comes in the *ignita* group, and can be distinguished from the others by its color, size (about 3.5 mm) and the fact that segment 3 of the antenna is equal in length to segment 4. The eggs are yellow, deposited by 1's or 2's on the under surface of the leaves. The ground color of the larva is dull yellow and the pupa is yellow; so far as the writer knows, they do not present any specific characters to differentiate them from other members of this genus.

it does not fit the material in question, and Illiger's original description of *ignita* concludes "plica submarginali," a character that no known species of our fauna, save *bimarginata* Say, possesses. The writer does not think it allowable to determine any species which lacks a submarginal fold as *ignita* Ill. until it has been definitely established that Illiger's original description is incorrect and that the type of *ignita* Ill. lacks submarginal plicae.

If we are to retain an American *ignita* Ill., it seems best, as Fall suggested, to consider the brilliant, coppery-golden form of the middle Atlantic states, the typical *ignita*. This is without doubt the species which Chittenden treated as the strawberry flea-beetle (U. S. Bur. Ent. Bul. 23 n. s., p. 70-79, figs. 17-18), although his description of the coloration of the adult is confusing, and leads one to suspect that more than one species may have been at work on the strawberries.

All 3 species of the *ignita* group from Maine *(corni, rosae, and ulmi)* are quite distinct from this typical *"ignita"* of Chittenden, although all the members of this group are closely related, and the adults can only be separated, aside from color and size which are constant at least in the 3 Maine species, by comparatively minute characters. All the constituents of the group have the ante-basal impression of the thorax deep and entire, and in all the structure of the last ventral segment of the male is the same, at least in so far as the writer has been able to determine. The biological habits (especially the choice of food-plants and the manner of egg deposition) and the color of the fat-body are definite and characteristic for each species. The larvae of all are very much alike; the ground color and the color of the anal proleg vary with the color of the fat-body. In the larva of *"ignita"* of Chittenden tubercle iii (see fig. 10) is present and setiferous on both the mesothorax and the metathorax (Chittenden, l. c., fig. 17); in *corni* and *ulmi* it is present on both, but non-setiferous; and in *rosae,* though present it is non-setiferous on the metathorax, and is usually entirely wanting on the mesothorax. The pupae of all are identical save in size and color.

The references to *ignita* Ill. and *carinata* Germ. are much confused in entomological literature. *Ignita* of Lugger (l. c.) is most certainly distinct from the 3 species of the *ignita* group

discussed above, and is probably a new species, although it appears to belong to this same group. Most of the references in economic literature to *carinata* Germ. should be to *ignita* Ill., and indeed the references to these two species are for the most part so vague that it is impossible to determine to what species they do refer. In the comparatively few instances in which the writer has felt sure that reference was made to one of the 3 species he has described as new, he has included these articles under the bibliography of that species.

Specimens of *corni* and *ulmi* submitted to Mr. C. W. Leng of New York City were reported as unquestionably *ignita* Ill. according to Horn's monograph.

The remaining species treated in this bulletin is the blueberry flea-beetle, *A. torquata* Le C., a member of the *carinata* group. It differs but slightly from the typical *carinata* Germ. as described by Horn, and is possibly identical with it. However since the life history of *torquata* differs from that of a typical *Altica* in that it hibernates as an egg and not as an adult, and since neither the life history of *carinata* nor its range of food plants is known, it seems better to the writer to run the risk of unwarrantably restoring a synonym than possibly to confuse this species with *carinata* Germ. if the 2 be distinct. This beetle, which is very injurious on the blueberry barrens in years when it is abundant, was determined for the writer by Mr. C. W. Leng of New York City.

DEFINITION OF THE TERMS USED IN THE DESCRIPTIONS.

Alutaceous: covered with minute cracks, like the human skin.

Ante-basal groove or impression: an impressed transverse line which may be either deep or shallow, extending entirely or partially across the prothorax slightly cephalad of its base.

Apex of elytron: the distal portion.

Apex of prothorax: the cephalic margin.

Base of elytron: the proximal portion.

Base of prothorax: the caudal margin.

Carina, frontal: an elevated median ridge or keel on the front of the head.

Humeral angle: the outer proximal angle of the elytron.

Metathoracic thickenings: a pair of chitinous bars, running cephalo-caudad on the metathorax, one at the base of each wing. (They are inconspicuous in young pupae but become dark brown and prominent in older pupae.)

Plica: a fold; a *submarginal plica* is a lateral fold in the elytron extending caudad from the umbo.

Post-humeral depression: a depression behind the umbo which may or may not be present.

Tubercle, frontal: a chitinous plate immediately caudad of (i. e., superior to) the antenna.

Umbo (plural *umbones)*: an elevation or swelling in the humeral angle of the elytron.

KEYS TO THE MAINE SPECIES OF ALTICA.

Key to the Adults.

(Including *ignita* Ill. and *"ignita"* of Chittenden.)

1. Elytra longitudinally plicate at the sides.....2.
1. Elytra not longitudinally plicate at the sides.....3.
2. Large blue species; 5-6 mm. long.....*bimarginata.*
2. Smaller species; 3-4 mm. long.....*ignita* Illiger.
3. Thorax with a deep ante-basal groove which extends completely across the thorax.....4.
3. Thorax with a moderate ante-basal groove which does not extend completely across the thorax.....8.
4. Thorax distinctly wider at the base than at the apex.....*chalybea.*
4. Thorax scarcely wider at base than at the apex.....5.
5. Brilliant cupreous or golden cupreous.....6.
5. Not so colored.....7.
6. Segment 3 of the antennae longer than segment 4; length 4 mm. .....*"ignita"* of Chittenden.
6. Segment 3 of antennae equal in length to segment 4; length 3 mm. ..... *rosae.*
7. Black; antennae three-fifth the length of the body.....*corni.*
7. Green, blue, or violet; antennae one-half the length of body....*ulmi.*
8. Prothorax less than one-half wider than long.....*carinata.*
8. Prothorax more than one-half wider than long.....*torquata.*

KEY TO THE EGGS.

1 .Eggs deposited in 1's or 2's.....2.
1. Eggs deposited in clusters of 3 or more.....3.
2. Eggs deposited on leaves (usually elm).....*ulmi.*
2. Eggs deposited on stems or ground at base.....*torquata.*
3. Eggs orange, deposited in the tubes of leaf-rooling Lepidoptera ..... *bimarginata.*
3. Eggs pale yellow, deposited on the under surfaces of leaves.....4.
4. On *Cornus* (dogwood).....*corni.*
4. On *Rosa* (rose).....*rosae.*

KEY TO THE LARVAE.

(Including *"ignita"* of Chittenden.)

1. Lateral setae (on tubercle vii-viii) 3 in number.....*bimarginata.*
1. Lateral setae 2 in number.....2.
2. Tubercle iii setiferous on both mesothorax and metathorax .....*"ignita"* of Chittenden.
2. Tubercle iii non-setiferous or absent on mesothorax and metathorax ..... 3.
3. Tubercle iii present on mesothorax.....4.
3. Tubercle iii wanting on mesothorax.....*rosae.*
4. Ground color of larva dirty white.....*corni.*
4. Ground color of larva darker.....*chalybea, torquata, ulmi.*
   (No characters are known to the writer by which these can be separated in alcholic material.)

KEY TO LIVING PUPAE.

1. 3 setae on apex of each femur.....2.
1. 2 setae on apex of each femur.....3.
2. Length 5 mm.; yellow-orange.....*bimarginata.*
2. Length less than 5 mm.; orange.....*torquata.*
3. Color white.....*corni.*
3. Color yellow .....4.
4. Length 4.5 mm. or more.....*chalybea, ulmi.*
4. Length less than 4.5 mm.....*rosae.*

KEY TO ALCOHOLIC PUPAE.

1. 3 setae on apex of each femur.....2.
1. 2 setae on apex of each femur.....3.
2. Length 5 mm. or more.....*bimarginata.*
2. Length less than 5 mm.....*torquata.*
3. Length 4.5 mm. or more.....*chalybea, ulmi.*
3. Length less than 4.5 mm.....4
4. Length 4 mm.....*corni.*
4. Length less than 4 mm.....*rosae.*

ALTICA CORNI, SP. N., THE DOGWOOD FLEA-BEETLE.

TECHNICAL DESCRIPTION OF THE STAGES.

DESCRIPTION OF THE ADULT.

Very elongate oval, somewhat convex; *body above* shining black with strong greenish or purplish metallic reflections; *antennae* black with purplish or greenish reflections, especially the proximal segment: nearly if not quite three-fifths the length of the body, and more than twice the width of the prothorax at its base: segments 2, 3, and 4 gradually increasing in length: segment 4 two and one-half times as long as wide; segment 10 not more than twice as long as wide, usually less; *eyes* black, not prominent, their width as seen from the front less than one-half the interocular distance; *frontal carina* moderately prominent, acute; *frontal tubercles* moderately large, flat, almost contiguous; *vertex* not punctuate; *width of head* across eyes more than two-thirds but less than four-fifths that of the prothorax at its widest point.

Prothorax one-half wider than long; margin well defined: base scarcely wider than the apex, regularly arcuate; sides nearly parallel at the base, convergent at the apex; basal angles prominent, slightly dentiform: apical angles obliquely truncate; surface comparatively finely punctate, but quite densely punctate; *antebasal* groove well defined and entire.

Elytra (across umbones) about one-third wider than the base of the prothorax: each elytron from two and one-half to three times as long as wide, and from two to two and one-half times as long as the width of the base of the prothorax; *surface* alutaceous, comparatively coarsely but densely punctate: *humeral angles* obtuse, more or less rounded; *umbo* slightly prominent; *post-humeral impression* faint.

Scutellum metallic black, like the elytra, sparsely punctate.

Body beneath shining metallic black: abdomen quite densely beset with fine white setae: legs black: the claws red brown, the setae and pulvilli white.

Length 3.5 mm.-4 mm.

Last ventral segment of male sinuate each side; lateral lobes comparatively large; median lobe short, semicircular, flat, the extreme edge sometimes reflexed.

Type locality, Orono, Maine; *male designated as type* deposited in the collection of the Maine Agricultural Experiment Station, Orono, Maine. *Paratypes* (which are also topotypes) deposited in the collection of the Maine Agricultural Experiment Station, Orono, Maine; of Cornell University, Ithaca, New York; and of the United States National Museum, Washington, D. C.

Figures. The last ventral segment of the male is shown in figure 11E.

DESCRIPTION OF THE EGG.

Subcylindrical, irregularly elliptical; surface minutely punctate and finely sculptured, entirely divided into polygonal areas, though the sculpturing is frequently obscure; color varying from yellow to dull orange; length about 1 mm. The eggs are shown in figure 12A.

DESCRIPTION OF THE LARVA.

The numbering of the tubercles. The only important paper with which the writer is familiar that deals with the numbering of the tubercles in chrysomelid larvae is that of Sanderson (1903. Notes upon the structure and classification of chrysomelid larvae. Proc. Ent. Soc. Wash. v. 5:21-30). While the writer is unable to accept all of the conclusions reached in this paper, especially in the homologizing of the thoracic tubercles (because Sanderson's paper takes no account of the individual setae), he hesitates to propose a new system which he recognizes as merely a tentative one. But since in each case he has made two drawings, one showing the actual setal arrangement in the larvae and the accompanying one the numbering of the tubercles used in this bulletin, but little confusion should result, especially as immediately below is appended a cross-reference table showing the corresponding tubercles when numbered according to Sanderson's scheme, and according to the writer's. No one recognizes more plainly than the writer the unsatisfactory points of both schemes, and that both must be displaced when the group as a whole has been carefully studied.

Sanderson.	Woods.
Prothorax.	
i-vi	i-viii
vii-viii	x
ix	xi
x	xii
xiii-xiv	xiii-xiv
Mesothorax and Metathorax.	
i, ii, iii	i, ii, iii
iv	iv-vi
v-vi	v-vii-viii
vii	ix

viii x
ix xi
x xii
xiii, xiv ..... xiii, xiv

Abdomen.

i, ii, iii, iv, v, vi, vii, viii ..... i, ii, iii, iv, v, vi, vii, viii
ix-x ..... ix-x
xiii xiii
xiv ..... xii-xiv

Description of full grown larva. Head, thorax, and abdomen distinct; abdomen composed of 10 segments; pronotum and dorsum of 9th abdominal segment strongly chitinized to form the prothoracic and anal shields respectively; one pair of jointed legs borne by each of the thoracic segments; a single median anal proleg borne by the 10th abdominal segment. Length 5-5.5 mm.

Head directed obliquely downward and forward, strongly chitinized, shining black; the *epicranial suture,* at first extending cephalad along the mesal line, soon splits, passing back of the antenna to the base of the mandible on each side: it divides the head into three large segments, the median dorsal one the *postclypeus,* and the other two forming the *epicranium;* the *clypeus* is very narrow; the *labrum* is moderately large, rounded in front, shining black; *mandibles* dark brown, moderate in size, with notched teeth at the apex; *trochantin* present at its base, non-chitinized; *maxilla* with the cardo completely, the stripes incompletely, chitinized, bearing anteriorly a palpifer with a three-segmented conical palpus, and a very small nodule which probably represents the lacinia; *labium* with a large, slightly chitinized basal piece, the fused submentum and mentum, bearing a ligula, unchitinized except at its base, from which arises a pair of small two-segmented palpi; *antennae* inserted on the side of the head near the base of the mandibles, three jointed, white, the basal segment much larger than the middle segment, and the distal segment very small; *ocelli* wanting; a *membrane* connects the head and prosternum which are not separated by a suture; a small chitinized sclerite in this membrane is probably the *gula.*

Body-wall of thoracic and abdominal segments dirty white, densely beset with dull black cuticular nodules; tubercles i-viii prominent, dull black; tubercles ix-xiv, dull brown.

Abdominal segments 1 to 8 bear setiferous tubercles, segments 1 through 7 being identical; *on the first seven* the arrangement is as follows: tubercles i and ii of each side are confluent forming a mid-dorsal row of two tubercles on each segment (the anterior the larger) bearing two setae each; tubercles iii, iv, v and vi are distinct, bearing one seta each, and the spiracle is borne on a tubercle which lacks setae between

tubercles v and vi, and vii and viii; vii and viii are fused into a single tubercle, the large lateral tubercle, bearing two setae; tubercles ix and x are fused into a single tubercle, bearing two setae; tubercle xi is wanting; tubercle xiii in each case is fused with its fellow of the opposite side forming a row of mid-ventral tubercles, bearing two setae each; tubercles xii and xiv are fused into a single small tubercle, which bears two setae.

Abdominal segment 8: the arrangement of the tubercles is the same except that the fused tubercles i are smaller, and that the ii's and iv's of both sides are fused into a single large tubercle bearing four setae, so that the relative size of the two mid-dorsal tubercles is just opposite that of the other abdominal segments.

Abdominal segment 9 is modified dorsally into a strongly chitinized anal shield, which doubtless represents a fusion of tubercles i-viii, with probably the setae of tubercles ii, iv, v, vi and viii persisting; ventrally it bears a large median tubercle, bearing four setae, which probably represents tubercles xiii and xiv of each side all fused together.

Abdominal segment 10 is very small; it has no setae nor tubercles, but bears ventrally the creamy white anal proleg (which doubtless represents a pair of prolegs fused together); the anal opening, shaped like an inverted Y, lies in the middle of the proleg.

Metathorax: tubercles i and ii are not fused across the middle line, leaving a thin place where the cuticula can yield to the strain and split at the time of molting; tubercle iii is present but non-setiferous; tubercles iv and vi are fused together into a single tubercle bearing two setae; tubercles v, vii, and viii are fused into a single large tubercle, bearing three setae; tubercles ix and x are separate, bearing one seta each; tubercles xi and xii are associated with the base of the coxa, the former strongly chitinized and non-setiferous, the latter bearing one seta; tubercle xiii on each side is fused with its fellow forming a mid-ventral tubercle, bearing two setae; tubercle xiv bears one seta.

Mesothorax: exactly similar to the metathorax except that a spiracle is present above the seta on tubercle ix.

Prothorax: dorsally modified into a strongly chitinized cephalic shield, formed by the fusion of tubercles i-viii; tubercle ix wanting; tubercle x bearing a single seta; tubercles xi and xii lie at the base of the coxa, both bearing a single seta; tubercles xiii and xiv on both sides have fused together, forming a large bell-shaped non-setiferous mid-ventral tubercle.

Spiracles. There are nine pairs of spiracles, eight abdominal and one thoracic; the abdominal spiracles are borne on un-numbered non-setiferous tubercles just above the lateral tubercles (fused vii and viii) of the first eight abdominal segments; the thoracic spiracle is borne on tubercle ix of the mesothorax; an homologous tubercle present on the metathorax shows no trace of a spiracular opening.

Legs. The legs are composed of five segments; the proximal segment is incompletely chitinized ectad and not at all entad; it fits closely into a socket formed by the infolded body wall, with which it is con-

tinuous, and articulates slightly with tubercle xi, which is chitinized and non-setiferous except on the prothorax; tubercle xii is contiguous to this segment caudad; the second segment which is chitinized proximally is barely visible ectad, but is much larger entad; the third segment, strongly chitinized ectad, is about equal in size to the second; the strongly chitinized fourth segment is the longest of the leg segments; the short, strongly chitinized distal segment bears a single pulvillus, and a single inward-curved claw. The setae are the same on all of the legs, except that the proximal segment of the prothoracic leg lacks the anterior seta borne on the ectal surface of the other legs. There is no homology between the segments of the larval legs and those of the adults, as has already been explained in the case of the alder flea-beetle. (Woods 1917. Me. Agr. Exp. Sta. Bul. 265, p. 265.)

Figures. The arrangement of the setae and tubercles of the full grown larva is shown in the following figures; dorsal aspect, figure 10A (prothorax, mesothorax, metathorax, abdominal segments 1, 8 and 9); ventral aspect, figure 11A (prothorax, mesothorax, metathorax, abdominal segments 1, 8, 9 and 10); lateral aspect, figure 10C (prothorax, mesothorax, metathorax, abdominal segments 1, 8, 9 and 10); the numbering of the tubercles according to the writer's scheme in corresponding diagrams, figures 10B, 10D, and 11B respectively; third instar larva, lateral aspect, figure 12E. The structure of the legs, head and mouth parts is exactly the same as in *A. bimarginata,* and has already been figured for that species (Woods. 1917. Me. Agr. Exp. Sta. Bul. 265, figs. 19-20).

Description of the newly hatched larva. The arrangement of setae and tubercles on a just hatched larva is the same as that described for the full grown larva. The tubercles are proportionately larger and crowded more closely together, and the head is proportionately larger. The setae are all clearly capitate. Length, 1 mm.

Head measurements of larvae.

1st instar. Minimum, .29 mm.; maximum, .36 mm.; average, .31 mm. (Estimated from 35 specimens.)

2nd instar. Minimum, .43 mm.; maximum, .52 mm.; average, .45 mm. (Estimated from 17 specimens.)

3rd instar. Minimum, .62 mm.; maximum, .71 mm.; average, .67 mm. (Estimated from 31 specimens.)

Ratio of measurements: 1.45; theoretical measurements: .31; .45; .65; actual average measurements: .31; .45; .67.

DESCRIPTION OF THE PUPA.

Description of just formed pupa. Pure creamy white, caudal spines black, spiracles and setae dark brown. Length 3-3.5 mm.; width 1.5 mm.

The general appearance is that characteristic of chrysomelid pupae: wings and elytra pushed ventrad; the legs sharply bent at the femoro-tibial joint, the femora extending away from the meson, the tibiae toward it, and the tarsi caudad along the middle line of the body; the metathoracic legs passing under the wings, the antennae extending caudad and bent under the mesothoracic legs.

There are nine abdominal segments (unless the anal plate may be reckoned as a vestigial tenth), the last bearing a pair of strong black caudal spines. The arrangement of the setae is that characteristic of the whole genus and does not present any specific character, except that it belongs to the group having two setae on each femur instead of three.

Seven pairs of spiracles are present. The first pair is located on the mesothorax, ventrad of the base of each elytron. The other six pairs are located on the first six abdominal segments. The last pair is smaller than the rest.

There is a considerable range of variation in the pupal setae. The typical arrangement is shown in figures 11C (dorsal aspect), and 11D, (dorsal aspect of tip of abdomen). The pupa of the elm flea-beetle which is almost identical is shown in figures 12F and 12G.

Homologies of pupal and larval setae. There are constantly three setae on each side of the head throughout the Alticini, which the writer has not yet succeeded in homologizing with the larval setae. There are eight setae on the prothorax, which are homologous with those on the cephalic shield of the larva. There are two setae on each side of the mesothorax and the metathorax, homologous with the setae of tubercles ii and iv of the larva. There are four setae on each side of the first 8 abdominal segments; these are homologous with the larval setae of tubercles ii, iv, vi, and viii respectively, and the spiracle occurs between setae vi and viii as in the larva; the spiracle is not developed on segments 7 and 8 of the pupa. On segment 9, there are four setae and a caudal spine on each side, these five probably homologous with the five larval setae.

Any one of these setae may be lacking in any given pupa, and very rarely the caudal spines themselves may be lacking. An extra seta corresponding to the seta of tubercle vi in the larva is sometimes present on the mesothorax or metathorax.

The setae of the pupae are formed by the same trichogen cells which formed the larval setae. They are not hollow sense hairs like the larval setae, but are solid and pointed. They are developed only on the dorsal side, or the anterior and posterior ends of the body, so that their function would appear to be to hold the pupa away from contact with the sides of the pupal cell, since the insect lies with the ventral aspect uppermost.

The accessory trichogen cells (those which will not be utilized in forming the pupal setae) are phagocytized during the prepupal period, after the larva has entered the ground and constructed its cell, so that sense hairs are of no further use to it; and the trichogens which form the pupal setae are themselves phagocytized within 24 hours after pupation. The trichogen cells of the adult hypodermis are entirely unrelated to those of the pupal or larval hypodermis, so far as the writer has been able to ascertain.

Description of the pupa ready to transform. Dorsum of prothorax gray; metathoracic thickenings brown; eyes and antennae jet black; mandibles dark red brown, black tipped; wings, tibiae, tarsi, and caudal portions of femora piceous; elytra colorless (though they appear gray as the wings show through them); otherwise like the newly formed pupa.

BIOLOGICAL HISTORY.

SUMMARY OF REARINGS.

Length of the egg stage. A record which was kept of 215 eggs deposited between June 16 and July 14, inclusive, may be tabulated as follows:

5 hatched in 7 days, 81 in 8 days, 63 in 9 days, 38 in 10 days, 9 in 11 days, and 19 in 12 days; average 9 days.

Length of the first larval instar. A record which was kept of 220 larvae which hatched between June 16 and July 14 inclusive, may be tabulated as follows:

63 molted to the second instar in 4 days after hatching from the egg, 45 in 5 days, 53 in 6 days, 21 in 7 days, 17 in 8 days, 10 in 9 days, and 11 in 10 days; average 6 days.

Length of the second larval instar. A record which was kept of 233 larvae which molted to the second instar between June 22 and July 30 inclusive, may be tabulated as follows:

14 molted to the third instar in 3 days after the first molt, 53 in 4 days, 99 in 5 days, 22 in 6 days, 35 in 7 days, 1 in 8 days, 5 in 9 days, and 4 in 11 days; average 5 days.

Length of the third larval instar. A record which was kept of 173 larvae which molted to the third instar between July 1 and August 7 inclusive, may be tabulated as follows:

13 entered the soil in 2 days after the second molt, 59 in 3 days, 45 in 4 days, 31 in 5 days, 15 in 6 days, 3 in 7 days, 2 in 9 days, and 5 in 13 days; average 4 days.

Length of the prepupal period. A record which was kept of 141 prepupae which entered the soil between July 8 and August 7 inclusive, may be tabulated as follows:

41 transformed to pupae in 5 days after entering soil; 41 in 6 days, 41 in 7 days, 17 in 8 days, and 1 in 9 days; average 6 days.

Length of the pupal period. A record which was kept of 148 pupae which transformed between July 13 and August 13 inclusive, may be tabulated as follows:

6 emerged as adults in 5 days after the pupal molt, 21 in 6 days, 51 in 7 days, 57 in 8 days, 11 in 9 days, and 2 in 10 days; average 7 days.

Causes of variation. The extremes of variation are due very largely to weather conditions. Hot dry weather favors rapid development, and cool damp weather retards it. The season of the year has no apparent bearing on the rapidity of development. There is often great variation in the time required for reaching maturity from individuals all of which hatched from the same egg cluster and lived under identical conditions.

Typical life history. The following is cited as a typical life history: 62 eggs deposited June 25 (1915) hatched July 3; all molted to the second instar on July 7; 16 molted to the third instar on July 11, 37 on July 12, and 9 died in the molt; 29 entered the soil as prepupae on July 14, 8 on July 15, 9 on July 16, 6 on July 19, and 1 died; 12 transformed to pupae on July 19, 2 adults emerging July 26, 7 on July 27 and 3 on July 28; 15 transformed to pupae on July 21, 4 emerging as adults on July 27, 7 on July 28, 2 on July 29, and 2 on July 30; 15 transformed to pupae on July 23, 5 emerging as adults on July 29, 5 on July 30, and 5 on July 31; 3 transformed to pupae on July 26, emerging as adults on August 3; 1 transformed to a pupa on July 27, emerging as an adult on August 4; 6 died before transforming.

SEASONAL HISTORY IN MAINE.

The dogwood flea-beetle passes the winter as an adult hidden away in the debris at the base of the dogwood bushes. They come out from their winter quarters in the spring when the

Cornus leaves are just separating from the blossom buds and are about half an inch long. In 1917 this was on June 2, and this is the earliest date on which the writer has taken a specimen; however in a normal year they probably appear about two weeks earlier. Only one beetle was taken at this time, and there was but slight indication of the work. On June 7 (1917) the leaves were quite well expanded and separated from the blossom buds, the beetles were abundant. In 1917 the dogwood did not blossom until June 18, which is at least 10 days later than is usual in Orono.

The first eggs in 1917 were deposited on June 5, but in 1918 larvae about 3 days old were collected in Orono, so eggs must have been laid at least as early as May 22. Eggs are not ordinarily found until the middle of June, but may be found from then on until the middle of July. In the laboratory, the last eggs were deposited on July 24, (1917). The majority of the eggs are deposited in early July.

The first larva to hatch in the laboratory appeared on June 14 (1917), but larvae were found in the field on June 12 (1917) and on June 3 (1918). Larvae may be found in the field from early June through mid-July, and scatteringly a few even in early August.

The adults are very scarce in the field by the 12th of July, and practically all of the hibernating adults are dead by the 20th. In the laboratory all have died on or before August 1, except for one female which lived until October 2. The writer doubts if they ever live as long as that under natural conditions. The first adult of the new generation was bred on July 15 (1917). The adults of the new generation do not feed at all, but enter into hibernation as soon as they have emerged.

There is only one generation each year, and no indication of a second under any conditions.

DISTRIBUTION.

During the past spring (1918) the writer has had a limited oportunity to observe something of the seasonal history of this species in Connecticut. They were found locally common on the dogwood in Middletown and later in Norfolk. They had already begun to pair on May 17 when they were first observed

and had deposited a few eggs. Eggs were to be found commonly a few days later. The first larvae were found on May 21, which must have come from eggs deposited at least as early as May 13. The Connecticut material exactly corresponds with the Maine material in every way.

THE EGG.

Coloration. When deposited the eggs are orange, but by 24 hours they have become the pale buff characteristic of the species. They do not turn gray before hatching. Each egg is streaked with excrement which lies on it like a black bar. The lateral tubercles of the mesothorax and metathorax show through the egg shell as 4 black spots about 24 hours before the larvae are ready to emerge.

Where deposited. The eggs are always deposited in clusters on the underside of the leaf of the food plant, on any part of the surface, but always so that the cluster lies against a vein. If there is more than one row of eggs, the eggs in the outer rows successively overlap those in the row next inner.

How many deposited. The eggs are deposited in clusters of from 2 to 41, though there are rarely more than 20 in a cluster. A count of 321 egg clusters may be summarized as follows:

Seven clusters were composed of 2 eggs each, 14 of 3, 19 of 4, 18 of 5, 23 of 6, 26 of 7, 25 of 8, 23 of 9, 30 of 10, 22 of 11, 31 of 12, 17 of 13, 20 of 14, 13 of 15, 9 of 16, 4 of 17, 8 of 18, 7 of 19, 1 of 20, 1 of 23, 1 of 29, 1 of 30, 1 of 41; mean of species 12; true average 9.9.

THE LARVA.

Color changes of the larva during growth. The body wall of the larva is covered with minute cuticular nodules, which, together with the tubercles, are the pigmented portions of the body. Just after hatching or immediately after a molt, the integument is translucent, and the larva appears entirely white, as no pigment has yet been formed, and the white fat-body shows through. In a few hours, pigment is formed in the tubercles and in the nodules. As the body wall is not stretched, the tuber-

cles and nodules lie very close together, and give the larva a dark aspect; late in the instar, the general color of the larva is much lighter, since the integument is stretched, the nodules farther apart, and the tubercles smaller in proportion to the body surface.

Such a series of color changes is very characteristic of all of the species treated in this bulletin, and indeed of all flea-beetles which the writer has studied. They are either white or yellow after a molt (according to the color of the fat-body), as there is no pigment in the cuticula; they rapidly become darker, and the darkness is at a maximum a few hours after the molt; then they gradually become lighter throughout the instar, and the coloration of the early and late part of the same instar is frequently quite different.

Hatching. When the larva is ready to emerge from the egg, the shell splits near, but not quite at, the anterior end, a very tiny slit first appearing. Soon a second slit appears parallel to the first. From one or the other of the openings thus formed is pushed out the mesothorax. Gradually the whole thorax is arched out of this opening, first the mesothorax and later the prothorax and metathorax. In about 10 minutes from the time the crack first appears, the fused tubercles v-vii-viii of the two posterior thoracic segments are exposed, and the larva has a decidedly hunch-backed appearance. After a hard struggle of about 10 minutes longer, the head also is withdrawn through this opening, and the legs almost immediately after. The legs are but little used for they are still soft and weak. Nearly all of the hatching process is accomplished simply by alternately contracting and relaxing the body muscles. In about 30 minutes the larva is two-thirds out of the shell, but it is usually another half hour before it finally crawls out completely.

Coloration after hatching. When the larva emerges from the egg shell, it is entirely grayish white, including head, legs, and shields, except for the 4 black spots on the thorax. These spots are formed by the fused tubercle v-vii-viii on each side of the mesothorax and metathorax, which are the only pigmented portions of the cuticula at the time of hatching. The larva becomes fully colored in about 2 hours.

Color description of a first instar larva, early.

Head, legs, prothoracic and anal shields shining black; body dark brown, almost black, lighter ventrally; dorsal and lateral tubercles dull black; ventral tubercles brown.

Color description of a first instar larva, late.

Head, legs, prothoracic and anal shields shining black; general aspect of body yellowish white; tubercles dull olive gray; lateral tubercles of meso- and meta-thorax darker and prominent.

The molt to the second instar (first molt). The process of molting is the same in all of the flea-beetles studied, and is described in detail under the second molt of the elm flea-beetle (page 188).

Coloration after the first molt. 6 min., absolutely pale translucent creamy white, the mandibles brown, setal punctures black; head, legs and prothorax white; 10 min., head, legs, and prothorax slightly darkish; 20 min., the same parts slightly darker, and the tubercles beginning to show dark; 30 min., the same parts somewhat darker; 45 min., head and prothorax quite blackish: tubercles decidedly dark: legs darker than the tubercles, but not as dark as the head; 60 min., head and prothoracic shield black: the body has a dark aspect; 75 min., head and prothoracic shining black, the legs black, the tubercles normally colored; 105 min., fully colored.

Color description of a second instar larva, early. Head, legs, prothoracic and anal shields shining black; general aspect of body almost black (integument yellowish white with the dark brown cuticular nodules very close together); tubercles dull black.

Color description of a second instar larva, late. Head, legs, prothoracic and anal shields shining black; general aspect of body yellowish white, not much lighter ventrally (cuticular nodules lighter brown and farther apart); dorsal and lateral tubercles dark gray brown; ventral tubercles brown; anal proleg white.

The molt to the third instar (second molt). The process of molting is the same in all of the flea-beetles studied, and is described in detail under the second molt of the elm flea-beetle (page 188).

Color description of a third instar larva, early. Head, legs, prothoraic and anal shields shining black; general aspect of body almost black above, lighter ventrally; dorsal and lateral tubercles dull black; ventral tubercles gray; anal proleg white.

Color description of a third instar larva, late. Head, legs, prothoracic and anal shields shining black; general aspect of the body light yellowish gray; dorsal and lateral tubercles deep gray brown; ventral tubercles gray; anal proleg white.

Feeding habits. The larvae skeletonize the leaves, leaving only a network of the veins. They feed mostly on the underside of the leaves,

and are to a slight extent gregarious. They are very sluggish, and their comparatively soft bodies are covered with their powdery excreta. The work of the larvae is illustrated in figure 13B.

THE PREPUPA.

Formation of the pupa cell. In all insects which undergo a complete metamorphosis, the wings are developed internally in the larva as hypodermal invaginations. Soon a part of this invagination evaginates to form the wing-bud proper, and just before the formation of the pupal cuticula, this wing-bud pushes out so as to lie on the outside of the hypodermis. The internal wing-bud of the larva is therefore external in the pupa, because it lay outside the hypodermis when the pupa cuticula was secreted. The period from the outpushing of the wing-bud in the larva until the molt to the pupa, is spoken of as the prepupal period.

In flea-beetles generally, the prepupal period is passed in the earth. As soon as the larva is fully fed, it enters the ground to complete its transformations. Sections of specimens of several different species fixed at this time show clearly that the entrance into the soil closely corresponds with the outpushing of the wing-buds.

The larvae enter any fairly loose soil, pupating about an inch below the surface. Here they construct a rude cell by contortions of the body, and the earth lining it is cemented together by a mucous secretion, probably poured out by the maxillary glands. (Labial glands, the ordinary salivary glands of insects are wanting in the flea-beetles, as in Coleoptera generally.) The earlier prepupa is straight, and can walk, but by the third day, the body is strongly arcuate, and the insect is unable to move its legs, due to the degeneration of the larval muscles.

Color changes of the prepupa. For about two days after entering the soil, the prepupae become darker in color, but then they become lighter, and by the fourth day are almost white.

THE PUPA.

The molt from the prepupa to the pupa. This molt is accomplished in the same way in all of the flea-beetles studied, and is described in detail under the elm flea-beetle (page 190).

Color cycle. When the pupa is first formed, it is a pure creamy white, save for the caudal spines which are black, and the setae and spiracles which are brown. As the pupa grows older, however, certain color changes appear, which are correlated with the progress of the internal metamorphosis, and furnish a reliable indication as to the age of any given pupa.

The first change to be noted is in the eyes, which become a light brown on the third day of pupal life, dark brown on the fourth, and black on the fifth. The wings become light gray usually on the fifth day, although sometimes it is as as late as the seventh day before this change appears, and a dark gray about 24 hours later. The elytra remain colorless, although as they lie over the wings, they appear to be colored. The mandibles become red brown on the fifth day.

THE ADULT.

Emergence. When the adult is ready to emerge, the elytra are pushed more or less dorsad, and the appendages are more or less straightened out before the skin cracks. The pupal cuticula cracks open along the dorsal line of the mesothorax; this is done by the scutellum, which is raised and lowered. At this same time the wings and elytra begin to increase in size, and about five minutes after the first slit appears, these appendages are about three-fourths as long as the body; meanwhile the metathorax has split way down the mid-dorsal line, and the mesothorax way up. In 8 minutes, the prothorax is free, and the head is exposed as far as the labrum. In 10 minutes the elytra and wings are as long as the body, the mouth parts are all free from the pupal cuticula, and the elytra about one-quarter exposed. All through this process, the insect continually contracts and expands the abdomen.

In 5 minutes more, the elytra are about half free, as well as 6 joints of the antennae, and one-third of the prothoracic femora. The antennae are freed by jerking the head backward as far as possible and then suddenly releasing it. In 24 minutes after the first split the right prothoracic leg was freed, and two-thirds of the elytra exposed. In 27 minutes, the left prothoracic leg was also freed, and a minute later the mesothoracic and metathoracic legs were drawn out almost simultaneously. In 33 minutes, the

beetle had succeeded in kicking the old skin off the end of the abdomen, and was entirely free from the pupal cuticula.

Coloration of adult. As the beetle emerges, the eyes, antennae, mouth parts, and legs (except the proximal two-thirds of all of the femora) are black; the tip of the pygidium is shining violet black, as are also parts of the pronotum and the scutellum. The first change is to be noted in the legs, which become fully colored in about 2 hours. The metathoracic legs are always the first to become pigmented. In about 5 hours, the head is black, except for the occiput, and also the whole of the pronotum. The elytra now begin to be gray and shiny, and are dark gray by 6 hours after emergence. In 7 hours the head is entirely black above. The normal coloration is reached in about 19 hours. The elytra never begin to turn gray until the legs are fully colored, and the beetle is all gray dorsally before it begins to darken up at all ventrally. The beetle is very soft as it emerges, and it remains in the pupal cell for about 20 hours before trying to break out or until it is fully colored and hardened.

Feeding habits. The adults feed freely on the leaves, biting holes through them. The work is characteristic, and is very different from the type of work done by the larvae. The nature of the work is shown in figure 13A. The beetles feed only in the spring. In the summer they enter into a hibernation as soon as they emerge, and feed only to a very limited extent, if at all.

Copulation. The beetles remain paired for several hours when they mate. One female pairs several times during the egg-laying season.

Number of eggs deposited by one female. Each female ordinarily lays about 400 eggs. The greatest number of eggs that was laid by any one female was 698 between June 8 and July 20 (1917). The greatest number laid by one beetle in 24 hours was 41, all in a single cluster, and the next greatest 34, in one cluster of 16 and another of 18.

FOOD PLANTS.

Natural food plants. The only plants on which the writer has ever taken beetles of this species in the field all belong to the genus *Cornus*. In Maine, the writer has found them mostly on the red osier dogwood, *C. stolonifera* Michx, and less frequently

on the panicled dogwood, *C. paniculata* L'Her. In Connecticut he has found them more frequently on the latter species.

Food plant tests. A large number of tests was carried out to determine the possible range of food plants. In these and all other food tests recorded in this paper, the experiments were made as follows: 6 larvae or adults were kept in a clean shell vial without food for 24 hours; then an uninjured leaf of the plant to be tested was introduced, and the insects were left undisturbed for a second 24 hours; at the end of that time the leaves were examined, and a record made as to whether they had been considerably eaten, slightly eaten, or left untouched.

The complete list of food plants used in these experiments is given below. The sequence of plant families and the form of the scientific name follows the use of the latest edition of Gray's Manual.

Family Gramineae, grass family: corn, *Zea mays* L.

Family Salicaceae, willow family: cultivated willow, *Salix* near *nigra* Marsh; heart-leaved willow, *Salix cordata* Muhl.; petiolate willow, *Salix petiolaris* Sm.; beaked willow, *Salix rostrata* Richards; aspen poplar, *Populus tremuloides* L.; balsam poplar, *Populus balsamifera* L.; cottonwood, *Populus deltoides* Marsh.

Family Myriaceae, gale family: sweet fern, *Myrica asplenifolia* L.

Famiy Betulaceae, birch family: hazel, *Corylus rostrata* Ait.; gray birch, *Betula populifolia* Marsh; alder, *Alnus incana* (L.) Moench.

Family Fagaceae, oak family: red oak, *Quercus rubra* L.

Family Urticaceae, nettle family: red elm, *Ulmus fulva* Michx.; white elm, *Ulmus americana* L.

Family Saxifragaceae, saxifrage family: syringa, *Philadelphus coronarius* L.; smooth gooseberry, *Ribes oxycanthoides* L.; European gooseberry, *Ribes Grossularia* L.; red currant, *Ribes vulgare* L.

Family Rosaceae, rose family: cultivated spiraea, *Spiraea* sp.; apple, *Pyrus Malus* L.; mountain ash, *Pyrus americana* (Marsh) DC.; shad bush, *Amelanchier oblongifolia* (T & G) Roem.; hawthorn, *Crataegus* sp.; wild strawberry, *Fragaria virginiana* Duchesne.; cultivated strawberry, *Fragaria* sp.; wild rose, *Rosa virginiana* L.: cultivated rose, *Rosa* sp.; Japanese rose, *Rosa Yvara;* choke cherry, *Prunus virginiana* L.; wild red cherry, *Prunus pennsylvanica,* L. f.; wild plum, *Prunus nigra* Ait.; cultivated plum, *Prunus domestica* L.

Family Leguminosae, pea family: cultivated bean, *Phaseolus* sp.

Family Aceridae, maple family: sugar maple, *Acer saccharum* Marsh.

Family Vitaceae, grape family: grape, *Vitis* sp.; wood-bine, *Psedera quinquefolia* (L.) Greene.

Family Tiliaceae, basswood family: basswood, *Tilia americana* L.

Family Onagraceae, evening primrose family: fireweed, *Epilobium angustifolium* L.; Marsh fireweed, *Epilobium palustre* L.; evening primrose, *Oenothera biennis* L.

Family Cornaceae, dogwood family: red osier dogwood, *Cornus stolonifera* Michx.; panicled dogwood, *Cornus paniculata* L'Her.; bunchberry, *Cornus canadensis* L.

Family Ericaceae, heath family: sheep laurel, *Kalmia angustifolia* L.; low blueberry, *Vaccinium pennsylvanicum* Lam.; velvet-leaf blueberry, *Vaccinium canadense* Kalm.

Family Oleaceae, olive family: lilac, *Syringa vulgaris* L.

Family Solanaceae, nightshade family: tomato, *Lycopersicon esculenium* L.

Family Compositae, composite family: Joe Pye weed, *Eupatorium purpureum* L.; goldenrod, *Solidago canadensis* L.

Food plants of the adult dogwood flea-beetle.

(i) Eaten readily.

Alder, red osier dogwood, panicled dogwood, bunchberry.

(ii) Refused.

Corn, cultivated willow, heart-leaved willow, petiolate willow, beaked willow, aspen poplar, balsam poplar, cottonwood, sweet fern, hazel, gray birch, red oak, red elm, white elm, syringa, smooth gooseberry, European gooseberry, red currant, cultivated spiraea, apple mountain ash, shad bush, wild strawberry, cultivated strawberry, wild rose, cultivated rose, Japanese rose, choke cherry, red cherry, wild plum, cultivated plum, bean, sugar maple, woodbine, basswood, fireweed, marsh fireweed, evening primrose, sheep laurel, low blueberry, velvet-leaf blueberry, lilac, tomato, Joe Pye weed.

Food plants of the larva of the dogwood flea-beetle.

(i) Eaten readily.

Red osier dogwood, panicled dogwood, bunchberry.

(ii) Eaten indifferently.

Alder, Japanese rose, (but not the other roses!), evening primrose, fireweed, marsh fireweed, bean.

(iii) Refused.

Corn, cultivated willow, heart-leaved willow, petiolate willow, beaked willow, aspen poplar, balsam poplar, cottonwood, hazel, birch, red oak, red elm, white elm, syringa, European gooseberry, red currant, cultivated spiraea, apple, mountain ash, shad bush, wild strawberry, cultivated strawberry, wild rose, cultivated rose, choke cherry, red cherry, wild plum, cultivated plum, sugar maple, woodbine, basswood, sheep laurel, low blueberry velvet-leaf blueberry, lilac, tomato, Joe Pye weed.

NATURAL ENEMIES.

Fungous diseases. Both in the laboratory and in the field, larvae, pupae, and adults are all very susceptible to the attacks of the parasitic fungus, *Sporotrichum globuliferum* Speng. This widely distributed fungus destroys many of these insects whenever conditions are favorable for its growth, and is without doubt an important agent in holding this species in check.

The prepupae and pupae are quite subject to a wilt disease, which is probably bacterial in its nature, although the writer has not made any attempt to isolate the causative organism.

Insect parasites. The writer has bred only a single parasite from the dogwood flea-beetle, a tachinid fly which works in the adult beetles. This fly which is not very common in Maine was determined for the writer as *Celatoria spinosa* Coquillet by Mr. C. W. Johnson of the Boston Museum of Natural History. The writer has also bred this fly from the beetles of *Altica ulmi* (see page 193), and it has been recorded by Coquillet as bred from the adults of *Diabrotica soror* LeC (Coquillet 1890, Insect Life, v.2:235).

The larvae are internal parasites of the adult beetles. The writer has but little data on the life history, but it seems probable that the flies deposit eggs on the over-wintering beetles in the spring or summer after they have come out from hibernation. The whitish larvae emerge from the beetles when they are full grown, killing their host. In a few hours they shrink up into brown puparia, and the adult flies emerge a week or ten days later.

CONTROL.

Like most flea-beetles, these insects can be controlled by arsenical sprays. A thorough spraying with arsenate of lead at the ordinary strength (3 pounds of the paste or 1 ½ pounds of the powder to 50 gallons of water) as soon as the beetles appear in the spring, and repeated in late June and mid-July for the larvae, is necessary, will hold this species in check whenever it is practicable or desirable to try to keep down their numbers.

ALTICA ROSAE, SP. N., THE ROSE FLEA-BEETLE.

TECHNICAL DESCRIPTIONS OF THE STAGES.

DESCRIPTION OF THE ADULT.

Elongate oval, distinctly convex; *body above,* brilliant cupreous, with metallic reflections; *antennae* piceous, the proximal segment cupreous and quite smooth, the rest pubescent with white setae; slightly more than one-half the length of the body, but less than twice the width of the prothorax at its base; segment 3 longer than segment 2 and very nearly, if not quite as long, as segment 4; segment 4 about two and a half times as long as wide; segment 10 not more than twice as long as wide, usually less; *eyes* black, not prominent, their width as seen from the front less than one-half the interocular distance; *frontal carina* moderate, acute; *frontal tubercles* moderately large, flat, almost continguous; *vertex* not punctate; *width of head* across the eyes about two-thirds that of the prothorax at its widest point.

Prothorax one-half wider than long; margin well defined; base scarcely wider than the apex, regularly arcuate; sides nearly parallel at the base, convergent at the apex; basal angles slightly dentiform, prominent; apical angles obliquely truncate; surface comparatively finely but quite densely punctate; *ante-basal groove* well defined and entire, though sometimes apparently evanescent at the extremities.

Elytra across umbones one-third wider than the base of the prothorax; each elytron slightly more than three times as long as wide, and slightly more than two times as wide as the base of the prothorax, *surface* minutely alutaceous, comparatively coarsely but densely punctate; *humeral angles* obtuse, decidedly rounded; *umbo* not prominent; *post-humeral* depression not strong.

Scutellum colored like the elytra, sparcely punctate.

Body beneath colored like the elytra; abdomen quite densely beset with fine white setae; *legs* colored like the body, except the under surfaces of the tarsal segments which are brown; the claws are red brown; the setae and pulvilli are white.

Last ventral segment of male sinuate each side; lateral lobes comparatively large; medium lobe short, semicircular, flat, the extreme edge sometimes reflexed. The last ventral segment of the male is exactly similar to that of *A. corni,* as shown in figure 11E.

Length 3 mm.

Type locality, Orono, Maine. Male designated as type deposited in the collection of the Maine Agricultural Experiment Station, Orono, Maine. *Paratypes* (which are also topotypes) deposited in the collection of the Maine Agricultural Experiment Station, Orono, Maine; of the Boston Society of Natural History, Boston, Mass.; of Wesleyan University, Middletown, Conn.; of Cornell University, Ithaca, N. Y.; and of the United States National Museum, Washington, D. C.

DESCRIPTION OF THE EGG.

Subcylindrical, irregularly elliptical, surface minutely punctate and finely sculptured, entirely divided into polygonal areas, although the sculpturing is frequently obscured; color varying from yellow to dull orange; length about 1 mm. The eggs are shown in figure 12B.

DESCRIPTION OF THE LARVA.

Description of the full grown larva. Head and legs shining black; prothoracic and anal shields more or less brown; general body color greenish yellow above and below; tubercles brown; general aspect almost black early in the instar, and light yellowish late in the instar; anal proleg light lemon yellow. Length 5-5.5 mm.

All of the other characters, such as the general structure of the body and the arrangement of setae and tubercles, are exactly the same as is described under the larva of the dogwood flea-beetle (page 157), except that tubercle iii is very rarely present on the mesothorax and if present is merely vestigial, and that tubercle iii is frequently absent on the metathorax as well, and if present is usually more or less vestigial. Both are non-setiferous in any case. There is frequently present an extra non-setiferous mid-ventral chitinization on the anterior edge of the thoracic segments.

Description of the newly hatched larva. The arrangement of setae and tubercles is exactly the same as in the full grown larva. The tubercles are proportionately larger, and crowded more closely together, and the head is proportionately larger. Length 1 mm.

Head measurements of larvae.

1st instar. Minimum, .27 mm.; maximum, .31 mm.; average, .30 mm. (Estimated from 11 specimens.)

2nd instar. Minimum, .46 mm.; maximum, .50 mm.; average, .47 mm. (Estimated from 11 specimens.)

3rd instar. Minimum, .62 mm.; maximum, .66 mm.; average, .64 mm. (Estimated from 17 specimens.)

Ratio of measurements: 1.56. Theoretical measurements: .30, .47, .73; actual average measurements: .30, .47, .64.

DESCRIPTION OF THE PUPA.

Description of the just formed pupa. Yellow; setae and spiracles brown; caudal spines black; otherwise exactly like *A. corni* (see page 160). Length 3-3 5 mm.; width 1.5 mm.

Description of pupa ready to transform. Dorsum of prothorax with irregular blackish splotches; metathoracic thickenings brown; eyes, interocular region and mouth parts black; wings dark gray or black; coxae, trochanters, and femora brown, the rest of the leg piceous, except the tarsi and the femoro-tibial joints which are black; otherwise like the newly formed pupa. (The elytra are colorless although they appear gray as the wings lie underneath them and show through.)

BIOLOGICAL HISTORY.

SUMMARY OF REARINGS.

Length of egg stage. A record which was kept of 59 eggs deposited between July 22 and July 31 inclusive, may be tabulated as follows:

18 hatched in 6 days, 37 in 7 days, and 4 in 8 days; average 7 days.

Length of the first larval instar. A record which was kept of 104 larvae which hatched between July 16 and July 30 inclusive, may be tabulated as follows:

18 molted to the second instar in 3 days after hatching, 76 in 4 days, 5 in 5 days, and 5 in 6 days; average 4 days.

Length of the second larval instar. A record which was kept of 96 larvae which molted to the second instar between July 18 and August 3 inclusive, may be tabulated as follows:

7 molted to the third instar in 2 days after the first molt, 32 in 3 days, 40 in 4 days, 16 in 5 days and 1 in 6 days; average 4 days.

Length of third larval instar. A record which was kept of 97 larvae which molted to the third instar between July 17 and August 12 inclusive, may be tabulated as follows:

2 entered soil in 2 days after the second molt, 43 in 3 days, 19 in 4 days, 19 in 5 days, 10 in 6 days, 3 in 7 days, and 1 in 8 days; average 4 days.

Length of the prepupal period. A record which was kept of 111 prepupae which entered the soil between July 20 and August 12 inclusive, may be tabulated as follows:

4 transformed to pupae in 3 days after entering soil, 18 in 4 days, 39 in 5 days, 29 in 6 days, 14 in 7 days, 4 in 8 days, 2 in 9 days, and 1 in 11 days; average 5 days.

Length of the pupal period. A record which was kept of 75 pupae which transformed between July 24 and August 14 inclusive, may be tabulated as follows:

5 emerged as adults in 6 days after the pupal molt, 24 in 7 days, 30 in 8 days, 13 in 9 days, and 3 in 10 days; average 8 days.

Typical life history. The following is cited as a typical life history: 9 eggs deposited July 9 (1917) hatched on July 16; all molted to the second instar on July 20; 3 molted to the third instar on July 24, 5 on July 25, and 1 on July 26; 3 entered the soil as prepupae on July 27, and 6 on July 28; 3 transformed to pupae on July 30, 2 adults emerging on August 7, and one of the pupae dying; 2 transformed to pupae on August 1, emerging as adults on August 8; 4 transformed to pupae on August 2, 2 emerging as adults on August 10 and 2 on August 11.

SEASONAL HISTORY IN MAINE.

Like the other members of the *ignita* group, the rose flea-beetle passes the winter as an adult, hidden away in the debris at the base of the rose-bushes. The writer has not had this species under observation in Maine in the spring, but, judging from Connecticut material, the beetles emerge from their winter quarters and begin ovipositing at approximately the same time as the dogwood flea-beetle. The oviposition period is exceptionally long even for a flea-beetle, and eggs were deposited in the laboratory as late as July 31 (1917). Eggs were found commonly in Maine on July 20 (1918) and the first larvae on July 25 (1918).

Many of the hibernating adults survive until late July, but the latest date to which one lived in the laboratory was August 8 (1917). The first beetle of the new generation to emerge in the laboratory transformed on July 31 (1917).

There is only one generation each year, at least in Maine.

DISTRIBUTION.

The writer has taken this species in Middletown, Conn., and has seen specimens collected in Massachusetts and New York.

In Maine the writer has taken this species in Orono and Ellsworth, and Doctor Patch has collected specimens in Portland, so it is probably generally distributed throughout the State.

THE EGG.

