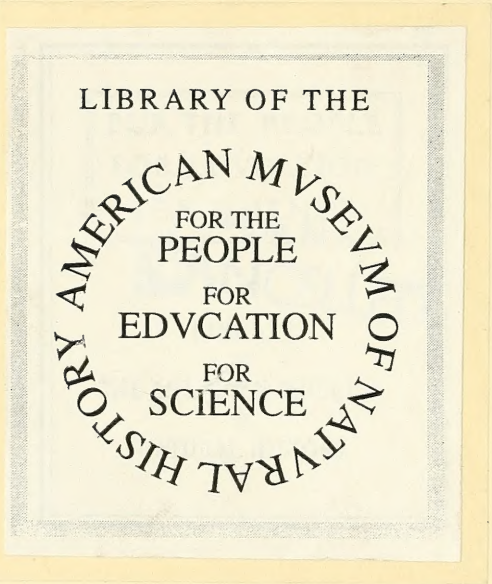
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THIRTY-THIRD ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO, MAINE

1917

UNIVERSITY OF MAINE

1917

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE

ORGANIZATION JANUARY TO JUNE, 1917.

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

THE STATION STAFF

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	JANIE L. FAYLE,	*Stenographer*
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	FRANK M. SURFACE, PH. D.,	*Biologist*
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	HARRY C. ALEXANDER,	*Laboratory Assistant*
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	ALICE W. AVERILL,	*Laboratory Assistant*
PLANT PATHOLOGY	WARNER J. MORSE, PH. D.	*Pathologist*
	†MICHAEL SHAPOVALOV, M. S.,	*Assistant*
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	C. HARRY WHITE,	*Scientific Aid*
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	WALTER E. CURTIS,	*Scientific Aid*
ROYDON L. HAMMOND,		*Seed Analyst and Photographer*
CHARLES C. INMAN,		*Assistant*

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

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

ORGANIZATION JULY TO DECEMBER, 1917.

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	MARIAN AVERY	*Clerk*
	ESTELLE M. GOGGIN	*Stenographer*
BIOLOGY	RAYMOND PEARL, PH. D.,	*Biologist**
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	VIOLA L. MORRIS,	*Laboratory Assistant*
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ROYDON L. HAMMOND,		*Seed Analyst and Photographer*
CHARLES C. INMAN,		*Assistant*

* 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 experment 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 neds 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 green house 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.

All the bulletins issued by the Station are sent to the members of the staffs of other Stations and the U. S. Department of Agriculture who ask for them, to all newspapers in Maine, to libraries and to agricultural exchanges. Bulletins which have to do with general agriculture and the Official Inspections which bear upon the feeding stuffs, fertilizer and seed inspections are sent to a general mailing list composed chiefly of farmers within the State. The publications having to do with the food and drug inspection are sent to a special list including all dealers in Maine and other citizens who request them. The annual report is sent to directors of experiment stations and to libraries. Copies of all publications are sent to the newspapers within the State and to those on the exchange list outside of the State.

BULLETINS ISSUED IN 1917.

No. 258 Some Commonly Neglected Factors underlying the Stock Breeding Industry. 28 pages. One illustration.

No. 259 Pupae of some Maine Species of Notodontoidea. 58 pages. 5 pages plates.

No. 260 Barn and Field Experiments in 1916. 36 pages.

No. 261 Report of Progress on Animal Husbandry Investigations in 1916. 24 pages.

No. 262 The Change of Milk Flow with Age as Determined from the Seven Day Records of Jersey Cows. 8 pages. One illustration.

No. 263 Syrphidae of Maine—Second Report. 24 pages. 5 pages of plates.

No. 264 The Currant Fruit Fly. 70 pages. 5 pages of plates.
No. 265 The Biology of the Alder Flea Beetle. 36 pages. 4 pages of plates.
No. 266 The Chemical Composition of Green Sprouted Oats. Fish Wastes as food for animals. 8 pages.
No. 267 The Aphid of Choke Cherry and Grain. 4 pages. One page of plates.
No. 268 Abstracts of papers not included in Bulletins, Finances. Meteorology Index. 36 pages.

OFFICIAL INSPECTIONS ISSUED IN 1917.

No. 81 Commercial Agricultural Seeds 1916. 28 pages.
No. 82 Miscellaneous Drug Preparations. 8 pages.
No. 83 Maine Packed Blueberries, Corn and Sardines. 16 pages.
No. 84 Commercial Feeding Stuffs, 1916-17. 68 pages.
No. 85 Commercial Fertilizers, 1917. 28 pages.

MISCELLANEOUS PUBLICATIONS ISSUED IN 1917.

No. 532 Official Daughter-Dam Test. 4 pages.
No. 533 Official Daughter-Dam Test. 1 page.
No. 534 Official Daughter-Dam Test. 1 page.

BIOLOGICAL PUBLICATIONS, 1917.

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

100. The Experimental Modification of Germ Cells. 1. General plan of Experiments with Ethyl Alcohol and certain Related Substances. By Raymond Pearl. Journal of Experimental Zoology, Vol. 22, No. 1, pp. 125-164.
101. The Experimental Modification of Germ Cells. 2. The effect upon the Domestic Fowl of the daily inhalation of Ethyl Alcohol and certain related substances. By Raymond Pearl. Journal of Experimental Zoology, Vol. 22, No. 1, pp. 165-186.
102. The Experimental Modification of Germ Cells. 3. The effect of Parental Alcoholism and certain other Drug Intoxications Upon the Progeny. By Raymond Pearl. Journal Experimental Zoology, Vol. 22, No. 2, pp. 241-310.
103. The Probable Error of a Difference and the Selection Problem. By Raymond Pearl. Genetics 2: pp. 78-81.
104. On the Differential Effect of Certain Calcium Salts upon the Rate of Growth of the Two Sexes of the Domestic Fowl. By Raymond Pearl. Science, N. S., Vol. XLIV, No. 1141, Pages 687-688.
105. Some Effects of the Continued Administration of Alcohol to the Domestic Fowl, with Special Reference to the Progeny. By Raymond Pearl. Proceedings of the National Academy of Sciences, Vol. 2, pp. 675-683.

106. A Note on the Fitting Parabolas. By John Rice Miner. Proceedings of the National Academy of Sciences, Vol. 3, pp. 91-95.
107. Some Commonly Neglected Factors Underlying the Stock Breeding Industry. By Raymond Pearl. Annual Report of the Maine Agricultural Experiment Station for 1917. Bulletin 258, pp. 1-28.
108. The Probable Error of Mendelian Class Frequency. By Dr. Raymond Pearl. American Naturalist, No. 603, pp. 144-156.
109. The Selection Problem. By Raymond Pearl. American Naturalist, No. 602. pp. 65-91.
110. Studies on the Physiology of Reproduction in the Domestic Fowl. XVII. The Influence of Age upon Reproductive Ability, with a description of a New Reproductive Index. By Raymond Pearl, Genetics, Vol. 2: 417-432.
111. Report of Progress on Animal Husbandry Investigations in 1916. By Raymond Pearl. Annual Report of the Maine Agricultural Experiment Station for 1917. Bulletin 261, pp. 121-144.
112. Studies on Oat Breeding-V: The F_1 and F_2 Generations of a Cross between a Naked and Hulled Oat. By Jacob Zinn and Frank M. Surface. Journal of Agricultural Research Vol. X, No. 6. Washington, D. C., pp. 293-312.
113. Studies on Imbreeding VII.—Some Further Considerations Regarding the Measurement and Numerical Expression of Degrees on Kinship. By Dr. Raymond Pearl. American Naturalist, Vol. LI, No. 609, pp. 545-549.
114. Sex Studies. By Alice M. Boring and Raymond Pearl. Anatomical Record, Vol. 13, No. 5, pp. 253-268.
117. The Change of Milk Flow with Age, as Determined from the Seven Day Records of Jersey Cattle. By Raymond Pearl and S. W. Patterson. Annual Report of the Maine Agricultural Experiment Station for 1917. pp. 145-152. Bulletin 262.
118. Studies of Imbreeding. VIII. A single Numerical Measure of the Total Amount of Imbreeding. American Naturalist, Vol. LI, No. 610, pp. 636-639.
119. The Sex Ratio in the Domestic Fowl. By Raymond Pearl. Proceedings of the American Philosophical Society, Vol. LVI, No. 5, pp. 416-436.

ENTOMOLOGICAL PAPERS FROM THE MAINE AGRICULTURAL EXPERIMENT STATION, 1917.

Ent. 88. Eastern Aphids, New or Little Known Part 1. By Edith M. Patch. Journal of Economic Entomology, Vol. 10, No. 4.
Ent. 90. Pupae of some Maine Species of Notodontoidea. By Edna Mosher. Bul. 259, Me. Agr. Exp. Station.
Ent. 92. An Infestation of Potatoes by a Midge. By Edith M. Patch. Journal of Economic Entomology, Vol. 10, No. 5.
Ent. 93. The Biology of the Alder Flea Beetle. By William C. Woods. Bul. 265, Me. Agr. Exp. Station.