Coloration. The eggs do not as a rule show any change in color before hatching, except that the 4 black thoracic spots show through the shell about 24 hours previous to the emergence of the larva.

Where deposited. The eggs are deposited on the lower surface of the leaves of the food plant. They are always streaked with excrement.

How many deposited. As is customary among chrysomelids, the eggs are deposited in clusters. Usually there are about 7 deposited in each cluster, and the largest number that the writer has found in any one group is 12.

THE LARVA.

Hatching. The process of hatching is exactly the same as that already described for *A. corni* on page 166.

Coloration after hatching. When the larva hatches from the egg it is entirely honey yellow, except for the 4 black thoracic spots characteristic of the just hatched flea-beetles, as the dorsal portion of the lateral tubercles (fused v, vii, and viii) of the mesothorax and the metathorax is the only pigmented portion of the cuticula when the larva ruptures the egg shell. The larva colors up gradually, requiring about 2 hours to reach the normal coloration.

Color description of a first instar larva, early. Head and legs shining black, prothoracic and anal shields brown; body dark olive yellow, tubercles dark black brown, general aspect almost black; anal proleg honey yellow.

Color description of a first instar larva, late. Head, prothoracic shield and legs shining black, anal shield brown; body honey yellow, slightly greenish, both above and below; tubercles dull brown; anal proleg honey yellow.

The molt to the second instar (first molt). The process of molting is the same in all of the flea-beetles studied, and is described in detail under the second molt of the elm flea-beetle (page 188).

Coloration after the first molt. The coloration after the first molt is exactly the same as that described below under the heading "coloration after the second molt."

Color description of the second instar larva, early. Head, legs, prothoracic shield and tubercles shining black; anal shield incompletely

black; body very dark olive brown above, lighter below; general aspect almost black; anal proleg honey yellow.

Color description of the second instar larva, late. Head and legs shining black, prothoracic and anal shields brown; body light greenish yellow above and below, tubercles brown; anal proleg honey yellow.

The molt to the third instar (second molt). The process of molting is the same in all of the flea-beetles studied, and is described in detail under the second molt of the elm flea-beetle (page 188).

Coloration after the second molt. After each molt the larva is entirely pale honey yellow, including the head, legs, shields, and tubercles, except that the spiracles are black, the setal punctures brown, and the mandibles reddish brown. It requires about 2 hours after the legs have been withdrawn from the old cuticula to reach the normal coloration. The process is typically approximately as outlined below:

30 min.: dorsal tubercles slightly dull; 45 min.: head, legs, shields, and tubercles blackish; 60 min.: head brown, shields, tubercles, and legs gray brown, body dull yellow brown; the apodemes of the head show black, and the antennae are fully colored; 75 min.: shields, tubercles, and legs, as well as head, brown; 90 min.: head, shields, legs, and tubercles, dark brown, body dark; 105 min.: head and legs brownish black; 120 min.: head and legs black; 135 min.: normal coloration.

Color description of the third instar larva, early. Head and legs shining black; prothoracic and anal shields incompletely black; tubercles dark brown, body dark olive yellow, whole aspect almost black; anal proleg honey yellow.

Color description of the third instar larva, late. Head and legs shining black, prothoracic and anal shields incompletely brown; body light greenish yellow above and below, tubercles brown; anal proleg honey yellow.

Variation. There is very great variation in the color of the prothoracic and anal shields in all of the instars, especially the last. They may be either black or brown, and completely or incompletely colored. They are more frequently brown than black, especially in the older larvae, and more frequently splotched than uniformly colored.

Feeding habits. The larvae feed exclusively on the underside of the leaves, which they skeletonize in a very characteristic fashion, leaving only a network of the veins and the upper epidermis.

THE PREPUPA.

Formation of the prepupal cell. As soon as it enters the soil the prepupa constructs a rude cell not far below the surface of the ground. The formation of the cell is discussed in more detail under the dogwood flea-beetle (page 168).

Coloration. The color fades out during prepupal life, and in the late prepupa, the legs and head are brown, the tubercles dull brown, and the general aspect of the body is dull yellowish.

THE PUPA.

The molt from the prepupa to the pupa. This molt is accomplished in the same way in all of the flea-beetles studied, and is described in detail under the elm flea-beetle on page 190.

Color cycle. The pupae of the rose flea-beetle pass through a series of color changes correlated with the progress of internal metamorphosis, as do the other chrysomelids which the writer has studied.

On the third day, the eyes become light brown, dark brown on the fourth, and black on the fifth. The mandibles turn reddish brown also, usually on the fifth day. The wings appear very light gray 48 hours before the adult is ready to emerge (usually on the sixth day), and dark gray 24 hours before emergence.

There is, of course, some variation as to the time in which these characters appear, but the appearance and sequence of these pigmentations is perfectly constant.

THE ADULT.

Emergence. The process of emergence is the same in all of the flea-beetles studied, and is described in detail under the dogwood flea-beetle on page 169.

Coloration. When the beetle first emerges, it is soft-bodied, and prevailingly yellow in color. It requires about 24 hours before it is fully hardened and colored, and the beetle remains up to this time in the pupal cell.

Feeding habits. The adults feed freely both in the fall and in the spring on the leaves of their food plants. They eat

little holes through the leaf, so that their work is as characteristic as, and very different from, that of the larvae.

Mating. As is usual among chrysomelids, the beetles remain in copulation several hours, and each female pairs several times in the course of the season.

Number of eggs deposited by one female. The writer has no data as to the number of eggs which one female is capable of depositing, but it is probably at least as high as that of the dogwood flea-beetle (see page 170), as a single female captured on July 22 deposited 51 eggs before the end of the month.

FOOD PLANTS.

Natural Food Plants. The only plants on which the writer has ever found this species in the field, either in Maine or Connecticut, belong to the genus *Rosa*. They seem to prefer the wild roses, but the writer has seen them several times on cultivated roses. The Massachusetts and New York specimens in the Boston Museum of Natural History are also labelled "wild rose". A number of laboratory tests to determine the possible range of food plants is recorded below.

FOOD PLANTS OF THE ADULT ROSE FLEA-BEETLE.*

(i) Eaten readily.
Wild rose, cultivated rose, Japanese rose, wild strawberry, cultivated strawberry.

(ii) Eaten indifferently.
Fireweed, marsh fireweed.

(iii) Refused.
Hazel, gray birch, alder, white elm, smooth gooseberry, cultivated spiraea, meadow sweet, apple, mountain ash, shad bush, choke cherry, red cherry, wild plum, grape, raspberry, evening primrose, red osier dogwood, basswood, low blueberry, hawthorn, golden-rod.

FOOD PLANTS OF THE LARVA OF THE ROSE FLEA-BEETLE.

(i) Eaten readily.
Wild strawberry, cultivated strawberry, wild rose, Japanese rose, cultivated rose.

(ii) Eaten indifferently.
Marsh fireweed.

(iii) Refused.

Corn, cultivated willow, heart-leaved willow, gray birch, alder, red oak, white elm, smooth gooseberry, European gooseberry, red currant, cultivated spiraea, app'e, mountain ash, shad bush, choke cherry, red cherry, wild plum, bean, maple, wood-bine, basswood, evening primrose, red osier dogwood, low blueberry, tomato.

NATURAL ENEMIES.

Fungous diseases. This species is susceptible to the same fungous diseases as the dogwood flea-beetle (see page 173).

Insect enemies. The writer has not yet found any parasitic or predaceous insects preying upon this species.

CONTROL.

Same as for the dogwood flea-beetle (see page 173).

ALTICA ULMI, SP. N., THE ELM FLEA-BEETLE.

TECHNICAL DESCRIPTION OF THE STAGES.

DESCRIPTION OF THE ADULT.

Elongate oval, distinctly convex; *body above* shining green, blue, violet, or red violet with greenish or purplish reflections; *antennae* black with purplish or greenish reflections, especially the proximal segment: proximal segment quite smooth, the others more or less pubescent with fine white setae: about one-half the length of the body and somewhat less than twice the width of the prothorax at its base: segments 2-3-4 successively longer: segment 4 nearly if not quite three times as long as wide: segment 10 not more than twice as long as wide, frequently less; *eyes* black, not prominent, their width as seen from the front less than one-half the interocular distance; *frontal carina* moderate, obtuse; *frontal tubercles* moderately large, flat, almost contiguous; *vertex* not punctate; *width of head* across the eyes about two-thirds that of the prothorax at its widest point.

---

*For the scientific names of the plants used in these tests, see page 171.

Prothorax one-half wider than long; margin comparatively wide; base scarcely wider than apex, regularly arcuate caudad; sides nearly parallel at the base, convergent at the apex; basal angles minutely dentiform, prominent; apical angles obliquely truncate; surface comparatively finely but quite densely punctate; *ante-basal* groove well defined and entire.

Elytra across umbones one-third wider than the base of the prothorax; each elytron from two and one-half to three times as long as wide, and slightly more than two times as long as the width of the base of the prothorax; surface alutaceous, comparatively coarsely but densely punctate; humeral angles obtuse, more or less rounded; umbo only moderately prominent; post-humeral depression not strong.

Scutellum colored like the elytra, sparsely punctate.

Body beneath colored like the body above; *abdomen* quite densely beset with fine white setae.

Legs colored like the body above, except the under surfaces of the two proximal segments of the tarsi and both surfaces of the three distal segments, which are brown, and the claws, which are red brown; the setae of the legs are white.

Last ventral segment of male sinuate on each side; lateral lobes comparatively large; median lobe short, semicircular, flat, the extreme edge sometimes slightly reflexed. The last ventral segment of the male is exactly similar to that of *A. corni,* as shown in figure 11E.

Length 4.5 mm.-5 mm.

Type locality, Orono, Maine; male designated as type deposited in the collection of the Maine Agricultural Experiment Station, Orono, Maine. *Paratypes* (which are also topotypes) deposited in the collections of the Maine Agricultural Experiment Station, Orono, Maine; of Wesleyan University, Middletown, Connecticut; of Cornell University, Ithaca, New York; and of the United States National Museum, Washington, D. C.

DESCRIPTION OF THE EGG.

Subcylindrical, irregularly elliptical; surface minutely punctate and finely sculptured, entirely divided into polygonal areas, although the sculpturing is frequently obscure; color yellow; length about 1 mm. The eggs are shown in figure 12C.

DESCRIPTION OF THE LARVA.

Description of the full grown larva. Head, legs, prothoracic, and anal shields shining black; general body color almost black, a little lighter ventrally; dorsal and lateral tubercles dull black, ventral tubercles brown; anal proleg yellow. Length 5.5 mm.

All of the other characters, such as the general structure of the body and the arrangement of setae and tubercles, are exactly the same as is described under the larva of *A. corni* (page 157).

Description of the newly hatched larva. The arrangement of the setae and tubercles is exactly the same as in the full grown larva. The tubercles are proportionately larger, and crowded more closely together, and the head is proportionately larger. Length, 1 mm.

Head measurements of larvae.

1st instar. Minimum, .29 mm.; maximum, .33 mm.; average, .31 mm. (Estimated from 30 specimens).

2nd instar. Minimum, .43 mm.; maximum, .55 mm.; average, .48 mm. (Estimated from 33 specimens).

3rd instar. Minimum, .62 mm.; maximum, .74 mm.; average, .68 mm. (Estimated from 65 specimens).

Ratio of measurements: 1.5; theoretical measurements: .31, .48 .72; actual average measurements: .31, .48, .68.

THE PUPA.

Description of just formed pupa. Bright orange yellow (not as orange as *A. bimarginata* Say); setae and spiracles dark brown, caudal spines black, appendages translucent; otherwise exactly like *A. corni* (see page 169). Length 3.5-4 mm; width 2 mm.

Description of pupa ready to transform. Dorsum of prothorax shining gray brown; metathoracic thickenings brown; eyes and antennae black; mandibles dark brown; wings and the greater part of each femur and tibia, piceous; tarsi black; coxae brown; head, between the eyes, dark brown; otherwise like the newly formed pupa. (The elytra are colorless although they appear gray as the wings lie underneath them and show through).

BIOLOGICAL HISTORY.

SUMMARY OF REARINGS.

Length of egg stage. A record which was kept of 46 eggs deposited between June 14 and July 21 inclusive, may be tabulated as follows:

5 hatched in 8 days, 5 in 9 days, 5 in 10 days, 8 in 11 days, 7 in 12 days, 6 in 13 days, 9 in 15 days, and 1 in 19 days; average 12 days.

Length of the first larval instar. A record which was kept of 71 larvae which hatched between June 22 and July 31 inclusive, may be tabulated as follows:

8 molted to the second instar in 5 days after hatching from the egg, 16 in 6 days, 20 in 7 days, 13 in 8 days, 11 in 9 days, 1 in 10 days, 1 in 11 days, and 1 in 12 days; average 7 days.

Length of the second larval instar. A record which was kept of 80 larvae which molted to the second instar between June 28 and August 8 inclusive, may be tabulated as follows:

2 molted to the third instar in 3 days after the first molt, 11 in 4 days, 32 in 5 days, 25 in 6 days, 6 in 7 days, and 4 in 8 days; average 5 days.

Length of the third larval instar. A record which was kept of 68 larvae which molted to the third instar between July 4 and August 8 inclusive, may be tabulated as follows:

5 entered soil in 4 days after the second molt, 17 in 5 days, 23 in 6 days, 12 in 7 days, 3 in 8 days, 1 in 9 days, 5 in 10 days, 1 in 11 days, and 1 in 12 days; average 6 days.

Length of the prepupal period. A record which was kept of 60 prepupae which entered the soil between July 14 and August 15 inclusive, may be tabulated as follows:

1 transformed to the pupal stage in 3 days after entering soil, 9 in 4 days, 23 in 5 days, 19 in 6 days, 4 in 7 days, 1 in 8 days, and 3 in 10 days; average 5 days.

Length of the pupal period. A record which was kept of 44 pupae which transformed between July 22 and August 22 inclusive, may be tabulated as follows:

2 emerged as adults in 6 days after the pupal molt, 10 in 7 days, 18 in 8 days, 10 in 9 days, and 4 in 10 days; average 8 days.

Typical life history. The following is cited as a typical life history: 6 eggs deposited June 20 (1917) hatched July 2; 1 molted to the second instar on July 8, 5 on July 9; 5 molted to the third instar on July 13, 1 on July 14; 3 entered soil as prepupae on July 17, 2 on July 18, and 1 on July 19; 3 transformed to pupae on July 22, emerging as adults on July 30: 3 transformed to pupae on July 23, 1 emerging as an adult on July 30, and 2 on July 31.

SEASONAL HISTORY IN MAINE.

Like the preceding species, the elm flea-beetles hibernate as adults. They pass the winter hidden away under fences or debris at the base of the elm trees, or under the loose bark on

the trunks. They come out from their winter quarters in early June, just as the elm buds are opening. The adults are not very active early in the season, and usually crawl back under the bark for protection during the night. In 1917, the writer found a few pairs on June 2, and by June 5, they were pairing commonly.

The earliest date on which the writer has found eggs in Maine is June 7 (1917) and eggs were not common until late in the month. Many beetles may be found pairing in late June and early July, but the latest date on which eggs have been deposited in the laboratory is July 15 (1917).

The earliest date on which the writer has found larvae is June 25 (1918), but a very few perhaps hatch slightly earlier. Most of the larvae are in the first instar in early July, with a few in the second instar; in mid-July, the great bulk are in the second instar, and a few in the early third; while later in the month, the great majority are in the third instar; although first instar larvae may still be found occasionally even as late as early August.

Most of the overwintering adults are dead by mid-July and the latest date to which one lived in the laboratory is August 10 (1916). The adults of the new generation begin to appear in late July (the earliest date on which one emerged in the laboratory was July 30, (1916), and are common by the tenth of August. They feed freely on the leaves during the rest of the summer and early fall, entering into hibernation at the approach of cold weather.

There is only one generation each year in Maine, although egg laying covers a very long period of time.

DISTRIBUTION.

The elm flea-beetle is common in Connecticut. The writer has also seen specimens collected in Pennsylvania by Professor Robert Matheson of Cornell University.

In Maine, the writer has noticed this species only in several localities and doubtless it is widely distributed through the state.

THE EGG.

Coloration. The eggs do not as a rule show any change in color before hatching, except that the 4 black thoracic spots show through the shell about 24 hours previous to the emergence of the larva.

Where deposited. The eggs are deposited on the lower surface of the leaves of the food plant, and at least on the elm, always in the angle formed by the union of one of the secondary veins with the mid-rib. The eggs may or may not be streaked with excrement.

How many deposited. The eggs are never deposited in clusters as in the case with most flea-beetles, but only one or two are laid in any given place. This is in marked contrast to the habits of related species.

THE LARVA.

Hatching. The process of hatching is exactly the same as that already described for *A. corni* on page 166.

Coloration after hatching. When the larva hatches from the egg, it is bright yellow (less orange than *bimarginata)*; the legs are translucent, the setal punctures brown, and the fused tubercles v-vii-viii of the mesothorax and the metathorax are very dark brown so that the larva appears yellow with four black spots. The coloration of the newly hatched larva, which gradually becomes darker is typically that outlined below:

10 min.: head slightly blackish, tips of the tarsi black, thoracic spots black; 20 min.: abdomen somewhat darkish, tubercles brown, head decidedly blackish, tarsi blackish and the rest of the legs dark; 30 min.: prothorax blackish, as dark as the abdomen, head dark gray; 40 min.: legs all gray, tubercles and prothorax gray, head almost black; 50 min.: darker, but no change in the relative coloration; 60 min.: tubercles legs and prothorax dark gray, body gray with only a faint suggestion of yellow, head shining black; 70 min.: no change; 90 min.: head, prothorax, and last joint of legs shining black; 120 min.: normal coloration.

Color description of a first instar larva, early. Head, prothoracic and anal shields, and legs shining black; general body color dull yellow; dorsal and lateral tubercles dull black brown; lateral tubercles (v-vii-viii) of mesothorax and metathorax shining black and very prominent; ventral tubercles brown; anal proleg yellow.

Color description of a second instar larva, late. Head, prothoracic and anal shields, and legs, shining black; general body color bright golden yellow, a little lighter ventrally than dorsally; dorsal and lateral tubercles black, ventral tubercles brown; anal proleg yellow.

The molt to the second instar (first molt). The molt to the second instar is exactly like that to the third instar, and is described below under that heading.

Coloration after the first molt. The coloration after the first molt is exactly the same process as that described below under the heading "coloration after the second molt."

Color description of the second instar larva, early. Head, prothoracic and anal shields, shining black; general body color very dark golden black, somewhat lighter ventrally; dorsal and lateral tubercles black, ventral tubercles brown; anal proleg yellow.

Color description of the second instar larva, late. Head, prothoracic and anal shields, and legs, shining black; general body color dark golden yellow (duller than in the late first instar), a little lighter ventrally; dorsal and lateral tubercles dull black, ventral tubercles brown, anal proleg yellow.

The molt to the third instar (second molt). A number of larvae was carefully watched while they accomplished the second molt. The first step in the process is the rupturing of the old cuticula, which splits along the mid-dorsal line of the metathorax, this crack extending forward on the mid-dorsal line of the mesothorax, the prothorax, and the Y-shaped head suture. Through the opening thus formed, the thoracic segments are arched out, the mesothorax being the first to bulge out. Within 5 minutes after the appearance of the split, the thoracic segments are well out, and in 10 or 15 minutes the head as well is free. All this is accomplished by the alternate contraction and relaxation of the body muscles. The legs are freed immediately after the head. To draw them out from the old cuticula, the body is hunched together, and then the head is thrown back suddenly as far as is possible, which results in extricating them one pair at a time, although these movements take place so rapidly that the legs seem to be withdrawn almost simultaneously. The legs are held appressed for several minutes as they are very soft when they are first drawn out, and the larva clings to the leaf only by the anal proleg. In about 5 minutes the legs are used a little to help push down the old cuticula from the abdomen, and in approximately 15 minutes after they have been withdrawn, the larva

releases the anal proleg, walks out of the old skin, and the molt is complete. This process takes about half an hour. The larva begins to feed immediately.

One can see very plainly that the invaginated portions of the ectoderm molt their chitinized linings, as well as the exposed parts. Under a binocular the molting of the intima of the fore and hind intestines and of the tracheae shows up very clearly. As is supposed to be the case with insects generally, the new setae are not formed inside of the old ones (although they are developed from the same trichogen cells) but lie flat on the body wall, between the new and old cuticulae. They spring up to the normal position as soon as they are free from the molted skin.

Coloration after the second molt. As the larva starts to walk, the body is entirely bright shining orange yellow, except for the brown setal punctures, the reddish brown mandibles, and the translucent legs. The coloration proceeds typically about as follows:

10 min.: no change; 20 min.: body slightly duller, but head, legs and prothorax unchanged; 30 min.: all three thoracic segments and the abdomen dull, head somewhat duller, legs paler; 40 min.: legs pale gray, head still yellow, thorax and abdomen blackish; 50 min.: head and prothorax duller and darker than the rest of the body, tubercles brown; 60 min.: no change; 70 min.: legs black, tubercles dark brown; 85 min.: larva darker, but no relative change; 100 min.: head and legs deep shining black; prothoracic shield dark shining brown; body dark; 115 min.: no change; 130 min.: prothoracic shield shining black; tubercles very dark brown; 150 min.: normal coloration.

Color description of the third instar larva, early. Head, prothoracic and anal shields, and legs shining black; general body color almost black (darker and duller than in early second instar), a little lighter below; dorsal and lateral tubercles dull black, ventral tubercles brown; anal proleg yellow.

Color description of the third instar larva, late. Head, prothoracic and anal shields, and legs, shining black; body dark golden yellow (darker than in late second instar), a little lighter below; dorsal and lateral tubercles dull black, ventral tubercles brown; anal proleg yellow.

Feeding habits. The larvae feed exclusively on the underside of the leaves, which they skeletonize in a very characteristic fashion. Their work is illustrated in figure 95 of bulletin 195 of this Station.

THE PREPUPA.

Formation of the prepupal cell. As is described more in detail under *A. corni* on page 168, the prepupa constructs a rude cell not far below the surface of the ground, as soon as it enters the soil.

Coloration. When the larva first enters soil as a prepupa, the head, shields, and legs are shining black, the body dark golden yellow, and the tubercles very dark brown. During prepupal life the body becomes somewhat duller at first, and the tubercles much lighter. In the late prepupa, the mesothorax and the metathorax are golden yellow above, and the general aspect of the body is golden brown above and golden yellow ventrally. All of the tubercles are light brown.

THE PUPA.

The molt to the pupa. The prepupal skin splits exactly as in the case of a larval molt, beginning at the base of the middorsal line of the metathorax. The pupa wriggles out through the opening thus formed, simply by the alternate contraction and relaxation of the somatic muscles, the head and thorax coming out first and later the abdomen. This molt requires about 50 minutes. The pupa is always formed with the ventral aspect uppermost, and it remains in this position throughout the period.

As was pointed out in the case of the alder flea-beetle (Bulletin 265, page 265), there is no homology between the larval legs and the imaginal legs. At the beginning of the molt, each leg, though fully formed, is curled up into a little pad at the base of the larval leg, but as soon as they are free from the old cuticula, they are straightened out so as lie in the position normal to the pupa. The wings and elytra lie pushed ventrad in the prepupa beneath the larval cuticula, in much the same relationship that they have in the pupa.

As is to be expected, the pupal setae lie flat on the body wall between the larval and pupal cuticulae, and do not extend up into the larval hairs. As soon as they are free from the larval cuticula they spring up into the normal position.

Color cycle. When the pupa is first formed, it is bright yellow, except for the black caudal spines, and the brown setae and spiracles. But as the pupa grows older, certain color changes appear very constantly and furnish a reliable key to the age of the pupa.

On the second day after the pupal molt, the eyes become light brown; they are a medium brown by the third day, and black by the fourth. By the fifth day, the mandibles are reddish brown, and at the same time, the wings become light gray. They become dark gray about 24 hours later.

THE ADULT.

Emergence. The emergence of the adult is exactly like the process already described for *A. corni* on page 169.

Coloration. When the beetle first emerges from the pupal cuticula, the prevailing body color is orange yellow. The eyes are black, as are also the antennae, and the parts of the legs; between the eyes the head is gray, but elsewhere it is yellowish; the labrum is yellow, the mandibles reddish brown, and the maxillae and labium black. All of the coxae are black, save the prothoracic, which are yellowish, as are all of the femora, except distally where they are piceous; the tibiae are black proximally, and the tarsi are black dorsally. There are 2 round gray spots on the pronotum. The elytra are yellow.

In about an hour the tibiae become entirely black, and the procoxae, piceous. The pronotum is gray except around the edges. The wings stretch out their full length behind, fully formed, and not wrinkled. After another hour, the scutellum is brown, and by four hours the elytra while still soft begin to have a greenish iridescence. In 5 hours, the pronotum is entirely dark, with greenish reflections. In 6 hours, the beetle is almost normally colored dorsally, and the ventral surface begins to show signs of coloration. The beetle is very soft when it is first formed, and it remains in the pupal cell for about 24 hours, or until it is fully colored and hardened.

Feeding habits. The adults feed very freely both in the spring and fall on the leaves of their food plants. They eat holes through the leaf, so that their work is as characteristic as, and very different from, that of the larvae. Their work on elm

leaves is shown in figure 94 of Bulletin 195 of this Experiment Station.

Mating. As is usual with chrysomelid beetles, each female pairs several times during the season, before she has finished depositing all of her eggs.

Number of eggs deposited by one female. These beetles do not thrive in confinement as well as most flea-beetles do, and the number of eggs deposited under laboratory conditions is probably somewhat smaller than the number normally deposited under natural conditions. The greatest number of eggs that was deposited by any one female was 181 between June 11 and July 15 (1917). The greatest number laid by one beetle in 24 hours was 17.

FOOD PLANTS.

Natural food plants. The only plant on which the writer has ever found this species in the field is the white elm, *Ulmus americana L.* But in the laboratory, the larvae, especially, ate with more or less readiness a surprisingly large number of other plants.

FOOD-PLANTS OF THE ADULT ELM FLEA-BEETLE.*

(i) Eaten readily.
White elm, red elm, basswood.

(ii) Eaten indifferently.
Cultivated willow, heart-leaved willow, petiolate willow, beaked willow, wild strawberry, cultivated strawberry, wild rose, cultivated rose, Japanese rose, fireweed, low blueberry.

(iii) Refused.
Aspen poplar, balsam poplar, sweet fern, hazel, gray birch, alder, red oak, syringa, smooth gooseberry, European gooseberry, cultivated spiraea, apple, mountain ash, choke cherry, red cherry, wild plum, cultivated plum, sugar maple, woodbine, marsh fireweed, evening primrose, red osier dogwood, bunchberry, sheep laurel, lilac, Joe Pye weed, grape (!).

---

*For the scientific names of the plants used in these tests, see page 171.

FOOD PLANTS OF THE LARVA OF THE ELM FLEA-BEETLE.

(i) Eaten readily.
White elm, red elm, basswood.

(ii) Eaten indifferently.
Corn, hazel, red oak, European gooseberry, mountain ash, shad bush, wild strawberry, cultivated strawberry, wild rose, cultivated rose, Japanese rose, choke cherry, red cherry, wild plum, cultivated plum, bean, fireweed, marsh fireweed, evening primrose, panicled dogwood, bunchberry, low blueberry, tomato.

(iii) Refused.
Cultivated willow (!), heart-leaved willow, aspen poplar, balsam poplar, sweet fern, gray birch (!), alder (!), syringa, cultivated spiraea, apple, red currant (!), woodbine, red osier dogwood (!), sheep laurel, lilac, Joe Pye weed.

NATURAL ENEMIES.

Fungous diseases. This species is susceptible to the same fungous diseases as *A. corni* (see page 173).

Insect enemies. But two species of insects have been found preying upon the elm flea-beetle, one a parasitic and the other a predaceous form.

The writer has bred a single specimen of *Celatoria spinosa* Coquillet from an adult elm flea-beetle. This is the same species which he has bred in considerably larger numbers from *A. corni* (see page 173).

The nymphs of one of the large soldier bugs *(Podisus modestus)* were found feeding on the larvae of this flea-beetle in Orono during the summer of 1917. Neither of these insect enemies was found in sufficient abundance so that they would appear to be of much effect in controlling the species.

CONTROL.

Same as for *A. corni* (see page 173).

BIBLIOGRAPHY.

Johannsen, Oskar Augustus, and Patch, Edith M. 1911. Maine Agricultural Experiment Station. Bulletin 195, p. 233-234, Figs. 94-95. (*Haltica carinata* as an elm leaf pest).

ALTICA TORQUATA LE CONTE, THE BLUEBERRY FLEA-BEETLE.

TECHNICAL DESCRIPTION OF THE STAGES.

DESCRIPTION OF THE ADULT.

Elongate oval, convex; *body above* brilliant cupreous with metallic reflections; *antennae* cupreous, becoming more or less piceous distally; segments 1-3 nearly smooth, the others (especially the distal ones) quite densely pubescent with fine whitish setae: slightly less than one-half the length of the body, and considerably less than twice the width of the prothorax at its base; segments 2-3-4 successively longer: segment 4 about two and one-half times as wide as long: segment 10 not more than twice as long as wide, frequently less; *eyes* black, their width as seen from the front less than one-half the interocular distance; *frontal carina* moderately prominent, acute; *frontal tubercles* moderately large, almost contiguous; *vertex* not punctate; *width of head* across eyes a little more than two-thirds that of the prothorax at its widest point.

Prothorax about two-thirds wider than long; margin narrow, thickened at the basal and apical angles; base but little wider than the apex, regularly arcuate caudad; sides nearly parallel at the base, convergent at the apex; basal angles subacute, prominent; apical angles rounded; surface alutaceous, comparatively finely and closely punctate; *ante-basal groove* shallow and incomplete.

Elytra (across umbones) one-fourth wider than the base of the prothorax; each elytron three times as long as wide, and slightly more than twice as long as the width of the base of the prothorax; surface minutely alutaceous, comparatively coarsely but densely punctate; humeral angles rounded; umbo scarcely prominent; post-humeral depression slight.

Scutellum colored like the elytra, sparsely punctate.

Body beneath colored like the body above, with strong greenish reflections; abdomen quite densely beset with fine white setae.

Legs colored like the body; claws red brown, pulvilli light brown; setae white; the femora of the hind legs are especially large, even for an *Altica*.

Last ventral segment of male sinuate each side; lateral lobes small, median lobe short, semicircular, flat, with a sharply defined impressed median line running about half the length of the segment.

Length, 5 mm.

Figure 12H is reproduced from the photograph of a beetle of this species. The last ventral segment of the male is shown in figure 11F.

DESCRIPTION OF THE EGG.

Subcylindrical, irregularly elliptical; surface minutely punctate and finely sculptured, entirely divided into polygonal areas, though the sculpturing is frequently obscure; color orange, length about 1 mm. The eggs are shown in figure 12D.

DESCRIPTION OF THE LARVA.

Description of the full grown larva. Head, legs, prothoracic and anal shields shining black; genral aspect dark brown or almost black; tubercles dull black; anal proleg orange. Length 6 mm.

All of the other characters, such as the general structure of the body and the arrangement of the setae and tubercles, are exactly the same as is described under the larva of the dogwood flea-beetle, page .

Description of the newly hatched larva. The arrangement of the setae and tubercles is exactly the same as in the full grown larva. The tubercles are proportionately larger and crowded more closely together, and the head is proportionately larger. The setae are all clearly capitate. Length 1.5 mm.

Head measurements of the larvae.

1st instar. Minimum, .31 mm.; maximum, .35 mm.; average, .33 mm. (Estimated from 9 specimens.)

2nd instar. Minimum, .46 mm.; maximum, .54 mm.; average, .50 mm. (Estimated from 16 specimens.)

3rd instar. Minimum, .69 mm.; maximum, .75 mm.; average, .72 mm. (Estimated from 23 specimens.)

Ratio of measurements: 1.5; theoretical measurements: .33, .50, .75; actual average measurements: .33, .50, .72.

THE PUPA.

Description of just formed pupa. Bright orange (more orange than that of the alder flea-beetle); setae and spiracles dark brown, caudal spines black, appendages translucent; otherwise exactly like that of the dogwood flea-beetle (see page 160). Length 4.5 mm.

Description of the pupa ready to transform. Dorsum of prothorax grayish brown; metathoracic thickenings brown; eyes and antennae black; mandibles dark brown; wings dark gray; legs more or less piceous; otherwise like the newly formed pupa. (The elytra are colorless, although they appear gray as the wings lie underneath them and show through.)

BIOLOGICAL HISTORY.

SUMMARY OF REARINGS.

Length of the egg stage. The eggs are deposited in the summer, but do not hatch until the following spring.

Length of the first larval instar. A record which was kept of 9 larvae which hatched between June 1 and June 4 inclusive, may be tabulated as follows:

6 molted to the second instar in 4 days after hatching from the egg, 2 in 5 days, and 1 in 6 days; average 4.5 days.

Length of the second larval instar. A record which was kept of 31 larvae which molted to the second instar between June 1 and June 5 inclusive, may be tabulated as follows:

1 molted to the third instar in 2 days after the first molt, 15 in 3 days, 14 in 4 days, and 1 in 5 days; average 4 days.

Length of the third larval instar. A record which was kept of 36 larvae which molted to the third instar between June 4 and June 11 inclusive, may be tabulated as follows:

13 entered soil in 3 days after the second molt, 5 in 4 days, 9 in 5 days, 8 in 7 days, and 1 in 8 days; average 5 days.

Length of the prepupal period. A record which was kept of 79 prepupae which entered the soil between June 9 and June 28 inclusive, may be tabulated as follows:

10 transformed to pupae in 5 days after entering soil, 8 in 6 days, 35 in 7 days, 10 in 8 days, 15 in 9 days and 1 in 12 days; average 7 days.

Length of the pupal period. A record which was kept of 61 pupae which transformed between June 15 and July 2 inclusive, may be tabulated as follows:

30 emerged as adults in 10 days after the pupal molt, 20 in 11 days, 6 in 12 days, 3 in 13 days, 1 in 14 days and 1 in 16 days; average 11 days.

Typical life history. The following is cited as a typical life history: 4 eggs deposited in July (1916) hatched June 1 (1917); 1 molted to the second instar on June 5, 2 on June 6, and 1 on June 7; 1 molted to the third instar on June 8, 1 on June 9 and 2 on June 10; 1 died during third instar, 1 entered the soil as a prepupa on June 12, and 2 on June 15; 1 transformed to a pupa on June 18, emerging as an adult on June 29; 1 transformed on June 21, emerging on July 2, and 1 transformed on June 21, emerging on July 3.

SEASONAL HISTORY IN MAINE.

Unlike the other flea-beetles of our fauna, which hibernate as adults, the blueberry flea-beetle passes the winter in the egg

stage, and the writer has no data which would indicate that the beetles ever live over the winter.

The larvae hatch in the spring before the buds are fully expanded, and feed on the opening buds, so that they do great damage if abundant. The writer has taken a few larvae well along in the second instar even as early as June 1, so it is evident that some of the eggs hatch as early as May 24. The majority of larvae hatch in early June, and by the twentieth most of them are in the last instar; very few larvae can be found after the first of July.

The pupal period is passed in the soil and is somewhat longer than that of related species. The first adult beetle bred in the laboratory emerged June 25, and the writer has taken none as early in the field, so this must represent about the earliest date on which they appear. It is 10 days or 2 weeks after emergence before they begin to pair, and several days later before eggs are deposited. The first eggs were deposited in the laboratory on July 12 (1917), and the last on August 16, (1917). The great bulk of eggs is deposited in late July or very early August.

Adults may be taken quite commonly until well into September, but the writer has seen no indication that the beetles ever survive the winter. There is only one generation each season.

DISTRIBUTION.

The blueberry flea-beetle is widely distributed in Maine, and the writer has taken specimens in Orono, Ellsworth, Cherryfield, and York County. Ordinarily this species is uncommon or rare in the state, but periodically it occurs in great abundance, especially on the blueberry barrens of Washington County, and when it is present in any considerable numbers, is capable of great damage, since it feeds on the opening blossoms, and consequently the attacked bushes bear no fruit. This beetle was increasingly common in 1914 and 1915, and was locally very abundant in 1916; the larvae were common in 1917, but there were very few beetles later in the summer, and no specimens were taken in Orono in 1918, nor were any complaints received of the work elsewhere in the state up to the time this bulletin went to press.

The writer has seen no specimens of this beetle in collections which he was sure were this species outside of the Maine material. But as Le Conte's description was based upon Kansas material, it is probably quite widely distributed through the United States.

THE EGG.

Where deposited. The writer has never succeeded in finding the eggs of this species in the field; but they are probably deposited on the ground at the base of the plants. In the laboratory, the beetles have almost invariably laid their eggs in the cheese cloth on the bottom of the rearing cages, and after careful searches in the field, no eggs were found on the twigs.

The habits of the larvae would tend to confirm this view, for the newly hatched grubs are very uneasy, and wander around several hours before they settle down to feeding.

How many deposited. The eggs are never deposited in clusters (so far as laboratory observations indicate), but are laid either singly or in little groups of 2 or 3.

THE LARVA.

Hatching. The process of hatching was not observed in this species.

Coloration after hatching. The larvae are entirely yellow orange when they hatch from the egg, with the same four black spots on the thorax (dorsal portion of fused tubercles v-vii-viii of the mesothorax and the metathorax) characteristic of the flea-beetles. The larva becomes fully colored in about 2 hours.

Color description of the first instar larva, early. Head, prothoracic and anal shields, and legs shining black; dorsal tubercles dull black, ventral tubercles brown; general aspect dark brown, or almost black above, and dark golden brown ventrally; anal proleg yellow.

Color description of the first instar larva, late. Head, prothoracic and anal shields, and legs, shining black; all tubercles brown; body above dark golden brown, lighter ventrally; anal proleg yellow.

The molt to the second instar (first molt.) The process of molting is the same in all of the flea-beetles studied, and is described in detail under the second molt of the elm flea-beetles (page 188).

Coloration after the first molt. The coloration after the first molt is exactly the same as that described below under the heading "coloration after the second molt."

Color description of the second instar larva. The second instar larva, both early and late, is colored exactly like the third instar larva.

The molt to the third instar (second molt). The process of molting is the same in all of the flea-beetles studied and is described in detail under the second molt of the elm flea-beetle (see page 188).

Coloration after the second molt. When the larva molts from the second instar to the third, it is entirely bright orange yellow at the time of the molt, including head, legs, and shields. The cuticula gradually becomes pigmented, and the normal coloration is attained about 2 hours after the larva has shed its skin.

Color description of the third instar larva, early. Head, legs, prothoracic and anal shields shining black; all of the tubercles dull black; general aspect dark brown or almost black above, scarcely lighter ventrally; anal proleg yellow.

Color description of the third instar larva, late. Head, legs, prothoracic and anal shields shining black; all of the tubercles brown; general aspect dark golden brown above, lighter ventrally; anal proleg yellow.

Feeding habits. The larvae feed voraciously on the opening buds and flowers of the blueberry, and later on the leaves. When they are abundant they can cause severe losses, as they destroy the blossoms and hence preclude the possibility of the plant setting fruit. Even when they do not sterilize the blossoms, they so injure the vitality of the plants that such berries as are produced are small and sour. Unlike the larvae of most flea-beetles, they do not skeletonize the leaves, but eat holes through them or eat out irregular notches in the sides.

THE PREPUPA.

Formation of the prepupal cell. As soon as the prepupa enters the soil, it constructs a rude cell not far below the surface of the ground. The formation of the cell is discussed in more detail under the dogwood flea-beetle (page 168).

Coloration. The color fades out during the prepupal, and in the late prepupa, the tubercles are dull brown, and the general aspect of the body is golden brown dorsally, and golden ventrally.

THE PUPA.

The molt from the prepupa to the pupa. This molt is accomplished in the same way in all flea-beetles, and is described in detail under the elm flea-beetle on page 190.

Color cycle. The pupae of the blueberry flea-beetle pass through a series of color changes correlated with the progress of internal metamorphosis, as do the other chrysomelids which the writer has studied.

On the fifth day of pupal life, the eyes become light brown, dark brown on the sixth, and black on the seventh. The mandibles also turn reddish brown, usually on the sixth day. Forty-eight hours before emergence the wings appear very light gray, and dark gray about 24 hours previous.

There is of course some variation as to the time in which these characters appear, but the appearance and sequence of these pigmentations is perfectly constant.

THE ADULT.

Emergence. The process of emergence is the same in all of the flea-beetles studied, and is described in detail under the dogwood flea-beetle on page

Coloration. The adult when just emerging from the pupa is entirely yellow, except that there are grayish spots on the pronotum, the antennae are piceous, and the legs are black at the femero-tibial joints. The body is very soft. In 6 hours the legs, head, elytra and pronotum are light gray and the antennae black. In 9 hours the beetle is almost normally colored above, but the ventral side has not yet become pigmented to any considerable extent. The normal coloration and hardness are not attained for about 24 hours after emergence and the beetle does not leave the pupal cell until that time.

Feeding habits. The adult beetles feed very voraciously on the leaves of the blueberry as soon as they have emerged, and continue feeding all summer. The character of their work is shown in figure 13C. They soon strip the bushes of their leaves and may do considerable damage.

Mating. As is usual among chrysomelids, the beetles remain in copulation several hours, and each female pairs several times before she finishes oviposition.

Number of eggs deposited by one female. The writer has no very trustworthy data as to the number of eggs which one female is able to deposit, for the beetles do not thrive in the laboratory. No individual which he has isolated has deposited more than 25 eggs, but this is doubtless far below the normal capacity. The writer would guess that the normal would approximate that of the elm flea-beetle (about 200), rather than that of the more prolific dogwood flea-beetle (about 600).

FOOD PLANTS.

Natural food plants. The only plant on which the writer has ever taken this species in the field is the low blueberry, *Vaccinium pennsylvanicum* Lam. Neither the adults nor larvae will eat the closely related velvet-leaf blueberry, *V. canadense* Kalm. A number of laboratory tests to determine the possible range of food plants is recorded below.

FOOD PLANTS OF THE ADULT BLUEBERRY FLEA-BEETLE.*

(i) Eaten readily.
Low blueberry.

(ii) Eaten indifferently.
Red oak.

(iii) Refused.
Corn, cultivated willow, heart-leaved willow, aspen, balsam poplar, cotton-wood, sweet fern, hazel, gray birch, alder, red elm, white elm, syringa, smooth gooseberry, European gooseberry, red currant, cultivated spiraea, apple, mountain ash, shad bush, wild strawberry, cultivated strawberry, wild rose, cultivated rose, Japanese rose, choke cherry, wild red cherry, wild plum (!), cultivated plum, bean, sugar maple, woodbine, basswood, fireweed, marsh fireweed, evening primrose, red osier dogwood, panicled dogwood, bunchberry, sheep laurel, velvet-leaf blueberry (!), lilac, tomato, Joe Pye weed.

FOOD PLANTS OF THE LARVA OF THE BLUEBERRY FLEA-BEETLE.

(i) Eaten readily.
Low blueberry.

(ii) Eaten indifferently.
Red oak, wild plum.

(iii) Refused.

---

*For the scientific names of the plants used in these tests see page 171.

Shad bush, wild rose, cultivated rose, red currant, velvet-leaf blueberry (!).

NATURAL ENEMIES.

Fungous diseases. This species is susceptible to the same fungous diseases as the dogwood flea-beetle (see page 173).

Insect enemies. The writer has not yet taken any predaceous insects preying upon this species, nor bred any parasites from any of the stages.

CONTROL.

The writer has not had occasion to make any experiments in the control of this species, but there seems no reason to doubt that it can be controlled by spraying with arsenate of lead at the ordinary strength (6 pounds, paste form, to 100 gallons of water) wherever it is practicable to apply this remedy. The first application should be made in early June for the larvae, and if necessary, a second between the 10th and 15th of July for the adults.

It is only on the extensive blueberry barrens of the state that this species appears in sufficient numbers to cause appreciable damage, and here the very nature of the land and its remoteness from the towns, makes spraying and similar methods of control practically out of the question.

Without doubt the practice of burning the barrens periodically keeps this as well as other insects (notably the blueberry maggot) in check, as it seems perfectly certain that the eggs, whether deposited on the ground as the writer suggested or on the bushes, would be killed by the fire. If it were noted some summer that the beetles were especially abundant on any given area of the barrens, it would probably be well to burn over that area the following spring for the sake of destroying the eggs, even if that particular section would not normally be burned over in the regular rotation.

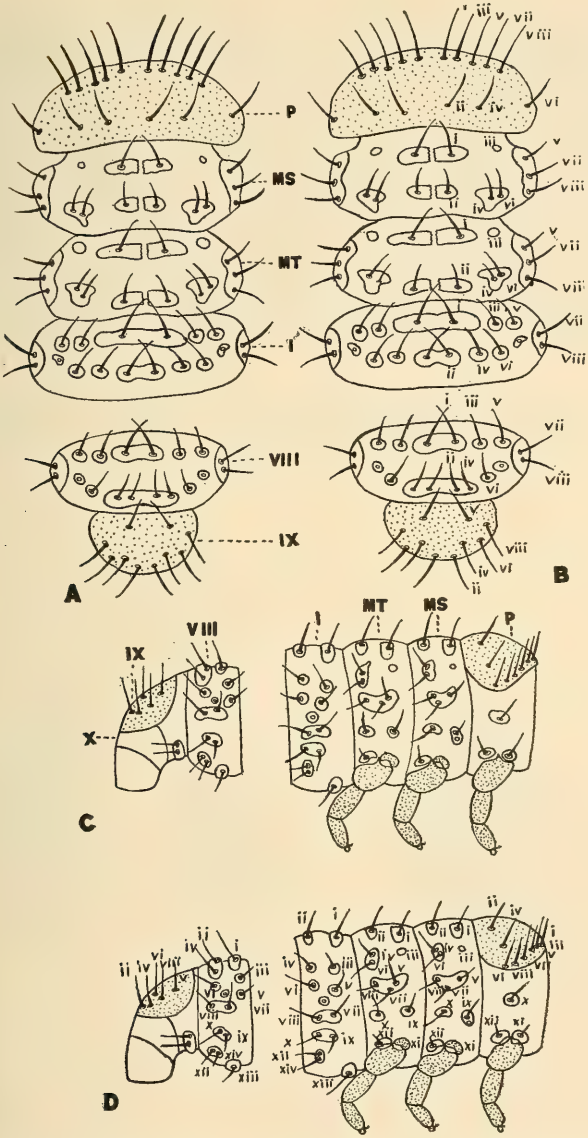

Figure 10. *Altica corni.* A, dorsal aspect of larva, showing setae and tubercles; B, same with setae numbered; C, lateral aspect of larva; D, same with setae numbered. For explanation see pages 157-158.

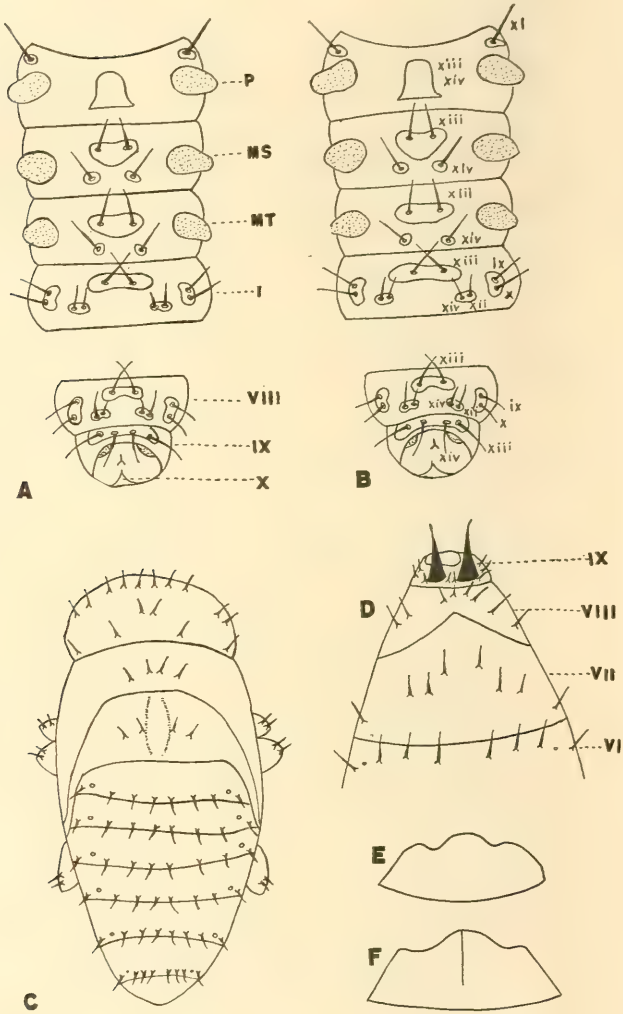

Figure 11. A-E, *Altica corni;* F, *Altica torquata* Lec. A, ventral aspect of larva; B, same with setae numbered; C, dorsal aspect of pupa; D, dorsal aspect of tip of abdomen of pupa; E, last ventral segment of male; F, last ventral segment of male.

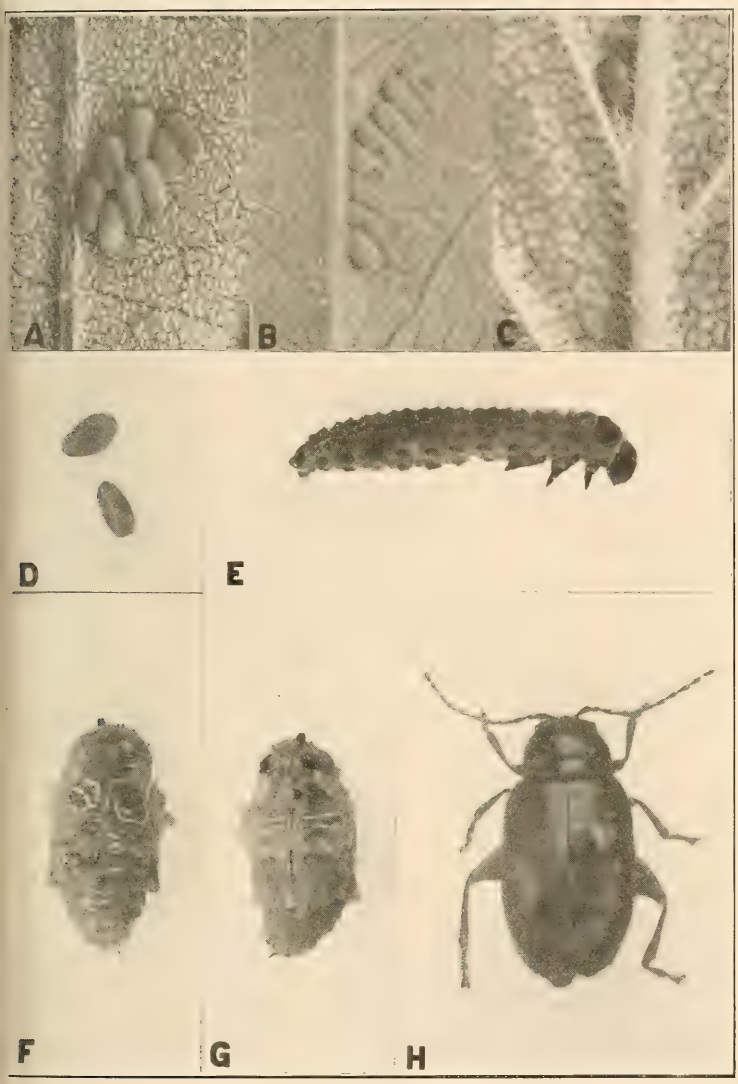

Figure 12. a, eggs of *A. corni;* b, eggs of *A. rosae;* c, eggs of *A. ulmi;* d, eggs of *A. torquata;* e, larva of *A. corni;* f, pupa of *A. ulmi,* dorsal aspect; g, pupa of *A. ulmi,* ventral aspect; h, adult of *A. torquata.*

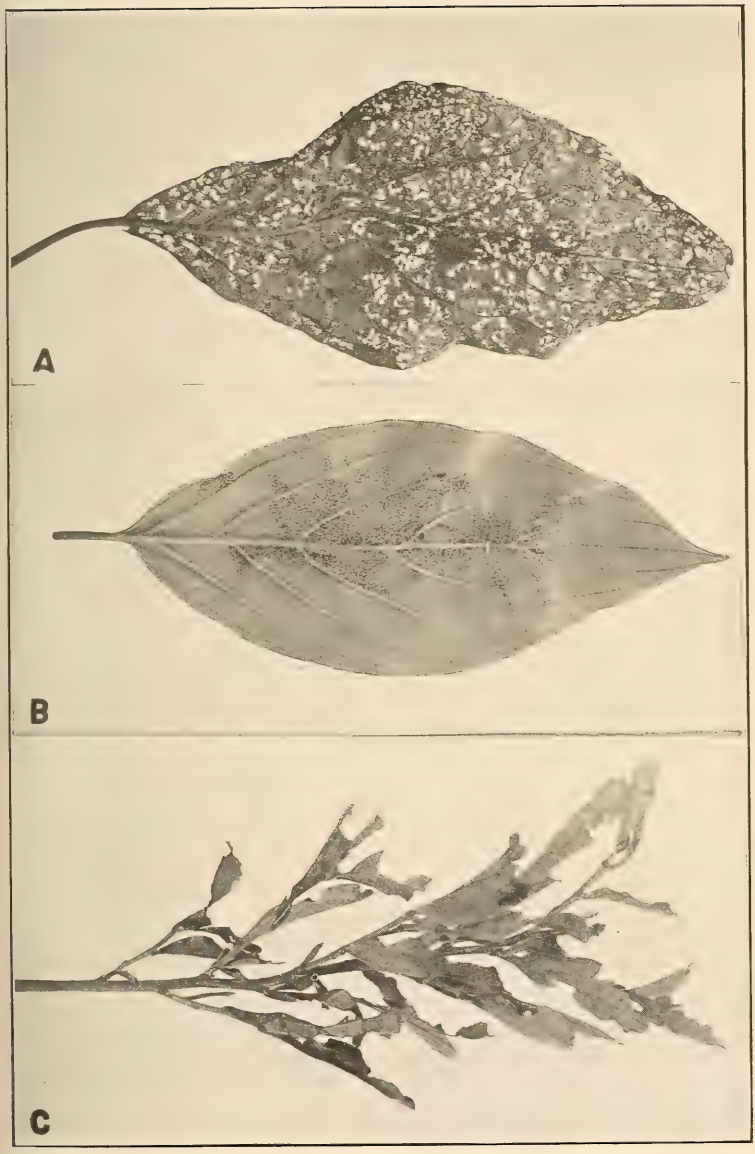

Figure 13. a, work of adult *A. corni;* b, work of larvae of *A. corni;* c, work of adult *A. torquata.*

BULLETIN 274

REPORT OF PROGRESS ON ANIMAL HUSBANDRY INVESTIGATION IN 1917.[1]

John W. Gowen.