Ent. 94. Syrphidae of Maine—Second Report. By C. L. Metcalf. Bul. 263, Me. Agr. Exp. Station.

Ent. 95. The Aphid of Choke Cherry and Grain, *Aphis pseudoavenae*. By Edith M. Patch. Bul. 267, Me. Agr. Exp. Station.

Ent. 96. The Currant Fruit Fly. By Henry H. P. Severin. Bul. 264, Me. Agr. Exp. Station.

THE STATION AND THE WAR.

In April at the time of the annual meeting of the Station Council the work of the Station for the preceding year was reviewed. This as usual covered work completed during the year, published and unpublished, work begun that would naturally be continued and plans for new lines of investigation. The whole plan along usual lines with some advances was adopted. The declaration of war followed quite shortly after this meeting. But for the few first weeks the work of the Station went on uninterruptedly. Plantings were made at both farms as usual and in accord with the plans approved by the Council. The usual amount of hatching at the poultry plant proceeded normally. The regular lines of investigation were entered upon. The usual special summer staff in entomology came to the Station early in June.

The National Academy of Sciences had in the preceeding fall appointed a committee on Agriculture with special view to war needs of which Doctor Raymond Pearl, Biologist of the Station, was the chairman. A meeting of this committee was held in Washington in May. President Wilson had previously asked Mr. Herbert Hoover, who had charge of the feeding of the Belgians under the Belgian Relief, to come to the United States to take charge of the food supply in America. Although legislation was still pending the administration had a pretty well thought out plan of action. At that time and later developments confirmed and strengthened this judgment, the most important branch of food service was thought to lie along statistical lines such as the amount of food in each country of the world, their normal production, their war production, their normal needs, their war needs and the same statistical information regarding the production, consumption, and possible exportation surplus of the United States. Mr. Hoover asked Doctor Pearl to come to Washington for the period of the war and take charge of this department of the Food Administration. The

project from the start was a large one and has been a constantly increasing one. Doctor Pearl felt the need of people that he knew and whose judgment he could rely upon to immediately assist him. This resulted in the Food Administration asking that the Station release for the period of the war Doctor Frank M. Surface, biologist to the Station and Mr. John Rice Miner, Computer in the Biological Department of the Station. Leaves of absence for the period of the war without salary were granted Doctors Pearl and Surface and Mr. Miner. They went to Washington the last of June, 1917. Expert clerical help was needed. The salaries offered were greatly in excess of what the Station could afford. This resulted in the two long experienced clerks, Miss Pooler and Miss Fayle, resigning from the Station and accepting positions with the Food Administration at Washington. After licensing of food manufacturers and dealers was adopted as a war measure the Food Administration needed to take charge of one of its divisions a man educated as a chemist and experienced both from the field and office standpoint with food inspection. For this work they chose Mr. Herman H. Hanson who had been associated as chemist with the work of this Station for many years. Leave of absence for the period of the war without salary was granted Mr. Hanson and he went to Washington in December.

Very soon after the declaration of war a meeting was called at the office of the Commissioner of Agriculture at Augusta to consider what could be done to promote agricultural production in Maine. After discussion at a morning meeting a committee was appointed to draw up a line of action to submit to the afternoon session. At the afternoon session the program as suggested by the committee was adopted and the committee was instructed to bring the whole matter to the attention of the Executive Committee of Public Safety. The Executive Committee adopted the plan, named Mr. Donald Snow of the Executive Committee as Chairman of the Maine Public Safety Committee on Food Production and Conservation. The Director of this Station was named as one of the other 7 members. This committee has met almost weekly and directly and through committees appointed by it has planned and coordinated the efforts made during the past year to increase the production and the conservation of food. This has taken about 20 per cent of the time of the Director since May, 1917.

With the danger of fuel shortage the Congress passed control laws and a Federal Fuel Administrator was appointed with very broad powers. He in turn appointed a Fuel Administrator in each State to each of whom were delegated the powers of the Federal Administrator. With the increasing shortage of fuel coal attention was turned to the use of fuel wood to replace fuel coal so far as possible particularly in household use. Fuel Administrator Hamlen for Maine, appointed the Director of this Station as chairman of the State Fuel Committee for Maine, and delegated to him the powers of the Fuel Administration for handling fuel wood. This is taking quite a considerable amount of time.