In conformity with previous reports,[2] this brief abstract leals with the progress which has been made during the past ·ear in the animal husbandry investigations carried on by the Maine Agricultural Experiment Station. As will be noted the vork has been energetically pushed toward the solution of prob-ems already outlined in previous reports and to the gathering of new information for the solution of other problems of im-portance to us as dairymen. The material advance that has been made in the solution of these problems may best be dealt vith by presenting the information under separate headings.

Analyses of Milk Records

The existing records of the milk production of the various breeds as given in the Advanced Registries have further been made use of in the investigations of the past year. The cor-·ection factors for the rise of milk and fat production with age have first of all been separately determined for another of the

[1]Papers from the Biological Laboratory of the Maine Agricultural Experiment Station, No. 124.

This report of progress during the year 1917 of the work on animal breeding and related lines (exclusive of the work with poultry) carried on in the Biological Laboratory of the Maine Agricultural Experiment Station, was presented by Director Chas. D. Woods as the report of the Committee on Breeding of the Maine Dairymen's Association, at the meeting held in Portland on Nov. 18, 1918.

[2]Pearl, R., Report of Progress on Animal Husbandry Investigations in 1916, Maine Agri. Expt. Sta., Annual Report pp. 121-144, 1916.

Pearl, R., Report on Animal Husbandry Investigation in 1915, Maine Agri. Expt. Sta. Misc. Publ., 519, 1-27, 1915.

breeds, the Guernsey. As previously pointed out in other reports, a knowledge of these correction factors for a given breed enables a direct comparison of the milk records made at different ages through the use of these factors to correct the records of said animals to their expected maximum. The working out of these correction factors for the Guernsey breed entailed the expenditure of a good deal of time and energy. This work is now completed and the correction factors have been used constructively to determine the influence that certain sires have had on the Guernseys as a breed. For this those sires are chosen which have had 2 or more of their daughters from advanced registry dams, tested. The total number of bulls which have this information is 272. As this report is a record of progress rather than a tabulation of complete results, it seems best that only a limited number of such sires be given and the complete list be reserved for a separate bulletin when a more adequate discussion may be given.

Before pointing out the immense practical bearing of this table on the selection and up-build of the herd, a few limitations of its use as it stands in the present paper, should be discussed. The table takes no cognizance of the absolute milk production of the dams; it only concerns itself with the question of whether the dam's record was higher than that of the daughter's. The importance of recognizing this point is best brought out by an example. It is altogether probable that a bull going into a herd composed of May Rilma's would have a harder time to raise the milk production of his daughters than he would if he went into a herd composed of 4000 pound cows. As a general influence on the herd the bull in the May Rilma herd might be a distinct failure and in the 4000 pound herd a great success. It would very possibly be true that from the breeds point of view it would be wise to transfer the failure of the May Rilma herd to the 4000 pound herd. For the man who had the May Rilma herd it would be wise, in any case, to get rid of the bull failing to maintain the production of his young stock.

Tables 1, 2, and 3 show the effectiveness of 37 Guernsey bulls in raising the production of milk, butter-fat per cent, and butter fat in the milk of their daughters. Each of these bulls

TABLE 1.

Transmitting Qualities for Milk Production of Certain Sires of the Guernsey Breed, as Indicated by the Yearly Records of Their Daughters in Comparison With That of the Dams of These Daughters.

NAME AND REGISTRY NUMBER OF SIRE	LBS. OF MILK BY WHICH THE DAUGHTERS' AVERAGE PRODUCTION IS DIFFERENT FROM DAMS'	
Sires which significantly raised the production of their daughters over that of the dams of these daughters	Is greater than their dams'	Is less than their dams'
Imp. Mashers Galore 8572	2674	
Ne Plus Ultra 15265	2145	
Glenwood's Main Stay 6067	2068	
Imp. Golden Secret of Lilyvale 10028	2028	
Triple Champion 13067	1871	
Glenwood's Stranford 9386	1851	
Imp. King of the May 9001	1847	
Ledyard Bay 11074	1813	
Imp. May Rose King 8336	1664	
Lavanton 11611	1553	
Christie's Combination 14651	1393	
Imp. Cora's Governor of Chilmark 8971	1248	
Lord Waukesha 10148	1114	
Imp. Masher's Sequel 11462	1114	
Jethro Bass 11366	1034	
Starlight's Excelsior 7992	860	
Glenwood's Champion 15639	434	
Glenwood Boy of Haddon 4605	431	
Imp. Spotswood Sequel 9686	393	
Dairymaid's King 12898	304	
Sires which did not significantly raise the production of their daughters over that of the dams of these daughters		
Onoko of Maple Row 11522	126	
Ollie's King of Belle Vernon 8041	120	
Rhea's King of the May 14368	61	
Skeezicks 9979		6
Capt. Robbie 7146		68
Vaillantcoeur 7749		73
Robiana's Standard 7254		78
May King of Ingleside 12558		111
Sires which lowered the production of their daughters as compared with that of the dams of these daughters		
Stranford's Glenwood of Pinehurst 3609		374
Imp. Governor 1 of the Chene 10563		395
Rinaldo 8917		402
Selma's Glenwood 12596		407
Imp. Galaxy's Sequel 16904		835
Casterilius 10980		888
Imp. Galaxy's Lavinius 12548		946
Coralette's Son 3987		984
Malcolm of Maplehurst 5626		1347

TABLE 2.

Transmitting Qualities for Butter-Fat Per Cent of Certain Sires of the Guernsey Breed, as Indicated by the Yearly Records of Their Daughters in Comparison With That of the Dams of These Daughters.

NAME AND REGISTRY NUMBER OF SIRE	PER CENT OF BUTTER-FAT BY WHICH THE DAUGHTERS' AVERAGE IS DIFFERENT FROM DAMS'	
Sires which significantly raised the butter-fat per cent of their daughters over that of the dams of these daughters	Is greater than their dams'	Is less than their dams'
Lord Waukesha 10148	.594	
Ledyard Bay 11074	.398	
Ollie's King of Belle Vernon 8041	.378	
Casterilius 10980	.299	
Onoko of Maple Row 11522	.282	
Imp. Galaxy's Sequel 16904	.244	
Imp. Governor 1 of the Chene 10563	.248	
Imp. Golden Secret of Lilyvale 10028	.188	
Lavanton 11611	.189	
Ne Plus Ultra 15265	.152	
Coralette's Son 3987	.131	
Rhea's King of the May 14368	.128	
Sires which did not significantly raise the butter-fat per cent of their daughters over that of the dams of these daughters		
Triple Champion 13067	.091	
Glenwood's Champion 15639	.050	
Starlight's Excelsior 7992	.025	
Stranford's Glenwood of Pinehurst 13609	.016	
Imp. King of the May 9001	.006	
Capt. Robbie 7146	.003	
Imp. Galaxy's Lavinius 12548		.002
Imp. Cora's Governor of Chilmark 8971		.011
May King of Ingleside 12558		.030
Imp. May Rose King 8336		.049
Robiana's Standard 7254		.080
Malcolm of Maplehurst 5626		.091
Sires which lowered the butter-fat per cent of their daughters compared with that of the dams of these daughters		
Jethro Bass 11366		.112
Imp. Spotswood Sequel 9686		.114
Selma's Glenwood 12596		.130
Christie's Combination 14651		.133
Skeezicks 9979		.141
Imp. Mashers Galore 8572		.196
Glenwood's Stranford 9386		.202
Vaillantcoeur 7749		.231
Dairymaid's King 12898		.244
Glenwood's Main Stay 6067		.251
Rinaldo 8917		.282
Imp. Masher's Sequel 11462		.334
Glenwood Boy of Haddon 4605		.638

TABLE 3.

Transmitting Qualities for Production of Butter-Fat of Certain Sires of the Guernsey Breed as Indicated by the Yearly Records of Their Daughters in Comparison With That of the Dams of These Daughters.

NAME AND REGISTRY NUMBER OF SIRE	BUTTER-FAT PRODUCTION BY WHICH THE DAUGHTERS' AVERAGE IS DIFFERENT FROM THEIR DAMS'	
Sires which significantly raised the butter-fat production of their daughters over that of the dams of these daughters	Is greater than their dams'	Is less than their dams'
Ledyard Bay 11074	138	
Imp. Golden Secret of Lilyvale 10028	124	
Ne Plus Ultra 15265	121	
Lord Waukesha 10148	120	
Imp. Mashers Galore 8572	116	
Triple Champion 13067	107	
Lavanton 11611	103	
Imp. King of the May 9001	93	
Imp. May Rose King 8336	84	
Glenwood's Main Stay 6067	70	
Glenwood's Stranford 9386	68	
Imp. Cora's Governor of Chilmark 8971	66	
Christie's Combination 14651	61	
Starlight's Excelsior 7992	42	
Jethro Bass 11366	39	
Ollie's King of Belle Vernon 8041	38	
Onoko of Maple Row 11522	36	
Imp. Masher's Sequel 11462	20	
Rhea's King of the May 14368	17	
Imp. Governor 1 of the Chene 10563	17	
Sires which did not significantly raise the production of their daughters over that of the dams of these daughters		
Imp. Spotswood Sequel 9686	12	
Capt. Robbie 7146	5	
Glenwood's Champion 15639	5	
Dairymaid's King 12898		9
Casterilius 10989		12
Imp. Galaxy's Sequel 16904		13
Robiana's Standard 7254		13
Stranford's Glenwood of Pinehurst 13609		15
Sires which lowered the production of their daughters as compared with that of the dams of these daughters		
Skeezicks 9979		17
Vaillantcoeur 7749		18
Selma's Glenwood 12596		20
Glenwood Boy of Haddon 4605		39
Imp. Galaxy's Lavinius 12548		47
Coralette's Son 3987		48
Rinaldo 8917		53
May King of Ingleside 12558		70
Malcolm of Maplehurst 5626		78

have at least 7 daughters in the advanced registry which also have the dams of these daughters recorded.

The results of this comparison shows that Imp. Mashers Galore 8572 raised the milk production of his daughters 2674 pounds over that of the milk production of their dams. The same bull lowered the test of the milk of his daughters 0.196 per cent and made a net gain of 116 pounds of butter fat for each of his daughters over that of their dams. This bull quite evidently improved the breed.

The question often comes up, "What bull am I going to buy?" This table enables us to answer the question in so far as the worth of the bull's hereditary qualities to raise or lower the milk production of his daughters over that of the cows to which he is mated, is concerned. An example will make this clear. The bulls Glenwood Boy of Haddon and Imp. Governor I of the Chene are offered for sale, "Which shall I choose to head my herd?" A glance at the table shows us that Glenwood Boy of Haddon caused his daughters to produce 431 pounds of milk over that of their dams; lowered the fat per cent of these daughters on an average 0.638 per cent; and caused a reduction of 39 pounds of butter-fat for the expected year's record. Imp. Governor 1 of the Chene lowered the production of his daughters 395 pounds of milk; raised the fat per cent of this milk 0.248 per cent; and caused a net increase of 17 pounds of butter-fat. These facts justify us in choosing Glenwood Boy of Haddon to head our herd if milk production is sought. If a high testing milk producing a larger quantity of butter-fat is desired the purchase of Imp. Governor 1 of the Chene is justified.

VARIATIONS AND MODE OF SECRETION OF MILK SOLIDS

As previously pointed out the study of existing milk records has been actively pushed. These studies on Holstein-Friesian cattle have been gathered together in a paper the contents of which may be briefly summarized. The average annual milk production of these cows was 15417 pounds, containing 528 pounds of butter-fat and 1303 pounds of casein, milk sugar, and ash together with other constituents of less amounts gen-

erally classified as solids-not-fat. The proportion of the butter-fat to the solids-not-fat is 1 to 2.55. This ratio is quite high for cow's milk as found in the other breeds and closely approaches that of human milk.

The interdependence of butter-fat per cent, amount of milk produced and age at commencement of test, in comparison with the association of solids-not-fat per cent, amount of milk produced and age at commencement of test may be determined by the correlation method. The following conclusions were derived from these relations.

As the amount of milk given by the cows in this test increases, the percentage composition of the butter-fat decreases. The amount of this decrease is highly significant measured statistically. Considered practically this fall in butter-fat content could not be easily detected in small samples. No such effect is noted for the solids-not-fat or put in another way, the quantity of milk produced for one year is independent of the concentration of the solids-not-fat. This, from the view of inheritance, means that the hereditary units for high or low milk production are separate and distinct from those causing a high or low percentage of solids-not-fat.

The correlations of the age when the yearly record commences with butter-fat and with solids-not-fat brings out the following points. Age of the cow does not effect the percentage of butter-fat in the milk significantly. As the age of the cow advances each lactation brings with it a decrease in the percentage of the solids-not-fat found in the milk.

This differential action of amount of milk produced and age gives us the citerion to prove that butter-fat and solids-not-fat cannot have a common mother substance from which they are derived by splitting.

The correlations between the variables, pounds of milk, butter-fat and solids-not-fat lead to the following conclusion. (a). Some of the factors responsible for high concentration of butter-fat are also responsible for high concentration of some of the solids-not-fat in cow's milk. (b). Practically considered this means that if it is desired to improve either the butter-fat or solids-not-fat concentration of the milk of a given herd,

the determination of the concentration of either solid and selection of the animals accordingly will result in a corresponding increase for the other solid.

Taken in conjunction with the above results the diurnal variations of cow's milk furnish the facts necessary to test the hypothesis to account for the mode of secretion of the milk solids. The data show that evening milk is between 0.678 and 0.723 per cent higher in butter-fat than the morning milk throughout the whole lactation. No appreciable difference occurs in the solids-not-fat.

For the clear understanding of the bearing of these data on the hypothesis to account for the mechanical mechanism by which the solids are released into the milk, it seems best to restate them in as simple terms as possible. These hypothesis may be placed in 3 groups:

A. The mammary gland cells break loose bodily and disintegrate in the alveoli.

B. The portion of the cells toward the alveoli become loaded with solids, break loose from the basal portion and disintegrate to form the milk solids.

C. The cells of the mammary gland secrete the materials of milk solids without themselves breaking down.

These data offer citeria between the theories to account for the secretion of the milk solids. On the cell disintegration theories the cell must contain a fixed quantity of solids-not-fat while the butter-fat varies so that in the longer interval between milkings the cell accumulates less fat than in the shorter time, or taken the other way, the cell contains relatively more protein and sugar than fat as the interval between milkings lengthens. This is contrary to our knowledge of fat formation for it is commonly accepted that first comes the cells composed largely of protoplasm and that as time goes on this cell is more and more loaded with fat at the expense of the protoplasm. Unless these mammary cells behave very differently in the formation of this fat than other body cells this variation is enough to seriously discredit the hypothesis of cell disintegration to account for these milk solids and in fact, to make it an absurdity. Furthermore, as far as our knowledge of the variations of secretory

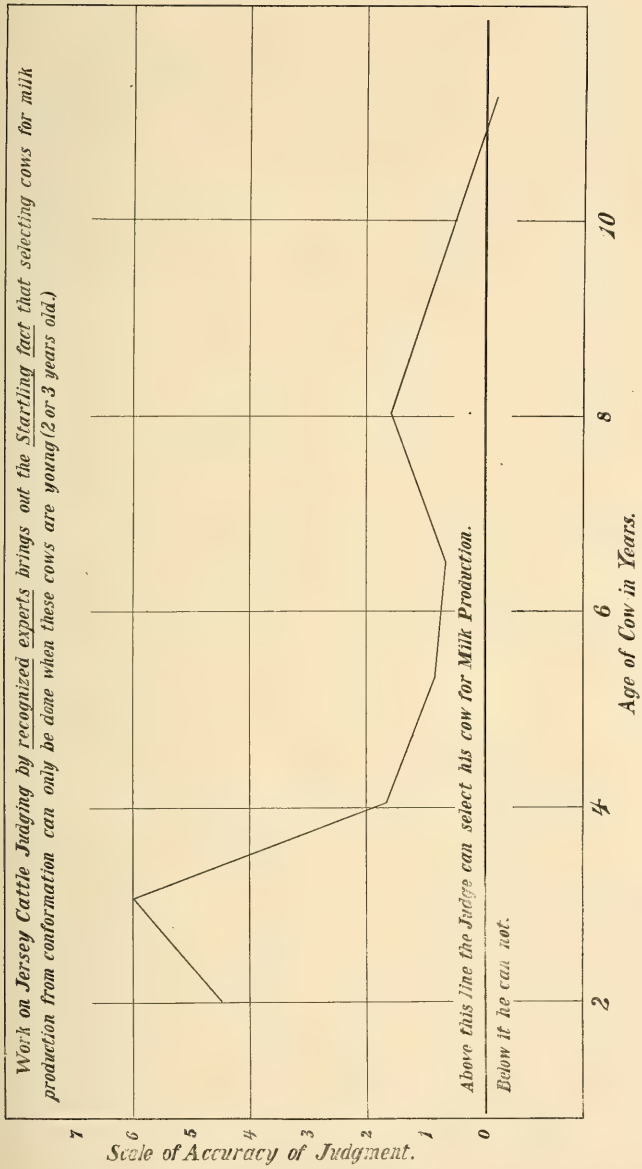

FIGURE I. Relation between Milk Production and their Adjudged Score of Jersey Registry of Merit Cows for Successive Age Groups.

Greatest accuracy of selection for milk production according to conformation is at 3½ years.[3]

glands goes the variations of this milk, fall in well with the secretory hypothesis to account for these solids.

CATTLE JUDGING AS A MEANS OF SELECTING COWS FOR THE HERD

The importance of this question would be hard to overestimate as a knowledge of the kind of conformation that goes with a high milk producing cow would be of material aid in the buying of cows for the herd and also for the selection of young heifers to be kept for further use. As indicated by a previous report the Biological Laboratory has a project on foot to accumulate an exact body of data to determine the relative value of the points used in judging dairy cattle for milk production. This work is progressing favorably. In the meantime use has been made of data found in volume 1 of the Registry of Merit published by the American Jersey Cattle Club. These data give the milk, butter-fat and butter-fat per cent together with the scores of some 672 milk cows at different ages. The resulting correlation of milk production and scores for the different age groups are shown in Table 4.

TABLE 4.

Correlation between Milk Production and Score of Jersey Registry of Merit Cows for the Successive Age Groups.

Age at Commencement of Test	Number of Animals	Correlation and Probable Error
1 year 6 months–2 years 6 months	190	—0.2117±.0467
2 years 6 months–3 years 6 months	144	—0.3088±.0508
3 years 6 months–4 years 6 months	98	—0.1080±.0673
4 years 6 months–6 years 0 months	94	—0.0608±.0693
6 years 0 months–7 years 0 months	37	—0.0752±.1103
7 years 0 months–9 years 0 months	70	—0.1863±.0778
9 years 0 months–and above	39	+0.0345±.1079

The data of this table show clearly that the cattle judge can only select the high producing cow from her external con-

[3]It should be remembered that the individual scores are those of Registry of Merit Cows which have year records of milk, butter-fat and butter-fat percent. The scores are all by judges of recognized merit. The scale of accuracy of judgment is taken as the correlation divided by its probable error.

formation when she is about 2 to 3 years old. Since these men who did the judging are recognized as experts it emphasizes even more strongly than it appears that the dairyman buying cattle for his herd should choose young stock as then he is more likely to choose the high producing cow at such time.

Figure 1, page 213, is inserted to show diagramatically this relation of milk production and score at the different age groups for Jersey Cattle, taking cognizance of their probable error.

These studies are now being continued on a larger scale by the help of the American Jersey Cattle Club in rendering any assistance they are able in furthering these studies. Through their kindness they have allowed us to copy the complete score cards on a much larger series of animals. The analyses of these records are being pushed and in due time are expected to give significant, practical results.

BREEDING EXPERIMENTS

The experiments in cattle breeding which are being carried out in cooperation with the University of Maine have progressed more slowly than in previous years. As pointed out in past reports these experiments are definite cross-breeding experiments so planned as to furnish data on problems of inheritance of milk, butter-fat and butter-fat per cent. All are familiar with the fact that such experiments are absolutely necessary for the adequate analyses of the laws of heredity behind the transmission of these qualities.

The most important results will come of course in the second hybrid generation. To October 16, 1918, 8 of these animals have been produced which will be retained in the herd. Of the first generation hybrid 25 are to be permanently kept in the herd for the production of the second generation. To make the herd of first generation animals complete only 2 more animals are necessary.

The herd has now reached the stage where first results are being obtained. Of the first generation heifers 8 are in milk, some of them for the second lactation; of the second generation one heifer is in milk. The results from this heifer are of especial interest for the reasons indicated above.

TABLE 5.

Calves Which have been Produced in the Hybridization Experiments between February 9, 1917 and October 15, 1918.

Calf	Sex	Dropped	Sire's Name and Registry Number	Breed of Sire	Dam's Name and Registry Number	Breed of Dam
42	♀	March 25, 1917	Crossbred No. 0	Jersey x Holstein-Friesian	Flora's Golden Poetess (264927)	Jersey
43	♂	April 30, 1917	Crossbred No. 0	Jersey x Holstein-Friesian	Crossbred No. 1	Jersey x Holstein-Friesian
44	♀	May 4, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Orono Madge (192781)	Aberdeen-Angus
45	♀	May 13, 1917	Kayan (167617)	Aberdeen-Angus	Pauline Posch (81048)	Holstein-Friesian
46	♀	June 6, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Lassie of M. F. (297736)	Jersey
47	♀	August 6, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Hearthbloom (147141)	Aberdeen-Angus
48	♂	August 10, 1917	Crossbred No. 0	Jersey x Holstein-Friesian	Crossbred No. 11	Jersey x Holstein-Friesian
49	♀	August 15, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Crossbred No. 2	Holstein-Friesian-Guernsey
50	♂	August 22, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Eventime 4th (155526)	Aberdeen-Angus
51	♂	August 27, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Crossbred No. 12	Holstein-Friesian-Guernsey
52	♂	October 11, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Orono Ellen (192783)	Aberdeen-Angus
53	♂	October 21, 1917	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Rosalie (M. S. J. C. A. 4887)	Jersey
55	♀	January 14, 1918	Crossbred No. 17	Aberdeen-Angus x Jersey	Crossbred No. 15	Jersey x Aberdeen-Angus
56	♂	January 19, 1918	Crossbred No. 17	Aberdeen-Angus x Jersey	Crossbred No. 16	Aberdeen-Angus x Jersey
57	♀	March 3, 1918	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Orono Madge (192781)	Aberdeen-Angus
58	♀	March 21, 1918	Kayan (167617)	Aberdeen-Angus	Rue Victoria (273096)	Jersey
59	♀	April 7, 1918	Crossbred No. 14	Holstein-Friesian x Jersey	Crossbred No. 1	Jersey x Holstein-Friesian
60	♀	May 25, 1918	Kayan (167617)	Aberdeen-Angus	Crossbred No. 22	Aberdeen-Angus x Guernsey
61	♀	June 21, 1918	Lakeland's Poet (102603)	Jersey	Delva Johanna DeKol (146774)	Holstein-Friesian
62	♀	June 28, 1918	Kayan (167617)	Aberdeen-Angus	Pauline Posch (81048)	Holstein-Friesian
63	♀	July 24, 1918	Lakeland's Poet (102603)	Jersey	Crossbred No. 11	Jersey x Holstein-Friesian
64	♀	July 31, 1918	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Lassie of M. F. (297736)	Jersey
65	♂	August 21, 1918	Crossbred No. 32	Aberdeen-Angus x Guernsey	Creusa of Orono 2nd Primrose (75232)	Guernsey
66	♀	August 24, 1918	Lakeland's Poet (102603)	Jersey	Crossbred No. 25	Jersey x Holstein-Friesian x Jersey x Holstein-Friesian
67	♂	September 17, 1918	Crossbred No. 32	Aberdeen-Angus x Guernsey	Crossbred No. 26	Aberdeen-Angus x Guernsey
68	♀	Setpember 21, 1918	Nepaul (23330)	Guernsey	Crossbred No. 12	[illegible]

The complete list of the calves which have been born into the cross-bred herd from February 7, 1917 to October 15, 1918 is shown in Table 5, page 216. This list together with those of previous reports will give the cross-bred animals thus far obtained.

The herd has already furnished the data for a bulletin[4] which is now in press. The results with which the bulletin dealt are, of course, largely those of color inheritance. The importance of such results is evident as it is already well known that the inter-relationship between inheritable characters is such that a knowledge of the inheritance of the colors of the cattle coat may lead to a knowledge of the inheritance of the factors for milk production. It is necessary, of course, to know the hereditary behavior of the coat colors, etc., before advantage can be taken of this knowledge. This first bulletin was planned to deal only with this color inheritance. In later studies the association of these characters with milk and butter-fat production will be considered.

The essential results may be quoted from the summary as follows:

"No influence on the vigor of the offspring would be expected from the width of the out-crosses as inbreeding studies showed the inbreeding low in amount.

"Black body color is dominant to the other colors in the first generation. In the second generation there occurred an orange coated bull and a dark Jersey heifer. This is to be expected on the grounds of a recessive dilution factor in the Guernsey breed. This factor is not normally present in the Jersey breed.

To clearly show the inheritance of Black and Fawn, Plate I has been drawn up to illustrate how the actual crosses were made and the coat colors of the resulting offspring.

"It has been shown that white marking of the body taken as a whole appears as a dominant. Study of the individual white areas, however, indicate that this is due to white in the

---

[4]Gowen, John W. Inheritance Studies of Certain Color and Horn Characters in First Generation Crosses of Dairy and Beef Breeds. Bulletin 272, Maine Agricultural Experiment Station.

inguinal region only for this alone appears as such a dominant The white spots on the face (star, star snip and blaze) neck shoulders, rump, flanks and legs are, in general, suppressed in the offspring when animals with these markings are mated to solid colored animals.

"As has been suggested but as has never been tested before the pigmented muzzle is dominant to the unpigmented muzzle.

"A black switch appears to cause the suppression of the other switch colors in the offspring. Because of this suppression and because all of the matings had at least one animal with a black switch as parent, it was impossible to study the behavior of the other colors. There was one case of segregation of a deep red orange switch from a back cross of a black animal carrying an orange coat and white switch, genetically. This case showed the separation of the factor for this red from that for both white and black.

"The character of polledness has been studied. Two horned animals resulting from crosses of polled x horned appeared On the basis of the other results these could not have resulted from a heterozygous polled condition. One of these cases had the horns tight on the head and the other loose. These cases then form exceptions to the previously accepted hypotheses of simple dominence for the polled character and require a subsidary hypothesis. The hypothesis suggested is that the male sex organs have some action on the presence or absence of horns Partial proof of this hypothesis is given by the fact that of the polled animals 10 were females, 2 males, 1 of which was doubtfully polled. Of those with scurs 1 female and 7 males had loose scurs; of those with tight scurs all (3) were males; of those with horns, all (2) were males. This would seem like a clear case where the male has some influence. The explanation of this difference appears to be due to a substance secreted by the germ cells. Should this prove true this forms an interesting parallel between cattle and sheep where the sex glands are known to produce such changes.

"The inherited characters of the beef type are shown to be divisible into 4 general regions of the body, head, fore quarters barrel and hind quarters. The type of head and heavy, deep

eshed fore quarters are transmitted to the offspring when either arent is of the Aberdeen-Angus breed. The body and hind uarters appear intermediate but in most cases resemble the airy parents.

"Data are given on the milk and fat production of some 4 f the cross-breds. The results indicate that milk and fat pro- uction are inherited separately. High milk production is domi- ant to low, high fat per cent is recessive to a low fat per cent n the milk. Put in less technical language the results of this ross indicate that in a cross between an animal from a high ilking strain mated to one of a low milking strain, the result- ng female offspring will have the milk production of the high train. In a cross between animals one of which is from a high est line and the other from a low test line the resulting offspring vill have a butter-fat test of the low test line. The number of hese milking first generation females is not great enough to nake this statement an absolutely sure conclusion."

INHERITANCE OF TWINNING AND PROBLEMS CONNECTED THEREWITH

During the past year a new project to obtain information f the frequency of twinning in cattle has been set in operation. n all some 500 of progressive breeders of the United States ave responded with some very excellent data on this subject. t is, of course, too early to have analyzed the results obtained rom this investigation. Some idea of the scope of the informa- ion may be had by a glance at the reproduction of the form sed as shown below.

MAINE AGRICULTURAL EXPERIMENT STATION

CHAS. D. WOODS, DIRECTOR

This Information Will Be Held Strictly Confidential

SPECIAL REPORT—MULTIPLE BIRTH RECORD

Name..... Address.....

On.....there was born at your farm a set of .....TWINS.....from the dam.....and sired by .....More complete information about this

multiple birth is desired. I shall be greatly obliged if you aid the solution of this important problem by filling out this blank to the best of your knowledge.

BREEDING HISTORY OF DAM

Were these.....TWINS.....her first calves?.....
If not, what has been her previous breeding history?.....

(The following tabular arrangement may be used in answering.)

Pregnancy	Year	No. of Young	Sex of Young	Sire of Calf or Calves

Did any of the two grand-dams, or four great grand-dams ever have more than one calf at birth?.....
If so please name them.....
Do you know of any tendency to multiple births in any of the relatives of either the sire or dam of these calves?.....*(Give as many particulars as you can)*.....
Has the sire of these TWINS ever sired any other twins or triplets?.....
.....If so give Names and Dates.....
TWIN DESCRIPTIONS. *(If these be triplets name unrecorded animal)*.....
Are either or both animals sterile?.....Name which.....
Do the females come in Heat?.....Will they take the bull?.....
If not, do they show any tendency to cover cows?.....Cite cases.....
If a freemartin or sterile, describe the external appearance of the crest, udder and genital organs.....
What is your breeding practice with freemartins?.....
Do you register a freemartin before it has bred?.....Have you had any other multiple births in your experience?.....If so, please describe them.....

Name of Twins	Dam	Sire

For the sake of helping to get definite information on cattle twins, would you be willing to let me know should other twins occur and fill out a similar blank?.....

Give any other information you can on the back of sheet.

In the above connection the cross-bred herd has furnished a heifer twin to a bull which is of great interest both practically and theoretically. This animal Cross-bred No. 19 came in heat

when 1 year and 236 days old. She was served one-half hour after the appearance of this heat by a vigorous young bull in the cattle yard. At this service she stood for 3 coverings of her own free will manifesting no difference in behavior from other normal cows. Subsequent anatomical examination showed this animal to be a typical freemartin with no uterus or ovary. The place of the ovary was taken by what is called the saccus vaginales with what appear to be the homologue of the gonad inside. This perverted gonad is about the size of a small pea bean.

From these facts the following conclusions appear justified. (1) A typical freemartin can come in heat that to all appearances is normal. (2) Heat can appear in cattle where only gonads of very different appearance from that of either normal sex is present. (3) The deduction appears justified that the growth or release of the egg is not the cause for the appearance of heat.

COOPERATIVE CATTLE BREEDING RECORDS

The cooperative cattle breeding project, in which about 200 of the leading breeders of cattle in Maine, and a few outside the State, have contributed was closed in September 1917 as the mass of the material collected was sufficient to satisfy the objects of its collection. As previously pointed out in other reports the amount of these data are very large, constituting a wholly unique mass of material for the study of many of the most vital problems in the physiology of reproduction in cattle.

These large amount of data will take a considerable time to analyze completely. Already some facts of considerable practical and scientific interest are available which it seems well to place immediately in the hands of the dairymen of the State. The points that will be dealt with are 5, (a), the effect of the size of the breed on the weight of the calf; (b), the normal length and variation of the period of gestation; (c), the change in the sex ratio due to twin births; (d), the time after the appearance of heat that service is most likely to cause conception to take place; (e), the decline in the number of conceptions as the number of necessary services increases.

(a) THE EFFECT OF THE SIZE OF THE BREED ON THE WEIGHT OF THE CALF

The fact that animals of a given breed vary in their weight at birth is something which has been known ever since animals were born. The difference in the weights of the births of one breed as directly compared with the weights of another breed is not so well known. Table 6 furnishes the material to make such a comparison extracted from the records collected by the Maine Agricultural Experiment Station through the active co-operation of the stock breeders of the State.

TABLE 6.

Table Showing the Average Birth Weights of Certain of the Breeds of Dairy and Beef Cattle.

Breed	Average birth weight in pounds
Grade Jersey	60.1114± .5887
Pure bred Jersey	53.9384± .5907
Grade Guernsey	67.9250± .8220
Pure bred Guernsey	63.4000±1.2469
Grade Ayrshire	61.1667± .8275
Pure bred Ayrshire	69.5918± .7797
Grade Holstein	80.8082± .5255
Pure bred Holstein	92.8761± .8791
Grade Shorthorn	65.7692±1.8316
Dutch belted	64.4737±1.1746
Grade Brown Swiss	75.0000±2.1198
Grade Aberdeen-Angus	74.0909±2.3681

The following facts come from a study of the cooperative records. The smallest breed also has the smallest weight at birth. The grades of the island breeds are generally larger than the pure breds. This is due probably to the influence of the blood from larger breeds found in the pedigree of the island grade stock. Pure bred Holstein-Friesian calves have the largest weight at birth showing that because an animal is bred to produce milk is no guarantee that its size at birth will not be as great as that of one of the properly beef breeds.

) THE NORMAL LENGTH AND VARIATION OF THE PERIOD OF GESTATION IN CATTLE

The analyses of the records on the average length of gesta-n in dairy cattle furnish striking evidence of the accuracy of tain human opinions grown up through years of experience. 1197 records of cattle births where the length of gestation s known, the average duration of gestation was 281 days, 15 urs and 45 minutes, or nearly the customary reckoning of 2 days. Half of these births had a length of gestation between 7 days and 286 days. The full range of the length of gesta-n for the births was from 215 days to 315 days or a range 100 days. Since there were no abortions included in the a it seems that under normal conditions the length of gesta-n may have considerable range even though most of the births concentrated around one point.

(c) THE CHANGE IN THE SEX RATIO DUE TO TWIN BIRTHS

The sex ratio which exists in twins has always been of con-erable interest both from the point of view of mode of twin duction and the manner in which identical twins are pro-ced. Our cooperative records furnish us some data on this estion which are of great interest. In 2573 births there were duced 21 twins or the proportion of twin births is about 1 every 125 births or 8.17 in 1000, compared to a frequency of inning among women[6] of about 1 in 89. The conclusion fol-s that the frequency of twinning varies considerably with species even in those which normally produce only one off-ing at birth.

Of especial interest is a comparison of the sex ratio as it urs in human and cattle births. In the 21 births above men-ned 3 were 2 males, 14 were male and female and 4 were 2 nales. Combining this data with that of Lillie,[7] as they are

---

[6]Veit, "Beitrage zur geburtshulflichen statistik, "Monatsschr f. Geb. VI., 1855.

[7]Lillie, F. R., The Freemartin; a Study of the Action of Sex Hor-nes in the Foetal Life of Cattle. Jour. of Expt. Zoo. Vol. 23, No. 2. 371-452.

entirely comparable being random samples of cattle twins have 22 where both are males, 38 where there are twins of ea sex, and 15 where both are females, or there are 37 twins the same sex to 38 of opposite sex, a condition as close to 1:2:1 chance radio as could be well hoped for. Comparing t with data presented by Nichols[8] where he found 234,497 wh there were 2 males, 264, 098 where the twins were of oppo sex, and 219,312 where the twins were both females or against the 1 like to 1 opposite sex of twins in cattle, the hum family, have 1.7 like to 1 opposite sex. The excess of the li sexed twins in the human family is known to be due to t identical twins, where two individuals of like sex come fr one egg.

The figures given above show that cattle do not prod this excess over the 1 like sex to 1 opposite sex. Since this true, it appears that in cattle the embroyological mechanism such that it does not favor the production of identical twi This conclusion is further borne out by evidence collected d ing the past year on the resemblance of the members of a p of like sexed twins.

(d) THE TIME AFTER THE APPEARANCE OF HEAT THAT SERV IS MOST LIKELY TO CAUSE CONCEPTION TO TAKE PLACE

Knowledge of problem (d) and (e) is so closely associat to successful cattle raising as to be almost essential to t proper management of the herd. The analysis of large ser of data on these problems collected through the cooperative forts of the Maine Station and the Maine Cattle Breeders therefore especially instructive. Table 7 presents the nec sary data for the first of these problems.

TABLE 7.

The Duration in Hours of the Time Between Appearance of Heat and Service Together with the Sex of the Resulting Offspring.

Sex of Offspring	Hours lapsed between time when heat was noticed and time of service																																						Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	35	41	52	69	
Male	77	132	116	154	77	81	44	59	33	41	24	35	20	31	21	16	10	8	2	7	1	5	4	4	9	1		1	3	1									1017
Female	77	131	90	147	66	85	40	60	45	38	26	31	34	26	19	20	9	9	1	3	3	10	3	2	6	2	1	1			1			1		1			988
Twins																																							
Two Males	1	1			1																																		3
Male and Female	2	2	2	2			1	1				1						1																					12
Two Females						1					1			1																									3
Sex unknown	2	8	5	6	5	2	1	3	2	3		1		2			1	1																					42
Total	159	274	213	309	149	169	86	123	80	82	51	68	54	60	40	36	20	19	3	10	4	15	7	6	15	3	1	2	3	1	1			1		1			2065
Unsuccessful Service	38	104	70	114	39	60	26	37	29	40	20	17	12	15	8	11	4	4	1	3	2	2	2	1	2	1		2	1			1	1		1		1	1	661
Total	197	378	283	423	188	229	112	160	109	122	71	85	66	75	48	47	24	23	4	13	6	17	9	7	17	4	1	4	4	1	1	1	1	1	1	1	1	1	2726

The necessary reduction of the statistics of table 7 to their means and constants to measure their variability is seen in table 8.

TABLE 8.

Means, Standard Deviations and Coefficients of Variation for the Hours between Observed Appearance of Heat and Service of the Cow.

Sex of Offspring	Discovery of Heat to Service	Standard Deviation	Coefficient of Variation
Male	5.9550± .1129	5.3355±.0798	89.5967± 2.1654
Female	6.1417± .1165	5.4285±.0824	88.3882± 2.1467
Two males	1.9167± .6619	1.6997±.4680	88.6789±39.1673
Male and female	4.6667± .9554	4.9068±.6756	105.1450±25.9416
Two females	9.5833±1.2850	3.2998±.9086	34.4333±19.5529
Sex unknown	5.1548± .4426	4.2528±.3130	82.5020± 9.3316
Total successful services	6.0200± .0795	5.3596±.0563	89.0302± 1.5032
Unsuccessful services	5.8627± .1574	6.0009±.1113	102.3565± 3.3417

The above data indicates the following conclusions.

(1) Successful services may occur 41 hours after the first observance of heat.

(2) The duration of the observed period of heat before service in the unsuccessful services extends up to 69 hours. The interval hours covered in these unsuccessful services is therefore slightly longer than in the successful ones.

(3) The average number of hours between observance of heat and services is the same (within the errors of random sampling) for the successful and unsuccessful services.

(4) When analyzed in groups of five hours periods it is found that the unsuccessful services occur most frequently in the 0-5 and 25 and above hour periods as compared with the successful services. From this the conclusion seems justified that the best time for service would be between 5 and 10 hours after appearance of heat.

(5) The choice of this time for service would not cause any difference in the sex of the resulting calves for Table 8 shows the average number of hours from the time heat is observed to service is the same whether the resulting birth be male or female.[8]

[8]Loc. Cit.

This conclusion in itself is important as one of the primary objects for which the cooperative record project was inaugurated was to collect statistics bearing on the question as to whether the proportion of males to females in cattle could be influenced or controlled by the time of service relative to the beginning of the period of heat. Some earlier statistics[9] appeared to indicate that there was a possibility of influencing the sex ratio by paying attention to this point.

The statistics analyzed in Table 8 probably prove conclusively, that the apparent relation between these two factors, which is believed by many breeders to exist and which our earlier studies appeared to indicate, was purely accidental. In fact taken on its face value without regard to probable errors instead of their being more females resulting from services in early heat, there are actual a slight access of males.

The conclusion of the previous incomplete analysis[10] of the cooperative data is therefore substantiated, that there is no significant preponderance of females when the service is early in heat.

(e) THE DECLINE IN THE NUMBER OF CONCEPTIONS AS THE NUMBER OF NECESSARY SERVICES INCREASES

This problem is an ever occurring one in the breeding operations of any dairy herd. When shall a valuable animal be sold as a non-breeder? This, of course, depends on the number of service trials the cow has had. Data on the time when conception took place in a large series of connected birth and service records are valuable in our cooperative records. These data are shown in Table 9.

---

[9]Pearl, R., and Parshley, H. M. Sex Studies V—Data on Sex Determination in Cattle. Biol. Bulletin, vol. 24, pp. 205-225, 1913.

Pearl, R. Brief Report of Progress on Animal Husbandry Investigations in 1914, Me. Agric. Expt. Sta. Misc. Publ. 503, pp. 1-11, 1914.

---

[10]Loc. Cit.

TABLE 9.

Table Showing the Number of the Services at which Conception Took Place in 1801 Births of Dairy and Beef Cattle.

Ordinal No. of services given at which conception took place	No. of cows conceiving at this particular service in the series of services	Percentage of cows conceiving at this service in the series of services
1	1412	78.40
2	277	15.38
3	82	4.55
4	18	1.00
5	7	.39
6	2	.11
7	1	.06
8	1	.06
9	0	.00
10	1	.06

This table shows that of 100 cows which are bred 78 of them conceive (so called stick) at the first service; 15 of them conceive at the second service; 4 at the third service; 1 at the fourth service and from this the number that conceive becomes so small as to be almost negligible. The place in this series at which the dairyman is justified in selling his cow is, of course, a matter for him to decide. It seems doubtful, however, if it would pay to keep a cow beyond the fifth service unless she is of considerable value.

[8]Loc. Cit.

BULLETIN 275

ABSTRACTS OF PAPERS PUBLISHED BY THE STATION IN 1918 BUT NOT INCLUDED IN THE BULLETINS.

A complete list of all the publications issued by and from the Station in 1918 is given on pages x to xi of the introduction to this Report. The following pages contain abstracts of the papers issued during the year that are not included in the Bulletins or Official Inspections for the year.

STUDIES IN INHERITANCE OF CERTAIN CHARACTERS OF CROSSES BETWEEN DAIRY AND BEEF BREEDS OF CATTLE.*

This constitutes a preliminary paper on the crossbred herd now being brought together by the Maine Agricultural Experiment Station for the purpose of studying some of the outstanding problems of dairy husbandry.

The first section of the paper is devoted to a study of the inbreeding in the foundation herd. It is shown that the inbreeding as measured by the best mathematical methods is no greater than would be expected to occur in any of the modern breeds when the animals were selected at random. Consequently it is safe to assume that the results of the study are not due to the width of the crosses, for, as has been pointed out, a number of the animals famous in their breed have been far more inbred than any of the parental stock used in these experiments.

The individual records of the animals composing both the parental generation and the first and second filial generations are given.

Black body color is dominant to the other colors in the first generation. In the second generation an orange-coated

---

*This is an abstract from a paper by John W. Gowen, having the same title and published in the Jour. Agr. Research, Vol. XV No. 1, pp. 1-57.

bull and a dark Jersey dun-coated heifer were segregated out. This is to be explained on the basis of a recessive dilutor in the Guernsey, segregated out along with the black color. The dark heifer shows that the Jersey does not normally possess this factor.

It has been shown that white marking of the body taken as a whole appears as a dominant. Study of the individual white areas, however, indicate that this is due to white in the inguinal region only, for this alone appears as such a dominant. The white spots on the face (star, star snip, and blaze), neck, shoulders, rump, flanks, and legs are, in general, suppressed in their offspring when such animals are mated to solid color.

As has been suggested, but as has never been tested before, the pigmented muzzle is dominant to the one not so pigmented.

Agreeing with the previous work of this laboratory it is shown that a pigmented tongue is dominant to a non-pigmented one.

A black switch appears to cause the suppression of the other switch colors in the offspring. Because of this suppression and because all of the matings had at least one animal with a black switch as parent, it was impossible to study the behavior of the other colors. There was one case of segregation of a deep red-orange switch from a back cross of a black animal carrying an orange coat and white switch, genetically. This case showed the segregation of the factor for orange switch from that for both white and black.

The character of polledness has been studied. Two-horned animals resulting from crosses of polled x horned appeared. On the basis of the other results these could not have resulted from a heterozygous polled condition. One of these cases had the horns tight on the head and the other loose. These cases then form exceptions to the previously accepted hypothesis of simple dominance for the polled character and require a subsidiary hypothesis. The hypothesis suggested is that the testes have some action on the presence or absence of horns. Partial proof of this hypothesis is given by the fact that of the polled animals 10 were females, 2 males, 1 doubtfully polled. Of those with scurs 1 female and 7 males had loose scurs; of those

with tight scurs all (3) were males; of those with horns all (2) were males. This would seem like a clear case where the male has some influence. The explanation of this difference appears to be due to a hormone secreted by the germ cells. Should this prove true, this forms an interesting parallel between cattle and sheep, in which the sex glands are known to produce such changes.

The qualities of beef production are shown to be divisible into four general regions of the body: head, fore quarters, barrel, and hind quarters. The type of head and heavy, deep fleshed fore quarters are transmitted to the offspring when either parent is of the Aberdeen-Angus breed. The body and hind quarters appear intermediate, but resemble most the dairy parents.

Data are given on the milk and fat production of some of the crossbreds. The results indicate that milk and fat production behave separately. High milk production is dominant to low, but high fat percentage is recessive to a low fat percentage in the milk.

STUDIES IN MILK SECRETION

IV. On the Variation and Mode of Secretion of Milk Solids.*

This paper is the fourth of a series of studies on milk now being conducted in the Biological Laboratory of the Maine Agricultural Experiment Station. The data for this study are taken from the semi-official year records of the pure bred Holstein-Friesian cows compiled and supervised by the Holstein-Friesian Association.

The means, standard deviations and coefficients of variation are given for these year records. The mean annual productions are 15417 pounds of milk, 528 pounds of butter-fat, 1303 pounds of solids-not-fat. The standard deviations are respectively 3742 pounds of milk, 134 pounds of butter-fat, 260 pounds of solids-not-fat and 2 years. The coefficients of variation are respectively 24, 25, 20 and 50. These data show Holstein-Friesian milk for one year to be large in amount and high

*This is an abstract from a paper by John W. Gowen, having the same title published in the Jour. Agr. Research.

in the ratios of solids-not-fat to butter-fat as compared with other breeds.

The correlations and linearity of regression between the variables butter-fat per cent, amount of milk and age at commencement of test lead to the following conclusions.

As the amount of milk given by the cows in this test increases, the percentage composition of the butter-fat decreases. The amount of this decrease is highly significant measured statistically. Considered practically this fall in butter-fat content could not be easily detected in small samples. No such effect is noted for the solids-not-fat or put in another way, the quantity of milk produced for one year is independent of the concentration of the solids-not-fat. This, from the view of inheritance, means that the hereditary units for high or low milk production are separate and distinct from those causing a high or low percentage of solids-not-fat.

The correlations of the age when the yearly record commences with butter-fat and with solids-not-fat brings out the following points. Age of the cow does not effect the percentage of butter-fat in the milk significantly. As the age of a cow advances each lactation brings with it a decrease in the percentage of the solids-not-fat found in the milk.

This differential action of amount of milk produced and age gives us the criterion to prove that butter-fat and solids-not-fat cannot have a common mother substance from which they are derived by splitting.

The correlations between the variables, pounds of milk, butter-fat and solids-not-fat lead to the following conclusion. (a). Some of the factors responsible for high concentration of butter-fat are also responsible for high concentration of some of the solids-not-fat in cow's milk. (b). Practically considered this means that if it is desired to improve either the butter-fat or solids-not-fat concentration of the milk of a given herd, the determination of the concentration of either solid and selection of the animals accordingly will result in a corresponding increase for the other solid.

Taken in conjunction with the above results the diurnal variations of cow's milk furnish the facts necessary to test the hypothesis to account for the mode of secretion of the milk solids. The data show that evening milk is between 0.678 and

0.723 per cent higher in butter-fat than the morning milk throughout the whole lactation. No appreciable difference occurs in the solids-not-fat.

For the clear understanding of the bearing of these data on the hypothesis to account for the mechanical mechanism by which the solids are released into the milk, it seems best to restate them in as simple terms as possible. These hypothesis may be placed in three groups:

A. The mammary gland cells break loose bodily and disintegrate in the alveoli.

B. The portion of the cells toward the alveoli become loaded with solids, break loose from the basal portion and disintegrate to form the milk solids.

C. The cells of the mammary gland secrete the materials of milk solids without themselves breaking down.

These data offer criteria between the theories to account for the secretion of the milk solids. On the cell disintegration theories the cell must contain a fixed quantity of solids-not-fat while the butter-fat varies so that in the longer interval between milkings the cell accumulates less fat than in the shorter time, or taken the other way, the cell contains relatively more protein and sugar than fat as the interval between milkings lengthens. This is contrary to our knowledge of fat formation for it is commonly accepted that first comes the cells composed largely of protoplasm and that as time goes on this cell is more and more loaded with fat at the expense of the protoplasm. Unless these mammary cells behave very differently in the formation of this fat than other body cells this variation is enough to seriously discredit the hypothesis of cell disintegration to account for these milk solids and in fact, to make it an absurdity. Furthermore, as far as our knowledge of the variations of secretory glands goes the variation of this milk, fall in well with the secretory hypothesis to account for these solids.

THE MEADOW PLANT BUG. *MIRIS DOLABRATUS*.*

(1) *Miris dolabratus* has been a conspicuous insect in timothy meadows in portions of the eastern United States dur-

*This is an abstract of a paper by Herbert Osborn, Consulting Entomologist, having the same title and published in the Journal of Agricultural Research, Vol. XV, No. 3, pp. 175-200. Oct. 21, 1918.

ing the past 40 years and now has a distribution as far west as Illinois and Minnesota and south in the Mississippi Valley into Kentucky.

(2) It is believed to be an introduced species, coming from Europe with timothy hay or other large stemmed grass shipped for forage or packing some time between 1800 and 1825.

(3) It feeds upon cultivated grasses, especially timothy, orchard grass, and meadow fescue, and when abundant must seriously affect the value of the crop.

(4) It is a dimorphic species, there being two forms of females, a long-winged and a short-winged form, the latter being far more plentiful, about 90 per cent.

(5) The species hibernates in the egg form; hatching occurs about May 25 to June 10 in Maine; and the nymphs pass through five instars of about six or seven days each, adults occurring from early July, mating and laying eggs from July 10 to August 1 for the short-winged forms necessarily in the fields where the females have developed.

(6) The eggs are laid in stems of grass or clover in fields where females have grown, being thrust through the wall of the stem and held by an expanded cap which is firmly held by the walls of the stem, the egg being protected in the hollow of the stem and in this position remain for at least eight or nine months before hatching.

(7) Measures for control so far evident and based on habits determined will consist especially of rotation, with probably some advantage from burning, early cutting, pasturing heavily in fall, and possibly by mechanical devices for capturing the nymphs or adults.

(8) The spread of the insect should be prevented by care in the disposition of timothy hay moved to a distance. No hay from an infested district should be allowed to be scattered in or near meadows in localities where the insect is not already present.

(9) Natural enemies consist so far as at present known of spiders, the predacious damsel bugs, *Reduviolus ferus,* a tachnid fly, *Phorantha occidentis,* and an undetermined species and a species of fungus, *Entomophthora* sp.

METEOROLOGICAL OBSERVATIONS.

For many years the meteorological apparatus was located in the Experiment Station building and the observations were made by members of the Station Staff. June 1, 1911, the meteorological apparatus was removed to Wingate Hall and the observations are in charge of Mr. James S. Stevens, professor of physics in the University of Maine.

In September, 1914 the meteorological apparatus was again moved to Aubert Hall, the present headquarters of the physics department.

The instruments used were at Lat. 44° 54′ 2″ N. Lon. 64° 40′ 5″ W. Elevation 135 feet.

The instruments used are the same as those used in preceding years, and include: Maximum and minimum thermometers; rain guage; self-recording anemometer; vane; and barometers. The observations at Orono now form an almost unbroken record of fifty years.

METEOROLOGICAL SUMMARY FOR 1918

Observations Made at the University of Maine

1918	January	February	March	April	May	June	July	August	September	October	November	December	Average	Total
Highest temperature	39	48	62	71	88	89	92	89	78	69	60	50	--------	--------
Lowest temperature	—22	—19	—11	21	31	35	51	38	31	25	14	—4	--------	--------
Mean temperature	11.1	17.4	27.9	43.2	57.6	59.5	68.5	65.7	55.5	48.1	37.4	24.0	42.99	--------
Mean temperature in 50 years	16.46	14.59	30.15	40.02	51.62	60.77	65.95	66.09	59.71	50.74	38.08	24.19	42.75	--------
Total precipitation in inches	3.55	2.91	1.65	2.20	1.69	2.41	6.89	2.58	4.29	5.47	2.33	2.00	--------	37.97
Mean precipitation in 50 years	2.54	3.47	4	2.93	3.53	3.47	3.49	2.33	3.42	3.86	3.44	3.51	--------	--------
Number of days with precipitation of .01 or more	12	11	5	6	6	8	12	7	11	11	9	4	--------	102
Snowfall in inches	35.5	19	16.5	1.5	--------	--------	--------	--------	--------	--------	--------	23.25	--------	95.75
Mean snowfall in 50 years	21.8	21.45	15.15	5.82	.23	--------	--------	--------	--------	.74	7.02	16.73	--------	--------
Number of clear days	18	14	19	22	22	17	15	21	15	18	17	12	--------	210
Number of fair days	4	5	4	3	5	8	14	6	8	9	5	11	--------	82
Number of cloudy days	9	9	8	5	4	5	2	4	7	4	8	8	--------	73
Total movement of wind in miles	3672	3939	4632	4780	4878	3790	2973	2890	3050	3852	3757	2800	3751	45013

REPORT OF THE TREASURER

The Station is a department of the University and its accounts are kept in the office of the Treasurer of the University. The books, voucher files, etc., are, however, all distinct from those of the other departments of the University. The classification of accounts is that prescribed by the auditors on the part of the Federal Government, and approved by the State Auditor. All of the accounts are audited by the State Auditor, and the Hatch Fund and Adams Fund accounts are also audited by the Office of Experiment Stations acting for the United States Secretary of Agriculture in accordance with Federal Law.

The income of the Station from public sources for the year that ended June 30, 1918, was:

U. S. Government, Hatch Fund appropriation.....	$15,000 00
U. S. Government, Adams Fund appropriation....	15,000 00
State of Maine, Animal Husbandry investigation appropriation	5,000 00
State of Maine, Aroostook Farm investigation....	5,000 00

The cost of maintaining the laboratories for the inspection analyses is borne by analysis fees and by the State Department of Agriculture. The income from sales at the experiment farms is used for the expense of investigations. The printing is paid for by an appropriation to the University.

At Aroostook Farm there are in connection with the cooperative work with the Federal Department of Agriculture expenditures mostly under "labor" for the Department and for which the Station is reimbursed. There are also certain expenditures for the Department made from sales of crops from Department investigations that do not appear in the tabular statements. They are carried as distinct and separate accounts, always with credit balances, on the Station ledger.

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1918

DISBURSEMENTS

Receipts	Hatch fund	Adams fund	Animal husbandry investigations
Salaries	5813.54	9256.98	3777.30
Labor	2696.58	1290.52	96.15
Publications	175.83	--------	--------
Postage and Stationery	982.19	49.61	65.79
Freight and Express	162.81	99.17	19.01
Heat, light and power	585.82	243.52	--------
Chemical and laboratory supplies		17.50	6.04
Seeds, plants and sundry supplies	448.73	355.00	137.11
Fertilizers	639.65	--------	--------
Feeding stuffs	1477.33	3122.81	477.87
Library	208.18	--------	--------
Tools, machinery and appliances	353.43	33.00	--------
Furniture and fixtures	135.83	--------	--------
Scientific apparatus and specimens	6.20	--------	98.67
Live stock	37.50	--------	8.25
Traveling expenses	488.08	344.29	66.17
Contingent expenses	40.00	40.00	160.00
Buildings	748.30	147.60	147.61
Total	15000.00	15000.00	5059.97

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1918 —Concluded.

DISBURSEMENTS

Receipts	Aroostook farm	General account	Inspection analysis
Salaries	1800.00	3137.62	9674.10
Labor	5641.93	1813.85	--------
Publications	--------	89.29	--------
Postage and Stationery	32.11	74.47	622.33
Freight and Express	51.71	124.49	121.16
Heat, light and power	76.44	340.76	507.51
Chemical and laboratory supplies	6.48	101.95	578.72
Seeds, plants and sundry supplies	1130.90	1499.11	14.84
Fertilizers	826.15	--------	--------
Feeding stuffs	1909.01	603.99	--------
Library	--------	5.25	--------
Tools, implements and machinery	105.50	585.50	--------
Furniture and fixtures	33.10	43.11	40.78
Scientific apparatus	--------	1.52	113.08
Live stock	400.00	200.00	--------
Traveling expenses	32.37	97.95	139.23
Contingent expenses	99.50	461.43	73.17
Buildings	507.37	370.44	--------
Total	11842.57	9550.73	11884.92

INDEX.

APPENDIX

Official Inspections

86 to 90

CONTENTS

COMMERCIAL AGRICULTURAL SEEDS, 1917.

THE CHIEF REQUIREMENTS OF THE LAW.

The following are the chief points of the law and the rules and regulations for carrying out the law regulating the sale of agricultural seeds which, as directed by the law, the Commissioner of Agriculture, has made.

1. *Kind of seeds coming under the law.* The law applies to the sale, distribution, transportation, or the offering or exposing for sale, distribution, or transportation of the seeds of alfalfa, barley, Canadian blue grass, Kentucky blue grass, brome grass, buckwheat, alsike clover, crimson clover, red clover, medium clover, white clover, field corn, Kaffir corn, meadow fescue, flax, hungarian, millet, oats, orchard grass, rape, redtop, rye, sorghum, timothy and wheat for seeding purposes.

2. *The brand.* Each lot or package shall be plainly marked with the name of the seed and its minimum percentage of purity.

3. *Mixtures.* Mixtures must be plainly marked with the name of the seed and the percentage of purity. In case the mixtures contain seeds not included in 1 these need not be named. (e. g., a mixture consisting of half redtop, 90 per cent pure, quarter Kentucky blue grass, 85 per cent pure and the remainder seeds not named in the law, could be marked "Redtop 45 per cent pure, Kentucky blue grass 21 per cent pure." The statement of the remaining constitutents may or may not be named.)

4. *Adulteration.* A seed is adulterated if its purity falls below its guaranty or if it contains the seed of any poisonous plant.

5. *Misbranding.* A seed is misbranded if the package or label bears any statement, design or device which is false or misleading in any particular, or if it does not carry the statements named in 2.

6. *Free analysis.* Free analysis of seeds on sale in Maine will be made of samples taken in accordance with directions furnished by the Commissioner of Agriculture. Sample not so taken may be refused examination. Blanks with full directions will be furnished on request.

7. *Paid analysis.* As an accommodation to residents of Maine samples of seeds not on sale in Maine will be examined

.t cost, and the results will not be published. The cost of the nalysis of blue grass or redtop is $1.00 per sample and for ther seeds 50 cents. Remittance should accompany the sample.

8. *Written guaranty.* No prosecution will lie against any erson handling agricultural seeds provided he obtains at the ime of purchase a written guaranty signed by the person resid- ng in the United States, from whom the purchase was made, o the effect that the seeds are not adulterated or misbranded vithin the meaning of the Maine law regulating the sale of gricultural seeds. After a person has been notified by the Commissioner of Agriculture that an article of agricultural eeds appears to be adulterated or misbranded the written guar- nty will not protect further sales.

9. *Hearings.* The person who is believed to have violated he law regulating the sale of seeds will be granted a hearing at which he may appear in person or by attorney or by letter. The notice of the hearing will name the time and place of the earing and a copy of the charge. Failure to appear will not rejudice the case. The hearing will be private and every pportunity will be given for explanation and establishment of nnocence. If the time appointed is not a convenient one, post- onement within reasonable limit will be granted.

Testing Seeds at Home.

It is important to the user of seeds not only to know their ercentage of purity and what kind of weeds they carry, but to lso know something of their vitality. In the case of seeds there re at least 3 ways whereby the user may be injured. A eed which carries foreign matter of any kind, in any consider- ble amount, is correspondingly lowered in value. But there is nother reason which is more important than the money consid- ration, and that is that the weed seeds which the seeds contain nay be pernicious. For example,—clover seed frequently car- ies plaintain seed. If this plaintain seed is the door-yard ariety which is present practically all over Maine, there would e comparatively little harm from using clover seed which con- ained it. On the other hand—lance leaved plaintain or rib rass is not abundant in Maine. It is an undesirable plant and sing seed carrying it might introduce a weed into land which is t present free from it. It is important that the farmer should

know the vitality as well as the purity of the seed that he is to use. No matter how pure a seed may be, if half of it will not sprout it has no more value than if the seed were half chaff.

While it is not easy to make an exact purity test, it is not difficult for a farmer to so acquaint himself with the seeds that he is ordinarily using that by the help of an ordinary reading or magnifying glass he will be able to tell whether the seed in question contains any considerable amount of impurities. If the seed is spread out upon a white plate, a little practice will enable a farmer to see whether a given seed is reasonably pure or not, and he will soon learn to detect the more common foreign seeds.

VITALITY OF SEEDS.

It is much easier for the farmer to test the vitality of seed than to make a purity examination. The following simple instructions for performing germination tests at home without any special apparatus will enable the farmer to learn for himself whether the seed that he is using has good vitality or not. Germination tests may be made in two ways,—the so-called blotting paper methods, and the sand method. In making the germination test with blotting paper, blue blotting paper of common weight, cut into strips about 6 x 19 inches, should be used. This is laid folded twice so as to get a piece of 3 thicknesses and about 6 inches square, on an ordinary dinner plate or platter. The seeds if small are placed on the top of the paper and if large between the folds. The paper is kept moist (not soaked) and at a temperature of 70 to 80 degrees F.

If only a vitality test is desired the blotting paper method is preferable, but if it is desired to know how many seeds may be expected to grow, the sand method is in some ways preferable. In this method a thin layer of fine sand is sprinkled on the bottom of a flat dish and the seeds to be tested placed on it under a thin covering of sand. This must be kept moist and well shaded and at a somewhat higher temperature than in the first case.

At the end of every second day in the case of some seeds and the third day in the case of those germinating more slowly the sprouted seeds should be removed from the blotters or the sand and counted, the per cent being readily found by referring back to the number of seeds which were taken for the test.

A list of weed seeds found in seeds examined in 1917.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908.

COMMON NAME.	SCIENTIFIC NAME.
1. American wild mint	Mentha canadensis (L.) Briquet
2. Barnyard grass	Echimochloa crusgalli (L.) Beauv.
3. Black medick	Medicago lupulina L.
4. Bird's foot trefoil	Lotus corniculatus L.
5. Blue vervain	Verbena hastata L.
6. Bracted plantain	Plantago aristata Michx.
7. Bull thistle	Cirsium lanceolatum (L.) Hill.
8. Canada thistle	Cirsium arvense (L.) Scop.
9. Catnip	Nepeta cataria L.
0. Charlock	Brassica arvensis L.
1. Chicory	Cichorium intybus L.
2. Clover dodder	Cuscuta epithymum Murr.
3. Common chickweed	Stellaria media (L.) Cyrill.
4. Common nightshade	Solanum nigrum L.
5. Common speedwell	Veronica officinalis L.
6. Corn camomile	Anthemis arvensis L.
7. Corn cockle	Agrostemma githago L.
8. Corn mayweed	Matricaria modora L.
9. Crabgrass	Digitaria sanguinalis (L.) Scop.
20. Crane's bill	Geranium maculatum L.
21. Dock	Rumex sp.
22. Ergot	*Claviceps purpurea (Fr.) Tul.
23. Evening primrose	Oenothera biennis L.
24. False flax	Camelina microcarpa Andrz.
25. Field dodder	Cuscuta arvensis Beyrich.
26. Field scorpion grass	Myosotis arvensis (L.) Hill.
27. Five finger	Potentilla monspeliensis L.
28. Flax dodder	Cuscuta epilinum Weihe.
29. Fowl meadow grass	Glyseria nervata (Willd.) Trin.
30. Giant ragweed	Ambrosia trifida L.
31. Goosefoot	Chenopodium album L.
32. Green foxtail	Setaria viridis (L.) Beauv.
33. Hare's ear	Conringia orientalis (L.) Dumort.
34. Hairy stickseed	Lappula eclimata Gilib.
35. Heal-all	Prunella vulgaris L.
36. Hedge mustard	Sisymbrium officinale (L.) Scop.
37. Hoary alyssum	Berteroa incana (L.) D. C.
38. Indian mallow	Abutilon theophrasti Medic.
39. Knot-grass	Polygonum aviculare L.
40. Lady's thumb	Polygonum persicaria L.
41. Large false flax	Camelina sativa (L.) Crantz.
42. Mayweed	Anthemis cotula L.
43. Mint	Mentha sp.
44. Moth mullein	Verbascum blattaria L.
45. Mouse-ear chickweed	Cerastium vulgatum L.
46. Mustard	Brassica nigra (L.) Koch.
47. Night-flowering catchfly	Silene noctiflora L.
48. Old-witch grass	Panicum capillare L.

*Sclerotia of the fungus.

A list of weed seeds found in seeds examined in 1917.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908.

COMMON NAME.	SCIENTIFIC NAME.
49. Ovoid spike rush	Eleocharis ovate (Roth.) R. & S.
50. Ox-eye daisy	Chrysanthemum leucanthemum L.
51. Pale persicaria	Polygonum lapathifolium L.
52. Pennsylvania persicaria	Polygonum pennsylvanicum L.
53. Peppergrass (field)	Lepidium campestre (L.) R. Br.
54. Peppergrass (wild)	Lepidium virginicum L.
55. Perennial sweet vernal grass	Anthoxanthum odoratum L.
56. Pigweed	Amaranthus retroflexus L.
57. Plantain	Plantago major L.
58. Poison hemlock	Conium maculatum L.
59. Purslane	Portulaca oleracea L.
60. Ragweed	Ambrosia artemisiifolia L.
61. Ribgrass	Plantago lanceolata L.
62. Rugel's plantain	Plantago rugelii Done.
63. Russian thistle	Salsola Kali tenuifolia (L.) G. F. W. Mey.
64. Sedge	Carex unidentified.
65. Sheep sorrel	Rumex acetosella L.
66. Shepherd's purse	Capsella Bursa-pastoris (L.) Medic.
67. Slender crabgrass	Digitaria filiformis (L.) Koeler.
68. Spiny sida	Sida spinosa L.
69. Sprouting crabgrass	Panicum dichotomiflorum Michx.
70. Spurge	Euphorbia preslii Guss.
71. Suckling clover	Trifolium dubium Sibth.
72. Sunflower	Helianthus annuus L.
73. Tumble-weed	Amaranthus graecizans L.
74. Virginia three-seeded mercury	Acalypha virginica L.
75. Vetch	Vicia sativa L.
76. White vervain	Verbena urticaefolia L.
77. Wild buckwheat	Polygonum convolvulus L.
78. Wild carrot	Daucus carota L.
79. Wild madder	Galium mollugo L.
80. Wild rose	Rosa pratincola Greene.
81. Willow herb	Epilobium adenocaulon Haussk.
82. Wormseed mustard	Erysimum cheiranthoides L.
83. Yarrow	Achillea millefolium L.
84. Yellow alyssum	Alyssum alyssoides L.
85. Yellow daisy	Rudbeckia hirta L.
86. Yellow foxtail	Setaria glauca (L.) Beauv.
87. Yellow rocket	Barbarea vulgaris R. Br.
88. Yellow-wood sorrel	Oxalis corniculata L.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	ALFALFA.			
8636	Bangor. R. B. Dunning & Co. Alfalfa	99.0	99.4	31.
	ALSIKE CLOVER.			
†8540	Ashland. H. B. Bartlett & Co. Globe Alsike #86930	99.0	98.1	65, 47, 31, 21, 3.
8654	Bangor. C. M. Conant. Bell Alsyke	97.5	98.3	21, 47.
8655	Bangor. C. M. Conant. Blue Jay Alsyke	98.5	99.0	3, 62.
8656	Bangor. C. M. Conant. Alsyke Clover	99.0	99.3	31.
8683	Bangor. Herbert A. Dunning. Alsyke	98.5	98.7	
8644	Bangor. R. B. Dunning & Co. Globe Alsike Clover	99.0	99.2	31, 54, 21.
8645	Bangor. R. B. Dunning & Co. Ace Alsike Clover	95.0	93.0	65, 3, 47, 24, 31, 21, 42, 8, 39, 69, 45, 86, 56, 26.
8678	Bangor. Kenduskeag Valley Farmer's Union. Alsike	98.0	97.2	3, 47, 65, 24, 8, 21, 48.
8669	Bangor. Knowles & Dow. Alsike Clover	98.0	97.3	47, 3, 9, 57.
8768	Brownfield. J. E. Clement. Alsike Clover	95.0	94.8	3, 65, 47, 31, 71, 24. 57.
8825	Burnham. Chute & Mitchell. Globe brand Alsyke	99.0	99.0	21, 65, 31.
8765	Denmark. Cyrus S. Barker. Alsike Clover	95.0	94.5	3, 47, 65, 24, 42, 21, 71, 54, 26.
8789	Derby. A. A. McKusick. Alsyke Ace brand	95.0	94.4	65, 47, 31, 3, 21, 67, 24, 64, 57, 42, 71, 48.
8796	Dexter. C. P. McCrilister. Alsyke Ace brand	90.0	89.2	65, 31, 42.
8798	Dexter. S. L. Small. Alsyke Eureka	98.5	98.2	47, 21, 65, 31.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	ALSIKE CLOVER—Continued.			
8791	Foxcroft. Central Maine Co-operative Association. Alsyke Clover	95.0	94.3	65, 47, 3, 21, 31, 56, 54, 61. 40, 86, 24.
8792	Foxcroft. A. W. Gilman. Pan American Alsyke	97.0	96.4	21, 61, 3, 65, 47, 31.
8760	Fryeburg. T. L. Eastman & Son. Alsike Clover	95.0	92.8	65, 47, 3, 31, 71, 13, 62, 61, 48, 27, 55, 40, 83, 24, 32. 21, 37.
8587	Gardiner. Gray-Hildreth Co. Alsike	97.0	99.3	3, 47.
†8501	Houlton. John Watson & Co. Globe Alsyke Clover Lot #86907	99.0	97.6	3, 47, 31, 65, 57, 32, 21.
†8505	Houlton. John Watson & Co. Globe Alsyke Clover Lot #86907	99.0	98.1	65, 47, 3, 21, 31, 79.
†8510	Houlton. John Watson & Co. Globe Alsyke Clover Lot #86907	99.0	98.3	3. 47, 65, 21, 32.
†8511	Houlton. John Watson & Co. Globe Alsyke Clover Lot #86907	99.0	98.3	3, 47, 65, 21. 32.
†8526	Houlton. John Watson & Co. Ace Alsyke Lot #86901	95.0	94.2	65, 47, 3. 21, 31, 62, 61, 71. 8, 49, 87.
†8527	Houlton. John Watson & Co. Globe Alsyke Lot #86907C	99.0	98.7	47, 65, 31, 24, 62. 73, 21.
†8529	Houlton. John Watson & Co. Globe Alsyke Lot #86907B	99.0	98.4	47, 31, 3, 65, 21.
†8543	Houlton. John Watson & Co. Globe Alsyke Lot #86938	99.0	98.9	31, 47, 21, 36.
†8545	Houlton. John Watson & Co. Ace Alsike Clover Lot #86964	95.0	96.5	65, 31, 3, 47, 62, 21, 23, 82, 53.
8722	Kennebunk. E. L. Littlefield. Alsike Clover	95.0	94.6	65, 47, 31, 21.
8577	Lewiston. J. B. Ham Co. Pan American Alsike	96.0	93.7	3, 47, 65, 45, 8.
8819	Madison. N. A. Weston. Alsyke Kaiser brand	92.0	91.8	65, 47, 3, 61, 31, 45, 35.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	ALSIKE CLOVER—Continued.			
8785	Milo. Farmer's Union. No name given	—	98.7	65, 3, 47, 16, 21.
8600	Monmouth. E. M. Marks Est. Globe Brand Alsike #89830	99.0	98.4	47, 3, 31, 24.
†8549	Newport. Judkins & Gilman Co. Pan American Alsike	97.0	97.6	3, 21, 56, 62, 65.
8814	Norridgewock. Lockwood & Smith. Blue Jay Alsyke	98.0	98.1	31, 3.
8556	Norway Lake. Norway Lake Supply Co. Ace Brand Alsyke	95.0	95.7	65, 3, 71, 24, 31, 21, 47.
8664	Old Town. Old Town Supply Co. Alsyke Clover	97.0	97.0	47, 3, 42, 24, 57, 31.
8744	Randolph. Gardiner Farmer's Union. Alsike	98.0	97.3	3, 47, 65.
8756	Rockland. Rockland Farmer's Union. Alsike	98.0	97.0	3, 47, 24, 65, 21, 8, 31, 9, 32, 48.
8732	Sabattus. O. R. Jones. Eureka Alsike	98.0	97.6	3, 65, 62, 31, 61, 42, 47, 21.
8810	Skowhegan. Skowhegan Farmer's Union. Ace Brand Alsyke	95.0	95.0	65, 47, 3, 53, 36.
8612	South Brewer. F. H. Brastow & Son. Alsyke Clover	98.0	99.0	3, 21.
8609	South Brewer. S. S. Herrick & Co. Alsike Clover	95.0	93.8	3, 65, 31, 61, 32, 24, 21, 35, 62, 67.
8706	Thorndike. Farmer's Union. Alsike, no guaranty given	—	98.9	3, 65, 16, 13, 47.
8759	Waterboro. A. C. Warren. Alsike Clover	95.0	96.7	65.
8696	Waterville. Central Maine Farmer's Exchange. Alsike	98.0	99.0	3, 65.
8687	Waterville. Merrill & Mayo Co. Alsyke	95.41	95.8	31, 47.
8688	Waterville. Merrill & Mayo Co. Alsyke	93.5	93.6	65, 47, 31, 3, 21, 23, 62, 57, 42, 53.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
8713	Wells. A. A. Whitney. Alsike Clover	98.0	94.3	65, 71, 55, 61.
	BARLEY.			
8563	Auburn. Oscar Holway Co. Two Row Barley #86265	97.0	97.9	
8623	Bangor. R. B. Dunning & Co. Two Row Barley	99.0	99.1	
8628	Bangor. R. B. Dunning & Co. Six Row Barley	99.0	98.5	77, 31.
8631	Bangor. R. B. Dunning & Co. Six Row Barley	98.0	99.4	77.
8703	Belfast. H. L. Whitten Co. Barley, no guaranty given	—	99.0	60.
†8591	Gardiner. Gray,-Hildreth Co. Barley	99.0	98.22	46, 77.
8575	Lewiston. E. P. Ham. Barley, not guaranteed	—	97.36	
8716	Saco. Saco Grain & Milling Co. Montana Barley	98.0	98.8	65.
	BUCKWHEAT.			
8565	Auburn. Oscar Holway Co. Globe Brand Jap. Buckwheat #69416	95.0	99.5	
8625	Bangor. R. B. Dunning. Japanese Buckwheat	99.0	99.9	
8629	Bangor. R. B. Dunning & Co. Silver Hull Buckwheat	99.0	99.9	
†8593	Gardiner. Gray-Hildreth Co. Buckwheat	99.0	99.82	60, 86.
8693	Waterville. Vigue Harness & Carriage Co. Buckwheat	98.0	96.5	60, 86, 2.
	CANADIAN BLUE GRASS.			
8639	Bangor. R. B. Dunning & Co. Canada Blue Grass	85.0	84.0	42, 45, 27, 62, 64.
	GERMAN MILLET.			
8661	Bangor. C. M. Conant Co. German Millet	95.0	98.8	86, 40, 32, 48.
8637	Bangor. R. B. Dunning & Co. German Millet	98.9	99.1	32, 56, 19.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	GERMAN MILLET—Concluded.			
8691	Waterville. Merrill & Mayo Co. Millet, not guaranteed	—	98.7	19, 31, 86, 32, 73, 14.
	HUNGARIAN.			
8728	Alfred. H. B. Fernald. Hungarian	95.0	98.0	32, 86, 14.
8559	Auburn. Oscar Holway Co. Hungarian	95.0	98.4	32, 86, 2.
8659	Bangor. C. M. Conant Co. Hungarian	96.0	98.5	32, 86, 48, 2, 56.
8620	Bangor. R. B. Dunning. Hungarian	98.0	99.0	48, 56, 31.
8603	Brewer. M. H. Perkins. Hungarian	98.0	99.2	32, 2, 40.
8774	Cornish. I. N. Brackett Co. Hungarian	95.0	96.3	51, 60, 48, 40, 39.
8751	East Gray. Gray Milling Co. Hungarian	95.0	98.7	51, 32, 40.
†8588	Gardiner. Gray-Hildreth Co. Hungarian	97.0	98.5	32, 48, 2, 51, 40, 86, 73.
8572	Lewiston. E. P. Ham. Hungarian Millet	98.0	99.0	56.
8668	Old Town. Old Town Supply Co. Hungarian	97.0	96.8	31, 56, 19, 48.
8755	Rockland. Rockland Farmer's Union. Hungarian	95.0	98.4	32, 85, 70, 67.
8729	Rumford. J. S. Morse. Hungarian	97.0	99.0	40, 48.
8553	South Paris. L. L. Russell. Hungarian	97.0	99.0	40, 2, 86, 69, 56.
	JAPANESE MILLET.			
8566	Auburn. Oscar Holway Co. Jap. Millet	98.0	98.5	86.
8660	Bangor. C. M. Conant Co. Jap. Millet	96.0	99.0	
8621	Bangor. R. B. Dunning. Jap. Millet	98.0	99.0	86, 52.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	JAPANESE MILLET-Concluded.			
8677	Bangor. Kenduskeag Valley Farmer's Union. Jap. Millet	—	89.3	86, 60, 31, 40, 77.
8673	Bangor. Knowles & Dow Co. Jap. Millet	95.0	86.9	86, 19, 67, 60, 52, 48, 68, 32, 40.
8700	Belfast. Farmer's Union. Jap. Millet	—	97.8	86, 60, 52.
8740	Buckfield. B. Spaulding & Sons. Jap. Millet	98.0	99.0	86, 52.
8804	Bucksport. C. B. Clay. Jap. Millet	98.0	98.8	86, 60.
8802	Bucksport. E. B. Gardner. Jap. Millet	89.4	90.2	86, 40, 60.
8773	Cornish. Small Bros. Co. Japanese Millet	98.0	98.8	60, 86, 32.
8737	East Sumner. R. G. Stephens Co. Millet	98.0	98.2	86, 52, 60.
†8592	Gardiner. Gray-Hildreth Co. Japanese Millet	99.0	98.8	60, 52.
8794	Hermon. B. H. Lord. Millet	—	94.8	86, 40, 60, 39, 52, 85, 83.
†8522	Newport. Judkins & Gilman Co. Japanese Millet	97.0	97.4	86, 52, 40, 60.
8817	Norridgewock. Norridgewock Farmer's Union. Jap. Millet	—	95.2	86, 60.
8554	South Paris. A. C. Maxim. Jap. Millet	98.0	98.3	52, 60, 86.
†8594	Walpole. R. A. Sprane. Japanese Millet	—	97.1	60, 86, 40.
†8595	Walpole. R. A. Sprane. Japanese Millet	—	97.8	86, 60, 52, 39, 31, 38, 72, 32.
8714	Wells. A. A. Whitney. Japanese Millet	98.0	98.4	86, 60, 72, 32.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	KENTUCKY BLUE GRASS.			
8718	Biddeford. Andrews & Horigan. Kentucky blue grass	80.0	78.0	64, 45, 59.
8778	North Berwick. D. W. Bragdon. Kentucky blue grass	80.0	75.2	65, 64, 45, 66, 54.
	MAMMOTH CLOVER.			
8653	Bangor. C. M. Conant Co. Mammoth Clover	99.25	98.7	65.
8795	Bangor. C. M. Conant Co. Mammoth Clover "Green"	—	99.1	65.
8642	Bangor. R. B. Dunning & Co. Ace Mammoth Red Clover	98.0	97.1	32, 65, 23, 31, 62, 67, 61, 40, 21, 48, 39, 47, 78.
8643	Bangor. R. B. Dunning & Co. Mammoth Red Clover	99.0	99.3	31, 32.
†8503	Houlton. John Watson & Co. Amoskeag Globe Mammoth Clover #71502	99.5	99.7	32, 21, 61, 65.
†8507	Houlton. John Watson & Co. Globe Mammoth #71502	99.5	99.6	65, 21, 32.
†8524	Houlton. John Watson & Co. Globe Mammoth Clover #71626	99.5	99.4	32, 61, 40, 21, 65.
†8525	Houlton. John Watson & Co. Ace Mammoth Clover #71599	98.0	98.9	32, 21, 61, 65, 67, 6, 40, 8, 62, 74.
†8542	Houlton. John Watson & Co. Globe Mammoth Clover #71704	99.0	98.9	31, 32, 65.
	OATS.			
8567	Auburn. D. A. Callahan. Regenerated Swedish Oats	97.0	97.1	77, 46, 86, 34, 21.
8627	Bangor. R. B. Dunning. Oats	—	100.0	
8699	Belfast. Swan, Whitten, Bickford. Oats	—	99.5	
8704	Belfast. H. L. Whitten Co. Oats	99.0	99.15	21, 40, 27, 77, 86, 31.
8719	Biddeford. Joel Bean & Son. Regenerated Swedish Oats	97.0	98.65	

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	OATS—Concluded.			
8746	Bowdoinham. C. P. Bates. Oats	—	99.7	86, 65.
8747	Bowdoinham. C. P. Bates. Oats	—	99.3	65, 40, 21, 31.
8748	Bowdoinham. W. B. & E. P. Kendall. Elward Seed Oats	—	99.8	
8749	Bowdoinham. W. B. & E. P. Kendall. Elward Seed Oats	—	99.85	
8750	Bowdoinham. W. B. & E. P. Kendall. Oats	—	99.1	40, 77, 31.
8769	Brownfield. J. E. Clement. Oats	95.0	99.75	
8675	Hampden. G. W. Smith. Oats	—	99.65	57, 27, 46.
8829	Hollis Center. Cash Grain Store. Oats	97.0	98.45	77, 72.
8733	Sabattus. O. R. Jones. Oats	98.0	98.9	86, 77.
8736	Sabattus. O. R. Jones. Oats	97.0	97.5	77, 21.
8614	South Brewer. F. H. Brastow. Oats	—	99.0	21, 65, 27, 8, 40, 39.
8726	Springvale. A. A. Wilson. Oats	—	99.4	21, 40, 32, 62.
8772	West Baldwin. H. A. Miles. Regenerated Swedish Oats	97.0	98.6	77.
8598	Winthrop. D. H. Maxim Est. Elwood Seed Oats	—	99.8	27.
	ORCHARD GRASS.			
8640	Bangor. R. B. Dunning & Co. Orchard Grass	87.5	89.6	
	RAPE.			
8634	Bangor. R. B. Dunning & Co. Rape	99.6	100.0	
	RED CLOVER.			
†8541	Ashland. H. B. Bartlett & Co. Globe Red Clover #71678	99.0	99.5	32, 61, 21, 31, 40, 86, 67.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	RED CLOVER—Continued.			
8560	Auburn. Oscar Holway Co. Globe Brand Clover	99.5	99.4	32.
8651	Bangor. C. M. Conant Co. Bell Red Clover	99.0	99.1	32, 61, 21, 25.
8652	Bangor. C. M. Conant Co. Veribest Red Clover	98.5	98.8	32, 65.
8641	Bangor. R. B. Dunning & Co. Queen Brand Red Clover	94.0	94.7	32, 61, 65, 31, 21, 56.
8646	Bangor. R. B. Dunning & Co. Ace Red Clover	98.0	98.9	32, 86, 31.
8680	Bangor. Kenduskeag Valley Farmer's Union. Red Clover	99.0	99.6	32, 86, 62.
8672	Bangor. Knowles & Dow Co. Eureka Clover	99.5	99.8	
8676	Bangor. Thompson Implement & Seed Co. Red Clover	98.0	99.1	3, 48, 32.
8822	Bingham. S. J. Whitney. Ace Clover	98.0	98.0	32, 14, 65, 46, 20, 69, 86.
8607	Brewer. A. C. Moore. Red Clover	98.0	98.4	61, 31, 32.
8766	Brownfield. L. R. Giles Co. Red Clover	98.0	98.0	61, 78, 11, 8.
8800	Bucksport. E. B. Gardner & Co. Ace Brand Clover	98.0	99.0	78, 32, 61, 4.
8824	Burnham. Chute & Mitchell. Clover	99.0	99.7	
8536	Corinna. Eastern Grain Co. Red Clover	98.0	98.3	61, 28, 73, 62, 21, 6.
8799	Corinna. J. F. Gray. Pan American Clover	98.0	98.0	8, 21, 61.
8776	Cornish. J. F. Jameson Co. Red Clover	98.0	98.7	32, 61, 78.
8775	Cornish. Pendexter Bros. Red Clover	98.0	97.8	32, 21, 78, 61.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed. Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	RED CLOVER—Continued.			
8764	Denmark. C. E. Cobb. Red Clover	98.0	97.6	4, 61, 65, 35, 32, 78, 31, 47.
8807	East Newport. Dow & Payne. Clover	99.5	99.8	14.
8602	Farmington. F. L. Butler. Eureka Clover	99.5	98.7	21, 32, 62, 86, 40, 65, 9, 31.
8601	Farmington. W. W. Small Co. Red Clover	98.0	99.2	61, 58, 3.
†8586	Gardiner. Gray-Hildreth Co. Red Clover	99.0	99.2	32, 21, 40.
8779	Gorham. J. H. Watson. Red Clover	98.0	97.7	61, 32, 21.
8674	Hampden. G. W. Smith. Clover	99.0	99.1	61.
†8502	Houlton. John Watson & Co. Globe Medium Clover #71600	99.3	99.4	32, 40.
†8506	Houlton. John Watson & Co. Globe Medium Clover #71600A	99.3	99.2	32, 40, 61, 57.
†8528	Houlton. John Watson & Co. Globe Medium Clover #71634	99.0	99.0	31, 32, 63, 56.
8573	Lewiston. E. P. Ham. Imperator Red Clover	97.0	98.6	31, 9, 62.
8568	Lewiston. Haskell Implement & Seed Co. Kaiser Brand Red Clover	96.0	96.4	61, 21, 40, 32, 65.
8788	Milo. H. Cotter Co. Ace Brand Red Clover	98.0	97.7	32, 65, 61, 21.
8786	Milo. Farmer's Union. Red Clover	—	99.4	32, 62, 21, 31.
†8521	Newport. Judkins & Gilman Co. Pan American Red Clover	98.0	98.5	32, 61, 62, 21, 40, 47, 35, 31, 67.
8815	Norridgewock. Lockwood & Smith. Clover	99.0	98.6	61, 65.
8665	Old Town. Old Town Supply Co. Red Clover	98.0	97.8	32, 62, 35, 61, 21.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	RED CLOVER—Continued.			
†8538	Portland. Allen, Sterling & Lothrop. Red Clover	99.7	99.5	32, 3, 63, 28.
8715	Saco. Saco Grain & Milling Co. Ace Brand Red Clover	97.0	98.8	61, 32, 21.
8723	Sanford. Hatch & Brown. Red Clover	98.0	98.0	3, 2.
8724	Sanford. S. J. Nowell. Red Clover	99.0	99.5	
8812	Skowhegan. Stewart & Smiley. Pine Tree Brand Clover	99.0	98.9	32, 70, 67, 61.
8821	Solon. C. E. Andrews. Clover	99.0	99.0	61, 32, 21, 65.
8708	South Berwick. F. M. Hersom. Red Clover	97.0	97.5	61, 78.
8613	South Brewer. F. H. Brastow & Son. Red Clover	99.5	99.8	
8608	South Brewer. S. S. Herrick & Co. Red Clover	98.0	99.1	32.
8727	Springvale. S. D. Hanson. Red Clover	96.0	89.3	32, 61, 21, 65, 31, 47, 62, 40, 69, 43, 46, 86, 2, 67, 5, 12, 79.
8707	Thorndike. Farmer's Union. Clover	—	99.5	32, 61, 62, 86, 21, 65.
8757	Union. W. A. Bessey. Red Clover Imperator.	97.0	97.6	61, 35, 57, 78, 21.
8689	Waterville. Merrill & Mayo Co. Red Clover	98.75	99.2	62, 32, 74, 48.
8690	Waterville. Merrill & Mayo Co. Climax N. Y. Clover	99.58	99.5	40, 32.
	REDTOP.			
8781	Baldwin. Wentworth Bros. Red Top	90.0	90.6	83, 22, 48, 27, 43.
8657	Bangor. C. M. Conant. Red Top	95.0	95.0	83, 64, 27, 22.
8658	Bangor. C. M. Conant. Red Top	90.0	92.4	83, 22, 45.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	REDTOP—Continued.			
8617	Bangor. R. B. Dunning & Co. Fancy Red Top	90.0	90.8	83, 27, 64, 62, 22, 85, 45.
8632	Bangor. R. B. Dunning & Co. Fancy Red Top	90.0	90.4	27, 65, 64, 85, 22, 83.
8633	Bangor. R. B. Dunning & Co. Fancy Red Top (Globe)	98.0	97.4	83, 22.
8681	Bangor. Kenduskeag Valley Farmer's Union. Red Top	99.5	93.3	83, 43, 22, 64.
8682	Bangor. Kenduskeag Valley Farmer's Union. Red Top	90.5	93.0	83, 22, 64, 43.
8670	Bangor. Knowles & Dow Co. Red Top	94.0	92.0	83, 62, 64, 45, 86.
8702	Belfast. Farmer's Union. No marks	—	92.6	83, 45, 64.
8805	Belfast. Swan, Whitten, Bickford. Red Top	90.0	86.8	83, 27, 22, 64, 57, 29, 26.
8558	Bethel. Woodbury & Purington. Fancy Red Top Ace Brand	90.0	91.2	27, 64, 62, 22, 83, 85.
8767	Brownfield. A. Blake. Ace Brand Redtop	90.0	91.8	83, 64, 27, 1.
8809	Canaan. E. H. Williams & Sons. Red Top	90.0	90.4	27, 83, 22, 64, 57.
†8537	Corinna. Eastern Grain Co. Red Top	90.0	90.9	83, 64, 22.
8752	East Gray. Gray Milling Co. Red Top Ace brand	90.0	90.0	83, 27, 64, 48, 22, 43, 45, 65, 57.
†8590	Gardiner. Gray-Hildreth Co. Red Top	90.0	89.3	64, 83, 27, 22, 57, 85, 48, 65, 29.
8793	Hermon. B. H. Lord. No marks	—	89.4	27, 83, 64.
8770	Hiram. L. Cotton & Son. Redtop	91.0	91.4	83, 27, 64, 62.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	REDTOP—Concluded.			
†8531	Houlton. John Watson & Co. Ace Red Top Lot R. T. 92628	90.0	91.1	83, 64, 65, 27, 22, 57, 45, 43.
8720	Kennebunk. G. W. Larabee. Red Top	97.0	92.6	83, 64, 65.
8569	Lewiston. Haskell Implement & Seed Co. Ace Brand Fancy Red Top #R. T. 92357	90.0	91.2	83, 64, 27.
8576	Lewiston. J. L. Hayes & Co. Pan American Red Top	90.0	89.8	83, 22, 64.
8787	Milo. Farmer's Union. Red Top	—	86.3	83, 22, 64, 65.
†8523	Newport. Judkins & Gilman Co. Pan American Red Top	90.0	86.9	83, 64, 22, 44.
8777	North Berwick. Boyle Bros. Redtop	90.0	89.2	83, 27, 64, 43, 45, 62.
8666	Old Town. Old Town Supply Co. Red Top	90.0	86.8	83, 22, 64.
8754	Rockland. Rockland Farmer's Union. Red Top	90.5	93.6	83, 27, 64, 22, 85.
8734	Sabattus. O. R. Jones. Eureka Red Top	94.0	94.8	83, 64, 22.
8717	Saco. Scales Hardware Co. Red Top	90.0	90.6	83, 27, 64, 45, 57, 22.
8710	South Berwick. R. B. Rideout. Ace Brand Redtop	90.0	90.8	83, 64, 43, 22.
8551	South Paris. N. Dayton Bolster. Ace Brand Fancy Red Top #92010	90.0	90.0	83, 64, 27, 49, 22, 48, 43.
8761	Waterboro. Langley's General Store. Ace Brand Redtop	—	91.6	83, 64, 27, 43, 66.
	RYE.			
8622	Bangor. R. B. Dunning. Winter Rye	99.0	100.0	
8624	Bangor. R. B. Dunning & Co. Winter Rye	99.0	100.0	
8571	Lewiston. Haskell Implement & Seed Co. Spring Rye #S. R. 101121	99.0	99.3	

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.
†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	SIBERIAN MILLET.			
8635	Bangor. R. B. Dunning & Co. Siberian Millet	99.0	99.4	32, 63, 31.
8584	North Jay. North Jay Grange Store. Siberian Millet	97.3	97.7	32, 48.
8811	Skowhegan. D. A. & W. E. Porter. Sib. Millet	97.9	99.7	
	TIMOTHY.			
†8539	Ashland. H. B. Bartlett & Co. Pine Tree Timothy #60440	99.5	99.6	27.
8561	Auburn. Oscar Holway Co. Timothy #60293	98.0	97.6	27, 64, 62, 85, 22, 53, 61, 49, 26, 5, 65.
8562	Auburn. Oscar Holway Co. Timothy T69722	98.0	98.4	27, 22, 49, 64.
8647	Bangor. C. M. Conant Co. Veribest Timothy	98.5	98.5	21, 62, 48, 27, 64.
8648	Bangor. C. M. Conant Co. Bell Timothy	99.5	99.3	62, 54.
8649	Bangor. C. M. Conant Co. Anchor Brand Timothy	99.75	99.7	
8650	Bangor. C. M. Conant Co. Blue Jay Timothy	99.65	99.6	62, 64, 31.
8618	Bangor. R. B. Dunning. Timothy	99.5	99.7	42, 23.
8619	Bangor. R. B. Dunning. Timothy	98.0	98.0	27, 85, 23, 62, 22, 64, 43.
8679	Bangor. Kenduskeag Valley Farmer's Union. Timothy	99.2	98.6	64, 62, 65, 27, 22, 83, 29, 23, 48, 43, 5.
8671	Bangor. Knowles & Dow Co. Timothy	99.7	99.6	
8701	Belfast. Farmer's Union. No marks	—	98.8	27.
8782	Berwick. J. Everett Tibbetts. Pine Tree Timothy	99.5	99.5	5.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	KIND OF SEED, NAME AND TOWN OF DEALER.	PURITY. Guaranty.	PURITY. Found.	*Kinds of Noxious Weed Seeds.
	TIMOTHY—Continued.			
8823	Bingham. S. J. Whitney. Timothy	99.5	99.7	65, 27, 23.
8605	Brewer. A. C. Moore. Timothy	99.5	99.3	31, 62.
8606	Brewer. A. C. Moore. Timothy	98.0	98.9	62, 27, 22, 23, 64.
8604	Brewer. M. H. Perkins. Timothy	99.0	99.2	27, 23, 62, 82, 85.
8741	Buckfield. B. Spaulding & Sons. Timothy T68749	98.0	98.0	27, 22, 85, 83, 53, 61.
8803	Bucksport. R. C. Marks. Pine Tree Timothy	99.5	99.5	65, 81.
8808	Canaan. A. Mason. Timothy	99.5	99.5	
8684	Carmel. W. C. Haskell. Timothy	98.0	98.5	62, 64, 44.
†8535	Corinna. Eastern Grain Co. Pine Tree Timothy	99.5	99.5	62, 85, 27, 22.
8797	Dexter. Dexter Grange Store. Timothy	99.5	99.5	21.
8790	Dover. V. L. Warren. Timothy	99.5	99.5	
8753	East Gray. Gray Milling Co. Oriole Timothy	99.5	99.4	62, 27.
8697	Fairfield. Fairfield Grain Co. Timothy	99.5	99.7	
8763	Fryeburg. T. L. Eastman & Son. Pine Tree Brand Timothy	99.5	99.4	62, 31, 27.
†8589	Gardiner. Gray-Hildreth Co. Timothy	99.5	99.5	21, 85, 23, 22, 31, 64, 56.
8780	Gorham. J. H. Watson. Pine Tree Timothy	99.5	99.7	
8783	Guilford. John Scales & Sons. Timothy	98.0	98.4	27, 64, 22.
8742	Hallowell. Frank S. Wingate. Timothy	99.2	99.3	64, 62.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.
†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	TIMOTHY—Continued.			
8743	Hallowell. Frank S. Wingate. Timothy	99.2	99.4	85.
8771	Hiram. A. W. Sadler. Timothy	98.0	98.5	27, 62, 22, 54.
†8494	Houlton. John Watson & Co. American Globe Timothy #69759	99.8	99.8	23, 27.
†8495	Houlton. John Watson & Co. Bennis Bright Hull Globe Timothy #69531	99.8	99.8	65.
†8496	Houlton. John Watson & Co. American Pine Tree Timothy #69999	99.5	99.6	23, 76, 62, 65.
†8498	Houlton. John Watson & Co. American B. H. Globe Timothy #60287	99.8	99.8	65.
†8499	Houlton. John Watson & Co. Pine Tree Timothy #60309	99.5	99.6	42.
†8500	Houlton. John Watson & Co. American B. H. Globe Timothy #60286	99.8	99.7	65. 27.
†8508	Houlton. John Watson & Co. P. T. Timothy #60309	99.5	99.6	31, 62, 64.
†8509	Houlton. John Watson & Co. B. H. Globe Timothy #60286	99.8	99.8	65, 61.
†8530	Houlton. John Watson & Co. B. H. Globe Timothy #60376	99.8	99.8	81.
†8544	Houlton. John Watson & Co. P. T. Timothy #60541	99.5	99.6	23, 85, 88, 48.
†8546	Houlton. John Watson & Co. B. H. Globe Timothy #60530	99.8	99.8	81.
†8547	Houlton. John Watson & Co. B. H. Globe Timothy #60439	99.8	99.8	
†8548	Houlton. John Watson & Co. P. T. Timothy #60450	99.5	99.7	31.
8574	Lewiston. E. P. Ham. Pan American Timothy	99.5	99.6	22.
8570	Lewiston. Haskell Implement & Seed Co. Timothy #701	99.0	99.1	62, 21, 65, 85.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	TIMOTHY—Continued.			
8818	Madison. Stanley, Harlow & Hight Co. Timothy Frontier	97.0	98.0	65, 27, 61, 62, 76, 19, 1, 85, 23.
8739	Mechanic Falls. H. A. Morison. Pine Tree Timothy	99.5	99.6	62, 27.
8784	Milo. Harris Bros. Timothy	99.5	99.0	62, 61, 6, 31, 85, 23.
8599	Monmouth. E. M. Marks Est. Square Deal Brand Timothy	99.0	99.0	65.
†8550	Newport. Judkins & Gilman Co. Pan American Timothy	99.5	99.5	23, 31, 64, 22.
8816	Norridgewock. Farmer's Union. Timothy	99.0	99.1	27, 65, 62.
8813	Norridgewock. W. W. Huntoon. Square Deal Timothy	99.0	99.2	62, 53.
8820	North Anson. North Anson Farmer's Union. Not marked	—	99.3	54, 62, 65, 59, 18.
8582	North Jay. North Jay Grange Store. Pine Tree Brand Timothy #60307	99.0	99.5	
8585	North Jay. H. E. Purington. Pine Tree Brand Timothy #69792	99.5	99.6	31.
8555	Norway Lake. Norway Lake Supply Co. Square Deal Brand Timothy	99.0	99.4	69, 53.
8712	Ogunquit. C. L. Maxwell. Timothy	98.0	98.3	62, 64, 50.
8667	Old Town. Old Town Supply Co. Timothy	99.50	99.7	
8806	Orland. A. R. Buck. Bison Timothy	97.8	97.8	27, 62, 23, 53, 65, 24.
8745	Randolph. Gardiner Farmer's Union. Timothy T60416	98.2	98.8	61, 62, 64, 5, 23.
8596	Readfield Depot. N. D. Gordon Co. Bell Brand Timothy	98.0	99.3	27, 47, 1.
8597	Readfield. N. D. Gordon Co. Frontier Brand Timothy	97.0	97.0	27, 22, 85, 62, 32, 23.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed. Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	TIMOTHY—Concluded.			
8730	Rumford. J. S. Morse. Timothy	97.0	97.8	23, 27, 5, 54, 65, 62.
8731	Sabattus. O. R. Jones. Pan American Timothy	99.5	99.6	36, 21.
8735	Sabattus. O. R. Jones. Pine Tree Timothy	99.5	99.6	
8709	South Berwick. F. M. Hersom. Pine Tree Brand Timothy	99.0	99.5	62.
8610	South Brewer. F. H. Brastow & Son. Timothy	99.5	99.5	23.
8611	South Brewer. F. H. Brastow & Son. Timothy	99.7	99.6	23.
8801	South Orrington. Perkins & Mitchell. Bison Timothy	97.7	97.8	27, 22, 62, 53, 42.
8552	South Paris. N. Dayton Bolster. Pine Tree Timothy	99.5	99.6	48, 64.
8725	Springvale. Ross & Bradford. Timothy	98.0	97.8	27, 62, 23, 54.
8705	Thorndike. Farmer's Union. Timothy	—	99.1	62, 21, 27, 31, 71, 23, 64, 82.
8758	Union. E. H. Burkett. Bison Brand Timothy	97.0	97.5	23, 62, 85, 27.
8692	Waterville. G. A. Kennison & Co. Timothy	99.5	99.6	
8685	Waterville. Merrill & Mayo. Timothy	99.68	99.6	48, 27, 76.
8686	Waterville. Merrill & Mayo. Timothy	99.05	99.2	21,65.
8762	Wells. Freeman E. Rankin. Pine Tree Brand Timothy	99.5	99.6	64.
8557	West Paris. D. H. Fifield. Bison Brand Timothy #68999	97.7	98.3	23, 62, 22, 27.
	WHEAT.			
8564	Auburn. Oscar Holway Co. Spring Wheat Fife	99.0	99.3	

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1917, arranged alphabetically by towns and dealers—Concluded.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	WHEAT—Concluded.			
8826	Augusta. Dept. of Agriculture. Wheat before screening	—	96.59	46, 17, 77, 10, 33, 40, 31, 47, 30, 41, 80, 86, 75.
8827	Augusta. Dept. of Agriculture. Wheat after screening	—	98.24	17, 10, 77, 46.
8583	North Jay. North Jay Grange Store. Blue Stem Wheat	99.0	98.9	
	WHITE CLOVER.			
8638	Bangor. R. B. Dunning & Co. White Clover	88.0	89.3	65, 31, 48, 71, 23, 32, 9, 57, 73, 36.

*The numbers refer to weeds named in the table on pages 5 and 6. E. g. 1 is for American wildmint, 2 is Barnyard grass, etc.

Table showing results of examination of samples of seeds in 1917.

Names of Weeds.	Kind of Seed and Number of Samples.											
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millet.	Hungarian.	Oats.	German millet.	Siberian millet.	Barley.	Kentucky bluegrass.
Number of samples examined	58	56	13	90	34	20	14	22	3	4	8	2
American wild mint	—	—	—	—	1	—	—	—	—	—	—	—
Barnyard grass	4	—	1	—	—	—	6	—	—	—	—	—
Black medick	6	42	—	—	—	—	—	—	—	—	—	—
Bird's foot trefoil	3	—	—	—	—	—	—	—	—	—	—	—
Blue vervain	1	—	—	5	—	—	—	—	—	—	—	—
Bracted plantain	2	—	2	1	—	—	—	—	—	—	—	—
Bull thistle	1	—	—	—	—	—	—	—	—	—	—	—
Canada thistle	2	7	—	—	—	—	—	1	—	—	—	—
Catnip	2	3	—	—	—	—	—	—	—	—	—	—
*Charlock	—	—	—	—	—	—	—	—	—	—	—	—
Chicory	1	—	—	—	—	1	—	—	—	—	—	—
Clover dodder	2	—	—	—	—	—	—	—	—	—	—	—
Common chickweed	—	2	—	—	—	—	—	—	—	—	—	—
Common nightshade	2	—	—	—	—	—	1	—	1	—	—	—
Common speedwell	—	—	1	—	—	—	—	—	—	—	—	—
Corn camomile	—	2	—	—	—	—	—	—	—	—	—	—
*Corn cockle	—	—	—	—	—	—	—	—	—	—	—	—
Corn mayweed	—	—	—	1	—	—	—	—	—	—	—	—
Crabgrass	1	—	—	1	—	2	2	—	2	—	—	—
Crane's bill	1	—	—	—	—	—	—	—	—	—	—	—
Dock sp.	21	34	6	7	—	—	—	6	—	—	—	—
Ergot	—	—	—	22	35	—	—	—	—	—	—	—
Evening primrose	—	3	3	24	—	—	—	—	—	—	—	—
False flax	—	15	—	1	—	—	—	—	—	—	—	—
Field dodder	1	—	—	—	—	—	—	—	—	—	—	—
Field scorpion grass	—	2	—	2	2	—	—	—	—	—	—	—
Five finger	1	2	—	32	20	—	—	—	—	—	—	—
Flax dodder	2	—	—	—	—	—	—	—	—	—	—	—
Fowl meadow grass	—	—	—	1	1	—	—	—	—	—	—	—
*Giant ragweed	—	—	—	—	—	—	—	—	—	—	—	—
Goosefoot	14	34	4	10	—	2	3	3	1	1	1	—
Green foxtail	43	6	10	1	—	4	8	1	3	3	—	—
Hare's ear	—	—	—	—	—	—	—	—	—	—	—	—
Hairy stickseed	—	—	—	—	—	—	—	1	—	—	—	—
Heal-all	5	3	—	—	—	—	—	—	—	—	—	—
Hedge mustard	—	3	—	1	—	—	—	—	—	—	—	—
Hoary alyssum	—	1	—	—	—	—	—	—	—	—	—	—
Indian mallow	—	—	—	—	—	1	1	—	—	—	—	—
Knot-grass	2	2	3	—	—	3	1	1	—	—	—	—
Lady's thumb	11	2	4	—	—	7	7	5	1	—	—	—
*Large false flax	—	—	—	—	—	—	—	—	—	—	—	—
Mayweed	—	10	—	3	—	—	—	—	—	—	—	—
Mint	1	—	—	2	9	—	—	—	—	—	—	—
Moth mullein	—	1	—	1	1	—	—	—	—	—	—	—

*Found in wheat.

Table showing results of examination of samples of seeds in 1917—Concluded.

Names of Weeds.	Kind of Seed and Number of Samples.											
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millet.	Hungarian.	Oats.	German millet.	Siberian millet.	Barley.	Kentucky bluegrass.
Mouse-ear chickweed	—	6	—	—	8	—	—	—	—	—	—	2
Mustard	2	1	—	—	—	—	—	3	—	—	1	—
Night-flowering catchfly	4	42	1	2	—	—	—	—	—	—	—	—
Old-witch grass	3	5	1	6	4	2	7	—	1	1	—	—
Ovoid spike rush	—	1	—	3	1	—	—	—	—	—	—	—
Ox-eye daisy	—	—	—	1	—	—	—	—	—	—	—	—
Pale persicaria	—	—	—	—	—	—	3	—	—	—	—	—
Pennsylvania persicaria	—	—	—	—	—	10	—	—	—	—	—	—
Peppergrass (field)	—	4	—	6	—	—	—	—	—	—	—	—
Peppergrass (wild)	1	3	—	5	—	—	—	—	—	—	—	1
Perennial sweet vernal grass	—	3	—	—	—	—	—	—	—	—	—	—
Pigweed	3	4	—	1	—	—	5	—	1	—	—	—
Plantain	2	8	—	—	6	—	—	1	—	—	—	—
Poison hemlock	1	—	—	—	—	—	—	—	—	—	—	—
Purslane	—	—	—	1	—	—	—	—	—	—	—	1
Ragweed	—	—	—	—	—	16	1	—	—	—	1	—
Ribgrass	32	9	4	7	—	—	—	—	—	—	—	—
Rugel's plantain	15	10	3	39	5	—	—	1	—	—	—	—
Russian thistle	3	—	—	—	—	—	—	—	—	1	—	—
Sedge	—	1	—	18	30	—	—	—	—	—	—	1
Sheep sorrel	15	40	12	17	6	—	—	3	—	—	1	1
Shepherd's purse	—	1	—	—	1	—	—	—	—	—	—	1
Slender crabgrass	7	2	3	—	—	2	1	—	—	—	—	—
Spiny sida	—	—	—	—	—	1	—	—	—	—	—	—
Sprouting crabgrass	2	1	—	1	—	—	1	—	—	—	—	—
Spurge	2	—	—	—	—	—	1	—	—	—	—	1
Suckling clover	—	8	—	1	—	—	—	—	—	—	—	—
Sunflower	—	—	—	—	—	2	—	1	—	—	—	—
Tumble-weed	1	1	—	—	—	—	1	—	1	—	—	—
Virginia three-seeded mercury	2	—	2	—	—	—	—	—	—	—	—	—
*Vetch	—	—	—	—	—	—	—	—	—	—	—	—
White vervain	—	—	—	4	—	—	—	—	—	—	—	—
Wild buckwheat	—	—	—	—	—	1	—	9	—	—	3	—
Wild carrot	10	—	1	—	—	—	—	—	—	—	—	—
Wild madder	1	—	1	—	—	—	—	—	—	—	—	—
*Wild rose	—	—	—	—	—	—	—	—	—	—	—	—
Willow herb	—	—	—	3	—	—	—	—	—	—	—	—
Wormseed mustard	—	1	—	2	—	—	—	—	—	—	—	—
Yarrow	—	1	—	2	34	1	—	—	—	—	—	—
Yellow alyssum	—	1	—	—	—	—	—	—	—	—	—	—
Yellow daisy	—	—	—	16	5	1	—	—	—	—	—	—
Yellow foxtail	8	1	—	—	1	18	7	4	2	—	—	—
Yellow rocket	—	2	—	—	—	—	—	—	—	—	—	—
Yellow-wood sorrel	—	—	—	1	—	—	—	—	—	—	—	—

*Found in wheat.

INSECTICIDES AND FUNGICIDES 1916 AND 1917

REQUIREMENTS OF THE LAW.

The law regulating the sale of fungicides and insecticides was enacted by the legislature of 1911. It is comparatively new and is only coming to be fully understood. During the years 1912 and 1913 a large part of the work of inspection was instructing dealers relative to the law and what they must do to conform with it. Nearly all of the dealers in fungicides and insecticides were visited by the inspectors during those years and many hundred letters were written regarding the law and its requirements. While much progress was made the law is still only partly understood. The need for the law, shown in the results of the first general and imperfect survey, is still more apparent as the inspections have been continued. The situation at the start would have been very discouraging were it not for the fact that it was no worse than was the case with grass seeds or feeding stuffs when the laws regulating those commodities were enacted.

The scope of the law is the same as the National Law. It is very broad and includes all materials which are used for preventing, destroying, repelling or mitigating fungi and insects that infest vegetation, man and other animals, or houses, or any environment whatever.

Every lot or package shall be plainly marked with the number of net pounds in the package, the name or trademark under which the article is sold, the name and address of the manufacturer or shipper, the minimum percentage of total arsenic and the maximum percentage of water soluble arsenic.

Before a fungicide or insecticide can be lawfully sold in the State it is necessary that it be registered and for that purpose there must be deposited with the Commissioner of Agriculture a certified copy of the statements named above, a registration fee of $10.00, and, if the commissioner requires, a sample of the fungicide or insecticide.

The registration fee is not assessed on a brand consisting of organic matter and not containing any added inorganic matter or mineral chemical, provided that a complete chemical analysis is given in, and as a part of, the required certificate.

It is necessary that every insecticide containing arsenic carry in addition to the weight, a chemical analysis stating the minimum percentage of total arsenic and the maximum percentage of water soluble arsenic which it contains. Standards are fixed for Paris green following the Federal law so that Paris green is adulterated if it does not contain at least 50 per cent of arsenious oxide (As_2O_3) or if it contains arsenic in water soluble form that is equivalent to more than 3.5 per cent of arsenious oxide (As_2O_3); and in the case of lead arsenate it is adulterated if it contains more than 50 per cent of water, if it contains total arsenic equivalent to less than 12.5 per cent of arsenic oxide (As_2O_5) and if it contains arsenic in water soluble form equivalent to more than 75 per cent of arsenic oxide (As_2O_5).

A fungicide or insecticide is adulterated if:—its strength or purity falls below the professed standard under which it is sold; any substance has been substituted wholly or in part for the article; any valuable constituent of the article has been wholly or in part extracted; or if it contains any substance or substances injurious to vegetation.

A fungicide or an insecticide is misbranded if:—the package or label bears any statement, design or device which is false or misleading in any particular; the container does not carry the statements named above; the printed statement attached to the container differs from the statements in the certificate; the registration fee has not been paid; it is in imitation of or offered for sale under the name of another article; it is labeled or misbranded so as to deceive the purchaser; any of the contents of the package as originally put up have been removed in whole or in part and other contents placed in such packages; or it consists partially or completely of any inert substance or substances which do not prevent, destroy, repel or mitigate insects or fungi and does not have the percentage amount of such inert substances plainly stated on the label.

RESULTS OF ANALYSES.

The results of the examination of all of the samples received from the Commissioner of Agriculture during the years 1916 and 1917 are given in the tables that follow.

Arsenical Insecticides Analyzed in 1916.

NAME AND ADDRESS OF MAKER. NAME OF GOODS AND SOURCE OF SAMPLE.	CLAIMS MADE ON LABEL.	RESULTS OF EXAMINATION
ARSENATE OF LEAD POWDER		
Corona Chemical Co., Newark, N. J. Dry Powdered Arsenate of Lead. G. W. Larrabee, Kennebunk and White Company, Rockland.	Not less than 98 per cent lead arsenate; 19.5 per cent total arsenic. Not more than 2 per cent inert ingredients; .5 per cent water soluble arsenic. ½ pound and 1 pound.	Nos. 30438 and 30497. Weight and composition as claimed.
Grasselli Chemical Co. Grasselli Arsenate lead Powder. Haskell Implement and Seed Co., Lewiston.	Not less than 96 per cent lead arsenate; 20 per cent total arsenic. Not more than 4 per cent inert ingredients; .75 per cent water soluble arsenic. One pound.	No. 30441. Weight and composition as claimed.
Sherwin and Williams Co., Chicago. Dry Powder Arsenate of Lead. Kendall and Whitney, Portland.	Not less than 30 per cent arsenic oxide. Not more than 1 water soluble arsenic. Half pound.	No. 30414. Weight and composition as claimed.
Swift's Arsenate of Lead Dry Powder. Merrimac Chemical Company, Boston. H. H. Crie Co., Rockland.	Not less than 63 per cent lead oxide; 25 per cent arsenic oxide. Not more than 1.5 per cent water soluble arsenic oxide. 1 pound.	No. 30428. Weight and composition as claimed.
ARSENATE OF LEAD PASTE		
Grasselli Arsenate of Lead Paste. Haskell Seed and Implement Co., Lewiston.	Not less than 15 per cent arsenic oxide. Not over 50 per cent water; .50 per cent water soluble arsenic. One pound.	Nos. 30439 and 30445. Weight and composition as claimed.
Lion Brand Arsenate of Lead Paste. Belfast Farmers' Union, Belfast.	Not less than 50 per cent arsenate of lead; 12.5 per cent arsenic oxide. Not more than 1 per cent water soluble arsenic.	No. 30461. Inside can rusty. Holes in bottom of can. Rust in sample. Water and arsenic as claimed. Weight of can contents 13.2 ounces.
P-W-R Lead Arsenate Paste. L. K. Leggett, Portland.	Not less than 15 per cent arsenic oxide. Not more than .75 per cent water soluble arsenic. One pound.	No. 30400. Weight as claimed. Slightly less total and slightly more water soluble arsenic than claim.
Swift's Arsenate of Lead. Merrimac Chemical Company, Boston, King-Dexter Co., Portland.	Not less than 31.50 per cent lead oxide; 12.50 per cent arsenic oxide. Not more than .75 per cent water soluble arsenic. One pound.	No. 30399. Weight and composition as claimed.
ARSENITE OF ZINC POWDER		
Thomsen Chemical Co., Baltimore, Md. Arsenite of Zinc Powdered. Skowhegan Farmers' Union, Skowhegan.	Not less than 30.5 per cent total arsenic. Not more than 1 per cent water soluble arsenic. 2 pounds.	No. 30470. Slightly under weight. Composition as claimed.
PARIS GREEN		
Ansbacher and Company's Paris Green. C. O. Sawyer and Co., Old Town.	Not less than 55 per cent arsenious trioxide and not more than 3½ per cent in free (uncombined) state. One pound.	No. 30462. Weight and composition as claimed.

Arsenical Insecticides Analyzed in 1916—Concluded.

NAME AND ADDRESS OF MAKER. NAME OF GOODS AND SOURCE OF SAMPLE.	CLAIMS MADE ON LABEL.	RESULTS OF EXAMINATION
Hi-grade Paris Green. Morris Hermann and Co., New York. Hall Knight Hard ware Co., Lewiston.	Not less than 50 per cent arsenious oxide combined with copper. Not more than 3½ per cent water soluble arsenic. One pound.	No. 3440. Weight and composition as claimed.
Lion Brand Paris Green. Searsport Grain and Grocery Co., Searsport.	Same as preceding.	No. 3463. Weight and composition as claimed.
Vitro Brand Paris Green. Nitrate Agencies, N. Y. Brooks Hardware Co., Augusta.	Same as preceding.	No. 30457. Weight and composition as claimed.
Pfeiffer's Strictly Pure Par's Green. A. F. Heald. Boston and E. G. Moore, Ellsworth.	Same as preceding.	Nos. 30417 and 30455. Weight and composition as claimed.
C. T. Raynolds & Co., Paris Green. Frank E. Robbins Portland and T. G. Seymour, South Brewer.	Same as preceding.	Nos. 30398 and 30456. Weight and composition as claimed.
Sherwin and Williams' Strictly Pure Paris Green. Kendall and Whitney, Portland, and Hall & Knight, Lewiston.	Same as preceding.	Nos. 30410 and 30444. Weight and composition as claimed.
Star Brand Paris Green. Fred L. Lavanburg, N. Y. Dunham-Hanson Co., Bangor and The White Company, Rockland.	Same as preceding.	Nos. 30420 and 30466. Weight and composition as claimed.
WATER SOLUBLE ARSENIC COMPOUNDS		
Briggs' Soluble Arsenate. Briggs Hardware Co., Caribou.	Not less than 40 per cent arsenic in water soluble form, 2 pounds.	No. 30418. Full weight. Slightly below claim in arsenic.
Hermann's Arsite. A. E. Chase Co., Brooks.	Not less than 28.8 per cent total arsenic. One pound.	No. 30464. Slightly under weight. Arsenic as claimed.
Watson's Soluble Arsenoid. John Watson Co., Houlton, A. M. Smith Co., Presque Isle.	Not less than 80 per cent sodium arsenate; 32.5 per cent water soluble arsenic. 2 pounds.	No. 30458. Slightly under weight. Arsenic in excess of claim.
MISCELLANEOUS		
Hammond's Slug Shot. Hammond Slug Shot Works, Fishkill, N. Y. Veazie Hardware Co., Rockland, and Wight Co., Rockland.	"Contains 70 per cent sulphur lime mixed with soluble amount of bluestone. Oxide of iron, Carbolic acid. Tobacco. 1 per cent arsenate. 1 pound."	No. 30425. Under weight. Composition as claimed. No. 30468. Full weight. Composition as claimed.
Hemingway's Ca-as-cu. W. F. Paradis, Van Buren.	"Copper arsenate 17¼ per cent. Calcium arsenate 40 per cent. Inert ingredients 42¾ per cent. Total arsenic 20 per cent. Water soluble arsenic ¾ per cent. One pound."	No. 30419. Weight and composition as claimed.
Kenyon's Potato Bug Poison. S. J. Whitney, Bingham, Maine.	"At least 3 per cent water soluble arsenate." 1 pound.	No. 30471. Short weight. Arsenic in excess of claim.

Combined Fungicides and Arsenical Insecticides Analyzed in 1916.

NAME AND ADDRESS OF MAKER, NAME OF GOODS AND SOURCE OF SAMPLE.	CLAIMS MADE ON LABEL.	RESULTS OF EXAMINATION
Bowker Insecticide Co., Boston, Mass. Bowker's Pyrox. Kendall and Whitney, Portland.	Not less than 13 per cent lead oxide; 1.5 per cent copper; 5.25 per cent arsenic oxide; 3.42 per cent arsenic. Not more than .75 per cent water soluble arsenic and 80.25 per cent inert ingredients. Weight 1 pound.	Nos. 30409 and 30460. Composition and weight as claimed.
Interstate Chemical Co., Jersey City, N. J. Key Brand Bordo-Lead.	Not less than 25 per cent dry lead arsenate; 2 per cent copper. Not more than 73 per cent inert ingredients. One pound.	No. 30554. Composition and weight as claimed.
Sherwin Williams' Tuber Tonic. R. B. Dunning and Co., Bangor.	Not less than 60 per cent Paris Green; 6 per cent copper and Bordeaux mixture; 24 per cent total arsenic. Not over 3 per cent water soluble arsenic.	No. 30453. Composition as claimed. Weight one pound.

BUG DEATH.

No. 30411. Bug Death, Danforth Chemical Co., Leominster, Mass. From Kendall and Whitney, Portland. Claims: Weight one pound. Zinc Oxide 47 per cent, lead oxide 5 per cent, inert ingredients 48 per cent. Over in weight and in zinc oxide. Up to claimed lead oxide.

HELLEBORE.

Three samples of hellebore were examined and found to consist of pure hellebore.

January, 1918.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

ANALYSTS.

James M. Bartlett
Roydon L. Hammond
Herman H. Hanson
Elmer R. Tobey

Official Inspections

87

MISCELLANEOUS FOOD MATERIALS.

CHAS. D. WOODS.

The Commissioner of Agriculture is the executive of the law regulating the sale of food in Maine. It is the duty of the Director of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and to publish the results of the analyses together with the names of the persons from whom the samples were obtained, and such additional information as may seem advisable.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

RESULTS OF ANALYSIS.

The results of analyses of samples of foods collected in the past 18 months follow. The samples of ice cream, oysters, clams, and sausage are widely representative of the goods on sale within the State . The butter samples were taken with the purpose of learning the composition of creamery and dairy butter with a view of making further standards and definitions. The other samples for the most part represent the examination of goods that were suspected by the inspectors or by consumers as not being what they purported to be.

BEEF.

Because of suspicion that dealers in Bath were selling beef which was unlawful samples were taken from Kennebec Beef Co., Swift & Company, W. H. Swett Estate. The samples consisted of salt beef, boned round and corned beef. They were analyzed as Station Nos. 16140 to 16143 and found to be lawful beef.

BONELESS COD FISH.

No. 18586. Jones' Pure Cod Fish, Alfred Jones Sons, Bangor. One pound. From Elmer R. Fox, Bangor. Sample taken because it was under weight. Examination showed that it had dried out so that it had about half the usual water content of dried cod fish. Passed.

CANNED CORN.

No. 18547. On Top Brand Sugar Corn, packed by Thomas and Co., Frederick, Maryland. Contents weigh about 1 pound 4 ounces. Found to be full weight, cans slightly discolored but not corroded. Solids above average for canned corn. No evidence of added starch or sugar. Some silk and husk in cans.

CARBONATED BEVERAGES.

BOTTLED SODA.

Samples of soda were collected from a large number of the bottlers in the State. For the most part the kinds were those that carry artificial color and flavor. They were tested for saccharine, kind of color and preservatives. No saccharine or unlawful color were found. Occasional samples were misbranded in that they were not labeled to show artificial color.

GINGER ALE.

Samples of Ginger Ale of the following makes were collected and examined. Forest City Ginger Ale, Forest City Bottling Works, Portland; Hebe Ginger Ale, The Hebe Co., Providence, R. I., Highland Ginger Ale, Thornhill, Lewiston; Ingleside Spring Co., Ginger Ale, Ingalls Bros., Portland Ginger Ale, Murdock and Freeman Co., Portland and Rumford Falls; and Underwood Ginger Ale, Underwood Spring Corporation, Portland. These were tested for preservative, coal tar colors and saccharine with negative results. The goods all appeared excellent with the exception of one of the samples of Ingleside Spring Co., Ginger Ale made by Ingalls Bros., Portland and purchased at Peoples' Store, Westbrook, contained a large amount of visible dirt and was unfit for drinking. Other samples of the same make appeared all right.

PROPRIETARY BEVERAGES.

Anzac. Cereal Beverage. Anzac Co., Boston. Sample 18148 from Cross Bottling Co., Augusta. Contained no alcohol.

Coca Cola. Coca Cola Company. Sample 18574 undiluted syrup purchased from Chas. F. Nichols, Orono. Total solids 56.46 per cent. Thirty c. c. carried .0385 grams of caffein. Dose of caffein is from .06 to .3 gram. An ordinary cup of coffee carries about .09 grams caffein.

Jesno. Supra Visum. Frank Jones Brewing Company, Portsmouth. Sample 18138 contained no alcohol and extracts that resemble malt.

Moxie. The Moxie Company. Sample 18573 purchased in Bangor contained no alcohol, caffein or alkaloid. No preservative found.

Pablo. The Happy "Hoppy" Drink. Made by Pabst at Milwaukee. Sample 18663 from Chandlerand Co., Machias. Contained no alcohol.

Red Cross. The drink that noxem all. Sample 17534 purchased from York Bottling Works, Biddeford, contained no alcohol, saccharine or preservatives.

Yip. The New Drink. Malty Hopy. A. G. Van Nostrand, Boston. Sample 17532 was sent by the makers to the Hanscom Bottling Works, Biddeford. It carried no alcohol.

COFFEE.

Three samples of coffee were collected in November and December and were analyzed as follows:

No. 17360. "Alliance Steel Cut Coffee. 1 pound full weight. Selected grades. Scientifically blended, producing a full rich cup of coffee. Trade Mark Reg. U. S. Pat. Office. Brazil Syndicate, Inc., New York." Sample purchased from S. H. Robinson & Son, Bangor. This sample was found to be one-half ounce short weight. Nothing foreign was found under the microscope.

No. 17361. "Alliance Steel Cut Coffee. Brazil Syndicate, Inc., New York. 1 pound full weight. Selected grades, scientifically blended, pro-

ducing a full rich cup of coffee." Sample purchased from F. P. Cook, Newport, Maine. This sample was found to be nearly one ounce short weight. Nothing foreign was found under the microscope.

No. 17362. "14 oz. net. Tumbler Inside. Silver Quarter Coffee. Swain, Earle & Co., Boston, Mass. A delicious blend of finest coffees." Sample was purchased from E. W. Wallace, Pittsfield, Maine, and found to contain nothing foreign. The weight was in accord with the weight claimed on the package—14 ounces.

EVAPORATED MILK.

No. 16457. A sample of Libby's Sterilized Unsweetened Evaporated Milk. Guaranteed to contain not less than 7.8% butter fat, 25.5% solids. Libby, McNeil & Libby, Chicago, Ill. 1 lb. "was received from a correspondent at Katahdin Iron Works, who was suspicious that the milk had made the men in the lumber camp ill. This was found to be in accord with guaranty on the label and to contain no tyrotoxicon or other poisonous matter.

CANNED SKIMMED MILK.

No. 18161. Hebe. A compound of evaporated skimmed milk and vegetable fat. Contains 6% vegetable fat and 24% total solids. Manufactured at Mt. Vernon, Washington, The Hebe Company, General offices, Seattle, Wash. Net contents 1 pound. Contents found as claimed.

FLAVORING EXTRACTS.

CHECKERBERRY.

A lawful flavoring extract of checkerberry carries 3 per cent of oil.

No. 17336, J. H. Hamel, Portland; Sample No. 17357, Layfayette Hotel Pharmacy, Portland; Sample 16534, Chas. E. MacIninch, Woodland, were all of the required strength.

LEMON.

A lawful extract of lemon carries 5 per cent of lemon oil.

Sample No. 16480, "Close's Pure Lemon Extract," Close Manufacturing Co., Portland; sample No. 16784, "T. & K. Extract Lemon, Prepared by Thurston & Kingsbury, Bangor;" sample No. 16789, "Three Crow Brand Extract Lemon," Atlantic Spice Co., Rockland, were up to the required strength and were full measure.

PEPPERMINT.

A lawful extract of peppermint carries not less than 3 per cent oil of peppermint.

No. 16790, Clifford Brand Extract Peppermint one-fifth standard put up for T. R. Savage Co., Bangor, was found in accord with the claim on the label.

VANILLA.

A lawful vanilla extract prepared from vanilla bean contains in 100 c. c. the soluble materials from not less than 10 grams of vanilla bean.

Sample 16481, "Close's Pure Extract Vanilla. Mfg. by Close Mfg. Co., Portland, Maine," and sample 17031, "Extract Vanilla. Prepared by John Wyeth & Bros., Philadelphia," were examined and passed as in accord with the food requirements as regards quality and quantity.

FRANKFURT COLOR.

Because the manufacturers of frankfurt sausages are finding it almost impossible to get certified colors for coloring their goods, because of war conditions, 3 samples were collected from C. F. Cook & Son, Forest City Packing Co., and Schonland Brothers, of Portland, manufacturers of sausages, and were examined as Station Nos. 17107 to 17109. No arsenic was found in the samples. The goods in question were made by the Preservaline Mfg. Co., and were known as "Pyro Color" and "Zanzarine. A mixture of uncertified analine colors and sodium chloride."

HORSE RADISH.

No. 18560. Balch's Horse Radish, E. W. Balch, Portland, was pure horse radish and vinegar.

KETCHUP.

No. 17106. A sample of "Eastern Star Brand Tomato Ketchup. Net weight when packed 11 ozs. Made from tomatoes, pure spices, vinegar and sugar. Free from coloring and preservatives. Eastern Importing Mfg. Co., Boston, Distributors" was collected by the inspector in October, 1916, from E. W. Balch Company of Portland. Found to carry no preservatives or artificial color, and to be accord with the weight claimed on the label.

MAYONNAISE DRESSING.

No. 17105. One sample of "De Luxe Mayonnaise Dressing. Contents 4 ozs. Put up by E. W. Balch Co., 491 Fore St., Portland," was collected from E. W. Balch of Portland. This was found to be unlawful in that it contained cottonseed meal instead of olive oil.

No. 17112. A sample of "Aunt Jane's Walnut Mayonnaise. Net weight 6 ozs. Made by Aunt Jane Co., Arlington, Mass.," was collected from C. W. Horton, Portland, Maine. This was found to contain no cottonseed meal, but was slightly short weight.

OLEOMARGARINE.

Nos. 18532 and 18544. "Nut-Made Brand Margarine. Free from animal fats." $\frac{1}{10}$ of 1% benzoate of soda. Providence Churning Company, Providence, R. I. All vegetable fat.

OLIVE OIL, ADULTERATED OR MISBRANDED.

No. 17481. "Atlantic Brand Salad Oil. Pressed from Cotton Seed. Contents 7½ ounces." This is straight cotton seed oil. It was misbranded in name for a lawful salad oil is pure olive oil. It was also short measure.

No. 17488. Purchased from Jed Puppus, Westbrook for olive oil. It was not labeled. It is straight cotton seed oil.

No. 18565. Purchased from Stanislaus Dyro, Portland. Goods in bulk. No claim made as to kind of oil. It had a flavor somewhat resembling olive oil. Its exact nature was not found. It was neither olive oil, cottonseed oil nor corn oil.

No. 18661. Purchased from Frank Karam, Bangor. "Finest Quality Olive Oil. Extra Pure. Termini Dimense, Sicilia, Italy." "Guaranteed absolutely Pure." Contains cottonseed oil and probably some corn oil.

SARDINES.

No. 18559. A sample of American Fisheries Company, American Sardines Cooked in pure Olive Oil was collected from L. A. Gordon, 171 York Street, Portland. The fish were firm, of good flavor and packed in olive oil.

SHRIMP.

No. 17531. Seafooco Brand Barataria Wet Pack Shrimp, packed by Sea Food Co., Biloxi, Miss., from John F. Hannaway, Biddeford. Full weight. No preservatives found. Appearance, odor and flavor good.

SUGAR.

No. 18588. A sample of suspected sugar from the Atlantic and Pacific Tea Company, Portland, was examined and found to be pure sugar.

TOMATO PUREE.

No. 16820. A sample of "Harbauer Stewed and Strained Tomatoes. Packed by Harbauer Co., Toledo, Ohio. Contents Average Weight 6 lbs. 7 ozs. Made from whole tomatoes," was collected from E. W. Brown Co., South Portland, Maine, and examined as Station No. 16820 and found to be in accord with label.

ICE CREAM.

Table showing the results of the examination of samples of ice cream collected in the season of 1916-17, arranged alphabetically by towns.

Station number.	TOWN AND DEALER.	Results of Examination.*
16802	Augusta. J. G. Johnson	Well above standard.
16801	Augusta. Mike Levine	Well above standard.
18291	Bath. F. H. Allen	Well above standard.
18286	Bath. Fred C. Cox	Lawful.
18293	Bath. D. F. Dougherty	Well above standard.
18289	Bath. R. P. McFadden	Lawful.
18292	Bath. William Mann	Slightly below standard.
18290	Bath. Harold W. Pinkham	Well above standard.
18287	Bath. M. O. Webber	Lawful.
18288	Bath. M. O. Webber	Well above standard.
18274	Biddeford. Jeane Biladeau	Slightly below standard.
18277	Biddeford. A. & G. Boucher	Low.
18278	Biddeford. Katherine Doyle	Low.
18275	Biddeford. P. Fredianis	Well above standard.
18279	Biddeford. H. L. Merrill	Low.
18599	Biddeford. H. L. Merrill	Low.
18600	Biddeford. Pandelepoulos Macoulis Co.	Lawful.
18273	Biddeford. Puritan Confectionary & Ice Cream Co.	Low.
18597	Biddeford. Puritan Confectionary & Ice Cream Co.	Well above standard.
18276	Biddeford. Geo. H. Vassil	Lawful.
18598	Biddeford. Geo. H. Vassil	Well above standard.
16857	Bridgewater. J. P. Sargent	Low.
16975	Brownville. S. H. Cohen	Low.
16976	Brownville Junction. W. L. McCann	Well above standard.
16977	Brownville Junction. Myer Minsky	Low.
18311	Camden. E. E. Boynton	Well above standard.
18312	Camden. Burkett Brothers	Well above standard.
18315	Camden. Elm St. Fruit Co.	Slightly below standard.
18310	Camden. F. L. Kennedy	Lawful.

*Explanation of terms. Lawful, just above standard. Well above standard, at least one per cent above standard. Slightly below, not more than one per cent below standard. Low, more than one per cent below standard.

ICE CREAM—Continued.

Station number.	TOWN AND DEALER.	Results of Examination.*
18313	Camden. George Miller	Well above standard.
18314	Camden. George Miller	Well above standard.
18601	Camden. George Mixer	Well above standard.
16909	Caribou. Caribou Drug Company	Well above standard.
16912	Caribou. Gammon Brothers	Lawful.
16911	Caribou. F. A. Havey	Well above standard.
16913	Caribou. A. T. Parsons	Slightly below standard.
16914	Caribou. A. T. Parsons	Well above standard.
16910	Caribou. Scates & Company	Well above standard.
18296	Damariscotta. Boggs Candy Shop	Low.
18297	Damariscotta. A. W. Kiersted	Lawful.
18298	Damariscotta. F. L. Smithwick	Well above standard.
16878	Fort Fairfield. Ft. Fairfield Drug Co.	Slightly below standard.
16874	Fort Fairfield. Hubert Smith	Well above standard.
16875	Fort Fairfield. Hubert Smith	Well above standard.
16876	Fort Fairfield. Scates & Company	Well above standard.
16877	Fort Fairfield. Scates & Company	Low.
16935	Fort Kent. Thomas Cherritt	Low.
18642	Fryeburg. E. O. Jewett	Slightly below standard.
16800	Gardiner. F. H. Call	Well above standard.
16799	Gardiner. Preston E. Glidden	Lawful.
16798	Gardiner. A. L. Jenks	Lawful.
18284	Houlton. Cochran Drug Store	Well above standard.
16851	Houlton. Cochran Drug Store	Well above standard.
18285	Houlton. O. F. French & Son	Well above standard.
16849	Houlton. O. F. French & Son	Well above standard.
16850	Houlton. Hathaway Drug Company	Slightly below standard.
16541	Houlton. Leighton & Feeley	Well above standard.
16847	Houlton. Leighton & Feeley	Well above standard.
16852	Houlton. John A. Miller	Well above standard.
16853	Houlton. John A. Miller	Well above standard.
18283	Houlton. J. K. Palmer	Well above standard.
16848	Houlton. J. K. Palmer	Well above standard.

*Explanation of terms. Lawful, just above standard. Well above standard, at least one per cent above standard. Slightly below, not more than one per cent below standard. Low, more than one per cent below standard.

ICE CREAM—Continued.

Station number.	TOWN AND DEALER.	Results of Examination.*
16844	Houlton. Susie Riley	Well above standard.
16846	Houlton. Robinson Grocery Co.	Well above standard.
16845	Houlton. West End Drug Store	Well above standard.
16948	Island Falls. A. R. Sanborn	Well above standard.
18323	Kennebunk. J. W. Bowdoin	Well above standard.
18321	Kennebunk. S. M. Parillo	Lawful.
18324	Kennebunkport. Mrs. W. F. Goodwin	Well above standard.
18325	Kennebunkport. C. W. Leach	Well above standard.
16306	Lubec. J. W. Mitchell	Well above standard.
18281	Mars Hill. Mars Hill Drug Co.	Lawful.
16859	Mars Hill. E. B. White	Low.
16860	Mars Hill. E. B. White	Low.
18603	Mechanic Falls. C. W. Cole	Low.
16968	Millinocket. G. F. Burton	Well above standard.
16969	Millinocket. St. John's Pharmacy	Well above standard.
16967	Millinocket. Whalen's Drug Store	Lawful.
16972	Milo. M. B. Fossa	Lawful.
16974	Milo. W. S. Owen	Low.
16973	Milo. G. E. Stanchfield	Low.
16856	Monticello. H. D. Hart	Low.
16867	North Windham. D. W. Cram	Well above standard.
16946	Oakfield. Oakfield Drug Store	Well above standard.
18320	Orgunquit. George Kossus	Well above standard.
16950	Patten. The Patten Bakery	Well above standard.
16951	Patten. E. J. Farnum	Well above standard.
16952	Patten. F. W. Peavey	Well above standard.
16825	Portland. John F. Bennett	Slightly below standard.
16826	Portland. John F. Bennett	Slightly below standard.
18241	Portland. Thomas Cristo	Lawful.
16485	Portland. S. Gitlin	Lawful.
18244	Portland. S. Gitlin	Well above standard.
18360	Portland. H. H. Hay & Son	Lawful.
16829	Portland. Thera Hilton	Lawful.

*Explanation of terms. Lawful, just above standard. Well above standard, at least one per cent above standard. Slightly below, not more than one per sent below standard. Low, more than one per cent below standard.

ICE CREAM—Continued.

Station number.	TOWN AND DEALER.	Results of Examination.*
18238	Portland. Thera Hilton	Well above standard.
18240	Portland. Vrilosori Johnson	Slightly below standard.
18204	Portland. Ira F. Lord & Son	Well above standard.
18202	Portland. Moustakis Bros.	Well above standard.
16827	Portland. Munjoy Ice Cream Co.	Lawful.
16828	Portland. Munjoy Ice Cream Co.	Lawful.
18237	Portland. Munjoy Ice Cream Co.	Low.
18361	Portland. Munjoy Ice Cream Co.	Low.
18203	Portland. Riker-Jaynes Company	Low.
18201	Portland. Geo. E. Sawyer Company	Well above standard.
16832	Portland. Simmons & Hammond	Well above standard.
16833	Portland. Simmons & Hammond	Lawful.
18363	Portland. Simmons & Hammond	Lawful.
18209	Portland. Smith & Brothers	Lawful.
16830	Portland. Geo. F. Soule	Slightly below standard.
16831	Portland. Geo. F. Soule	Lawful.
18245	Portland. Geo. F. Soule	Low.
18362	Portland. Geo. F. Soule	Low.
18236	Portland. H. I. Tepperman	Well above standard.
17128	Portland. Chas. B. Thomas	Slightly below standard.
17129	Portland. Chas. B. Thomas	Low.
17130	Portland. Chas. B. Thomas	Low.
16823	Portland. Chas. B. Thomas	Low.
16824	Portland. Chas. B. Thomas	Low.
18239	Portland. Chas. B. Thomas	Well above standard.
18242	Portland. John J. Thuss	Low.
16834	Portland. J. Vonyik	Well above standard.
16835	Portland. J. Vonyik	Well above standard.
18243	Portland. West End Dairy Company	Low.
16836	Portland. John Zakarian	Low.
16897	Presque Isle. S. Christopher	Well above standard.
16895	Presque Isle. Stanley Judd	Well above standard.
16893	Presque Isle. G. P. Larabee	Lawful.

*Explanation of terms. Lawful, just above standard. Well above standard, at least one per cent above standard. Slightly below, not more than one per cent below standard. Low, more than one per cent below standard.

ICE CREAM—Concluded.

Station number.	TOWN AND DEALER.	Results of Examination.*
18272	Presque Isle. G. P. Larabee	Well above standard.
16896	Presque Isle. Peoples' Drug Store	Low.
16892	Presque Isle. W. S. Thompson & Co.	Well above standard.
16894	Presque Isle. H. N. Whitney	Well above standard.
18307	Rockland. Corner Drug Store	Well above standard.
18596	Rockland. A. C. Jones	Lawful.
18309	Rockland. C. W. Sheldon	Well above standard.
18306	Rockland. T. R. Sweetland	Low.
18308	Rockland. George A. Tarr	Slightly below standard.
16929	Van Buren. Albert & Fils	Well above standard.
16927	Van Buren. T. M. Findlen	Well above standard.
16928	Van Buren. T. M. Findlen	Well above standard.
18300	Waldoboro. O. E. Ludwig	Low.
18301	Waldoboro. G. M. Gallagher	Well above standard.
18299	Waldoboro. C. B. Stahl	Well above standard.
18302	Warren. J. C. Munsey	Slightly below standard.
18303	Warren. O. H. Robinson	Well above standard.
16805	Waterville. Green Bros. Co.	Well above standard.
16804	Waterville. Soda Spa	Low.
16803	Waterville. Waterville Drug Store	Well above standard.
18317	York Beach. H. Gleekman	Low.
18316	York Beach. E. C. Howe	Low.
18318	York Beach. Holland Drug Store	Well above standard.

*Explanation of terms. Lawful, just above standard. Well above standard, at least one per cent above standard. Slightly below, not more than one per cent below standard. Low, more than one per cent below standard.

SIRUPS.

Table showing results of analyses of samples of maple and compound sirups purchased in the spring of 1916. Package sirup sold as branded. Samples arranged alphabetically by towns in which purchased.

Station number.	MAKER AND BRAND.	NAME AND ADDRESS OF DEALER.	REMARKS.
16434	New England Maple Syrup Co., Boston, Mass. "Golden Tree Granulated and Maple Sugar Syrup. Net capacity about 11 ozs."	Capitol Fish Market, Augusta.	Contained too much water. About half maple.
16445	Goulding Maple Syrup Co., Whitman, Mass. "Appletone Brand Blended Syrup. 75 per cent granulated, 25 per cent maple. Weight about 31½ ozs."	Hunt's Cash Store, Augusta.	As claimed.
16435	Vesper Preserve Co., Ayer, Mass. "Winner Brand. Artificially colored and flavored. Syrup. A mixture of granulated and maple sugar. Contents 24 liquid ozs."	Pomerleau & Huard, Augusta.	About one-fourth maple.
16433	C. M. Tice & Co., Boston, Mass. "Verhampshire Brand Sugar Syrup. A compound of cane and maple syrups. 1 pint 4 ozs."	John F. Turner, Augusta.	About half maple.
16436	Towle Maple Products Co., St. Johnsbury, Vt. "Towle's Great Mountain Brand Syrup. Net weight 27 ozs."	L. S. Young, Augusta.	About one-fourth maple.
16432	Rigney & Co., Brooklyn, N. Y. "Park Brand Syrup. Made from pure rock candy syrup and maple sugar. 1 pint 4 ozs."	Cash Market Co., Gardiner.	About one-fourth maple.
18043	In bulk. No marks.	Scott Bros., Gardiner.	Pure maple.
16431	Rigney & Co., Brooklyn, N. Y. "Favorite Brand Table Syrup. Made of corn and refiners' cane syrups. Net weight 1¼ lbs."	F. L. Clarke, Gardiner.	As claimed.
16430	H. S. Melcher Co., Portland, Me. "Red Cross Brand Fancy Sugar Syrups. A compound of cane and maple sugar syrups. 1 pt. 13 ozs."	C. M. Day, Gardiner.	About one-fourth maple.
16429	Mansfield, Witham & Co. Lowell, Mass. "Spindle City Syrup. Liquid measure 6 ozs."	R. W. Hill, Gardiner.	About one-third maple.
16428	Great Atlantic & Pacific Tea Co., Jersey City, N. J. "A. & P. Choice Corn Syrup. Compound corn syrup and sugar refiners' syrup. 1 lb. 14 ozs."	Great Atlantic & Pacific Tea Co., Hallowell.	As claimed.
16427	Rigney & Co., Brooklyn, N. Y. "De-Fi Brand Syrup. A blend of cane and maple sugars. 12 ozs. fluid contents."	Great Atlantic & Pacific Tea Co., Hallowell.	About one-fourth maple.

SIRUPS—Concluded.

Station number.	MAKER AND BRAND.	NAME AND ADDRESS OF DEALER.	REMARKS.
16726	Maplevale Sugar and Syrup Works, H. Waits & Sons, Morrisville, Vt. "Pure Maple Syrup."	W. S. Dunn & Co., Portland.	As claimed.
18658	Pure corn-sugar syrup. Bulk goods.	John D. Johnson, Portland.	A mixture of refiners' sirup and glucose (Corn sirup).
16441	Maine Pickling Co., Portland, Me. "Maine Brand Maple Syrup. Made from maple and cane sugar. 7 ozs."	A. F. Armstrong, Waterville.	Contained too much water. About one-half maple.
16437	New England Maple Syrup Co., Boston, Mass. "Golden Tree Granulated and Maple Sugar Syrup. Net capacity about 6 ozs."	Henry J. Collins, Waterville.	About one-fifth maple.
16442	Hudson Mfg. Co., New York. "Lion Brand Corn and Refiners' Syrup. 1 lb. 12 ozs."	Great Atlantic & Pacific Tea Co., Waterville.	As claimed.
16440	Goulding Maple Syrup Co., Whitman, Mass. "Appletone Brand Blended Syrup. 75 per cent granulated, 25% maple sugar. Net weight about 31½ ozs."	Hersom & Bonsall, Waterville.	As claimed.
16438	Corn Products Refining Co., New York, N. Y. "Karo. Prepared from Corn Syrup and a selected quality of refiners' syrup."	Wm. Lacombe, Waterville.	As claimed.
16439	A. H. Pelletier, Waterville, Me. "15 ozs. net of cane sugar syrup, maple flavor."	North End Market, Knowlton & Russell, Waterville.	As claimed.
16444	"Towle Maple Products Co., St. Paul, Minn., St. Johnsbury, Vt. "Towle's Log Cabin Syrup. Cane sugar and maple sugar. 1 pint."	Charles Pomerleau, Waterville.	About one-fourth maple.
16443	A. H. Pelletier, Waterville, Me. "15 net ozs. of cane sugar syrup, maple flavor.	W. J. Pooler, Waterville.	As claimed.

CIDER VINEGAR REDUCED WITH WATER.

The following samples of cider vinegar were collected and analyzed, and with the exception of Station Nos. 15459 and 15934, were found to be up to the acid strength required by the standard—not less than 4 per cent acetic acid. These two samples were slightly below the standard in acid strength. These vinegars are cider vinegars which have been reduced by adding water.

Station number.	MAKER AND BRAND.	NAME AND ADDRESS OF DEALER.
15459	"Williams Apple Cider Vinegar. Reduced with water to 40 grains. Made by The Williams Bros. Co., of Detroit."	W. E. Chase, Bath.
15935	"Williams Apple Cider Vinegar. Reduced with water to 40 grains. Made by The Williams Bros. Co., of Detroit."	W. E. Chase Co., Bath.
15934	"Williams Apple Cider Vinegar. Reduced with water to 40 grains. Made by The Williams Bros. Co., of Detroit."	Kimball Bros. Co., Bath.
15818	"Pure Cider Vinegar. Fermented. Reduced from 6% to a uniform total strength of 5%. Made at Medina, N. Y. H. J. Heinz Co., Pittsburg, Pa."	Geo. F. Hilborn, Portland.
16780	"Maine Brand Cider Vinegar. Put up by Maine Pickling Co., Portland."	Maine Pickling Co., Portland.

OLIVE OIL.

Table giving a list of brands of olive oil and the dealers from whom the samples were purchased. They were all olive oil without adulteration except that as noted some packages were slightly short measure. Arranged alphabetically by towns.

Station number.	MAKER AND BRAND.	NAME AND ADDRESS OF DEALER.	REMARKS.
17558	"Benefit Brand Pure Olive Oil. C Size. 15 ozs. Net. Distributed by The Direct Importing Co., Boston, Mass."	Auburn. Direct Importing Co.	Slightly short measure.
17555	"Marvel Brand Absolutely Pure Imported Cream Olive Oil. C. A. Weston Co., Sole Distributers, Portland, Me. One Pint."	Auburn. Olfene's Public Market Co.	
17557	"Pericles Brand Pure Greek Olive Oil. Packed by E. G. Sophos, Lowell, Mass. ½ pint."	Auburn. Frank Salkos & Barbalos.	Slightly short measure.

OLIVE OIL—Concluded.

Station number.	MAKER AND BRAND.	NAME AND ADDRESS OF DEALER.	REMARKS.
17529	"Imported Olive Oil. Put up by Kenton Grocery Co., Biddeford, Me."	Auburn. Kenton Grocery Co.	
18660	Olive Oil. Imported. Pure. Extra Paseo brand. Registered trade mark "Olio D'Olivia Puro Importato. Societa Olearoa Ligure. Porto Marirazio, Italy.	Joseph Profita, Bangor.	
17562	"Pure Olive Oil. Bottled in France for S. S. Pierce Co., Boston, Mass. Vve Chaffard Brand. One pint."	Lewiston. Atwood's Market.	
17566	"Pure California Olive Oil. Sylmar Brand. Los Angeles Olive Growers Assoc., Los Angeles. Calif. 10 ozs. net."	Lewiston. Boston Tea Store.	Slightly short measure.
17569	"Grandee Brand Pure Olive Oil. 6 fluid ounces. Bottled by Colen D. Mawer Co., New York."	Lewiston. Josiah Bowker Market.	
17567	"Libby Brand Pure Imported Olive Oil. 1-16 gallon. Packed for Libby, McNeil & Libby, Chicago, Ill."	Lewiston. Cloutier's Market.	Slightly short measure.
17599	"Imported Pure Virgin Olive Oil. Stemma Brand. ⅛ gal. Microutsicos Bros., N. Y."	Lewiston. James Fearis.	Slightly short measure.
17564	"Solo Brand Pure Olive Oil. France Conserves Co., Paris, France. 16 ozs."	Lewiston. Lewiston Cash Market.	
17559	"Superfine Pure Italian Olive Oil. Packed in Italy. One pint."	Lewiston. Eva Lotti.	Short measure.
17560	"Nabob Brand Pure Olive Oil. Product of Spain. ¼ gallon."	Lewiston. Mohican Co.	Slightly short measure.
17602	"Pure Olive Oil. Imported. H. J. Heinz Co., Pittsburg, Pa. 8 ozs."	Lewiston. Palmer's Market.	
17568	"La Superba Extra Quality Pure Virgin Cream Olive Oil. 4 fluid ounces. H. T. Asche, N. Y."	Lewiston. I. Simard & Son.	
17480	"A. & P. Brand Pure Imported Olive Oil. Great Atlantic & Pacific Tea Co., Jersey City, N. J. 4 fluid ounces."	Portland. Great Atlantic & Pacific Tea Co.	
18565	In bulk.	Stanislaus Dyro, Portland.	Not olive oil.

FRANKFURT STYLE SAUSAGE.

Table giving the results of examination of Frankfurt Style of Sausage and not found to contain any adulteration but were true to name. Arranged alphabetically by towns.

Station number.	Town and Dealer.	Results of Examination.
17687	Auburn. E. A. Bickford	Slightly underweight.
17710	Auburn. Damon & Cole	Short weight.
17712	Auburn. West M. Dunn	Short weight.
17720	Auburn. Merrow Packing Co.	
17686	Auburn. Albert M. Penley & Son	Slightly underweight.
17776	Bangor. Bangor Cash Market	Short weight.
17777	Bangor. Canty's Bros. Cash Market	Short weight.
17774	Bangor. Eureka Market Company	Slightly underweight.
17887	Bangor. J. E. Foley Company	Short weight.
17819	Bangor. E. R. Fox	Short weight.
17778	Bangor. F. L. Frank & Company	Slightly underweight.
17821	Bangor. Robert Hickson's Sons	Slightly underweight.
17783	Bangor. Lord Brothers	
17779	Bangor. C. J. Lynch	
17892	Bangor. D. J. McGrath	Slightly underweight.
17856	Bangor. Ray & Stevenson	Short weight.
17859	Bangor. F. H. Robinson & Son	
17812	Bangor. F. I. Simpson	Short weight.
17890	Bangor. W. F. White	Slightly underweight.
17820	Bangor. N. W. Whitman	
17899	Brewer. Danforth Brothers	Slightly underweight.
17906	Brewer. N. H. Hall	
17905	Brewer. Kenney & McMahon	
17907	Brewer. Arthur C. Moore	
17904	Brewer. M. H. Perkins	Short weight.
17900	Brewer. Daniel Rooney	Slightly underweight.
17679	Lewiston. F. L. & M. E. Hoxie	Short weight.
17938	Old Town. Louis Brissett & Company	Slightly underweight.
17940	Old Town. L. H. Penney	
17935	Orono. Chester T. Page	Short weight.
17933	Orono. James I. Parks	Short weight.
17903	South Brewer. F. W. Kyer & Company	Slightly underweight.
17896	South Brewer. F. W. Wentworth	Slightly underweight.

FRANKFURT STYLE SAUSAGE WITH CEREAL.

Table giving results of examination of Frankfurt Style of Sausage containing added cereal and water but plainly marked to show that fact. Arranged alphabetically by towns.

Station number.	TOWN AND DEALER.	Results of Examination.
17556	Auburn. Olfene's Public Market Co.	Short weight.
17891	Bangor. R. C. Jordan	Slightly underweight.
17610	Lewiston. Arthur J. Auger	Slightly underweight.
17706	Lewiston. D. Cassavant & Company	Short weight.
17675	Lewiston. Golder & McCarthy	Short weight.
17673	Lewiston. W. A. Ray	Short weight.
17711	New Auburn. S. Vincent	Short weight.

ADULTERATED FRANKFURT STYLE SAUSAGE.

Table showing the results of examination of goods sold as Frankfurt Style Sausage adulterated by addition of water and cereal without any mention of that fact on label. Arranged alphabetically by towns.

Station number.	TOWN AND DEALER.	Results of Examination.
17685	Auburn. O. F. Holmes	Slightly underweight.
17707	Auburn. Fred B. Ross	Short weight.
17855	Bangor. A. F. Anderson	Short weight.
17888	Bangor. Peter A. Anderson	Slightly underweight.
17889	Bangor. J. H. Brennan	Short weight.
17860	Bangor. H. G. Burrill	Slightly underweight.
17818	Bangor. G. A. Chapman	Short weight.
17485	Bangor. O. A. Fickett Co.	
17775	Bangor. O. A. Fickett Co.	Slightly underweight.
17815	Bangor. John F. Fleming	Short weight.
17816	Bangor. Gallagher Brothers	Short weight.
17814	Bangor. T. F. Gallagher	Short weight.
17811	Bangor. H. E. Jellison & Co.	Short weight.

ADULTERATED FRANKFURT STYLE SAUSAGE—Continued.

Station number.	TOWN AND DEALER.	Results of Examination.
17780	Bangor. A. W. Joy Company	
17857	Bangor. A. H. Kane	Slightly underweight.
17798	Bangor. G. W. & C. S. Leighton	Slightly underweight.
17813	Bangor. H. E. McDonald	Slightly underweight.
17822	Bangor. W. D. Matherson & Son	
17781	Bangor. C. H. Phillips (Meat cart)	Short weight.
17858	Bangor. E. F. Piper	
17898	Brewer. F. B. Marsh	Slightly underweight.
17991	Brewer. Southworth Bros.	
17563	Lewiston. Atwood's Market	Short weight.
17676	Lewiston. E. W. Beaumont & Company	Short weight.
17616	Lewiston. Begin Bros. Co.	Short weight.
17611	Lewiston. Napoleon Bolduc	
17680	Lewiston. Caron & Langelier	Short weight.
17714	Lewiston. C. H. Cloutier & Co.	Slightly underweight.
17609	Lewiston. Cut Price Market	Slightly underweight.
17674	Lewiston. Doucette & Marcous	Short weight.
17619	Lewiston. Chas. Dube	Short weight.
17677	Lewiston. Fogg & Miller	Slightly underweight.
17603	Lewiston. E. Janelle & Co.	Slightly underweight.
17565	Lewiston. Lewiston Cash Market	Slightly underweight.
17604	Lewiston. Marcotte & Cote	
17561	Lewiston. Mohican Company	Short weight.
17614	Lewiston. D. Morissette & Bros.	Slightly underweight.
17678	Lewiston. A. D. Morse	Short weight.
17716	Lewiston. Joseph Nolin	Slightly underweight.
17715	Lewiston. F. J. Ouellette	Short weight.
17620	Lewiston. Leonia Ouellette	Short weight.
17601	Lewiston. Palmer's Market	Short weight.
17713	Lewiston. G. E. Robergs	Slightly underweight.
17615	Lewiston. O. Roger	Short weight.
17612	Lewiston. Edmond Verville	Short weight.
17708	Lewiston. F. I. Wills	Short weight.
17709	New Auburn. J. C. Beaucage	Short weight.
17683	New Auburn. Landry's Cash Market	Slightly underweight.

ADULTERATED FRANKFURT STYLE SAUSAGE—Concluded.

Station number.	TOWN AND DEALER.	Results of Examination.
17682	New Auburn. L. Leberge & Son	
17681	New Auburn. Pierre Nadeau	Slightly underweight.
17684	New Auburn. Eugene Z. Reny	Short weight.
17942	Old Town. S. A. Fish	Short weight.
17937	Old Town. Old Town Meat Market	Slightly underweight.
17936	Old Town. Percy Hurd	Slightly underweight.
17939	Old Town. C. O. Stevens Co.	Short weight.
17897	South Brewer. M. F. Ayer	Short weight.
17902	South Brewer. S. S. Herrick & Co.	Short weight.

PORK SAUSAGE.

Table giving results of examination of sausage sold as Pork Sausage which were not found to contain adulteration but were true to name. Arranged alphabetically by towns.

Station number.	TOWN AND DEALER.	Results of Examination.
17772	Bangor. M. C. Baker	Slightly underweight.
17773	Bangor. W. A. Bean	
17486	Bangor. O. A. Fickett Co.	Short weight.
17487	Bangor. G. W. & C. S. Leighton	
17817	Bangor. Fred McAvery	Slightly underweight.
17784	Bangor. Pearson & Spencer	
17782	Bangor. Thompson & Waldron	
18523	Bath. Cash Market Company	
18528	Bath. Lowells Market	Slightly underweight.
18524	Bath. Thomas Malia	
18527	Bath. E. L. Marr	Slightly underweight.
18525	Bath. Fred Stevens	Slightly underweight.
18567	Biddeford. Garon & Houle	Short weight.
17605	Lewiston. Parady & Boisvert	Slightly underweight.
17618	Lewiston. A. T. Reny	
17941	Old Town. Boyle & Gibbons	Slightly underweight.

ADULTERATED PORK SAUSAGE.

Table giving the results of examination of sausage sold as pork sausage but adulterated by addition of cereal without statement of fact, arranged alphabetically by towns.

Station number.	TOWN AND DEALER.	Results of Examination.
18566	Biddeford. Garson & Houle	Slightly underweight.
17608	Lewiston. Josiah Bowker Market	Short weight.
17613	Lewiston. D. Giguere	
17607	Lewiston. Guimond & Simard	Short weight.
17606	Lewiston. Nadeau & Michaud	Short weight.
17617	Lewiston. I. Simard & Son	Short weight.
17600	Lewiston. Spear & Webster	
17934	Orono. E. J. Peters	

OPENED OYSTERS.

Table showing the results of examination of samples of oysters purchased in the fall and winter of 1916-17, arranged alphabetically by towns.

Station number.	TOWN AND DEALER.	Results of Examination.
18463	Augusta. G. D. Haskell & Son	Lawful.
18458	Augusta. Edson Loche	Lawful.
18467	Augusta. Merrell Bros.	Lawful.
18457	Augusta. A. L. Rose	Adulterated with water.
18460	Augusta. H. M. Springer	Adulterated with water.
18465	Augusta. Wadleigh Grocery Co.	Lawful.
18466	Augusta. Webber & Hewett	Lawful.
18455	Augusta. L. S. Young	Adulterated with water.
18462	Augusta. William Young	Adulterated with water.
18493	Auburn. C. A. Kimball	Lawful.
18492	Auburn. Jerry Murphy	Adulterated with water.
18491	Auburn. Olfrene Public Market Co.	Adulterated with water.
18580	Bangor. Alfred Jones Sons	Lawful.
18579	Bangor. G. W. & C. S. Leighton	Adulterated with water.
18577	Bangor. C. W. Morrill	Lawful.
18584	Bangor. Staples Cash Market	Adulterated with water.

OPENED OYSTERS—Concluded.

Station number.	TOWN AND DEALER.	Results of Examination.
18526	Bath. Fred Stevens	Adulterated with water.
18516	Biddeford. Andrews & Harrigan	Adulterated with water.
18519	Biddeford. Bibeau Bros.	Lawful.
17346	Biddeford. Joseph Carrier	Adulterated with water.
18514	Biddeford. John F. Hannaway	Lawful.
18555	Biddeford. John F. Hannaway	Lawful.
18479	Hallowell. J. E. D. Purrington	Lawful.
18480	Hallowell. A. A. Shea	Lawful.
18477	Hallowell. Webber & Hewett	Lawful.
18494	Lewiston. Paul Levesque	Adulterated with water.
18497	Lewiston. The Mohican Company	Lawful.
18496	Lewiston. J. F. Sullivan	Lawful.
18498	Lewiston. Walker Bros.	Adulterated with water.
18604	Norway. L. J. Brooks	Adulterated with water.
18592	Rockland. Francis Cobb & Co.	Adulterated with water.
18595	Rockland. W. V. Spencer	Lawful.
18501	Portland. Brown Bishop Co.	Lawful.
18511	Portland. M. B. Greenleaf & Son	Adulterated with water.
18499	Portland. Gribben Bros.	Lawful.
18505	Portland. J. H. McDonald	Lawful.
18502	Portland. Munjoy Fish Market	Lawful.
18508	Portland. George C. Shaw & Co.	Lawful.
18503	Portland. Vickerson Bros. Market	Lawful.
18510	Portland. C. H. Vose	Adulterated with water.
18551	Saco. H. L. Allen	Lawful.
18549	Saco. F. H. Merrow	Adulterated with water.
18548	Saco. E. K. Weymouth	Lawful.
18487	Waterville. Hersom F. Bonsall	Lawful.
18536	Waterville. Hersom F. Bonsall	Lawful.
18535	Waterville. Harry J. Collins	Adulterated with water.
18488	Waterville. McCullums Cash Market	Adulterated with water.
18486	Waterville. B. K. Meservey	Lawful.
18539	Waterville. R. W. Moore	Adulterated with water.
18569	Westbrook. Cressey & Graffam	Lawful.
18571	Westbrook. Davis & Crawford	Adulterated with water.

OPENED CLAMS.

Table showing results of examination of samples of opened clams purchased in the fall and winter of 1916-17, arranged alphabetically by towns.

Station number.	TOWN AND DEALER.	Results of Examination.
18464	Augusta. G. D. Haskell & Son	Adulterated with water.
18587	Augusta. G. D. Haskell & Son	Adulterated with water.
18456	Augusta. A. L. Rose	Adulterated with water.
18459	Augusta. H. M. Springer	Adulterated with water.
18454	Augusta. L. S. Young	Adulterated with water.
18461	Augusta. William Young	Adulterated with water.
18581	Bangor. Alfred Jones Sons	Adulterated with water.
18578	Bangor. G. W. & C. S. Leighton	Adulterated with water.
18576	Bangor. C. W. Morrill	Adulterated with water.
18583	Bangor. Staples Cash Market	Adulterated with water.
18517	Biddeford. Andrews & Harrigan	Adulterated with water.
17347	Biddeford. Andrews & Harrigan	Lawful.
17343	Biddeford. Joel Bean & Son	Lawful.
18520	Biddeford. Bibeau Brothers	Adulterated with water.
17344	Biddeford. Bibeau Brothers	Lawful.
18513	Biddeford. A. Brunelle	Adulterated with water.
18552	Biddeford. A. Brunelle	Adulterated with water.
18553	Biddeford. A. Brunelle	Adulterated with water.
18518	Biddeford. Jos. A. Carrier	Adulterated with water.
18556	Biddeford. Jos. A. Carrier	Adulterated with water.
17342	Biddeford. Garron & Houle	Adulterated with water.
17345	Biddeford. J. P. Gartland	Lawful.
18557	Biddeford. J. P. Gartland	Lawful.
18515	Biddeford. J. F. Hannaway	Adulterated with water.
18554	Biddeford. J. F. Hannaway	Adulterated with water.
18521	Biddeford. Joseph Menard	Adulterated with water.
18558	Biddeford. Joseph Menard	Adulterated with water.
18478	Hallowell. J. E. D. Purrington	Lawful.
18481	Hallowell. A. A. Shea	Adulterated with water.
18495	Lewiston. Paul Levesque	Adulterated with water.
17096	Lewiston. R. L. & C. E. Harris	Lawful.
17350	Lewiston. Harvey Market	Adulterated with water.

OPENED CLAMS—Continued.

Station number.	TOWN AND DEALER.	Results of Examination.
17097	Lewiston. Paul Levesque	Adulterated with water.
17348	Lewiston. Paul Levesque	Lawful.
17084	Lewiston. Robert Stewart, Jr.	Lawful.
17085	Lewiston. J. F. Sullivan	Adulterated with water.
17349	Lewiston. Walker Fish Market	Adulterated with water.
17070	Pine Point. Leavitt Brothers	Lawful.
18140	Pine Point. Leavitt Brothers	Adulterated with water.
17063	Pine Point. F. H. Snow	Lawful.
17064	Pine Point. F. H. Snow	Lawful.
17065	Pine Point. F. H. Snow	Adulterated with water.
17066	Pine Point. F. H. Snow	Adulterated with water.
17067	Pine Point. F. H. Snow	Lawful.
17071	Pine Point. F. H. Snow	Adulterated with water.
17072	Pine Point. F. H. Snow	Adulterated with water.
17073	Pine Point. F. H. Snow	Adulterated with water.
17074	Pine Point. F. H. Snow	Adulterated with water.
17132	Pine Point. F. H. Snow	Adulterated with water.
17133	Pine Point. F. H. Snow	Lawful.
17134	Pine Point. F. H. Snow	Lawful.
17135	Pine Point. F. H. Snow	Lawful.
17136	Pine Point. F. H. Snow	Adulterated with water.
17137	Pine Point. F. H. Snow	Adulterated with water.
17138	Pine Point. F. H. Snow	Adulterated with water.
17139	Pine Point. F. H. Snow	Adulterated with water.
17140	Pine Point. F. H. Snow	Adulterated with water.
17141	Pine Point. F. H. Snow	Lawful.
18141	Pine Point. Fred Snow	Lawful.
18142	Pine Point. Fred Snow	Adulterated with water.
18143	Pine Point. Fred Snow	Lawful.
18144	Pine Point. Fred Snow	Lawful.
18145	Pine Point. Fred Snow	Lawful.
17068	Pine Point. H. B. Snow	Lawful.
17069	Pine Point. H. B. Snow	Lawful.
17131	Pine Point. H. B. Snow	Lawful.
17035	Portland. E. C. Dyer	Lawful.

OPENED CLAMS—Concluded.

Station number.	TOWN AND DEALER.	Results of Examination.
17036	Portland. E. C. Dyer	Lawful.
17037	Portland. E. C. Dyer	Lawful.
17038	Portland. E. C. Dyer	Lawful.
17075	Portland. E. C. Dyer	Lawful.
18512	Portland. M. B. Greenleaf & Son	Lawful.
17033	Portland. J. H. McDonald	Lawful.
18506	Portland. J. H. McDonald	Adulterated with water.
17078	Portland. P. E. Meserve	Lawful.
17079	Portland. P. E. Meserve	Lawful.
18509	Portland. George C. Shaw & Co.	Adulterated with water.
17080	Portland. S. A. Skillings & Son	Adulterated with water.
18507	Portland. S. A. Skillings & Son	Lawful.
18500	Portland. Tribben Brothers	Lawful.
18504	Portland. Vickerson Bros. Market	Adulterated with water.
17039	Portland. George Wilcox	Adulterated with water.
17040	Portland. Geo. Wilcox	Adulterated with water.
17041	Portland. Geo. Wilcox	Adulterated with water.
17042	Portland. Geo. Wilcox	Adulterated with water.
17076	Portland. Geo. Wilcox	Adulterated with water.
17077	Portland. Geo. Wilcox	Adulterated with water.
18594	Rockland. W. V. Spencer	Adulterated with water.
18593	Rockland. Philip Thomas	Adulterated with water.
18550	Saco. H. L. Allen	Lawful.
18489	Waterville. McCullums Cash Market	Adulterated with water.
18537	Waterville. F. E. McCallum	Adulterated with water.
18538	Waterville. R. W. Moore	Adulterated with water.
18485	Waterville. S. E. Whitcomb Co.	Lawful.
18570	Westbrook. Davis & Crawford	Adulterated with water.

BUTTER.

Table giving the results of the chemical analysis of butter on sale in Maine. The samples are arranged alphabetically by the name of the town and dealer. The maker's name is given when known.

Station number.	TOWN, DEALER, BRAND.	Weight* ounces.	Water per cent.	Salt per cent.	Casein per cent.	Fat per cent.	ounces.* Fat
17424	Augusta, Hersom & Bonsall. "The Arlington Brand."	16.4	12.4	3.0	0.8	83.7	13.7
17423	Augusta, John P. Squire & Co. "Squire's Arlington Creamery Butter."	15.6	25.7	1.1	1.1	72.0	11.2
18610	Bangor, The Frank Grocery Co. "Liquid Gold." Fairmount Creamery Co.	15.7	13.7	2.6	1.0	82.5	13.0
18605	Bangor, Fred T. Hall & Co. J. H. Crosby, Glenburn.	15.3	12.7	2.9	1.3	82.8	12.3
18606	Bangor, Fred T. Hall & Co. C. W. Danforth, Bradford Center. "Fancy Dairy Butter."	16.0	11.7	4.9	1.2	81.9	13.1
18611	Bangor, H. E. MacDonald. "Superior Pure Creamery Butter." C. J. Jean Co.	15.5	15.0	3.8	1.2	79.8	12.4
18609	Bangor, Morrill's Fish Market. "Brookfield Creamery Butter."	16.0	13.3	2.7	1.0	82.9	13.3
18607	Bangor, Staples & Griffin. "W M. Chadbourne."	15.1	11.1	5.4	1.3	82.0	12.3
18608	Bangor, Townsend's Cash Store. E. R. Chase, Kenduskeag."	16.2	11.6	4.2	1.3	82.6	13.4
18613	Belfast, Belfast Farmers' Union. "Choice Dairy Butter. O. A. Shibles, Morrill."	13.5	17.0	5.0	2.2	75.6	10.2
18614	Belfast, Central Market. "Choice Dairy Butter, G. H. Wing, Belfast."	15.2	12.5	5.5	2.2	79.6	12.1
18634	Biddeford, John F. Hannaway. "Dairy Butter, C. J. Wakefield, Lyman."	16.1	14.6	4.2	1.6	79.4	12.8
18635	Biddeford, John F. Hannaway. Dairy Butter.	15.6	12.1	1.8	1.5	84.4	13.2
18636	Biddeford, John F. Hannaway. "Choice Dairy Butter."	16.6	11.8	4.2	1.9	82.8	13.7
18637	Biddeford, John F. Hannaway "Choice Dairy Butter."	16.2	11.5	6.3	1.4	80.5	13.0
18638	Biddeford, John F. Hannaway.	16.7	11.0	6.1	1.5	81.2	13.5
18630	Biddeford, Joseph Menard. Willowdale Creamery, Limerick.	15.4	9.9	4.0	1.7	84.2	12.9

*If the package was a half pound size the found weights are doubled. A pound of standard butter should contain 13.2 ounces of butter fat.

BUTTER—Continued.

Station number.	TOWN, DEALER, BRAND.	Weight* ounces.	Water per cent.	Salt per cent.	Casein per cent.	Fat per cent.	Fat ounces.*
18631	Biddeford, Joseph Menard. Dairy Butter. S. B. Stone, No. Kennebunkport, Me.	15.4	9.8	3.9	1.0	85.1	13.1
18632	Biddeford, Joseph Menard. D. W. Marston.	15.6	10.8	4.29	1.4	83.4	13.0
18633	Biddeford, Portland & Biddeford Provision Co. "Daniel McIntire, No. Kennebunkport, Me..	14.7	8.6	3.6	1.5	86.1	12.7
18627	Biddeford, Joseph Stride & Co. "Turner Center Creamery Print Butter."	16.0	14.7	3.3	1.1	80.6	12.9
18628	Biddeford, Joseph Stride & Co. "Albert L. Hanson, Hollis Center, Me."	15.3	14.0	4.5	1.1	80.2	12.3
18629	Biddeford, Joseph Stride & Co. "Choice Dairy Butter, Albert L. Hanson, Hollis Center, Me."	15.9	11.8	4.8	1.9	81.3	12.9
18615	Brooks, Brooks Farmers' Union. "Dairy Butter, A. S. Bailey, Brooks, Me."	14.9	10.4	2.0	1.2	86.2	12.9
18655	Kittery, C. M. Prince & Son.	15.4	13.0	4.5	1.1	81.1	12.5
14192	Lewiston, Caron & Lengelier. "Pierre Begin, Windsor Mills, Beurre Canadien."	14.4	14.1	2.9	0.9	81.9	11.8
14191	Lewiston, O. Roger. "Pierre Begin, Windsor Mills, Beurre Canadien."	14.5	12.7	1.7	1.3	84.2	12.2
14190	Lewiston, I. Simard & Sons. "Beurre Canadien. Pierre Begin, Windsor Mills, P. Q."	14.3	12.5	1.2	1.1	85.0	12.1
18616	Portland, Herbert C. Ayer. "Choice Dairy Butter, Woodland Farm, Falmouth."	16.2	9.4	2.8	1.1	86.5	14.0
18620	Portland, John H. Charles	16.7	11.1	6.0	1.7	81.1	13.6
18626	Portland, L. B. Chipman. "H. P. Hood & Sons Butter."	15.4	10.0	2.6	1.4	85.8	13.2
18625	Portland, Harry Sclar. "Sweet Clover Butter. The Fairmount Creamery Co."	15.9	12.1	2.4	0.8	84.5	13.4
18624	Portland, Geo. C. Shaw Co. "Primrose Creamery Butter."	15.8	11.0	2.6	0.9	85.4	13.5
16051	Portland, S. K. Ames.	16.0	11.1	1.9	1.2	85.6	13.7
16052	Portland, S. K. Ames.	15.8	12.5	2.6	1.0	83.8	13.2
16053	Portland, S. K. Ames.	15.7	11.2	1.5	1.2	85.9	13.5

*If the package was a half pound size the found weights are doubled. A pound of standard butter should contain 13.2 ounces of butter fat.

BUTTER—Concluded.

Station number.	TOWN, DEALER, BRAND.	Weight* ounces.	Water per cent.	Salt per cent.	Casein per cent.	Fat per cent.	Fat ounces.*
17479	Portland, John P. Squire & Co. "Squire's Arlington Creamery Butter."	16.0	17.5	3.3	1.0	77.9	12.4
18617	Portland, Sullivan & Osgood. W. C. Pease, Cornish, Maine.	17.1	9.6	8.7	1.4	80.2	13.7
18618	Portland, Sullivan & Osgood. J. G. Turnbull Co., Orleans, Vt.	15.6	14.0	4.2	1.0	80.6	12.6
18619	Portland, Sullivan & Osgood. H. D. Winn, Falmouth, Maine.	16.4	12.0	3.9	1.6	82.3	13.5
18621	Portland, W. L. Wilson Co. Mr. Knight, Windham, Maine.	17.2	11.7	5.7	2.2	80.2	13.8
18622	Portland, W. L. Wilson Co. "Choicest Creamery Butter." Waterford Creamery, Waterford.	16.1	13.0	2.4	1.3	83.1	13.4
18623	Portland, W. L. Wilson Co. "Cherry Circle Extra Fancy Creamery Butter." Fox River Butter Co.	16.0	12.4	3.4	0.9	83.1	13.3
17339	Winslow, D. B. Mason. "Squire's Arlington Creamery Butter. John P. Squire & Co."	14.4	25.7	2.3	0.7	71.1	9.2

*If the package was a half pound size the found weights are doubled. A pound of standard butter should contain 13.2 ounces of butter fat.

BUTTER.

The Maine law regulating the sale of dairy products is distinct from though consistent with the general pure food law. The law fixes the standards for milk and for cream but does not for manufactured products such as cheeses, butter and ice cream. The present Federal Standards Committee is engaged upon an investigation of the composition of commercial butter with a view of fixing new standards and definitions. To assist in the inquiry the samples above reported were collected by the Maine inspectors. Under the standards now in force butter should carry not less than 82.5 per cent milk fat. Hence a pound of lawful butter will contain at least 13.2 ounces of butter fat.

An inspection of the table shows that as a whole dairy butters are much more thoroughly worked than are creamery butters. Dairy butters mostly carry from 9 to 13 per cent of water and creamery butters carry about 5 per cent more water on the average. Some of the larger dairies are apparently quite skillful in the adulteration of butter by leaving a large amount of water in the finished product. Two samples of John P. Squire and Company's Arlington Brand Butter had over 25 per cent of water and one of the "pounds" weighed 14.4 ounces. It contained 9.2 ounces of butter fat instead of the 13.2 ounces that it should have.

INDEX.

July, 1918.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

ANALYSTS.

James M. Bartlett
Roydon L. Hammond
Herman H. Hanson
Elmer R. Tobey

Official Inspections

88

COMMERCIAL AGRICULTURAL SEEDS, 1918.

CHAS. D. WOODS.

The Commissioner of Agriculture is the executive of the law regulating the sale of agricultural seeds in Maine. It is the duty of the Director of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and to publish the results of the analyses together with the names of the persons from whom the samples were obtained, and such additional information as may seem advisable.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

THE CHIEF REQUIREMENTS OF THE LAW.

The first law regulating the sale of seeds was enacted by the Legislature of 1897. This was revised by the Legislature of 1905. This was again revised by the Legislature of 1911 so as to conform with the requirements recommended by the Association of Official Seed Analysts and agreed to by the American Seed Dealers Association.

The following are the chief points of the law and the rules and regulations for carrying out the law regulating the sale of agricultural seeds which, as directed by the law, the Commissioner of Agriculture, has made.

1. *Kind of seeds coming under the law.* The law applies to the sale, distribution, transportation, or the offering or exposing for sale, distribution, or transportation of the seeds of alfalfa, barley, Canadian blue grass, Kentucky blue grass, brome grass, buckwheat, alsike clover, crimson clover, red clover, medium clover, white clover, field corn, Kaffir corn, meadow fescue, flax, hungarian, millet, oats, orchard grass, rape, redtop, rye, sorghum, timothy and wheat for seeding purposes.

2. *The brand.* Each lot or package shall be plainly marked with the name of the seed and its minimum percentage of purity.

3. *Mixtures.* Mixtures must be plainly marked with the name of the seed and the percentage of purity. In case the mixtures contain seeds not included in 1 these need not be named. (e. g., a mixture consisting of half redtop, 90 per cent pure, quarter Kentucky blue grass, 85 per cent pure and the remainder seeds not named in the law, could be marked "Redtop 45 per cent pure, Kentucky blue grass 21 per cent pure." The statement of the remaining constituents may or may not be named.)

4. *Adulteration.* A seed is adulterated if its purity falls below its guaranty or if it contains the seed of any poisonous plant.

5. *Misbranding.* A seed is misbranded if the package or label bears any statement, designed or device which is false or misleading in any particular, or if it does not carry the statements named in 2.

6. *Free analysis.* Free analysis of seeds on sale in Maine will be made of samples taken in accordance with directions furnished by the Commissioner of Agriculture. Sample not so

taken may be refused examination. Blanks with full directions will be furnished on request.

7. *Paid analysis.* As an accommodation to residents of Maine samples of seeds not on sale in Maine will be examined at cost, and the results will not be published. The cost of the analysis of blue grass or redtop is $1.00 per sample and for other seeds 50 cents. Remittance should accompany the sample.

8. *Written guaranty.* No prosecution will lie against any person handling agricultural seeds provided he obtains at the time of purchase a written guaranty signed by the person residing in the United States, from whom the purchase was made, to the effect that the seeds are not adulterated or misbranded within the meaning of the Maine law regulating the sale of agricultural seeds. After a person has been notified by the Commissioner of Agriculture that an article of agricultural seeds appears to be adulterated or misbranded the written guaranty will not protect further sales.

9. *Hearings.* The person who is believed to have violated the law regulating the sale of seeds will be granted a hearing at which he may appear in person or by attorney or by letter. The notice of the hearing will name the time and place of the hearing and a copy of the charge. Failure to appear will not prejudice the case. The hearing will be private and every opportunity will be given for explanation and establishment of innocence. If the time appointed is not a convenient one, postponement within reasonable limit will be granted.

TESTING SEEDS AT HOME.

It is important to the user of seeds not only to know their percentage of purity and what kind of weeds they carry, but to also know something of their vitality. In the case of seeds there are at least three ways whereby the user may be injured. A seed which carries foreign matter of any kind, in any considerable amount, is correspondingly lowered in value. But there is another reason which is more important than the money consideration, and that is that the weed seeds which the seeds contain may be pernicious. For example,—clover seed frequently carries plaintain seed. If this plaintain seed is the door-yard variety which is present practically all over Maine, there would be comparatively little harm from using clover seed which con-

tained it. On the other hand—lance leaved plaintain or rib grass is not abundant in Maine. It is an undesirable plant and using seed carrying it might introduce a weed into land which is at present free from it. It is important that the farmer should know the vitality as well as the purity of the seed that he is to use. No matter how pure a seed may be, if half of it will not sprout it has no more value than if the seed were half chaff.

While it is not easy to make an exact purity test, it is not difficult for a farmer to so acquaint himself with the seeds that he is ordinarily using that by the help of an ordinary reading or magnifying glass he will be able to tell whether the seed in question contains any considerable amount of impurities. If the seed is spread out upon a white plate, a little practice will enable a farmer to see whether a given seed is reasonably pure or not, and he will soon learn to detect the more common foreign seeds.

VITALITY OF SEEDS.

It is much easier for the farmer to test the vitality of seed than to make a purity examination. The following simple instructions for performing germination tests at home without any special apparatus will enable the farmer to learn for himself whether the seed that he is using has good vitality or not. Germination tests may be made in two ways,—the so-called blotting paper methods, and the sand method. In making the germination test with blotting paper, blue blotting paper of common weight, cut into strips about 6 x 19 inches, should be used. This is laid folded twice so as to get a piece of three thicknesses and about six inches square, on an ordinary dinner plate or platter. The seeds if small are placed on the top of the paper and if large between the folds. The paper is kept moist (not soaked) and at a temperature of 70 to 80 degrees F.

If only a vitality test is desired the blotting paper method is preferable, but if it is desired to know how many seeds may be expected to grow, the sand method is in some ways preferable. In this method a thin layer of fine sand is sprinkled on the bottom of a flat dish and the seeds to be tested placed on it under a thin covering of sand. This must be kept moist and well shaded and at a somewhat higher temperature than in the first case.

At the end of every second day in the case of some seeds, and the third day in the case of those germinating more slowly, the sprouted seeds should be removed from the blotters or the sand and counted, the per cent being readily found by referring back to the number of seeds which were taken for the test. If 100 seeds are used, the number that sprout give the vitality per cent.

Results of Inspection

The grass seeds on sale in Maine were inspected in 1918 by the Seed Analyst. His experience makes it possible to tell by observation in most instances whether a seed is or is not up to its guaranteed purity. In 1918 he visited 225 dealers and examined 811 samples of seeds. The varieties examined are given in the table on page 76.

The table on pages 66 and 67 gives a list of the weed seeds found in the grass seeds examined. The table on pages 68 and following give the results of the examination of the samples of seeds that were handled in the laboratory during the season. Only samples taken in accordance with the directions prescribed by the Commissioner of Agriculture and those taken by the inspector are here reported. The first column gives the laboratory number and in the case of samples sent in by correspondents this fact is indicated by the sign †.

The second column gives the kind of seed, the name and address of the dealer and the brand and lot number. The first column of figures gives the guaranteed percentage of purity and the next column shows the percentage of pure seeds found in the sample. The last column gives the list by numbers of the noxious weed seeds found in the sample. By reference to the table on pages 66 and 67 the kinds of weed seeds these numbers represent can be learned. Sometimes part of the impurities are other grass and clover seeds. These are not listed.

The following illustrates the way the table may be used to find the story it has to tell.

The first seed in the table (page 68) is an alsike clover, the sample was taken at Merrill Brothers, Augusta. It was offered under the name of Eureka Alsike. Its lot number was 116 W. D. It was guaranteed to be 97 per cent pure. It was found to be 98.9 per cent pure. It contained black medick and sheep sorrell as noxious weed seeds.

A list of weed seeds found in seeds examined in 1918.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908.

COMMON NAME.	SCIENTIFIC NAME.
1. American wild mint	Mentha canadensis (L.) Brig.
2. Ball mustard	Neslia paniculata (L.) Desv.
3. Barnyard grass	Echinochloa crusgalli (L.) Beauv.
4. Black medick	Medicago lupulina L.
5. Blue vervain	Verbena hastata L.
6. Bracted plantain	Plantago aristata Michx.
7. Canada thistle	Cirsium arvense (L.) Scop.
8. Charlock	Brassica arvensis L.
9. Common chickweed	Stellaria media (L.) Cyrill.
10. Corn cockle	Agrostemma githago L.
11. Dock	Rumex sp.
12. Evening primrose	Oenothera biennis L.
13. Ergot	*Claviceps purpurea (Fr.) Tul.
14. False flax	Camelina microcarpa Andrz.
15. Field peppergrass	Lepidium campestre (L.) R. Br.
16. Five finger	Potentilla monspeliensis L.
17. Giant ragweed	Ambrosia trifida L.
18. Goosefoot	Chenopodium album L.
19. Great bindweed	Convolvulus sepium L.
20. Green foxtail	Setaria viridis (L.) Beauv.
21. Hairy stickseed	Lappula echinata Gilib.
22. Heal-all	Prunella vulgaris L.
23. Hemp nettle	Galeopsis tetrahit L.
24. Lady's thumb	Polygonum persicaria L.
25. Large false flax	Camelina sativa (L.) Crantz.
26. Mayweed	Anthemis cotula L.
27. Mint	Mentha sp.
28. Moth mullein	Verbascum blattaria L.
29. Mouse-ear chickweed	Cerastium vulgatum L.
30. Mustard	Brassica nigra (L.) Koch.
31. Night-flowering catchfly	Silene noctiflora L.
32. Old-witch grass	Panicum capillare L.
33. Ovoid spike rush	Eleocharis ovata (Roth.) R. & S.
34. Pale persicaria	Polygonum lapathifolium L.
35. Pennsylvania persicaria	Polygonum pennsylvanicum L.
36. Penny cress	Thlaspi arvense L.
37. Perennial sweet vernal grass	Anthoxanthum odoratum L.
38. Pigweed	Amaranthus retroflexus L.
39. Plantain	Plantago major L.
40. Quack grass	Agropyron repens (L.) Beauv.
41. Ragweed	Ambrosia artemisiifolia L.
42. Ribgrass	Plantago lanceolata L.
43. Rugel's plantain	Plantago rugelii Done.
44. Russian thistle	Salsola Kali tenuifolia (L.) G. F. W. Mey.
45. Sedge	Carex unidentified
46. Sheep sorrel	Rumex acetosella L.
47. Shepherd's purse	Capsella Bursa-pastoris (L.) Medic.
48. Slender crabgrass	Digitaria filiformis (L.) Koeler.

*Sclerotia of the fungus.

A list of weed seeds found in seeds examined in 1918.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908.

COMMON NAME.	SCIENTIFIC NAME.
49. Spurge	Euphorbia preslii Guss.
50. Spurry	Spergula arvensis L.
51. Sweet clover	Melilotus alba Desv.
52. Vetch	Vicia sativa L.
53. Virginia three-seeded mercury	Acalypha virginica L.
54. Wild buckwheat	Polygonum convolvulus L.
55. Wild carrot	Daucus carota L.
56. Wild peppergrass	Lepidium virginicum L.
57. Wild rose	Rosa pratincola Greene.
58. Yarrow	Achillea millefolium L.
59. Yellow daisy	Rudbeckia hirta L.
60. Yellow foxtail	Setaria glauca (L.) Beauv.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1918, arranged alphabetically by towns and dealers.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	ALSIKE CLOVER.			
8836	Augusta. Merrill Bros. Eureka Alsike 116 W. D.	97.0	98.9	4, 46.
8842	Augusta. J. A. Shaw. Ace Alsike No. 86285	93.0	94.0	46, 31, 14, 32.
8913	Caribou. James H. Glenn. Pine Tree Alsike No. 448ALS	97.0	97.1	31, 46, 7, 18, 11, 43, 39, 4, 16.
8914	Caribou. James H. Glenn. Diamond G Alsike No. ALS929	98.0	98.0	31, 39, 45.
8880	Corinna. Eastern Grain Co. Pan American Alsike No. A1796	97.0	96.2	4, 56, 16, 9, 26, 46, 11.
8920	Fort Kent. Fred E. Michaud. Choice Alsike C. M. Brand	98.5	94.2	46, 31, 14, 4, 29, 18, 11, 16, 15, 39, 7, 56, 47, 42.
†8946	Houlton. John Watson & Co. Globe Alsyke No. 86200	98.9	98.8	4, 18, 31, 46, 51, 7.
8872	Newport. Judkins & Gilman Co. Pan American Alsike	97.5	97.9	4, 39.
8846	Oakland. M. Libby. Ace Alsike No. 86285	93.0	93.6	46, 31, 37, 11.
8909	Presque Isle. Aroostook Co-operative Co. Alsike Bread Brand	99.09	98.9	4, 46, 31, 43.
8849	Waterville. Farmer's Union of Maine. Alsike	99.0	95.1	31, 43, 7, 11.
	BARLEY.			
8940	Brunswick. Brunswick Farmer's Union. Barley	—	99.1	
8884	Ellsworth. H. C. Stratton. Chevalier Barley	98.0	98.0	54.
8903	Fort Fairfield. S. Nightingale & Son. Fancy Oderbrucker Barley	97.67	95.65	54, 10.
8882	Foxcroft. A. W. Gilman & Co. Chevalier Barley	98.0	98.64	
8886	Machias. L. W. Longfellow & Co. Fancy Two Row Barley	97.14	98.32	

*The numbers refer to weeds named in the table on pages 66 and 67. E.g. 1 is for American wildmint, 2 is Ball mustard, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1918, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	BARLEY—Concluded.			
8887	Machias. L. W. Longfellow & Co. Fancy Oderbrucker Barley	96.44	96.35	54, 11.
8927	Patten. Patten Grange Store. Seed Barley	96.0	98.90	
8866	Skowhegan. Steward & Smiley. Two Row Barley	98.0	99.35	54, 57.
	BUCKWHEAT.			
8888	Machias. L. W. Longfellow & Co. Japanese Buckwheat	98.0	99.60	41, 54.
	HUNGARIAN.			
8833	Augusta. Merrill Bros. Hungarian Millet	97.0	95.7	38, 20, 34, 32, 18, 24, 41, 44.
8855	Waterville. Farmer's Union of Maine. Hungarian	98.70	98.4	20, 32, 60, 34.
	JAPANESE MILLET.			
8853	Waterville. Farmer's Union of Maine. Japanese Millet	93.75	93.3	60, 20, 35, 54.
	MAMMOTH CLOVER.			
†8947	Houlton. John Watson & Co. Globe Mammoth Clover No. 72077	99.3	99.5	11, 43, 30, 18.
	OATS.			
8938	Bath. Bath Grain Co. Clipped White Oats	—	98.69	
8933	Bridgton. Bridgton Farmer's Union. Oats 315	—	98.94	54, 30, 19.
8941	Brunswick. Brunswick Farmer's Union. Oats	—	99.48	54, 30, 19.
8939	Brunswick. D. & C. E. Scribner Co. Seed Oats	—	95.18	54, 52, 30, 11, 24, 60, 40.
8917	Caribou. Caribou Grange Store. Bulk Seed Oats	—	98.22	54, 30, 57, 24.
8877	Clinton. Gerald Bros. Oats Natural White	—	98.98	24, 54, 30, 19.
8870	Clinton. E. E. Merrill. Silver Maine Oats	99.0	99.65	54, 30.

*The numbers refer to weeds named in the table on pages 66 and 67. E.g. 1 is for American wildmint, 2 is Ball mustard, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1918, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	Seeds. *Kinds of Noxious Weed
	OATS—Continued.			
8879	Dexter. S. L. Small. Oats	—	98.10	30, 54, 24.
8932	East Brownfield. L. R. Giles Co. Recleaned Seed Oats	—	98.85	54, 60, 30.
8905	Fort Fairfield. S. Nightingale & Son. Imperial Seed Oats	96.57	97.25	54, 57, 24, 11, 46.
8922	Fort Kent. Fort Kent Mill Co. Crosby Seed Oats	—	99.73	11, 30.
8883	Foxcroft. Central Maine Co-operative Association. Oats	—	99.36	54, 57.
8929	Hallowell. Frank S. Wingate. Oats	—	98.64	54, 11, 24, 56.
8896	Houlton. John Watson & Co. Regenerated Swedish Oats	—	98.65	54, 57.
8889	Machias. L. W. Longfellow & Co. Imperial Oats	99.82	98.96	54, 30, 24.
8861	Madison. Stanley, Harlow & Hight Co. Fancy Silver Maine White Oats	99.0	99.86	54.
8859	Madison. N. A. Weston. Alberta Prolific White Seed Oats	—	99.79	
8860	Madison. N. A. Weston. Oats	—	97.66	60.
8876	Newport. Hanson & Pingree. Seed Oats	98.20	99.63	54.
8935	Norway. H. E. Gibson. Recleaned Seed Oats	—	99.28	30, 54.
8930	Randolph. Gardiner Farmer's Union. No. 2 White Oats, Car 20786	—	99.22	54, 24.
8925	Smyrna Mills. Smyrna Mills Grange Store. Recleaned Seed Oats	—	99.15	54, 46.
8918	Van Buren. F. J. Parent. White Western Oats	99.0	99.33	54, 60.
8848	Waterville. G. A. Kennison & Co. Oats	98.20	99.71	

*The numbers refer to weeds named in the table on pages 66 and 67. E.g. 1 is for American wildmint, 2 is Ball mustard, etc.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1918, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	OATS—Concluded.			
8856	Waterville. Merrill & Mayo Co. Oats	—	99.53	24, 30.
8931	Westbrook. John Lawrensen. Seed Oats	—	99.52	
8892	West Pembroke. A. H. Brown & Son. Fancy Silver Maine Oats	99.0	99.70	
8936	Winthrop. D. H. Maxim Est. Oats	—	99.54	
	RED CLOVER.			
8837	Augusta. Merrill Bros. Eureka Clover E. 2	99.5	98.9	20, 43, 11, 60, 24, 32, 53, 48.
8841	Augusta. J. A. Shaw. Ace Clover No. C72259	97.5	98.2	42, 18, 6, 20, 11.
8902	Fort Fairfield. Knowles, Dow & Co. Eureka Clover	99.5	99.8	
†8945	Houlton. John Watson & Co. Globe Medium Clover Lot No. 72076	98.8	98.4	20, 43, 11, 60.
8873	Newport. Judkins & Gilman Co. Pan American Red Clover	98.5	98.5	42, 3, 20, 46.
8845	Oakland. M. Libby. Ace Red Clover No. 71510	98.0	99.0	42, 20, 18, 53.
8868	Pittsfield. E. W. Wallace. Ace Clover No. C71743	98.0	97.3	20, 42, 24, 46, 18, 11, 22, 60, 53, 43, 49, 44, 55.
8908	Presque Isle. Aroostook Co-operative Co. Ursa Red Clover	99.08	99.0	20, 3, 42.
8851	Waterville. Farmer's Union of Maine. Med. Clover	99.0	99.0	42, 18, 43.
	REDTOP.			
8857	Anson. Geo. W. Booth. Fancy Ace Redtop No. 92934	90.0	89.6	58, 16, 45, 39, 13, 26.
8838	Augusta. Merrill Bros. Ace Red Top No. 92035	90.0	90.2	58, 16, 43, 45, 46.

*The numbers refer to weeds named in the table on pages 66 and 67. E.g. 1 is for American wildmint, 2 is Ball mustard, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1918, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	REDTOP Concluded.			
8840	Augusta. J. A. Shaw. Ace Red Top No. 92934	90.0	89.6	58, 16, 45, 39, 1, 13, 28, 29, 33, 26.
8847	Oakland. M. Libby. Ace Red Top No. R. T. 92438	—	90.6	58, 45, 13, 16, 5.
8850	Waterville. Farmer's Union of Maine. Red Top	95.0	95.5	58, 26, 13, 39, 45, 29.
	RYE.			
8852	Waterville. Farmer's Union of Maine. Rye	99.0	99.61	24, 11.
	TIMOTHY.			
8942	Augusta. A. M. Brown. Timothy No. 69636	98.0	98.1	59, 43, 46, 16, 45.
8839	Augusta. A. M. Brown. Pine Tree Timothy No. 69718	99.5	99.6	18.
8834	Augusta. Merrill Bros. Pine Tree Timothy No. 60460	99.5	99.7	
8835	Augusta. Merrill Bros. Pan American Timothy No. 88	99.5	99.4	
8843	Augusta. J. A. Shaw. Pine Tree Timothy No. 60625	99.5	99.5	18.
8915	Caribou. Caribou Grange Store. Interstate Extra Quality Timothy	99.69	99.7	58.
8906	Fort Fairfield. S. Nightingale & Son. King Timothy	99.6	99.6	
8919	Fort Kent. W. L. Savage. Pine Tree Timothy	99.7	99.8	
8895	Houlton. John Watson & Co. Pine Tree Timothy No. 61781	99.7	99.7	
†8943	Houlton. John Watson & Co. P. T. Timothy No. 61782	99.6	99.6	43, 56, 13.
†8944	Houlton. John Watson & Co. B. H. Globe Timothy No. 61675	99.8	99.8	
8891	Machias. L. W. Longfellow & Co. Arrow Timothy	99.1	98.6	43, 46, 7, 12.
8862	Madison. Stanley, Harlow & Hight Co. Pan American Timothy	99.5	99.3	43, 45, 1, 16.

*The numbers refer to weeds named in the table on pages 66 and 67. E.g. 1 is for American wildmint, 2 is Ball mustard, etc.

†Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1918, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	TIMOTHY—Concluded.			
8912	Mars Hill. E. M. Smith. King Timothy	99.6	99.6	26, 12.
8875	Newport. Hanson & Pingree. Pine Tree Timothy N. 60545	99.6	99.6	16.
8871	Newport. Judkins & Gilman Co. King Timothy	99.6	99.6	
8874	Newport. Judkins & Gilman Co. Pan American Timothy	99.5	99.6	12, 45.
8844	Oakland. M. Libby. Timothy No. 60455	98.0	97.8	16, 13, 43, 46, 27, 12.
8893	Pembroke. Hobart-Pattengall Co. Pine Tree Timothy No. 60574	99.7	99.7	
8867	Pittsfield. E. W. Wallace. Pine Tree Timothy No. 60514	99.5	99.7	16.
8869	Pittsfield. Whitten & Emerson. Pan American Timothy	99.5	99.5	12, 13.
8907	Presque Isle. Aroostook Co-operative Co. Monitor Brand Timothy	99.0	99.9	59, 13, 45.
8864	Skowhegan. Steward & Smiley. Pine Tree Timothy No. 60300	99.5	99.6	
8865	Skowhegan. Steward & Smiley. Pan American Timothy No. 38398	99.5	99.6	
8854	Waterville. Farmer's Union of Maine. Timothy	99.5	99.5	56, 18.
	WHEAT.			
8923	Ashland. Craig & Howe. Wheat grown by N. C. Howe	—	95.08	50, 23, 46, 24.
8924	Ashland Grange Store. Wheat grown by R. R. Bearce	—	95.80	
8937	Bath. Kimball Bros. Co. Seed Wheat	99.0	99.54	54, 25, 2.
8934	Bridgton. F. C. Knight. Wheat	—	99.54	
8916	Caribou. Caribou Grange Store. Spring Wheat in bulk	—	100.00	
8878	Dexter. Dexter Grange Store. Marquis Wheat No. M. W. 86358	—	99.94	

*The numbers refer to weeds named in the table on pages 66 and 67. E.g. 1 is for American wildmint, 2 is Ball mustard, etc.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1918, arranged alphabetically by towns and dealers—Concluded.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	WHEAT—Continued.			
8885	Ellsworth. H. C. Stratton. Marquis Spring Wheat No. 101413	99.0	99.30	8.
8900	Fort Fairfield. S. Nightingale & Son. Marquis Spring Wheat, Car C & N. W. 130990	—	98.76	54, 18, 25, 2, 36.
8901	Fort Fairfield. S. Nightingale & Son. Marquis Spring Wheat, Car C & N. W. 130990	—	98.83	54, 18, 25, 2, 21, 36.
8904	Fort Fairfield. S. Nightingale & Son. Spring Seed Wheat	96.0	97.90	54, 18, 25, 30, 2, 21.
8921	Fort Kent. Fort Kent Mill Co. Minneapolis Seed Wheat	—	98.74	30, 8, 38.
8881	Foxcroft. A. W. Gilman & Co. Marquis Spring Wheat No. 694	—	99.66	54, 57.
8898	Houlton. Houlton Grange Store. Marquis Spring Wheat in bulk	—	98.57	54, 18, 25, 30, 36.
8899	Houlton. Houlton Grange Store. Marquis Spring Wheat in bulk	—	97.56	54, 18, 25, 36, 8, 30, 10.
8897	Houlton. John Watson & Co. Marquis Spring Wheat No. 101415	98.3	99.60	54, 10, 8.
8890	Machias. L. W. Longfellow & Co. Spring Wheat	97.3	98.86	54, 18, 30, 2, 21, 25.
8858	Madison. N. A. Weston. Wheat M. W. 86332	—	99.99	
8894	Milltown. S. S. Pineo. Marquis Spring Wheat No. 101414	99.0	99.52	17.
8926	Patten. Patten Grange Store. Seed Wheat No. 101414	99.0	99.64	
8910	Presque Isle. Aroostook Co-operative Co. Spring Wheat in bulk before cleaning	—	98.90	54, 18, 25, 36.
8911	Presque Isle. Aroostook Co-operative Co. Spring Wheat in bulk after cleaning	—	99.77	54, 30.
8863	Skowhegan. Steward & Smiley. Wheat M. W. 86358	—	99.76	

*The numbers refer to weeds named in the table on pages 66 and 67. E.g. 1 is for American wildmint, 2 is Ball mustard, etc.

Table showing results of examination of samples of seeds in 1918.

Names of Weeds.	Kind of Seed and Number of Samples											
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millet.	Hungarian.	Oats.	Wheat.	Barley.	Rye.	Buckwheat.
Number of samples examined	10	11	1	26	5	1	2	28	22	8	1	1
American wild mint	—	—	—	1	1	—	—	—	—	—	—	—
Ball mustard	—	—	—	—	—	—	—	—	5	—	—	—
Barnyard grass	2	—	—	—	—	—	—	—	—	—	—	—
Black medick	—	7	—	—	—	—	—	—	—	—	—	—
Blue vervain	—	—	—	—	1	—	—	—	—	—	—	—
Bracted plantain	1	—	—	—	—	—	—	—	—	—	—	—
Canada thistle	—	3	—	1	—	—	—	—	—	—	—	—
Charlock	—	—	—	—	—	—	—	—	4	—	—	—
Common chickweed	—	1	—	—	—	—	—	—	—	—	—	—
Corn cockle	—	—	—	—	—	—	—	—	2	1	—	—
Dock	4	5	1	—	—	—	—	4	—	1	1	—
Evening primrose	—	—	—	5	—	—	—	—	—	—	—	—
Ergot	—	—	—	5	4	—	—	—	—	—	—	—
False flax	—	2	—	—	—	—	—	—	—	—	—	—
Field peppergrass	—	1	—	—	—	—	—	—	—	—	—	—
Five finger	—	3	—	5	4	—	—	—	—	—	—	—
Giant ragweed	—	—	—	—	—	—	—	—	1	—	—	—
Goosefoot	4	3	1	3	—	—	1	—	7	—	—	—
Great bindweed	—	—	—	—	—	—	—	3	—	—	—	—
Green foxtail	8	—	—	—	—	1	2	—	—	—	—	—
Hairy stickseed	—	—	—	—	—	—	—	—	3	—	—	—
Heal-all	1	—	—	—	—	—	—	—	—	—	—	—
Hemp nettle	—	—	—	—	—	—	—	—	1	—	—	—
Lady's thumb	2	—	—	—	—	—	1	9	1	—	1	—
Large false flax	—	—	—	—	—	—	—	—	8	—	—	—
Mayweed	—	1	—	1	3	—	—	—	—	—	—	—
Mint sp.	—	—	—	1	—	—	—	—	—	—	—	—
Moth mullein	—	—	—	—	1	—	—	—	—	—	—	—
Mouse-ear chickweed	—	1	—	—	2	—	—	—	—	—	—	—
Mustard	—	—	1	—	—	—	—	12	6	—	—	—
Night-flowering catchfly	—	8	—	—	—	—	—	—	—	—	—	—
Old-witch grass	1	1	—	1	—	—	2	—	—	—	—	—
Ovoid spike rush	—	—	—	—	1	—	—	—	—	—	—	—
Pale persicaria	—	—	—	—	—	—	2	—	—	—	—	—
Pennsylvania persicaria	—	—	—	—	—	1	—	—	—	—	—	—
Penny cress	—	—	—	—	—	—	—	—	5	—	—	—
Perennial sweet vernal grass	—	1	—	—	—	—	—	—	—	—	—	—
Pigweed	—	—	—	—	—	—	1	—	1	—	—	—
Plantain	—	4	—	1	3	—	—	—	—	—	—	—
Quack grass	—	—	—	—	—	—	—	1	—	—	—	—
Ragweed	—	—	—	—	—	—	1	—	—	—	—	1
Ribgrass	6	1	—	1	—	—	—	—	—	—	—	—
Rugel's plantain	5	3	1	5	1	—	—	—	—	—	—	—
Russian thistle	1	—	—	—	—	—	1	—	—	—	—	—

Table showing results of examination of samples of seeds in 1918—Concluded.

Names of Weeds.	Kind of Seed and Number of Samples											
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millet.	Hungarian.	Oats.	Wheat.	Barley.	Rye.	Buckwheat.
Sedge sp.	—	1	—	4	5	—	—	—	—	—	—	—
Sheep sorrel	2	8	—	3	1	—	—	2	1	—	—	—
Shepherd's purse	—	1	—	—	—	—	—	—	—	—	—	—
Slender crabgrass	1	—	—	—	—	—	—	—	—	—	—	—
Spurge	1	—	—	—	—	—	—	—	—	—	—	—
Spurry	—	—	—	—	—	—	—	—	1	—	—	—
Sweet clover	—	1	—	—	—	—	—	—	—	—	—	—
Vetch	—	—	—	—	—	—	—	1	—	—	—	—
Virginia three-seeded mercury	3	—	—	—	—	—	—	—	—	—	—	—
Wild buckwheat	—	—	—	—	—	1	—	19	11	4	—	1
Wild carrot	1	—	—	—	—	—	—	—	—	—	—	—
Wild peppergrass	—	2	—	2	—	—	—	1	—	—	—	—
Wild rose	—	—	—	—	—	—	—	4	1	1	—	—
Yarrow	—	—	—	1	5	—	—	—	—	—	—	—
Yellow daisy	—	—	—	2	—	—	—	—	—	—	—	—
Yellow foxtail	3	—	—	—	—	1	1	4	—	—	—	—

Table showing the result of the inspection of seed in lots at dealers in 1918. These seeds were all examined at the dealers to see if they were in accord with guarantees upon them. In doubtful cases samples were taken to the laboratory.

Names of Seeds and Number of Lots of Each Inspected.													
Timothy.	Red clover.	Alsike clover.	Mammoth clover.	Redtop.	Hungarian.	Japanese millet.	Barley.	Buckwheat.	Oats.	Wheat.	Others miscellaneous.	Total number of lots.	Number of dealers visited.
194	135	121	17	89	30	34	34	14	57	54	33	811	225

August, 1918.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

ANALYSTS.

James M. Bartlett
Roydon L. Hammond
Herman H. Hanson
Elmer R. Tobey

Official Inspections

89

COMMERCIAL FEEDING STUFFS, 1917-8

CHAS. D. WOODS.

The Commissioner of Agriculture is the executive of the law regulating the sale of feeding stuffs in Maine. It is the duty of the Director of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and to publish the results of the analyses together with the names of the persons from whom the samples were obtained, and such additional information as may seem advisable.

Note. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

REFERENCE LIST OF FEEDING STUFFS REGISTERED EXAMINED IN 1917-18.

Results of Inspection.

The following pages contain the report of the analyses of commercial feeding stuffs made since the publication of Official Inspections 84.

There are reported in all about 350 samples, including all received up to July 1, 1918. About one third of the samples were submitted by dealers and consumers. The other samples were drawn by the inspectors of the State Department of Agriculture. In the course of their work the inspectors covered the entire state with the exception of extreme northern and eastern parts. Practically all stores buying feed directly from out-of-state points were visited at least once, most of them twice, and some of the larger wholesale places, three or more times. The slow delivery by the railroads and the unsettled condition of markets due to the war have resulted in the collection of only about half the usual number of samples.

Occasionally brands of unregistered feeding stuffs are found on sale in the State. This usually comes about because selesmen offer their goods to the local dealers thinking that the companies they represent have already taken care of the requirements of the law. The local dealers do not at times give sufficient attention to the requirements for written guarantees to protect themselves in this respect, and it therefore sometimes happens that they unintentionally violate the law in this respect. Usually such brands are promptly registered by the manufacturers or shippers upon calling their attention to the oversight. Dealers should always ascertain before purchase whether or not the brands offered for sale are registered in Maine, and a written guaranty should be obtained stating that the feeding stuffs in question conforms in all respects to the requirements of the Maine Feeding Stuffs Law. On the receipt of every new shipment of goods the dealer should take a sample according to directions which are furnished by the Commissioner of Agriculture, and send at once for analysis.

During the past season there have been several occasions to refer the consideration of low grade goods to the Federal Board of Food and Drug Inspection for investigation under the National Law. Whenever a lot of goods which do not come up to the guarantees is found an official sample is obtained if possible together with papers to prove the interstate shipment. The results of the examination and these papers are at once referred to the Board of Food and Drug Inspection, and if the Board deems this important a case is commenced against the shipper. During the last season a number of cases, particularly of low grade cottonseed meal, have thus been referred to the authorities acting under the National Law.

DESCRIPTION OF TABLE.

The first column gives the Station number assigned to each sample. The next column shows the kind of feed, the brand under which it is sold, and the name of the shipper or maker. The three next columns gives the composition as claimed by the maker or shipper and the last column gives the results of the examination. The number of samples examined, how many were in accord with guaranty, how many were not in accord and in what respects, the number of weed seeds found (if samples were examined for weed seeds), and any other information that has a bearing on the lawful sale of the goods, are given for each brand. In the discussion, when a sample is spoken of as "slightly" below (in the case of fiber, above) guaranty, it means that the deviation from guaranty was so small that another sample from the same lot of goods might be found in accord. The significance of a "slight" deviation depends to a considerable extent upon the findings in regard to the other constitutents of the same sample and other samples of the same brand. In the weed seed enumeration, a "few" means from two to eight in a half pint sample; "some" means eight to fifteen; "many" not more than seventy-five; and "very many" means up two per cent of weed seeds. When practicable, the weed seeds found in the samples are given in detail; when the varieties are too numerous for a detailed statement, the quantity found is given.

Table showing the results of examination of Commercial Feeding Stuffs from July 1, 1917 to June 30, 1918.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
	COTTON SEED MEAL.	%	%	%	
7654 7798 7993	American Red Tag. Union Seed & Fertilizer Co., New York.	38.62	11.50	6.00	As claimed.
7784	Avon. J. M. Macdonald, Cincinnati, O.	36.00	14.00	5.00	As claimed.
8056	Battle Brand. W. P. Battle & Co., Memphis, Tenn.	36.00	15.00	5.00	As claimed.
7945	Big League Prime. Eldred Mill Co., Jackson, Mich.	38.62	12.00	6.00	As claimed.
7677 7679 7680 7681 7700 7707 7717 7732 7807 7814 8058	Buckeye Good. The Buckeye Cotton Oil Company, Cincinnati, O.	36.00	14.00	5.00	As claimed.
7881	Byronville Cotton Oil Co., Byronville, Ga.	36.00	—	—	Low in protein.
8055	Continental Cotton Oil Co.	36.00	—	—	As claimed.
7704 7882 8002 7858	East St. Louis Cotton Oil Co., National Stock Yards, Ill.	38.50	12.00	6.00	Two samples seriously below in protein. Two samples as claimed.
7662 7663 7729 7739 7871 7941 8001 8008 8043	Danish Brand. Humphreys-Godwin Co., Memphis, Tenn.	36.00	15.00	5.00	Five samples seriously below in protein. Others barely up to claim.
7696 7760 7992	Dove Brand Prime. F. W. Brode & Co., Memphis, Tenn.	38.63	12.00	6.00	As claimed.
7683 7684 7685 7686 7687 7714	Eagle Brand. C. L. Montgomery & Co., Memphis, Tenn.	38.63	8.00	6.00	As claimed.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	COTTON SEED MEAL—Continued.				
7757 7879 7959 7965 8003 8006	East St. Louis Brand. East St. Louis Cotton Oil Co., National Stock Yards, Ill.	38.50	12.00	6.00	One sample seriously and one sample slightly below in protein. Others as claimed.
7665 7668 7669 7670 7671 7672 7673 7674 7675 7676 7701 7743 7974 8034	Forfat Brand. Humphreys-Godwin Co., Memphis, Tenn.	38.55	12.00	5.00	Ranged from two per cent low to two per cent above in protein. Most of the samples about as claimed.
7763 7912	Gilt Edge Brand. Empire Cotton Oil Co., Atlanta, Ga.	36.00	14.00	5.50	As claimed.
7883 7970 7998 8014 8040 8048	Jay Brand. F. W. Brode & Co., Memphis, Tenn.	36.00	14.00	5.00	One sample seriously below in protein. Others about as claimed.
7664 7667	Kineda Prime. J. M. Macdonald, Cincinnati, O.	38.60	12.00	6.00	Low in protein. High in fiber.
7691 7692 7693 7694 7695 7861 8004 8041 8054 8062	Puritan Brand. J. E. Soper Co., Boston, Mass.	36.00	15.00	5.00	Three samples low in protein. Others about as claimed.
7697 7698 7699 7728 8042	St. Clair Brand. East St. Louis Cotton Oil Co., National Stock Yards, Ill.	36.00	16.00	5.00	About as claimed.
7758 7837	Second Class Cotton Seed Meal. Byronville Cotton Oil Co., Byronville, Ga.	36.00	—	—	Below in protein.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	COTTON SEED MEAL—Concluded.				
7678 7682 7702 7703 7799 7788 7843 7895 7944	Surety Brand. Union Seed & Fertilizer Co., New York.	36.00	14.00	5.50	About as claimed.
7918	Tip Top Prime. Meridan Grain & Elevator Co.	38.62	10.00	6.50	Seriously low in protein and fat. High in fiber.
	COTTON SEED FEEDS.				
7877 8045	Columbia. Union Seed & Fertilizer Co., New York.	20.56	25.00	3.00	About as claimed.
7659 7660	F. W. Brode & Co., Memphis, Tenn.	20.00	22.00	5.00	Seriously low in protein.
7880 7968	F. W. Brode & Co., Memphis, Tenn.	36.00	14.00	5.00	About as claimed.
7811	Fox Brand. F. W. Brode & Co., Memphis, Tenn.	20.00	22.00	5.00	As claimed.
7688 7689 7690 7946	Globe Brand. C. L. Montgomery & Co., Memphis, Tenn.	20.00	27.00	3.50	As claimed.
7791	Holstein Brand. Lanier Bros., Nashville, Tenn.	36.00	14.00	5.00	As claimed.
7852 7940 7999 8000 8007 8015 8016 8017 8018	Jay Brand. F. W. Brode & Co., Memphis, Tenn.	36.00	14.00	5.00	Two samples seriously low in protein. Others as claimed.
7929	M. F. B. M. F. Baringer.	20.00	26.00	3.00	About as claimed.
7897	77 Cotton Seed Feed. Humphreys-Godwin Co., Memphis, Tenn.	20.00	28.00	4.00	About as claimed.
	LINSEED MEALS.				
7903	Amco Old Process Linseed Meal. American Milling Co., Peoria, Ill.	30.00	10.00	5.00	About as claimed.
7824 8050	"Hypro" Pure Old Process. American Linseed Co., New York.	34.00	8.00	5.00	As claimed.
7749 7979	Old Process Ground Linseed Cake. Midland Linseed Products Co., Minneapolis, Minnesota.	32.00	9.50	5.00	As claimed.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	LINSEED MEALS—Concluded.				
7848	Old Process Ground Oil Cake. Archer-Daniels Linseed Co., Buffalo, New York.	33.00	10.00	6.00	As claimed.
7966	Old Process Oil Meal. American Linseed Co., Peoria, Illinois.	34.00	8.00	5.00	As claimed.
7915	Pure Old Process Oil Meal. Spencer, Kellogg & Sons, Inc., Buffalo New York.	33.00	10.00	5.00	As claimed.
	STARCH FACTORY BY-PRODUCTS.				
7759 7949	Buffalo Corn Gluten Feed. Corn Products Refining Co., New York.	23.00	8.50	1.00	As claimed.
7984	Clinton Gluten Feed. Clinton Sugar Refining Co., Clinton, Iowa.	20.00	8.00	3.00	As claimed.
7866	Cream of Corn Gluten Feed. American Maize Products Co., New York.	23.00	8.00	1.50	As claimed.
7864	Diamond Corn Gluten Meal. Corn Products Refining Co., New York.	40.00	4.00	1.00	As claimed.
7914	Douglas Corn Gluten Feed. Douglas Co., Cedar Rapids, Iowa.	23.00	8.00	1.00	As claimed.
7860	Jenks Corn Gluten Feed. Huron Milling Co., Harbor Beach, Mich.	22.00	8.00	3.00	As claimed.
7956	KKK Corn Gluten Feed. J. C. Hubinger Bros. Co., Keokuk, Iowa.	23.00	7.50	2.40	Slightly low in protein.
7708	Keever Corn Gluten Feed. The Keever Starch Co.	20.00	8.00	3.00	As claimed.
7718	Staley's Corn Gluten Feed. A. E. Staley Mfg., Decatur, Ill.	23.00	12.00	2.50	As claimed.
	BREWERS' GRAINS & DISTILLERS' GRAINS.				
7862	Atlas Distillers' Grains. Atlas Feed & Milling Co., Peoria, Ill.	30.00	14.00	10.00	As claimed.
7723 7773	Brewers' Dried Grains. Western Grains & Feed Co., Chicago, Ill.	25.00	16.00	5.00	Dealer's sample low in protein. Official sample in accord with claim.
7711 7724 7849	Columbia Corn Distillers' Grains. Grain Products Sales Co., Buffalo, New York.	30.00	14.00	10.00	One sample low in protein. Others as claimed.
7741 7964	Empire State Dairy Feed. American Milling Co., Peoria, Illinois.	30.00	14.00	10.00	As claimed.
7831	Hector Distillers Dried Grains. The Hottelet Co., Milwaukee, Wis.	30.00	14.00	10.00	As claimed.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	DRIED BEET PULP.				
7890	Dried Beet Pulp.	8.00	20.00	0.50	As claimed.
	BRAN, MIDDLINGS, MIXED FEED, RED DOG FLOUR.				
7898	Anchor Pure Bran. Kemper Mill & Elevator Co., Kansas City, Mo.	14.50	10.00	4.00	As claimed. No weed seeds.
7911	Big Diamond Wheat Bran with ground screenings not exceeding mill run. Big Diamond Mills Co.	14.00	11.07	4.00	As claimed.
7917	Blackhawk Bran with ground screenings not exceeding mill run. Western Flour Mills Co., Davenport, Iowa.	13.30	11.25	3.00	As claimed.
7839	Bran. Russell-Miller Milling Co., Minneapolis, Minn.	13.00	11.00	4.00	Analysis as claimed. Contained ground screenings.
8012	Bran. F. W. Stock & Sons, Hillsdale, Mich.	14.00	10.00	3.00	As claimed.
7924	Bran with ground screenings not exceeding mill run. Central Minn. Power & Milling Co.	14.60	12.30	2.70	As claimed.
7793	Buckeye Feed. Quaker Oats Co., Chicago, Illinois.	15.50	8.50	4.50	Analysis as claimed. Some weed seeds.
7842	Choice Wheat Bran. Niagara Falls Milling Co.	12.00	13.00	3.00	Analysis as claimed. Contained some ground screenings.
7790	Choice Wheat Bran with trace of screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y.	13.75	12.50	3.00	As claimed.
7771	Choice Michigan Bran. Christian Breisch & Co., Lansing, Mich.	—	—	—	Contained some corn cockle. Analysis of average bran.
7821	Commander Bran. Commander Mill Co., Minneapolis, Minn.	14.00	11.00	4.00	Analysis as claimed. Contained some ground screenings.
7909	Cr. Wheat Bran with ground screenings not exceeding mill run. Cannon Valley Milling Co.	15.00	14.60	4.00	As claimed.
8053	Durum Wheat Bran with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn.	11.00	14.00	4.00	As claimed.
7719	Eldred Pure Bran. Eldred Mill Co., Jackson, Michigan.	14.21	10.33	3.66	Analysis as claimed. Contained some corn cockle hulls.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	BRAN, MIDDLINGS, MIXED FEED, RED DOG FLOUR—Continued.				
7923	Elmco Bran. Listman Mill Co., La Crosse, Wis.	14.87	12.27	3.31	Analysis as claimed. Contained some corn cockle hulls.
7870	Fancy Coarse Wheat Bran. La Grange Mills, Red Wing, Minn.	13.50	13.70	4.00	Analysis as claimed. Contained some corn cockle and wild buckwheat hulls.
7731	Gwinn's Wheat Bran with ground screenings not exceeding mill run. Gwinn Milling Co., Columbus, O.	15.00	10.00	4.00	As claimed.
7827	Komo Pure Wheat Bran. St. Paul Milling Co.	14.00	12.00	4.00	Analysis as claimed. Contained some corn cockle and wild buckwheat hulls.
7847	Nokomos Durum Wheat Bran. Yerxa, Andrews & Thurston, Inc., Minneapolis, Minn.	12.00	13.00	5.50	Analysis as claimed. Contained many corn cockle and wild buckwheat hulls.
7769	Pure Bran. Eldred Mill Co., Jackson, Michigan.	14.21	10.93	3.65	Analysis as claimed. Contained a few corn cockle hulls.
7794	Pure Wheat Bran. Highland Milling Co., Highland, Ill.	14.30	10.00	3.55	As claimed. No weed seeds.
7948	Pure Wheat Bran. Maple Leaf Milling Co., Toronto, Canada.	15.50	12.00	4.50	Practically as claimed except a few corn cockle hulls.
7800	Pure Wheat Bran Flakes. Barber Milling Co., Minneapolis, Minn.	13.00	10.00	4.00	Analysis as claimed. Contained a few corn cockle and wild buckwheat hulls.
7822	Pure Wheat Bran and Screenings. Liberty Mills, Nashville, Tenn.	14.50	9.50	4.00	As claimed.
7960	Pure Wheat Bran and Screenings, Mixed 2%. The Williamson Milling Co.	15.50	12.00	3.50	As claimed.
7779	Pure Winter Wheat Bran. David Stott Flour Mills, Inc., Detroit, Mich.	14.00	10.00	4.00	Analysis as claimed. Contained corn cockle and wild buckwheat hulls.
7774	Seal of Minnesota Bran. New Prague Flouring Mill Co., New Prague Minn.	13.30	11.25	3.00	Analysis as claimed. Contained some corn cockle and wild buckwheat hulls.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	BRAN, MIDDLINGS, MIXED FEED, RED DOG FLOUR—Continued.				
7994	Soft Winter Wheat Bran. Ellis Grove Milling Co.	—	—	—	Analysis as an average wheat bran.
7844	Spring Wheat Bran. Western Canada Flour Mills Co.	14.00	11.00	4.00	Analysis as claimed. Contained some wild buckwheat hulls.
7906	Spring Wheat Bran and Screenings. David Stott Flour Mills, Inc., Detroit, Mich.	13.50	11.50	4.00	As claimed.
7916	Triangle Bran. The Mansfield Milling Co., Inc., Mansfield, Ohio.	14.00	10.00	4.00	Analysis as claimed. Contained ground screenings.
7926	Trojan Bran. The Allen & Wheeler Co., Troy, Ohio.	14.50	9.50	4.00	Analysis as claimed. Contained some corn cockle hulls.
7981	Victor Spring Wheat Bran with ground screenings not exceeding mill run. Victor Milling Co., Victor, New York.	14.00	15.00	4.00	As claimed.
7936	Voigt's Crescent Bran with ground screenings not exceeding mill run. Voigt Milling Co., Grand Rapids Mich.	14.00	11.00	4.00	As claimed.
7720	Wheat Bran. Canby Roller Mills.	14.30	14.60	4.50	Analysis as claimed. Contained some wild buckwheat hulls.
7725 7786	Wheat Bran. The Commercial Milling Co., Detroit, Michigan.	14.50	12.00	3.50	Analysis as claimed. Contained a few corn cockle and wild buckwheat hulls.
7899	Wheat Bran. Maple Leaf Milling Co., Toronto, Canada.	15.50	12.00	4.50	Analysis as claimed. Contained many wild buckwheat hulls.
8052	Wheat Bran & Screenings. Colburn Bros. Co.	14.50	10.00	3.50	As claimed.
7710	Wheat Bran with ground screenings not exceeding mill run. William G. Crocker, Minneapolis, Minn.	13.00	13.00	4.00	As claimed.
7806	Wheat Bran with ground screenings not exceeding mill run. Empire Milling Co., Minneapolis, Minn.	14.00	11.00	4.00	As claimed.
7888	Wheat Bran with ground screenings not exceeding mill run. Hunter-Robinson Milling Co.	15.50	11.00	4.00	As claimed.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
	BRAN, MIDDLINGS, MIXED FEED, RED DOG FLOUR—Continued.	%	%	%	
7751	Wheat Bran with ground screenings not exceeding mill run. The Ogilvie Flour Mills Co.	13.00	15.00	4.00	As claimed.
7875	Wheat Bran with ground screenings not exceeding mill run. Peninsular Milling Co.	14.00	11.00	3.50	As claimed.
7789	Wheat Bran with ground screenings not exceeding mill run. Pillsbury Flour Mills, Minneapolis, Minn.	13.00	13.00	4.00	As claimed.
7876	Wheat Bran with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn.	13.00	13.00	4.00	As claimed.
7910	Wheat Bran with ground screenings not exceeding mill run. Wisconsin Milling Co.	14.50	11.00	4.00	As claimed.
7835	Winter Wheat Bran. Quaker City Flour Mills Co., Philadelphia, Pa.	13.00	10.00	3.00	Analysis as claimed. Contained some corn cockle hulls.
7938	Acme Middlings. Acme-Evans Co., Indianapolis, Ind.	16.50	8.00	4.00	Analysis as claimed. Contained a few wild buckwheat hulls.
7767	"A" Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn.	15.00	8.00	4.00	As claimed.
7755	Dairy Maid Winter Wheat. (Mixed feed with ground screenings not exceeding mill run). Federal Milling Co., Lockport, N. Y.	13.50	11.00	2.25	As claimed.
7778	Dairy Maid Winter Wheat Middlings with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y.	13.50	8.50	2.50	As claimed.
7896	Durum Wheat Bran Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn.	12.50	11.00	4.00	As claimed.
7921	Elmco Fancy White Middlings. Listman Mill Co., La Crosse, Wis.	17.23	6.03	4.80	As claimed.
7922	Elmco Middlings. Listman Mill Co., La Crosse, Wis.	17.70	9.59	5.11	As claimed.
7787 7976	Fancy Canadian Middlings with ground screenings not exceeding mill run. Maple Leaf Milling Co., Toronto, Canada.	16.00	10.00	5.50	As claimed.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	BRAN, MIDDLINGS, MIXED FEED, RED DOG FLOUR—Continued.				
7952	Middlings. F. W. Stock & Sons, Hillsdale, Mich.	16.50	6.00	4.00	Slightly low in protein.
7753	Middlings with ground screenings not exceeding mill run. The Ansted & Burke Co., Springfield, O.	15.00	5.50	5.00	As claimed.
7957	Middlings with ground screenings not exceeding mill run. The Ogilvie Flour Mills Co.	15.00	11.00	4.00	As claimed.
7905	Pennant Middlings with ground screenings not exceeding mill run David Stott Flour Mills, Inc., Detroit, Mich.	15.00	7.00	4.50	As claimed.
7801	Pillsbury's Bran Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minnesota.	14.00	11.00	4.00	As claimed.
7768	Pure Middlings. Eldred Mill Co. Jackson, Michigan.	16.93	6.74	6.20	As claimed.
8026	Snowball Flour Middlings with ground screenings not exceeding mill run. Shane Bros. & Wilson Co., Minneapolis, Minn.	17.40	8.40	5.90	As claimed.
7782	Standard Middlings with ground screenings not exceeding mill run. The Cleveland Milling Co., Cleveland, O.	13.00	9.00	4.00	As claimed.
8046	Standard Middlings with ground screenings not exceeding mill run. Hecker-Jones-Jewell Milling Co. Buffalo, N. Y.	16.00	10.00	4.75	As claimed.
7854	Standard Middlings with ground screenings not exceeding mill run Duluth-Superior Milling Co., Duluth, Minn.	16.50	8.10	4.70	As claimed.
7971	Trojan Middlings. The Allen & Wheeler Co., Troy, O.	15.00	6.00	4.00	As claimed.
7835	Wheat Middlings with ground screenings not exceeding mill run Barber Milling Co., Minneapolis, Minn.	14.50	11.00	4.75	As claimed.
7730	Wheat Middlings with ground screenings not exceeding mill run. The Gwinn Milling Co., Columbus O.	13.00	9.50	4.00	As claimed.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	BRAN, MIDDLINGS, MIXED FEED, RED DOG FLOUR—Continued.				
7980	Wheat Middlings with ground screenings not exceeding mill run. The Highland Milling Co., Highland, Ill.	15.00	6.00	4.00	As claimed.
7933	Wheat Middlings with ground screenings not exceeding mill run. Madelia Roller Mills, Madelia Minn.	14.25	5.35	3.00	As claimed.
7785	Wheat Standard Middlings with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn.	14.00	11.00	4.00	As claimed.
7943	Wirthmore Middlings. Chas. M. Cox Co., Boston, Mass.	14.50	7.00	4.00	As claimed.
7850	Acme Feed. Acme-Evans Co., Indianapolis, Indiana.	16.00	9.00	4.00	Analysis as claimed. Contained few chess seeds and corn cockle hulls.
7887 7986	Boston Mixed Feed. Duluth-Superior Milling Co., Duluth, Minn.	16.00	9.75	4.50	Analysis as claimed. Contained a few corn cockle and wild buckwheat hulls.
7813	Champion Mixed Feed with ground screenings not exceeding mill run. Portland Milling Co., Portland, Mich.	13.56	8.47	3.58	As claimed.
7772	Eldred Pure Mill Feed. Eldred Mill Co., Jackson, Mich.	14.87	9.63	4.05	Analysis as claimed. Contained a few corn cockle and wild buckwheat hulls.
7908	Franklin Mixed Feed. St. Albans Grain Co.	15.00	9.50	4.50	Analysis as claimed. Contained ground screenings.
7797	Improved Grafton Wheat Feed. Grafton Roller Mill Co., Grafton N. Dakota.	14.00	8.40	2.70	Analysis as claimed. Contained ground screenings.
7972	Jenks Mixed Feed with ground screenings not exceeding mill run. The Huron Milling Co., Harbor Beach, Mich.	12.18	5.85	4.60	As claimed.
7766	Kent Mixed Feed. The Williams Bros. Co., Kent, Ohio.	15.00	8.00	5.00	Low in fat. Contained a few corn cockle hulls.
7756	Lucky Spring Wheat Mixed Feed with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y.	14.00	11.00	3.00	As claimed.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	BRAN, MIDDLINGS MIXED FEED, RED DOG FLOUR—Continued.				
7931	Mixed Feed. Waggoner-Gates Milling Co., Independence, Mo.	15.50	10.00	4.00	Analysis as claimed Contained a few corn cockle hulls.
7770	Mixed Feed with ground screenings not exceeding mill run. Christian Breisch & Co., Lansing, Mich.	14.61	7.06	3.63	As claimed.
7950	Mixed Feed with ground screenings not exceeding mill run. Webster Mill Co.	15.30	10.40	4.80	As claimed.
7958	Mixed Feed, Wheat Bran and Middlings run together. Highland Milling Co., Highland, Ill.	15.00	9.00	4.00	Analysis as claimed. Contained a few chess seeds.
7989	Monarch Fancy Wheat Feed with ground screenings not exceeding mill run. F. W. Stock & Sons Hillsdale, Mich.	16.00	10.00	4.00	As claimed.
7796 7891	National Feed Wheat Bran & Middlings with ground screenings not exceeding mill run. National Milling Co., Toledo, Ohio.	15.00	10.00	3.75	As claimed.
7747	N. M. Co.'s Mixed Feed. Noblesville Milling Co., Noblesville, Indiana.	16.00	9.00	4.00	Analysis practically as claimed. Contained a few corn cockle and wild buckwheat hulls.
7780 7975	Occident Wheat Feed. Russel-Miller Milling Co., Minneapolis, Minn.	15.00	10.00	4.50	Analysis as claimed. Contained a few corn cockle and wild buckwheat hulls.
7715	Peerless Mixed Feed with ground screenings not exceeding mill run. Fuller-Holway Co., Augusta, Me	14.00	7.90	4.00	As claimed.
7973	Pyramid Mixed Feed with ground screenings not exceeding mill run. Kimball Bros. Co., Bath, Maine	13.56	8.47	3.58	As claimed.
7995	St. Paul Queen Mixed Feed. Capitol City Milling & Grain Co.	15.00	9.50	4.00	As claimed.
7752 7983	Snowflake Mixed Feed. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind.	15.20	8.00	4.30	Analysis about as claimed. Contained a few corn cockle and wild buckwheat hulls.
7927	Trojan Mixed Feed. The Allen & Wheeler Co., Troy, O.	14.50	8.00	4.00	Analysis as claimed. Contained a few corn cockle hulls.
7855	Try Me Mixed Feed with ground screenings not exceeding mill run. Sparks Milling Co., Alton, Ill.	16.00	9.00	3.60	As claimed.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	BRAN, MIDDLINGS, MIXED FEED. RED DOG FLOUR—Concluded.				
7776	Wheat Bran and Middlings run together with ground screenings not exceeding mill run. The Highland Milling Co., Highland, Ill.	15.00	9.00	4.00	As claimed.
7775	Wheat Mixed Feed with ground screenings not exceeding mill run Geo. Urban Milling Co., Buffalo, N. Y.	15.00	12.00	4.00	As claimed.
7737	Wirthmore Wheat Feed. Chas. M. Cox Co., Boston, Mass.	15.00	7.00	4.50	Analysis as claimed. Contained ground screenings.
7804	White Satin Mixed Feed. Barber Milling Co., Minneapolis, Minn.	15.00	9.00	4.50	Analysis as claimed. Contained a few corn cockle hulls.
7764	XX Daisy. Pillsbury Flour Mil's Co., Minneapolis, Minn.	16.00	4.00	4.00	As claimed.
7872	Adrian Red Dog Flour. Wa hburn-Crosby Co., Minneapolis, Minn.	16.00	4.00	4.00	As claimed.
7721	Elmco Red Dog Flour. Listman Mill Co., La Crosse, Wis.	16.70	1.90	4.00	Low in protein and fat.
7742	Mayflower Red Dog. Mayflower Mills, Ft. Wayne, Ind.	10.00	5.00	2.00	As claimed.
7884	Red Dog Feed. St. Albans Grain Co.	15.00	7.00	4.00	As claimed.
7982	Red Dog. Baldwin Flour Mills.	16.00	4.00	5.00	Slightly low in protein and fat.
7808	XXX Comet. Northwe-tern Consolidated Co., Minneapolis, Minn.	16.00	4.00	5.00	As claimed.
	ADULTERATED WHEAT FEEDS.				
7820	Blue Grass Valley Feed. A. Waller & Co., Inc., Henderson, Ky.	9.00	17.00	2.00	As claimed.
	CORN AND OATS GROUND TOGETHER.				
7909	Corn & Oat Chop. E. A. Clark Portland, Maine.	—	—	—	Unguaranteed. A low grade corn and oat chop.
7830	Corn & Oat Chop. J. B. Ham Co. Lewiston, Maine.	10.00	5.00	4.00	As claimed.
7812	Corn & Oat Chop. Merrill & Mayo Company, Waterville, Maine.	10.00	6.00	5.00	As claimed.
7803	Corn & Oat Feed. Eastern Grain Co., Pittsfield, Maine.	11.00	6.00	5.00	As claimed.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	CORN AND OATS GROUND TOGETHER—Concluded.				
7736	Corn & Oats. Yeatons Mills, South Berwick, Me.	10.50	5.50	5.00	As claimed.
7761	Corn & Oats Ground. F. H. Brastow & Son, South Brewer, Maine.	—	—	—	Corn and oats of about average composition.
7745	Corn & Oats Ground. Dinsmore Grain Co., Branch Mills Palermo, Maine.	—	—	—	Corn and oats of about average composition.
7712	Farmers Union C. & O. Feed. Farmers Union Grain and Supply Co., Waterville.	10.00	6.00	4.00	As claimed.
	FEEDS UTILIZING CORN AND OAT BY-PRODUCTS.				
7825	Acme Stock Feed. Acme-Evans Co., Indianapolis, Ind.	9.00	9.00	4.00	Slightly low in fat.
7893	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	11.00	9.00	4.00	As claimed.
7892	Bufceco Steam Cooked Feed. Buffalo Cereal Co., Buffalo, N. Y.	10.00	8.00	4.00	As claimed.
7885	Bufceco Stock Feed. Buffalo Cereal Co., Buffalo, New York.	10.00	10.00	5.00	As claimed.
8032	Camps Surprise Chop Feed. The Toledo Grain & Milling Co.	9.00	9.00	4.00	As claimed.
8025	Crosbys Special Stock Food. E. Crosby & Co., Brattleboro, Vt.	10.00	12.75	4.00	As claimed.
7809 7865	Daily Dividend Stock Feed. Merrill & Mayo Co., Waterville, Me.	10.00	12.75	4.00	As claimed.
8022	Farmers Union Stock Feed. Farmers Union Grain & Supply Co., Waterville, Maine.	10.00	12.00	4.00	As claimed.
7783	Haskells Stock Feed. W. H. Haskell & Co., Toledo, O.	9.00	9.00	6.00	As claimed.
7955	Iowa Stock Feed. Purity Oats Co., Davenport, Iowa.	10.00	12.75	4.00	Slightly low in protein. High in fiber.
7735	Monmouth Corn & Oats Feed. E. M. Marks, Monmouth, Maine.	7.00	10.00	3.00	As claimed.
8039	Nu-Life Stock Feed. Fred L. Creassey, Boston, Mass.	8.00	8.00	3.00	As claimed.
7733	Oat Feed. Robin Hood Mills, Ltd., Moose Jaw, Sask.	5.25	28.00	2.50	As claimed.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	FEEDS UTILIZING CORN AND OAT BY-PRODUCTS—Concluded.				
7889 8010	Portage Stock Feed. The Akron Feed & Milling Co., Akron, O.	8.50	10.00	4.00	As claimed.
7744 8044	Schumacher Feed. The Quaker Oats Co., Chicago, Illinois.	10.00	10.00	3.25	As claimed.
7765	Stock Feed. Park & Pollard Co., Boston, Mass.	9.00	12.00	1.50	As claimed.
7655 7656 7657 7658 7874 7953	Syragold Stock Feed. Syracuse Milling Co., Syracuse, N. Y.	10.00	13.00	3.00	Four samples below in protein. Two samples practically up in protein.
7961	White Diamond Feed. The Quaker Oats Co., Chicago, Illinois.	8.00	8.00	3.35	As claimed.
7738	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass.	9.00	9.50	4.00	As claimed.
	HOMINY FEEDS AND CORN FEED MEAL.				
8020	Coarse Feeding Corn Meal. David Stott Flour Mills, Inc., Detroit Mich.	8.00	3.00	5.00	As claimed.
7990	Corn Feed Meal. Empire Mills.	8.80	3.00	3.80	As claimed.
7781	Badger Hominy Feed. Chas. A. Krause Milling Co., Milwaukee, Wisconsin.	10.00	5.00	6.00	As claimed.
7834	"Blue Ribbon" Hominy Chop. J. E. Soper Co., Boston, Mass.	10.00	5.00	6.00	As claimed.
8036	Bufceco Hominy Feed. Buffalo Cereal Co., Buffalo, N. Y.	10.00	4.00	6.00	As claimed.
7954 8047	Homco Hominy Feed. American Hominy Co., Indianapolis, Ind.	10.00	7.00	6.00	Slightly low in protein.
7939	Homcoline Feed. American Hominy Co., Indianapolis, Ind.	17.00	7.00	5.00	As claimed.
7859	Hominy Feed. The Patent Cereals Co., Geneva, N. Y.	10.00	5.00	6.00	As claimed.
8023	Logan Hominy Feed. The Standard Cereal Co., Chillicothe, O.	9.00	6.00	7.00	As claimed.
8049	Paragon Hominy Meal. Chas. M. Cox Co., Boston, Mass.	9.50	7.00	7.50	As claimed.
8019	Peerless Hominy Feed. Akron Milling Co., Sioux Falls, Iowa.	11.00	4.00	7.00	As claimed.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	HOMINY FEEDS AND CORN FEED MEAL—Concluded.				
7754	Pure Hominy Feed. National Feed Co., St. Louis, Mo.	10.50	10.00	8.50	As claimed.
8030	Snowflake Brand Hominy. Oscar Holway Co., Auburn, Maine.	9.75	7.00	7.00	As claimed.
7919	Spring Garden Hominy Feed. Baltimore Pearl Hominy Co., Baltimore, Maryland.	10.00	6.00	6.00	As claimed.
8033	Wades Corn Feed Meal. John Wade & Sons, Memphis, Tenn.	—	—	—	A fair quality corn feed meal.
8031	Yellow Corn Mill Feed. Russell-Miller Milling Co., Minneapolis, Minn.	10.00	12.00	10.00	As claimed.
7795	Yellow Hominy Feed. The Quaker Oats Co., Chicago, Illinois.	9.00	4.00	4.00	As claimed.
	MOLASSES FEEDS.				
8028	Clover Leaf Mill Dairy Feed. Clover Leaf Milling Company, Buffalo, New York.	13.50	15.00	3.50	As claimed.
8029	Clover Leaf Dairy Ration. Clover Leaf Milling Company, Buffalo, New York.	16.00	15.00	3.50	Low in protein. High in fiber.
7907	Iroquois Dairy Feed. Buffalo Cereal Co., Buffalo, New York.	17.00	10.00	4.00	Slightly too high in fiber. Few weed seeds.
7716	O Molene Feed. Ralston Purina Co., Buffalo, N. Y. & St. Louis, Mo.	9.70	8.00	3.20	Analysis as claimed. Contains few weed seeds.
7963	Quaker Dairy Feed with Molasses. Quaker Oats Co., Chicago, Ill.	16.00	16.00	5.50	Low in protein.
7947	Special Dairy Feed. International Sugar Feed Co., Minneapolis, Minn.	15.00	14.00	4.50	Slightly low in protein and high in fiber. Contains some weed seeds.
7930	Tioga Dairy Feed. Tioga Mill & Elevator Co., Waverly, N. Y.	17.00	12.00	4.00	As claimed.
	MISCELLANEOUS COMPOUNDED FEEDS.				
7740 7977	Big Q Dairy Ration. The Quaker Oats Co., Chicago, Illinois.	21.00	10.50	6.00	As claimed.
7828	Blatchfords Calf Meal. Blatchfords Calf Meal Factory, Waukegan, Ill.	24.00	6.75	5.00	As claimed.
8027	Clover Leaf Calf Meal. Clover Leaf Milling Co., Buffalo, N. Y.	25.00	7.00	5.00	As claimed.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	MISCELLANEOUS COMPOUNDED FEEDS—Concluded.				
8037	"Criterion" Barley Feed. Sheffield-King Milling Co., Minneapolis, Minn.	8.00	22.00	3.00	As claimed.
7799	Crosbys Ready Ration. E. Crosby Co., Brattleboro, Vermont.	25.00	9.00	7.00	Protein and fat as claimed. Fiber much in excess. Contains few weed seeds.
7857 7991	Farmers Union Ready Ration. Farmers Union Grain & Supply Co., Waterville, Maine.	25.00	10.00	6.00	As claimed.
7726	G. M. Dairy Ration. Gray Milling Co., East Gray, Maine.	25.00	12.00	5.00	As claimed.
7792	Grunn Dairy Feed. The Grunn Milling Co.	15.00	9.00	4.00	As claimed.
7748	Larro Feed. The Larrowe Milling Co., Detroit, Mich.	20.00	14.00	3.00	As claimed.
7713	Lucky Strike Stock Feed. Illinois Feed Mills, St. Louis, Missouri.	12.00	20.00	3.00	As claimed.
7920	Orono Dairy Feed. J. B. Ham Co., Brunswick, Maine.	22.00	10.00	5.00	As claimed.
7810 7985	Red Horn Dairy Feed. Hales & Edwards Co., Chicago, Illinois.	25.00	15.00	4.00	Analysis as claimed. Contains few weed seeds.
7759	Rydes Calf Meal. Rydes & Co., Chicago, Ill.	25.00	6.00	5.00	As claimed.
7777 7833	Stevens 44 Dairy Ration. Park & Pollard Co., Boston, Mass.	24.00	14.00	5.00	Analysis as claimed. Contains few weed seeds.
8021	Syragold Milk Ration. Syracuse Milling Co., Syracuse, N. Y.	20.00	15.00	4.50	Protein and fat as claimed. Fiber too high.
7816	Towle's Balanced Ration. J. N. Towle & Co., Bangor, Maine.	22.13	9.13	5.72	As claimed.
7817	Towle's Pig Feed. J. N. Towle & Co., Bangor, Maine.	18.00	7.22	6.00	Analysis about as claimed. Contains few weed seeds.
7913 7987	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind.	26.00	11.00	5.50	Analysis as claimed. Contains few weed seeds.
7746	Union Grains. The Ubiko Milling Co., Cincinnati, Ohio.	24.00	10.00	7.00	As claimed.
7942	Wirthmore Balanced Ration. Chas. M. Cox Co., Boston, Mass.	25.00	9.50	5.00	Protein and fat as claimed. Fiber too high. Contains some weed seeds.

Feeding Stuffs—Continued.

Station number.	BRAND. MAKER.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	COMPOUNDED POULTRY FEEDS.				
8038	Baby Buster Chick Feed. Park & Pollard Co., Boston, Mass.	11.00	5.00	2.00	As claimed.
7996	"B. G." Dry Mash. Bath Grain Co., Bath, Maine.	18.00	12.00	4.00	As claimed.
7838	Blatchford's Calf Meal. Blatchford's Milk Mash Factory, Waukegan, Ill.	17.50	10.00	4.00	As claimed.
7836	Chic Chic Concentrated Poultry Feed. Russia Cement Co.	50.00	1.00	2.00	Practically as claimed.
7967	Dirigo Dry Egg Mash. Oscar Holway Co., Auburn, Maine.	17.50	10.00	4.00	Analysis as claimed. Contains some weed seeds.
7841	Dirigo Little Chick Feed. Oscar Holway Co., Auburn, Maine.	10.00	5.00	2.50	Analysis as claimed. Contains many weed seeds.
7840	Dirigo Scratch Grains. Oscar Holway Co., Auburn, Maine.	10.00	5.00	2.50	Analysis as claimed. Contains many weed seeds.
7815	Dry Feed. J. N. Towle & Co. Bangor, Maine.	20.00	—	10.00	Composition bears little relation to claims. Overruns in protein, under in fat. Carries about 7 per cent fiber. Contains a few weed seeds.
7829	Dry Mash. J. B. Ham Co. Lewiston, Me.	15.00	12.00	3.50	Analysis as claimed. Contains a few weed seeds.
7868	Elm City Laying Mash. Merrill & Mayo Co., Waterville, Maine.	17.50	10.00	4.00	As claimed.
7867	Elm City Scratch Feed. Merrill & Mayo Co., Waterville, Maine.	10.00	5.00	2.50	Analysis as claimed. Contains many weed seeds.
7856	Elmore Egg Mash. Elmore Milling Co., Oneonta, New York.	23.00	8.00	4.00	As claimed.
7852	Farmers Union Scratch Feed. Farmers Union Grain & Supply Co., Waterville, Maine.	10.00	5.00	3.50	As claimed.
7869	"Fill the Basket" Egg Mash. Blatchfords Calf Meal Factory, Waukegan, Ill.	19.00	10.00	4.00	Analysis as claimed. Contains few weed seeds.
7727	G. M. Dry Mash. Gray Milling Co., East Gray, Me.	20.00	12.00	5.00	Analysis as claimed. Contains few weed seeds.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	COMPOUNDED POULTRY FEEDS—Continued.				
8009	Growing Feed. Park & Pollard Co., Boston, Mass.	10.00	8.00	1.50	As claimed.
7823	H. H. Dry Feed. E. P. Ham, Lewiston, Maine.	15.00	11.00	4.00	As claimed.
7851	Herwish Scratch Feed. Elmore Milling Co., Oneonta, New York.	10.00	5.00	3.50	Analysis as claimed. Contains many weed seeds.
7846	Humpty Dumpty Scratch Feed. The Ansted & Burk Co., Springfield, O.	11.00	4.00	3.00	Analysis as claimed. Contains many weed seeds.
7832	Intermediate Chick Feed. Park & Pollard Co., Boston, Mass.	10.00	5.00	1.50	Analysis as claimed. Contains some weed seeds.
7873	Iowa Scratch Feed. Purity Oats Co., Davenport, Iowa.	10.00	5.00	3.25	Analysis as claimed. Contains many weed seeds.
8035	Iroquois Scratching Grains, Buffalo Cereal Co., Buffalo, N. Y.	10.00	5.00	3.00	As claimed.
7802	Lay or Bust Dry Mash. Park & Pollard Co., Boston, Mass.	18.00	12.00	1.50	As claimed.
7894	Mash Feed. J. G. Lappin & Co., Portland, Maine.	—	—	—	An average feed with few weed seeds.
7762	Monarch Poultry Mash. F. H. Brastow & Son, S. Brewer, Me.	20.00	7.00	5.50	Protein and fat as claimed. Too high in fiber.
7734	Monmouth Dry Mash. E. M. Marks, Monmouth, Me.	18.00	8.00	5.00	Protein and fat as claimed but contains excessive fiber.
7902	Peerless Growing Feed. E. A. Clark & Co., Portland, Maine.	14.00	5.00	4.00	As claimed.
7901	Peerless Poultry Mash. E. A. Clark & Co., Portland, Maine.	20.00	10.00	3.00	Protein and fat as claimed. Fiber excessive. Contains few weed seeds.
7988	Purina Scratch Feed. Ralston Purina Co., Buffalo, N. Y. & St. Louis, Mo.	10.00	4.00	2.50	Analysis as claimed. Contains many weed seeds.
7962	Quaker Poultry Mash. Quaker Oats Co., Chicago, Ill.	17.50	10.00	4.00	As claimed.
7878	Queen Poultry Mash. The Albert Dickinson Co., Chicago, Illinois.	11.00	10.00	2.50	As claimed.

Feeding Stuffs—Continued.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
		%	%	%	
	COMPOUNDED POULTRY FEEDS—Concluded.				
8051	Red Ribbon Scratch Feed. Park & Pollard Co., Boston, Mass.	10.00	5.00	1.50	As claimed.
7932	Schumacher Poultry Mash. Quaker Oats Co., Chicago, Ill.	17.50	10.00	4.00	As claimed.
8011	Schumacher Scratch Grains. Quaker Oats Co., Chicago, Ill.	10.00	5.00	2.50	As claimed.
7886	The Scratch Feed for Poultry. S. W. Thaxter & Co., Portland, Me.	10.00	5.00	2.50	Analysis as claimed. Contains some weed seeds.
7951	Screened Scratch Feed. Park & Pollard Co., Boston, Mass.	10.00	5.00	1.50	Analysis as claimed. Contains very many weed seeds.
7925	Tom Boy Poultry Mash. Purity Oats Co., Davenport, Iowa.	15.00	10.00	4.00	As claimed.
7937	Wirthmore Gritless Chick Feed. Chas. M. Cox Co., Boston, Mass.	11.00	3.50	3.00	Analysis as claimed. Contains few weed seeds.
7928	Wirthmore Growing Feed with Scraps. Chas. M. Cox Co., Boston, Mass.	15.00	4.50	4.50	Below in protein and fat. Too high in fiber. Contains few weed seeds.
	ALFALFA MEALS.				
7863	Alfalfa. Park & Pollard Co., Boston, Mass.	12.00	30.00	1.00	As claimed.
7978	Alfalfa Meal. The Albert Dickinson Co., Chicago, Ill.	12.00	35.00	1.00	As claimed.
7935	Red Star Brand Alfalfa Meal. Somers & Co., San Francisco, Cal.	16.60	29.50	1.40	As claimed.
	DRIED MEAT AND FISH WASTES.				
7836	Chic-Chuick Concentrated Poultry Feed. Russia Cement Co., Gloucester, Mass.	50.00	1.00	2.00	About as claimed.
7819	Dow's Favorite Poultry Meal. John C. Dow & Co., Boston, Mass.	30.00	—	12.00	As claimed.
7904	Greene's Old-Fashioned Meat Scraps for Poultry. Greene Chick Feed Co., Marblehead, Mass.	35.00	—	5.00	Very low in protein.
7818	Ground Beef Scraps. John C. Dow Co., Boston, Mass.	43.00	—	12.00	As claimed.
7934	Lords Egg Maker for Poultry. Lord Bros. Co., Portland, Me.	45.00	2.50	2.50	As claimed.

Feeding Stuffs—Concluded.

Station number.	Brand. Maker.	Claimed Analysis. Protein, not less than.	Fiber, not more than.	Fat, not less than.	Results of Examination.
	DRIED MEAT AND FISH WASTES —Concluded.	%	%	%	
7845	Portland Bone & Meat Meal for Hogs & Chicks. Portland Rendering Co., Portland, Maine.	35.00	—	8.00	Low in protein, and high in fat.
7826	Portland Poultry Food. (Cooked Meat & Bone Scraps). Portland Rendering Co., Portland, Maine.	40.00	—	8.00	As claimed.
7969	Whitman & Pratt's Animal Meal. Whitman & Pratt Rendering Co., Lowell, Mass.	33.00	—	10.00	As claimed.

October, 1918.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

ANALYSTS.

James M. Bartlett
Roydon L. Hammond
Herman H. Hanson
Elmer R. Tobey

Official Inspections

90

COMMERCIAL FERTILIZERS, 1918

CHAS. D. WOODS.

The Commissioner of Agriculture is the executive of the law regulating the sale of fertilizers in Maine. It is the duty of the Director of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and to publish the results of the analyses together with the names of the persons from whom the samples were obtained, and such additional information as may seem advisable.

NOTE. All correspondence relative to the inspection laws should be addresssed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

THE FERTILIZER LAW

The law requires the registration of all commercial fertilizers carrying nitrogen (ammonia), phosphoric acid, potash and lime with the Commissioner of Agriculture previous to their being offered for sale. Each package shall carry a plainly printed statement showing the net weight, the name of the goods and the maker, and a chemical analysis showing the minimum percentages of available nitrogen (ammonia), available and total phosphoric acid and potash and in the case of agricultural lime limestone, marl, etc., the minimum percentage of lime. The full text of the law will be sent on application to the Commissioner of Agriculture, Augusta, Maine.

THE RESULTS OF THE ANALYSES

Because of the demand made by the war upon chemists for war purposes it has been impracticable to keep the usual chemical staff at the Station and this resulted in a delay in completing the analyses. Illness in the clerical force of the Commissioner caused delay in returning the analysis reports with names of brands, makers and guaranties. And an entire change in office clerical help at the Station due to the former clerks being called to Washington by the Federal Food Administration made a delay in the tabulation of the results. From these three causes there is an unavoidable delay of weeks in the issue of this number of Official Inspections.

The tables giving the analyses of the samples collected by the Commissioner of Agriculture during the year 1917 follow. The samples were sent to the Station without description other than an identifying number. The data given in the left hand page tables and the guarantees were furnished after the analyses were completed.

The table on the left hand pages gives the Station number of the sample, the name, manufacturer and place when collected.

The table on the right hand pages gives the Station number of the samples and the detailed analyses. By means of the Station numbers the two tables are readily compared.

Under the head of "Nitrogen" in the tables are found 5 columns of figures under the following headings.

1. The nitrogen from nitrates. In this column is given the percentage of nitrogen present as nitrate. Nitrate nitrogen is wholly and quickly available.

2. Nitrogen from ammonia salts. In this column is given the nitrogen from ammonium salts, chiefly sulphate. Ammonia nitrogen is not as quickly available as nitrate nitrogen.

3. Active nitrogen. In this column is given the nitrogen obtained by subtracting the inactive nitrogen found by the alkaline permanganate method from the total nitrogen found. It therefore is the sum of the nitrogen from sodium nitrate, ammonium sulphate, soluble organic, and active insoluble organic nitrogen. It gives the available nitrogen as near as we are at present able to determine by laboratory methods. While it perhaps is not as accurate as the methods for determining available phosphoric acid, enough vegetation experiments have been made to show that it can be quite safely relied on for most nitrogenous materials, excepting perhaps cottonseed meal, which is very little used in fertilizers for this State. Just as available phosphoric acid is a better measure than the total phosphoric acid of the value of a fertilizer so the active nitrogen is a better measure than is the total nitrogen. Neither of them are perfect measures but they give close approximations to the value as plant food of the nitrogen (ammonia) and phosphoric acid carried by the goods.

4. Total nitrogen found.

5. Total nitrogen guaranteed.

Phosphoric Acid. The table shows the percentages of available and total phosphoric acid found and guaranteed.

Potash. The table shows the percentages of water soluble potash found and guaranteed.

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
	AMERICAN AGRICULTURAL CHEMICAL CO., NEW YORK CITY.	
5003	A. A. C. Co. Northern Maine Potato Special 1916	Searsport
5067	A. A. C. Co. Northern Maine Potato Special 1916	Houlton
5095	A. A. C. Co. Revised Aroostook High Grade	Searsport
4936	Ammoniated Fertilizer A	Belfast
5096	Ammoniated Fertilizer AA	Skowhegan
4926	Ammoniated Fertilizer AAAA	Belfast
5097	Ammoniated Fertilizer AAAA	Skowhegan
4999	Ammoniated Fertilizer VX	Searsport
5074	Ammoniated Fertilizer VX	Belfast
4973	Bradley's Complete Manure for Potatoes & Vegetables	Bangor
5047	Bradley's Complete Manure for Potatoes & Vegetables	Houlton
5153	Bradley's Corn Phosphate 1916	Portland
4979	Bradley's Extra Potato & Root Special	Bangor
5111	Bradley's Extra Potato & Root Special	Lewiston
5165	Bradley's General Fertilizer	Saco
4935	Bradley's Grain Fertilizer	Belfast
5197	Bradley's Grain Fertilizer	Lewiston
4977	Bradley's Liberty Potato Manure	Bangor
5046	Bradley's Liberty Potato Manure	Houlton
4930	Bradley's Maine Potato Special	Belfast
5051	Bradley's Maine Potato Special	Houlton
5127	Bradley's Maine Potato Special	Exeter
4961	Bradley's Northland Potato Grower	Bangor
5049	Bradley's Northland Potato Grower	Houlton
5196	Bradley's Northland Potato Grower	Lee
5149	Bradley's Potato Fertilizer 1916	Portland
4950	Bradley's Potato Manure 1916	Bangor
5110	Bradley's Potato Manure 1916	Lewiston
4929	Bradley's Root Crop Manure	Belfast
5050	Bradley's Root Crop Manure	Houlton
5212	Bradley's Root Crop Manure	Lee
4932	Bradley's Special Corn Phosphate without Potash	Belfast
5108	Bradley's Special Corn Phosphate without Potash	Lewiston
4989	Bradley's Special Potato Fertilizer without Potash	Portland
5106	Bradley's Special Potato Fertilizer without Potash	Lewiston
5152	Bradley's Special Potato Fertilizer without Potash	Portland
4931	Bradley's Special Potato Manure without Potash	Belfast
5109	Bradley's Special Potato Manure without Potash	Lewiston
4964	Bradley's Special XL Superphosphate without Potash	Belfast
5113	Bradley's Special XL Superphosphate without Potash	Lewiston
4952	Bradley's XL Superphosphate of Lime 1916	Bangor
5112	Bradley's XL Superphosphate of Lime 1916	Lewiston

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen.					Phosphoric Acid.				Potash.	
							Available.		Total.			
		As nitrate.	As ammonia.	Active.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
5003	9.82	1.40	1.24	3.34	3.49	3.29	9.69	9.00	10.12	10.00	1.18	1.00
5067	10.60	1.70	1.10	3.16	3.36	3.29	8.52	9.00	10.00	10.00	1.09	1.00
5005	9.24	1.76	1.38	3.78	4.10	4.11	9.98	10.00	10.72	11.00	3.89	4.00
4936	8.31	0.48	0.26	0.95	1.21	0.82	9.48	10.00	10.63	11.00	------	0.00
5096	9.37	1.24	0.20	1.71	1.84	1.65	9.80	10.00	11.34	11.00	------	0.00
4926	6.41	0.57	1.50	2.76	3.63	3.29	10.45	10.00	12.10	11.00	------	0.00
5097	11.03	1.32	0.76	2.72	2.85	3.29	10.05	10.00	11.51	11.00	------	0.00
4999	9.22	1.96	1.40	4.18	4.36	4.11	9.66	10.00	11.06	11.00	------	0.00
5074	11.04	1.92	1.30	4.36	4.64	4.11	9.53	10.00	11.10	11.00	------	0.00
4973	8.84	1.64	1.12	3.29	3.55	3.29	9.38	9.00	10.34	10.00	1.14	1.00
5047	9.95	1.70	1.18	3.21	3.43	3.29	8.73	9.00	10.22	10.00	1.15	1.00
5153	10.00	1.16	0.46	1.61	1.81	1.65	9.98	10.00	11.38	11.00	1.18	1.00
4979	9.04	1.74	1.04	3.07	3.35	3.29	9.70	10.00	10.96	11.00	2.90	3.00
5111	9.18	1.74	0.84	3.12	3.31	3.29	10.33	10.00	11.68	11.00	3.11	3.00
5165	4.78	0.60	0.36	1.35	1.72	1.65	9.27	10.00	12.76	11.00	------	0.00
4935	8.41	0.54	0.84	1.15	1.25	0.82	9.72	10.00	10.87	11.00	------	0.00
5107	9.77	0.60	0.14	1.88	1.12	0.82	10.72	10.00	11.73	11.00	------	0.00
4977	8.35	1.80	1.46	4.20	4.44	4.11	8.56	8.00	10.15	9.00	------	0.00
5046	7.30	2.12	1.56	4.28	4.44	4.11	8.06	8.00	9.01	9.00	------	0.00
4930	7.40	1.60	1.40	4.15	4.40	4.11	10.44	10.00	12.08	11.00	------	0.00
5051	8.60	2.20	1.46	3.99	4.22	4.11	10.04	10.00	10.80	11.00	------	0.00
5127	13.56	------	------	------	4.21	4.11	9.35	10.00	11.82	--------	0.36	0.00
4961	7.85	1.42	1.00	3.18	3.38	3.29	8.68	8.00	9.98	9.00	3.75	4.00
5049	8.70	1.72	1.08	3.15	3.38	3.29	8.10	8.00	8.93	9.00	4.01	4.00
5196	8.96	1.68	1.18	3.31	3.45	3.29	8.10	8.00	9.66	9.00	3.91	4.00
5149	8.71	1.44	0.56	2.16	2.40	2.06	8.01	8.00	8.98	9.00	1.18	1.00
4950	8.44	1.06	1.10	2.80	2.90	2.47	8.63	9.00	9.44	10.00	1.25	1.00
5119	9.41	1.32	0.90	2.29	2.73	2.47	9.14	9.00	10.17	10.00	1.28	1.00
4929	7.72	0.70	1.18	3.41	3.63	3.29	10.08	10.00	11.26	11.00	------	0.00
5050	9.23	1.90	1.08	3.38	3.62	3.29	10.31	10.00	11.45	11.00	------	0.00
5212	11.43	1.94	0.66	3.21	3.36	3.29	10.27	10.00	11.51	11.00	------	0.00
4932	7.23	1.04	0.66	2.31	2.53	1.65	9.54	10.00	10.77	11.00	------	0.00
5108	9.86	1.00	0.01	1.66	1.81	1.65	10.31	10.00	11.72	11.00	------	0.00
4989	8.56	0.70	0.54	1.80	1.93	1.65	9.65	10.00	10.78	11.00	------	0.00
5196	9.48	0.40	0.40	1.38	1.77	1.65	10.69	10.00	11.89	11.00	------	0.00
5152	8.25	1.14	0.60	1.90	2.05	1.65	10.24	10.00	11.49	11.00	------	0.00
4931	7.61	0.95	1.00	2.21	2.40	2.47	9.56	10.00	10.95	11.00	------	0.00
5109	11.14	1.54	0.50	2.42	2.58	2.47	10.23	10.00	11.68	11.00	------	0.00
4934	8.23	1.04	1.46	2.69	2.81	2.47	9.80	10.00	10.98	11.00	------	0.00
5113	10.55	1.52	0.58	2.34	2.55	2.47	9.88	10.00	11.22	11.00	------	0.00
4952	8.53	1.22	0.88	2.74	2.88	2.47	8.93	9.00	9.88	10.00	1.24	1.00
5112	9.22	1.38	0.70	2.27	2.43	2.47	9.07	9.00	9.90	10.00	1.35	1.00

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
5105	Bradley's Three Star Special with Potash	Lewiston
5185	Bradley's Triple X Potato Special	Lincoln
4938	Cereal & Root Fertilizer	Belfast
4997	Darling's A-1 Fertilizer	Searsport
5052	Darling's A-1 Fertilizer	Houlton
4915	Darling's Big Four Potato Grower	Lee
5048	Darling's Big Four Potato Grower	Houlton
4933	Extra Quality Potato Manure	Belfast
4975	Grain and Seeding Fertilizer	Bangor
5091	Great Eastern Superior Potato Grower	Searsport
5071	Great Eastern Superior Potato Grower	Presque Isle
5148	High Grade Fertilizer 1916	Portland
5177	High Grade Fertilizer 1916	Mattawamkeag
4960	Monarch Potato Manure	Bangor
5164	Odorless Grass & Lawn Top Dressing without Potash	Saco
5160	Quinnipiac Special Corn Manure without Potash	Springvale
5159	Quinnipiac Special Potato Phosphate without Potash	Springvale
4937	Special Vegetable Fertilizer	Belfast
5150	Williams & Clark Special Americus Corn Phosphate without Potash	Portland
5151	Williams & Clark Special Americus Potato Manure without Potash	Portland
	ARMOUR FERTILIZER WORKS, BALTIMORE, MARYLAND.	
5139	Armour's Acid Phosphate Fertilizer	Portland
5138	Armour's Bone Meal	Portland
5014	Armour's Fertilizer 5-8-3	Bucksport
5019	Armour's 5-10-0	Bucksport
5053	Armour's 5-10-0	Houlton
5015	Armour's 4-8-4	Bucksport
5054	Armour's 4-8-3	Houlton
5069	Armour's 4-8-3	Presque Isle
5137	Armour's 4-10-0	Portland
5140	Armour's 2-8-3 Fertilizer	Portland
5017	Armour's 2-8-2 Fertilizer	Bucksport
5115	Armour's 2-8-2 Fertilizer	Lisbon Falls
5116	Armour's 2-10 Fertilizer	Lisbon Falls
5020	Tuscarora 5-10-0	Bucksport
5016	Tuscarora 4-8-4	Bucksport
5018	Tuscarora 2-8-2	Bucksport
	BAUGH & SONS CO., BALTIMORE, MARYLAND.	
5078	Baugh's Aroostook 5-10-0	Caribou
5080	Baugh's Aroostook 4-8-4	Caribou
5005	Baugh's Aroostook 4-8-4	Skowhegan
5192	Baugh's Aroostook 4-8-4	Lincoln

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen. As nitrate.	Nitrogen. As ammonia.	Nitrogen. Active.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.
5105	8.91	0.86	0.62	2.75	2.95	2.47	8.50	8.00	10.23	9.00	3.57	3.00
5185	12.23	1.80	1.32	3.76	4.06	4.11	9.89	10.00	11.19	11.00	3.33	4.00
4938	10.22	1.14	1.12	2.33	2.56	2.47	9.93	10.00	11.04	11.00	------	0.00
4997	9.18	2.00	1.36	4.23	4.38	4.11	9.69	10.00	11.09	11.00	------	0.00
5052	9.26	2.24	1.48	4.06	4.25	4.11	10.16	10.00	10.95	11.00	------	0.00
4915	16.81	------	------	------	3.31	4.00	8.42	8.00	10.05	9.00	3.52	4.00
5048	8.82	1.80	1.12	3.18	3.41	3.29	8.36	8.00	9.12	9.00	3.96	4.00
4933	8.09	1.98	1.44	4.16	4.39	4.11	10.55	10.00	12.15	11.00	------	0.00
4975	9.11	0.72	0.54	1.89	1.98	1.65	10.12	10.00	11.33	11.00	------	0.00
5001	8.24	1.60	1.06	3.28	3.36	3.29	8.02	8.00	8.72	9.00	3.94	4.00
5071	9.37	1.90	1.08	3.07	3.30	3.29	8.08	8.00	8.80	9.00	3.78	4.00
5148	9.55	1.52	0.64	2.37	2.48	2.47	10.06	9.00	11.33	10.00	1.24	1.00
5177	10.09	1.26	0.62	2.55	2.72	2.47	8.58	9.00	9.88	10.00	1.06	1.00
4960	7.85	1.82	1.06	3.64	3.87	3.29	8.36	8.00	9.23	9.00	3.78	4.00
5164	8.64	2.22	1.32	3.89	4.16	4.11	9.93	10.00	11.73	11.00	------	0.00
5160	9.62	1.12	0.00	1.57	1.79	1.65	9.76	10.00	11.61	11.00	------	0.00
5159	10.04	1.16	0.00	1.38	1.77	1.65	9.75	10.00	11.57	11.00	------	0.00
4937	9.35	1.48	0.30	3.29	3.59	3.29	9.90	10.00	11.20	11.00	------	0.00
5150	10.37	1.20	0.24	1.60	1.79	1.65	9.83	10.00	11.25	11.00	------	0.00
5151	9.67	1.14	0.20	1.43	1.72	1.65	9.70	10.00	11.22	11.00	------	0.00
5139	11.82	------	------	------	------	------	16.47	10.00	16.77	16.50	------	0.00
5138	3.56	------	------	------	2.06	2.47	------	------	29.43	22.00	------	0.00
5014	5.67	2.32	0.10	3.92	4.44	4.11	8.05	8.00	9.51	8.50	3.22	3.00
5019	11.54	1.78	1.50	4.32	4.64	4.11	10.31	10.00	10.77	10.50	------	0.00
5053	6.44	2.04	1.18	4.07	4.61	4.11	10.58	10.00	11.82	10.50	------	0.00
5015	6.89	1.84	0.86	3.18	3.50	3.29	7.98	8.00	9.30	8.50	4.19	4.00
5054	5.30	1.80	0.58	3.14	3.60	3.29	8.49	8.00	9.76	8.50	3.46	3.00
5069	5.35	1.40	0.74	3.11	3.58	3.29	8.12	8.00	9.69	8.50	3.48	3.00
5137	8.34	------	1.72	3.05	3.65	3.29	9.70	10.00	10.70	10.50	------	0.00
5140	6.84	0.44	0.30	1.19	1.63	1.65	8.54	8.00	9.01	8.50	2.98	3.00
5017	11.00	1.92	------	2.21	2.23	1.65	8.74	8.00	10.04	8.50	2.20	2.00
5115	10.89	0.46	0.74	1.57	1.93	1.65	8.14	8.00	10.52	8.50	2.19	2.00
5116	10.09	0.50	0.26	1.49	1.91	1.65	9.90	10.00	11.06	10.50	------	0.00
5020	12.29	0.50	1.30	4.20	4.57	4.11	10.28	10.00	10.80	10.50	------	0.00
5016	6.89	1.98	0.92	3.22	3.63	3.29	7.97	8.00	9.42	8.50	4.14	4.00
5018	12.40	2.00	0.10	2.09	2.14	1.65	8.92	8.00	9.91	8.50	2.27	2.00
5078	8.30	2.06	1.80	3.93	4.12	4.12	9.80	10.00	10.97	11.00	------	0.00
5080	9.15	1.40	0.96	2.53	2.68	3.30	8.62	8.00	9.79	9.00	3.36	4.00
5095	10.29	2.26	0.40	3.06	3.50	3.30	8.30	8.00	9.59	9.00	4.16	4.00
5192	10.39	2.10	1.42	4.01	4.09	3.30	7.84	8.00	8.96	9.00	3.84	4.00

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
5175	Baugh's Durable Plant Food	Mattawamkeag
5176	Baugh's High Grade Ammoniated Animal BB Brand	Mattawamkeag
5094	Baugh's Peruvian Guano Substitute for Potatoes & A'l Crops	Skowhegan
	BOWKER FERTILIZER CO., BOSTON, MASS.	
5145	Bowker's Complete	Westbrook
5155	Bowker's Complete	Manchester
4920	Bowker's Four-Ten Hill & Drill	Belfast
5041	Bowker's Four-Ten Hill & Drill	Houlton
5191	Bowker's Four-Ten Hill & Drill	Lincoln
5203	Bowker's Four-Ten Hill & Drill	Lee
4928	Bowker's One-Ten Sure Crop	Belfast
4924	Bowker's Potato Phosphate 1916	Belfast
5161	Bowker's Potato & Vegetable Fertilizer Revised	Saco
4982	Bowker's Soluble Phosphate	Portland
4922	Bowker's Three-Ten All Round	Belfast
5193	Bowker's Three-Ten All Round	Lincoln
4921	Bowker's Two-Ten Farm & Garden	Belfast
5043	Bowker's Two-Ten Farm & Garden	Houlton
4925	Stockbridge Five-Eight General Crop	Belfast
5194	Stockbridge Five-Eight General Crop	Lincoln
5206	Stockbridge Five-Eight General Crop	Lee
4927	Stockbridge Five-Ten Early Crop	Belfast
5040	Stockbridge Five-Ten Early Crop	Houlton
4978	Stockbridge General Crop Manure 1916	Bangor
4981	Stockbridge General Crop Manure 1916	Portland
4904	Stockbridge Market Garden Manure	Lee
4907	Stockbridge Market Garden Manure	Lee
4914	Stockbridge Market Garden Manure	Lee
4923	Stockbridge Market Garden Manure	Belfast
5044	Stockbridge Market Garden Manure	Houlton
5186	Stockbridge Market Garden Manure	Abbott Village
5189	Stockbridge Market Garden Manure	Lincoln
5200	Stockbridge Market Garden Manure	Lee
5201	Stockbridge Market Garden Manure	Lee
5215	Stockbridge Market Garden Manure	Lee
	JOSEPH BRECK & SONS, CORP., BOSTON, MASS.	
5158	Breck's Rams Read Brand Pulverized Sheep Manure	Sanford
	CHESAPEAKE CHEMICAL COMPANY, BALTIMORE, MARYLAND.	
5007	C. C. Company's 4-8-4 Fertilizer	Belfast
5013	C. C. Company's Maine Special Fertilizer	Belfast
5011	C. C. Company's Potato Compound	Searsport
5009	C. C. Company's Special Improved Mixture with 5% Undecomposed Bone	Searsport
	COE-MORTIMER CO., NEW YORK CITY, N. Y.	
5066	E. Frank Coe's Aroostook Potato Special 1916	Houlton
5195	E. Frank Coe's Aroostook Potato Special 1916	Lee

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen.					Phosphoric Acid.				Potash.	
							Available.		Total.			
		As nitrate.	As ammonia.	Active.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
5175	11.25	1.08	0.30	1.83	2.00	1.65	7.97	8.00	9.26	9.00	2.29	2.00
5176	3.94	0.36	2.16	3.25	3.47	3.30	10.55	10.00	13.15	11.00	------	0.00
5094	10.21	2.34	1.10	4.10	4.38	4.12	8.24	8.00	9.92	9.00	1.37	1.00
5145	9.44	1.94	0.98	3.12	3.40	3.29	9.86	10.00	11.19	11.00	2.90	3.00
5155	8.71	1.76	0.96	3.26	3.52	3.29	9.96	10.00	11.30	11.00	3.13	3.00
4920	8.53	1.96	1.14	3.39	3.54	3.29	10.00	10.00	11.35	11.00	------	0.00
5041	10.31	1.56	1.42	3.23	3.36	3.29	10.04	10.00	11.64	11.00	------	0.00
5191	9.06	1.92	0.88	3.29	3.38	3.29	9.75	10.00	11.27	11.00	------	0.00
5203	10.91	1.66	0.86	3.17	3.34	3.29	10.47	10.00	11.63	11.00	------	0.00
4928	8.28	0.64	0.20	0.90	1.05	0.82	9.84	10.00	10.75	11.00	------	0.00
4924	8.98	1.14	0.56	1.85	2.07	1.65	9.91	10.00	10.60	11.00	1.38	1.00
5161	11.58	1.30	0.86	2.59	2.87	2.88	7.76	8.00	8.88	9.00	4.11	4.00
4982	7.81	------	------	------	------	------	14.17	14.00	15.12	15.00	------	0.00
4922	9.00	1.04	0.74	2.47	2.66	2.47	10.03	10.00	11.22	11.00	------	0.00
5193	9.98	1.40	0.58	2.40	2.57	2.47	9.60	10.00	11.37	11.00	------	0.00
4921	8.99	1.12	0.62	1.74	1.88	1.65	9.66	10.00	10.87	11.00	------	0.00
5043	8.60	1.00	0.52	1.69	1.81	1.65	9.42	10.00	10.84	11.00	------	0.00
4925	7.36	1.60	1.05	3.95	4.23	4.11	7.79	8.00	9.24	9.00	------	0.00
5194	8.41	1.98	1.28	4.24	4.42	4.11	8.65	8.00	9.80	9.00	------	0.00
5206	8.88	2.12	1.48	4.10	4.13	4.11	8.70	8.00	10.23	9.00	------	0.00
4927	6.77	0.55	1.48	3.92	4.30	4.11	9.72	10.00	11.26	11.00	------	0.00
5040	9.15	2.50	1.54	4.37	4.50	4.11	9.80	10.00	10.72	11.00	------	0.00
4978	9.20	1.72	1.04	3.35	3.49	3.29	9.41	9.00	10.58	10.00	1.34	1.00
4981	7.45	1.66	1.18	3.39	3.58	3.29	9.86	9.00	10.85	10.00	1.39	1.00
4904	11.70	------	------	------	2.93	3.29	8.01	8.00	9.89	9.00	3.54	4.00
4907	--------	------	------	------	2.80	3.29	6.37	8.00	8.89	9.00	3.51	4.00
4914	11.86	------	------	------	3.07	3.29	7.60	8.00	9.73	9.00	3.82	4.00
4923	7.80	1.36	0.96	2.99	3.25	3.29	7.47	8.00	8.88	9.00	3.87	4.00
5044	10.66	2.18	0.84	3.07	3.34	3.29	7.84	8.00	9.66	9.00	4.21	4.00
5186	13.38	1.52	0.94	------	3.00	3.29	7.77	8.00	9.53	9.00	4.09	4.00
5189	9.93	2.02	0.88	3.39	3.32	3.29	8.02	8.00	9.56	9.00	4.35	4.00
5200	12.02	1.70	0.30	2.93	3.32	3.29	8.58	8.00	9.64	9.00	3.42	4.00
5201	10.24	1.86	0.86	3.12	3.36	3.29	8.50	8.00	10.53	9.00	4.15	4.00
5215	13.72	------	------	------	3.26	3.29	8.04	8.00	9.22	9.00	3.64	4.00
5158	11.31	------	------	------	1.92	1.65	--------	--------	1.65	1.00	2.97	1.50
5007	8.78	2.80	0.18	3.42	3.57	3.28	8.39	8.00	9.12	9.00	3.84	4.00
5013	6.27	1.68	0.16	2.81	2.99	3.28	8.10	8.00	8.82	9.00	1.93	2.00
5011	10.14	2.62	1.00	3.97	4.11	4.10	8.44	10.00	10.11	11.00	------	0.00
5009	10.41	2.12	1.00	3.31	3.40	3.28	9.72	9.00	11.50	10.00	------	0.00
5066	8.93	1.98	1.40	3.84	4.05	4.11	9.22	10.00	10.62	11.00	------	0.00
5195	8.14	2.00	1.38	3.90	4.1	4.1	8.15	8.00	9.21	9.00	------	0.00

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4967	E. Frank Coe's Celebrated Special Potato Fertilizer Revised	Bangor
5058	E. Frank Coe's Celebrated Special Potato Fertilizer Revised	Houlton
5180	E. Frank Coe's Celebrated Special Potato Fertilizer Revised	Lincoln
5198	E. Frank Coe's Celebrated Special Potato Fertilizer Revised	Lee
4944	E. Frank Coe's Excelsior Potato Fertilizer 1916	Belfast
5059	E. Frank Coe's Excelsior Potato Fertilizer 1916	Houlton
5190	E. Frank Coe's Excelsior Potato Fertilizer 1916	Lincoln
5197	E. Frank Coe's Excelsior Potato Fertilizer 1916	Lee
5157	E. Frank Coe's Gold Brand Excelsior Guano	Mechanic Falls
4966	E. Frank Coe's High Grade Ammoniated Superphosphate 1916	Bangor
5099	E. Frank Coe's High Grade Ammoniated Superphosphate 1916	Skowhegan
4945	E. Frank Coe's High Grade Potato Fertilizer Revised	Belfast
4965	E. Frank Coe's Prolific Crop Producer 1916	Bangor
5063	E. Frank Coe's Prolific Crop Producer 1916	Houlton
5184	E. Frank Coe's Red Brand Excelsior Guano 1916	Lincoln Ctr.
4917	E. Frank Coe's Special Potato Fertilizer	Winn
	DARLING & COMPANY, NATIONAL STOCK YARDS.	
5103	Darling's Sheep Manure	Skowhegan
5123	Darling's Sheep Manure	Oakland
	DOMINION FERTILIZER CO., LTD., ST. STEPHEN, N. B., CANADA.	
5087	Dominion Complete Potato Manure 4-9-1	Caribou
5090	Dominion Complete Potato Manure 4-9-1	Caribou
5140	Dominion 4-8-4	Winn
5167	Dominion 4-8-4	Pattagumpus
5168	Dominion 4-8-4	Lincoln
5091	Dominion General Crop 4-10-0	Skowhegan
5086	Dominion King Brand 5-10	Caribou
5170	Dominion King Brand 5-10	Lincoln
5295	Dominion King Brand 2-10	Lee
5169	Dominion 1-8-1	Lincoln
5171	Dominion 3-8-3	Lee
5171	Dominion Vegetable Corn & Grain Manure 2-9-1	Lincoln
	ESSEX FERTILIZER CO., BOSTON, MASS.	
5029	Essex Fish Fertilizer 3-10	Winthrop
5025	Essex 4-8-4	Winthrop
5072	Essex 4-8-4	Presque Isle
5118	Essex Grain Grass & Potato Fertilizer 1-12	Brunswick
5026	Essex High Grade 5-8	Winthrop
5087	Essex High Grade 5-8	Caribou
5028	Essex Market Garden & Potato Manure 3½-10	Winthrop
5117	Essex Market Garden & Potato Manure 3½-10	Brunswick

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen. As nitrate.	Nitrogen. As ammonia.	Nitrogen. Active.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.
4967	8.03	1.86	1.08	3.23	3.45	3.29	8.09	8.00	9.04	9.00	3.59	4.00
5058	8.08	1.80	1.00	3.11	3.31	3.29	8.14	8.00	9.23	9.00	3.45	4.00
5180	11.43	2.10	0.64	3.50	3.60	3.29	8.27	8.00	10.25	9.00	4.70	4.00
5198	9.23	1.82	0.96	3.19	3.35	3.29	8.41	8.00	9.89	9.00	4.37	4.00
4944	9.55	1.82	1.52	3.92	4.37	4.11	10.31	10.00	11.42	11.00	------	0.00
5059	7.91	2.10	1.48	3.85	4.13	4.11	11.37	10.00	12.70	11.00	------	0.00
5190	10.08	2.06	1.50	4.21	4.30	4.11	10.00	10.00	11.54	11.00	------	0.00
5197	10.62	1.58	1.50	4.04	4.17	4.11	10.00	10.00	11.41	11.00	------	0.00
5157	9.20	1.40	0.70	2.53	2.63	2.47	8.77	9.00	9.98	10.00	1.02	1.00
4966	10.51	1.60	0.30	2.59	2.84	2.47	10.36	10.00	11.70	11.00	------	0.00
5099	11.05	1.00	0.56	2.59	2.77	2.47	9.92	10.00	11.11	11.00	------	0.00
4945	9.55	1.38	1.30	3.29	3.80	3.29	9.57	10.00	11.20	11.00	------	0.00
4965	10.51	1.84	0.20	3.37	3.62	3.29	10.63	10.00	11.80	11.00	------	0.00
5060	9.79	1.80	0.76	3.22	3.48	3.29	10.25	10.00	11.70	11.00	------	0.00
5184	8.93	1.86	1.24	3.74	4.05	4.11	7.76	8.00	8.56	9.00	1.36	1.00
4917	13.62	------	------	------	3.02	3.29	7.67	8.00	8.52	--------	3.75	4.00
5100	11.48	0.20	------	------	2.43	2.06	--------	--------	2.81	1.00	1.81	1.00
5123	9.25	------	0.26	2.17	2.36	2.50	--------	--------	2.77	1.00	2.18	1.00
5085	9.11	1.98	0.60	3.28	3.56	3.30	8.96	9.00	10.84	10.00	1.02	1.00
5090	10.88	1.28	0.70	3.20	3.63	3.30	9.07	9.00	10.09	10.00	0.87	1.00
5146	13.45	------	------	------	3.71	3.30	8.93	8.00	10.19	--------	2.33	4.00
5167	12.98	------	------	------	3.25	3.30	7.47	8.00	8.52	--------	3.04	4.00
5168	9.60	1.24	0.92	3.80	3.37	3.30	8.10	8.00	8.84	9.00	2.71	3.00
5091	10.03	2.06	0.60	3.16	3.70	3.30	10.16	10.00	11.79	11.00	------	0.00
5086	11.14	1.90	0.64	3.70	4.10	4.10	9.88	10.00	11.66	11.00	------	0.00
5170	10.49	2.36	0.66	4.11	4.51	4.10	10.01	10.00	11.01	11.00	------	0.00
5205	9.71	2.48	0.78	3.99	4.36	4.10	9.72	10.00	10.57	11.00	------	0.00
5169	7.48	0.66	0.22	1.28	1.44	0.82	8.61	8.00	9.33	9.00	0.63	1.00
5174	11.81	0.88	0.54	2.34	2.48	2.50	8.18	8.00	10.04	9.00	3.13	3.00
5171	9.07	0.90	0.22	1.51	1.70	1.60	8.24	9.00	9.72	10.00	1.00	1.00
5029	9.17	1.98	0.08	2.34	2.60	2.46	9.67	10.00	10.60	11.00	------	0.00
5025	7.56	1.94	0.80	3.08	3.28	3.28	8.47	8.00	9.36	9.00	3.76	4.00
5072	8.67	1.50	------	3.07	3.28	3.28	7.81	8.00	8.72	9.00	3.96	4.00
5118	10.01	------	------	0.91	1.10	0.82	12.19	12.00	13.91	13.00	------	0.00
5026	6.20	1.84	1.00	3.68	3.92	4.10	7.89	8.00	8.91	9.00	------	0.00
5087	7.48	1.46	0.60	3.57	4.10	4.10	8.66	8.00	9.49	9.00	------	0.00
5028	10.22	1.90	0.38	2.33	2.52	2.87	9.93	10.00	11.73	11.00	------	0.00
5117	8.92	1.00	------	2.40	2.50	2.87	8.81	10.00	12.10	11.00	------	0.00

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
5199	Essex Potato Phosphate for Potatoes and Roots 4-10	Lee
5210	Essex Potato Phosphate for Potatoes and Roots 4-10	Lee
5120	Essex Potato Phosphate for Potatoes & Vegetables	Brunswick
5027	Essex Potato Phosphate 4-10	Winthrop
5154	Essex 2-8-4	Winthrop
5119	Ground Bone	Brunswick
	HUBBARD FERTILIZER CO., BALTIMORE, MD.	
5010	Hubbard's Aroostook Gem	Searsport
5068	Hubbard's Aroostook Gem	Presque Isle
5006	Hubbard's Four-Eight-Four Fertilizer	Searsport
5061	Hubbard's Four-Eight-Four Fertilizer	Houlton
5012	Hubbard's Potato Grower	Searsport
5064	Hubbard's Potato Grower	Houlton
5008	Hubbard's Special Compound	Searsport
5063	Hubbard's Special Compound	Houlton
	INTERNATIONAL AGRICULTURAL CHEMICAL CORPORATION, BUFFALO FERTILIZER WORKS, HOULTON, MAINE.	
5039	Buffalo Five-Eight-Two	Houlton
4912	Buffalo Five-Ten	LaGrange
5037	Buffalo Five-Ten-Naught	Houlton
5075	Buffalo Five-Ten-Naught	Ft. Fairfield
4905	Buffalo Four-Eight-Four	LaGrange
4906	Buffalo Four-Eight-Four	Island Falls
4910	Buffalo Four-Eight-Four	LaGrange
4911	Buffalo Four-Eight-Four	LaGrange
5038	Buffalo Four-Eight-Two	Houlton
5084	Buffalo Four-Eight-Two	Caribou
5035	Buffalo Four-Nine-One	Houlton
5089	Buffalo Four-Nine-One	Caribou
5036	Buffalo Four-Ten-Naught	Houlton
5083	Buffalo Three-Eight-Three	Caribou
5057	Buffalo Three-Nine-One	Houlton
5055	Buffalo Three-Ten-Naught	Houlton
5098	Buffalo Three-Ten-Naught	Skowhegan
5056	Buffalo Two-Nine-One	Houlton
	LISTERS AGRICULTURAL CHEMICAL WORKS, NEWARK, N. J.	
4969	Lister's Corn & Potato Fertilizer 1916	Bangor
4988	Lister's Corn & Potato Fertilizer 1916	Portland
4963	Lister's Crescent Ammoniated Superphosphate 1916	Bangor
4959	Lister's Excelsior Guano 1916	Bangor
5000	Lister's 4-8-4 Fertilizer	Searsport
4970	Lister's High Grade Special for Spring Crops 1916	Bangor
4968	Lister's Plant Food 1916	Bangor
4972	Lister's Potato Manure 1916	Bangor
4983	Lister's Potato Manure 1916	Portland

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen. As nitrate.	Nitrogen. As nitrate.	Nitrogen. Active.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.
5199	8.42	1.14	0.82	3.07	3.30	3.28	9.86	10.00	11.14	11.00	------	0.00
5210	8.27	1.24	0.78	3.22	3.40	3.28	10.08	10.00	11.36	11.00	------	0.00
5120	10.49	1.34	0.64	2.92	3.14	3.28	10.00	10.00	11.03	11.00	------	0.00
5027	8.34	1.46	0.64	3.01	3.22	3.28	9.50	10.00	10.43	11.00	------	0.00
5154	7.38	0.96	------	1.48	1.88	1.64	8.02	8.00	8.63	9.00	4.18	4.00
5119	4.61	------	------	------	2.68	2.46	--------	10.00	25.23	20.00	------	0.00
5010	9.34	3.34	1.10	4.49	4.62	4.10	9.32	10.00	9.74	11.00	------	0.00
5068	10.38	2.84	0.92	3.93	4.12	4.10	10.28	10.00	11.30	11.00	------	0.00
5006	8.80	3.00	------	3.40	3.55	3.28	8.21	8.00	8.98	9.00	3.86	4.00
5061	8.92	3.20	------	3.42	3.63	3.28	8.06	8.00	8.73	9.00	4.15	4.00
5012	6.23	1.66	0.12	2.81	3.02	3.28	7.94	8.00	8.58	9.00	1.95	2.00
5064	7.79	3.18	------	3.39	3.55	3.28	8.02	8.00	8.62	9.00	2.01	2.00
5008	10.58	2.26	0.94	3.37	3.48	3.28	10.07	9.00	11.67	10.00	------	0.00
5063	8.96	2.42	1.04	3.44	3.55	3.28	11.01	9.00	12.18	10.00	------	0.00
5039	8.31	2.08	0.84	3.91	4.38	4.10	8.14	8.00	9.47	9.00	2.14	2.00
4912	8.27	------	------	------	4.12	4.10	9.77	10.00	10.71	--------	0.31	0.00
5037	9.04	2.66	0.74	4.31	4.70	4.10	10.08	10.00	12.00	11.00	------	0.00
5075	10.61	2.04	0.78	3.82	4.07	4.10	10.31	10.00	11.99	11.00	------	0.00
4905	13.97	------	------	------	3.12	3.40	7.39	8.00	8.45	9.00	4.10	4.00
4906	11.35	------	------	------	3.08	3.40	8.41	8.00	9.49	9.00	4.06	4.00
4910	11.65	------	------	------	3.06	3.29	8.29	8.00	8.97	--------	4.04	4.00
4911	14.23	------	------	------	3.30	3.29	8.29	8.00	9.05	--------	3.93	4.00
5038	8.21	1.96	0.70	3.36	3.77	3.30	8.13	8.00	9.44	9.00	2.00	2.00
5084	7.67	2.04	0.56	3.06	3.67	3.30	8.00	8.00	9.91	9.00	2.08	2.00
5035	8.40	2.00	0.08	3.34	3.66	3.30	9.27	9.00	11.09	10.00	1.14	1.00
5089	8.32	0.96	0.24	2.82	3.50	3.30	9.31	9.00	10.76	10.00	1.18	1.00
5036	9.17	1.96	0.70	3.14	3.47	3.29	10.15	10.00	11.47	11.00	------	0.00
5083	8.28	1.24	0.60	2.25	2.50	2.50	8.03	8.00	9.20	9.00	2.95	3.00
5057	8.87	1.52	0.40	2.43	2.79	2.40	9.26	9.00	10.72	10.00	1.09	1.00
5055	8.46	1.52	0.40	2.43	2.81	2.50	10.26	10.00	11.60	11.00	------	0.00
5098	9.09	1.26	0.40	2.63	2.70	2.50	10.11	10.00	11.89	11.00	------	0.00
5056	7.10	1.10	0.64	2.42	2.66	1.64	10.00	9.00	11.16	10.00	0.85	1.00
4969	7.33	1.06	0.66	------	2.19	2.06	7.35	8.00	8.00	9.00	1.27	1.00
4988	8.67	1.12	0.64	2.12	2.24	2.06	8.05	8.00	8.89	9.00	1.16	1.00
4963	9.05	0.80	0.56	1.98	2.03	1.65	10.30	10.00	11.44	11.00	------	0.00
4959	9.17	0.96	0.74	2.32	2.42	2.47	9.80	10.00	10.97	11.00	------	0.00
5000	8.65	1.54	1.12	3.25	3.45	3.29	7.87	8.00	8.69	9.00	3.93	4.00
4970	9.05	1.00	0.22	2.07	2.35	2.06	10.68	10.00	11.43	11.00	1.26	1.00
4968	8.11	0.56	0.34	1.04	1.15	0.82	9.55	10.00	10.28	11.00	------	0.00
4972	8.12	1.78	1.10	3.90	4.24	4.11	8.58	8.00	9.51	9.00	1.12	1.00
4983	7.99	1.46	1.08	3.85	4.32	4.11	7.92	8.00	8.85	9.00	1.13	1.00

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4964	Lister's Special Potato Fertilizer 1916	Bangor
4986	Lister's Special Potato Fertilizer 1916	Portland
4974	Lister's Standard Superphosphate of Lime 1916	Bangor
4971	Lister's Success Fertilizer	Bangor
4987	Lister's Success Fertilizer 1916	Portland
4976	Lister's Superior Ammoniated Superphosphate 1916	Bangor
4985	Lister's Superior Ammoniated Superphosphate 1916	Portland
4962	Lister's 3-8-3 Fertilizer	Bangor
4984	Lister's 3-8-3 Fertilizer	Portland
	LITTLEFIELD & SONS CO., NEW AUBURN, MAINE.	
5114	Littlefield's Bone Meal	New Auburn
	LOWELL FERTILIZER CO., BOSTON, MASS.	
5104	Lowell Animal Brand High Grade Manure for All Crops	Skowhegan
4941	Lowell Animal Brand 3½-10	Belfast
5141	Lowell Bone Fertilizer	Portland
5143	Lowell Empress Brand	Gorham
5147	Lowell 4-8-2	South Windham
4946	Lowell High Grade 5-8	Bangor
5144	Lowell Potato Manure	Gorham
4940	Lowell Potato Phosphate 4-10	Belfast
5208	Lowell Potato Phosphate 4-10	Lee
4942	Lowell 2-8-4	Belfast
5126	Lowell 2-8-2	Waterville
	MORISON BROTHERS, BANGOR, MAINE.	
4958	Morison Bros. Acid Phosphate 16 per cent	Bangor
4954	Morison Bros. 4-10-0	Bangor
4957	Morison Bros. Nitrate of Soda	Bangor
4953	Morison Bros. 3-8-5 Fertilizer	Bangor
4955	Morison Bros. 3-8-2 For All Crops	Bangor
4956	Morison Bros. War Brand Potato Fertilizer	Bangor
	NATIONAL FERTILIZER CO., NEW YORK CITY.	
5004	National Extra High Grade Potato Fertilizer	Searsport
5092	National Market Garden Fertilizer Revised	Skowhegan
5188	National Market Garden Fertilizer Revised	Lincoln
4943	National Nitrogen Phosphate Mixture No. 4	Belfast
5045	National Nitrogen Phosphate Mixture No. 4	Houlton
4998	National Nitrogen Phosphate Mixture No. 6	Searsport
5065	National Nitrogen Phosphate Mixture No. 6	Houlton
5187	National Nitrogen Phosphate Mixture No. 6	Lincoln
5002	National Pine Tree State Potato Fertilizer	Searsport
5202	National Pine Tree State Potato Fertilizer	Lee
	NATIONAL GUANO CO., AURORA, ILL.	
4951	Sheep's Head Pulverized Sheep Manure	Bangor
	NEW ENGLAND FERTILIZER CO., BOSTON, MASS.	
4994	New England Corn & Grain Fertilizer 1½-10	Randolph
5156	New England Corn Phosphate	New Gloucester

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen. As nitrate.	Nitrogen. As ammonia.	Nitrogen. Active.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.
4964	8.68	2.20	1.38	4.06	4.28	4.11	9.92	10.00	12.17	11.00	------	0.00
4986	8.48	2.24	1.40	4.15	4.29	4.11	10.11	10.00	10.87	11.00	------	0.00
4974	7.73	1.30	0.84	2.71	2.83	2.47	9.20	9.00	10.55	10.00	1.25	1.00
4971	9.12	0.64	0.22	1.25	1.36	1.23	9.62	10.00	10.31	11.00	1.00	1.00
4987	9.70	0.68	0.46	1.60	1.63	1.23	9.44	10.00	10.25	11.00	1.41	1.00
4976	8.88	1.36	1.06	3.25	3.45	3.29	10.53	10.00	11.67	11.00	------	0.00
4985	9.01	1.52	1.10	3.32	3.42	3.29	9.76	10.00	10.74	11.00	------	0.00
4962	6.98	1.19	0.76	------	2.70	2.47	7.52	8.00	8.97	9.00	2.90	3.00
4984	8.88	1.18	0.76	2.58	2.63	2.47	8.24	8.00	9.19	9.00	2.88	3.00
5114	3.32	------	------	------	1.52	1.25	--------	--------	29.71	28.00	------	0.00
5104	7.93	0.88	0.32	2.66	2.48	2.87	8.91	10.00	12.15	11.00	------	0.00
4941	9.02	1.00	0.10	2.35	2.92	2.87	9.94	10.00	11.07	11.00	------	0.00
5141	3.82	------	------	------	2.34	2.40	--------	10.00	27.48	20.00	------	0.00
5143	10.65	0.70	------	0.97	1.19	1.23	10.32	10.00	11.80	11.00	------	0.00
5147	8.35	1.74	0.64	3.24	3.35	3.28	8.28	8.00	9.11	9.00	1.88	2.00
4946	5.93	1.60	0.96	3.73	4.03	4.10	8.10	8.00	9.24	9.00	------	0.00
5144	9.96	1.56	------	2.28	2.49	2.46	10.00	10.00	10.79	11.00	------	0.00
4949	9.56	1.44	0.86	3.16	3.36	3.28	9.51	10.00	10.91	11.00	------	0.00
5208	7.40	1.28	0.58	2.82	2.97	3.28	9.92	10.00	10.68	11.00	------	0.00
4942	8.55	1.04	0.46	1.65	2.03	1.64	8.42	8.00	9.43	9.00	3.69	4.00
5126	9.33	1.20	------	1.69	1.90	1.64	7.97	8.00	8.77	9.00	2.33	2.00
4958	12.13	------	------	------	------	------	16.58	16.00	16.81	--------	------	0.00
4954	9.30	1.86	0.24	3.45	3.95	3.29	10.58	10.00	12.47	--------	------	0.00
4957	1.56	15.80	------	------	15.80	15.00	--------	--------	--------	--------	------	0.00
4953	6.16	1.34	0.06	2.68	2.99	2.46	8.65	8.00	10.73	--------	5.10	5.00
4955	7.12	1.46	0.10	2.61	2.91	2.46	8.09	8.00	10.32	--------	2.01	2.00
4956	8.37	1.44	0.68	2.95	3.47	3.29	8.56	8.00	10.69	--------	3.87	4.00
5004	9.24	1.76	1.42	3.74	4.09	4.11	9.87	10.00	11.08	11.00	3.87	4.00
5092	9.31	1.68	0.70	2.40	2.89	2.47	8.29	8.00	9.73	9.00	3.36	3.00
5188	10.62	1.46	0.22	2.44	2.76	2.47	8.80	8.00	9.74	9.00	2.64	3.00
4943	9.97	1.72	1.46	3.90	4.21	3.29	10.13	10.00	11.37	11.00	------	0.00
5045	9.16	1.92	1.24	3.37	3.51	3.29	10.46	10.00	11.60	11.00	------	0.00
4998	9.24	2.04	1.44	4.23	4.35	4.11	9.75	10.00	11.12	11.00	------	0.00
5065	9.41	2.32	1.40	4.26	4.43	4.11	10.42	10.00	11.48	11.00	------	0.00
5187	10.67	1.78	1.38	3.97	4.12	4.11	9.61	10.00	11.46	11.00	------	0.00
5002	8.48	1.60	1.10	3.28	3.48	3.29	8.01	8.00	8.70	9.00	3.95	4.00
5202	9.74	1.14	0.84	3.08	3.29	3.29	7.84	8.00	8.99	9.00	4.27	4.00
4951	4.55	------	------	------	2.75	2.25	--------	1.00	3.71	1.25	2.12	1.50
4994	9.02	0.46	0.02	1.07	1.29	1.23	10.08	10.00	11.36	11.00	------	0.00
5156	7.89	1.58	0.22	2.11	2.21	2.05	8.88	10.00	12.29	11.00	------	0.00

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
5142	New England 4-8-4	Westbrook
5172	New England 4-8-4	Lee
5173	New England 4-8-4	Lee
4949	New England High Grade 5-8	Bangor
5079	New England High Grade 5-8	Caribou
5211	New England High Grade 5-8	Lee
4992	New England High Grade 4-10	Randolph
4990	New England Potato Fertilizer 3-10	Randolph
4991	New England Superphosphate 3½-10	Randolph
4996	New Eng'and 2-8-4	Bangor
5178	New England 2-8-2	Chester
5179	New England 2-8-2	Chester
	PARMENTOR & POLSEY FERTILIZER CO., BOSTON, MASS.	
5076	P. & P. 4-8-4	Caribou
4995	P. & P. High Grade 5-8 Fertilizer	Bangor
5077	P. & P. High Grade 5-8 Fertilizer	Caribou
4947	P. & P. Potato Phosphate 4-10	Bangor
4948	P. P. Plymouth Rock Brand for All Crops	Bangor
	PORTLAND RENDERING CO., PORTLAND, MAINE.	
5103	Portland Organic Fertilizer "They Double The Dollar Animal Brand"	Skowhegan
5023	Portland Organic Fertilizer "They Double the Dollar Potat Grower"	Augusta
5101	Portland Organic Fertilizer "They Double the Dollar Potat Grower"	Skowhegan
5024	Portland Organic Fertilizer "They Double the Dollar Potato Phosphate"	Augusta
5102	Portland Organic Fertilizer "They Double the Dollar Potato Phosphate"	Skowhegan
	SAGADAHOC FERTILIZER CO., BOWDOINHAM, MAINE.	
5134	Acid Phosphate	Bowdoinham
5135	Dirigo Fertilizer	Bowdoinham
5129	Nitrate of Soda	Bowdoinham
5132	Sagadahoc 4-8-5 Fertilizer	Bowdoinham
5207	Sagadahoc 4-8-5 Fertilizer	Lee
4918	Sagadahoc 4-8-4 Fertilizer	Winn
5130	Sagadahoc 4-8-4 Fertilizer	Bowdoinham
5181	Sagadahoc 4-8-4 Fertilizer	Winn
5182	Sagadahoc 4-8-4 Fertilizer	Winn
5183	Sagadahoc 4-8-4 Fertilizer	Lincoln Ctr.
5204	Sagadahoc 4-8-4 Fertilizer	Lee
4993	Sagadahoc High Grade 2-10-2	Randolph
5121	Sagadahoc High Grade 2-10-0	Waterville
5136	Sagadahoc Q & L Brand Bone Lime and Potash Fertilizer	Bowdoinham
5131	Sagadahoc Special Corn Fertilizer 3-10-3	Bowdoinham
5209	Sagadahoc Special Corn Fertilizer 3-10-3	Lee
5123	Sagadahoc 2-10-1 Fertilizer	Bowdoinham

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen.					Phosphoric Acid.				Potash.	
							Available.		Total.			
		As nitrate.	As ammonia.	Active.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
5142	8.99	1.50	0.82	2.64	3.13	3.28	8.27	8.00	9.16	9.00	3.64	4.00
5172	10.46	1.28	0.78	3.03	3.35	3.28	8.20	8.00	9.39	9.00	3.68	4.00
5173	9.85	1.26	0.56	3.16	3.43	3.28	8.46	8.00	9.37	9.00	4.16	4.00
4949	7.16	1.60	0.94	3.63	3.99	4.10	8.05	8.00	9.11	9.00	------	0.00
5079	7.05	1.50	0.68	3.67	4.07	4.10	7.70	8.00	8.61	9.00	------	0.00
5211	7.25	1.58	0.80	3.80	4.03	4.10	8.41	8.00	9.56	9.00	------	0.00
4992	7.65	0.94	0.80	3.07	3.45	3.28	10.37	10.00	11.17	11.00	------	0.00
4990	9.48	1.66	0.06	2.61	2.93	2.46	10.42	10.00	11.05	11.00	------	0.00
4991	8.86	1.00	0.52	2.88	3.13	2.87	10.12	10.00	10.87	11.00	------	0.00
4996	8.14	0.88	------	1.70	1.95	1.64	8.19	8.00	9.08	9.00	3.55	4.00
5178	9.47	1.22	------	1.52	1.67	1.64	8.41	8.00	8.77	9.00	2.10	2.00
5179	9.41	1.20	------	1.58	1.69	1.64	8.33	8.00	8.87	9.00	2.08	2.00
5076	8.61	1.60	0.68	2.71	2.94	3.28	7.90	8.00	8.80	9.00	3.76	4.00
4995	6.13	1.84	0.96	4.01	4.42	4.10	8.22	8.00	9.29	9.00	------	0.00
5077	6.62	1.64	1.06	3.86	4.08	4.10	8.08	8.00	9.14	9.00	------	0.00
4947	9.05	0.90	0.80	3.16	3.49	3.28	10.78	10.00	11.62	11.00	------	0.00
4948	7.88	1.14	0.56	2.75	2.93	2.87	9.61	10.00	10.74	11.00	------	0.00
5103	7.78	1.00	0.70	3.02	3.29	2.88	11.36	10.00	12.17	11.00	------	0.00
5023	7.78	2.06	0.36	3.71	4.06	4.10	8.09	8.00	9.79	9.00	------	0.00
5101	7.26	1.58	0.40	4.83	4.16	4.10	9.36	8.00	10.11	9.00	------	0.00
5024	8.75	1.86	0.44	3.48	3.76	3.28	10.09	10.00	11.81	11.00	------	0.00
5102	9.82	1.42	0.40	3.61	3.90	3.28	10.00	10.00	11.65	11.00	------	0.00
5134	11.78	------	------	------	------	------	17.54	16.00	18.32	--------	------	0.00
5135	4.48	------	------	1.03	1.12	1.00	4.54	6.00	9.04	8.00	0.65	1.00
5129	1.25	15.52	------	15.52	15.00	------	--------	--------	--------	--------	------	0.00
5132	11.24	1.36	0.28	2.87	3.26	3.29	8.43	8.00	9.60	9.00	5.00	5.00
5207	10.07	1.86	0.26	2.81	3.23	3.29	8.47	8.00	9.08	9.00	5.15	5.00
4918	15.93	------	------	------	2.42	3.29	8.05	8.00	8.39	--------	3.38	4.00
5130	10.71	1.56	0.26	3.04	3.44	3.29	8.53	8.00	9.68	9.00	4.11	4.00
5181	14.79	2.56	0.42	3.14	3.24	3.29	8.00	8.00	8.30	9.00	3.91	4.00
5182	15.43	2.30	0.54	2.93	2.96	3.29	8.00	8.00	8.26	9.00	4.02	4.00
5183	15.32	2.14	0.50	2.83	3.04	3.29	7.86	8.00	8.40	9.00	4.03	4.00
5204	9.51	1.46	------	2.49	3.31	3.29	8.53	8.00	9.03	9.00	4.55	4.00
4993	11.55	1.04	0.30	1.83	1.87	1.65	9.89	9.00	10.43	10.00	2.17	2.00
5121	13.93	0.80	0.26	1.62	1.81	1.65	9.60	10.00	10.82	11.00	2.01	2.00
5136	4.39	0.58	------	1.13	1.24	0.82	4.04	3.00	7.94	5.00	1.06	1.00
5131	11.78	1.36	0.20	2.29	2.54	2.47	10.53	10.00	11.33	11.00	3.15	3.00
5209	10.45	1.20	0.24	2.07	2.40	2.47	10.19	10.00	10.93	11.00	3.57	3.00
5133	7.10	0.78	0.14	1.44	1.75	1.65	7.11	10.00	9.75	11.00	1.03	1.00

Descriptive List of Fertilizer Samples, 1918.

Station number.	Manufacturer, place of business and brand.	Sample taken at
	VIRGINIA-CAROLINA CHEMICAL CO., NEW YORK, N. Y.	
5022	Owl Brand Potato and Truck Fertilizer with 10 per cent Potash	Augusta
5021	V. C. C. Co.'s Ammoniated Bone Phosphate for All Crops	Augusta
5093	V. C. C. Co.'s Beef, Blood & Bone, BBB without Potash	Skowhegan
5073	V. C. C. Co.'s Star Brand Potato & Vegetable Compound	Presque Isle
5088	V. C. C. Co.'s Star Brand Potato & Vegetable Compound	Caribou
5062	V. C. C. Co.'s 20th Century Potato Manure, without Potash	Houlton
	WHITMAN & PRATT RENDERING CO., LOWELL, MASS.	
5136	Ground Bone	Saco
5031	Whitman & Pratt's Corn Success Brand	Fairfield
5125	Whitman & Pratt's Corn Success Brand	Oakland
5162	Whitman & Pratt 1-10 Brand	Saco
5030	Whitman & Pratt's Potato Manure	Fairfield
5124	Whitman & Pratt's Potato Manure	Oakland
5033	Whitman & Pratt 2-8-4 Brand	Fairfield
5032	Whitman & Pratt 2-8-2 Brand	Fairfield

Analysis of Fertilizer Samples, 1918.

Station number.	Water.	Nitrogen.					Phosphoric Acid.				Potash.	
							Available.		Total.			
		As nitrate.	As ammonia.	Active.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
5022	5.09	0.46	0.80	1.53	1.71	1.65	8.44	8.00	9.79	9.00	1.26	1.00
5021	8.84	0.34	0.70	1.64	1.96	1.65	10.68	10.00	11.73	11.00	------	0.00
5093	5.86	0.58	2.00	3.39	3.83	3.29	10.14	10.00	11.27	11.00	------	0.00
5073	11.60	0.44	2.44	3.51	3.73	3.29	8.14	8.00	8.69	9.00	3.31	3.00
5088	11.38	1.96	0.12	3.07	3.47	3.29	8.07	8.00	8.49	9.00	3.12	3.00
5062	11.10	3.40	0.46	4.21	4.51	4.11	9.84	10.00	10.60	11.00	------	0.00
5163	4.05	------	------	------	2.64	2.46	------	10.00	25.46	20.00	------	0.00
5031	8.97	1.96	0.18	2.52	2.63	2.46	9.67	10.00	11.11	11.00	------	0.00
5125	11.14	1.36	------	2.38	2.46	2.46	10.00	10.00	10.55	11.00	------	0.00
5162	6.99	0.40	------	0.76	0.95	0.82	9.90	10.00	10.63	11.00	------	0.00
5030	9.18	2.00	0.60	3.06	3.29	3.29	10.12	10.00	11.05	12.00	------	0.00
5124	9.05	1.24	0.48	2.69	3.00	3.28	10.10	10.00	10.90	11.00	------	0.00
5033	7.65	1.32	0.14	1.57	1.78	1.64	8.12	8.00	9.23	9.00	4.04	4.00
5032	7.52	1.00	0.40	1.51	1.74	1.64	8.08	8.00	8.58	9.00	1.96	2.00

Table Showing the Results of Examination of Samples of Lime and Limestone Collected by the Inspectors in 1917.

Station number.	Name of Maker	Brand	Calcium Oxide Per Cent	
			Found	Claimed
4939	Rockland Rockport Lime Co.	R. R. Land Lime	59.10	60.00
5128	Rockland Rockport Lime Co.	R. R. Ground Limestone	50.72	51.00