Ordinarily the Station Staff does no work at all analogous to extension service. But the needs of the year called for expert direction of the work along the lines of insect and plant disease control. Doctor Edith M. Patch, Station Entomologist, has acted as leader for the work along insect control and Doctor Warner J. Morse, Plant Pathologist to the Station, has acted as leader along plant disease control. As part of his work in connection with the Fuel Administration the Director has acted as leader in improvement wood lot cutting demonstrations.

It will be noted that the Station has granted leave of absence for the period of the war to 4 of its ablest workers and has partly diverted for war needs the time of 3 others of its most important staff members. Although all of these accepted the added war work with enthusiasm and have endeavored to have it interfere as little as possible with Station activities it has not made it possible to maintain the Station program entact. In common with the rest of the Country the Station is glad to "do its bit."

CHANGES IN STAFF.

The temporary changes are noted in the preceding section. Gem C. Russell, Stenographer, Doctor Maynie R. Curtis, Assistant Biologist, John H. Perry, Assistant Chemist, Harry C. Alexander, Laboratory Assistant (Chemistry) Donald S. Clark, Laboratory Assistant (Plant Pathology) Blanche F. Pooler, Clerk and Janie L. Fayle, Stenographer resigned at the end of the fiscal year although the services of part were retained for a few weeks later.

Marian Avery, Clerk, Estelle M. Goggin, Stenographer, Silvia Parker, Assistant Biologist, Helen A. Ring, Laboratory Assistant (Biology), Viola L. Morris, Laboratory Assistant (Plant Pathology), Harold L. King, Assistant Chemist were appointed for the year beginning July 1, 1917 although not all of them reported for work at once.

The Station was very fortunate in securing the services of Doctor John W. Gowen as Assistant Biologist during the period of the war to continue lines of work that would have suffered otherwise. Doctor Gowen did post graduate work at the University of Maine. His major was under Doctor Pearl and along the lines of animal husbandry investigation. When Doctor Pearl was called by the Food Administration Doctor Gowen was just completing his work for the doctorate at Columbia University. He brought to the Station the skill and experience that he had obtained from his work under Doctor Pearl and the broadened view from 2 years of study at Columbia University.

THE STATION PLANT.

There have been few changes in the plant during the year. At Aroostook Farm the Federal Department of Agriculture in addition to the green house built last year has constructed a potato storage house with office for the use of the Department Horticulturist. The whole plant at Orono and both Experiment Farms have been maintained in good order and in high efficiency.

BULLETIN 258.

SOME COMMONLY NEGLECTED FACTORS UNDERLYING THE STOCK BREEDING INDUSTRY.[1]

By Raymond Pearl.

The Breeding Industry.

Animal-breeding as an industry lies at the foundation of animal husbandry, which in turn is a basic element of the art of agriculture. Before any of the domestic animals can be used to provide food or clothing for mankind, the animals themselves must be produced. It is the function of the art or craft of animal-breeding to *produce* the world's supply of domestic animals of all kinds.

An attribute of living organisms, which fundamentally differentiates them from non-living matter, is the faculty of self-reproduction. Certain cells of the body in all higher animals are able, under suitable conditions, to go through a process of development which has as its end result the production of a new individual of the race or species. Through these cells (known as reproductive cells, or gametes) the animal has the power of reproducing itself. A new and distinct individual existence is brought into the world. Nothing like this is known in the inorganic realm. The stone in the field is not capable, through any self-initiated or self-perpetuated activity, of causing the coming into existence of a new stone, essentially like itself in form, size, structure, chemical composition and every other quality. Only plants and animals—in other words, living things—can do this.

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[1]Papers from the Biological Laboratory of the Maine Agricultural Experiment Station, No. 107.

The substance of this paper was presented as an address before the Maine Live Stock Breeders' Association at its meeting in Augusta, December 5, 1916. The introductory portion is a reprint, with some slight changes and corrections of typographical errors, of a paper entitled "The Animal-Breeding Industry," published in the Scientific Monthly, July, 1916, pp. 23-30.

It is this fundamental attribute of self-reproduction which the art of animal-breeding makes use of for the benefit of mankind. The breeder attempts to direct and control the reproduction of certain species and varieties of animals which possess qualities that are of value. Thus the breeder of dairy cattle endeavors so to control and direct the reproduction of these animals that he shall be able to produce cows which will yield a large amount of milk. The beef-cattle breeder tries to produce animals which carry on their frames a large amount of meat of good edible quality. The sheep-breeder has for his object to bring about the plentiful reproduction of animals bearing a large amount of wool. And so on, always the breeder is trying to control, guide and direct a fundamental biological process (reproduction) in such way that the product may be most valuable to him in some direction, either utilitarian, æsthetic or other. The more complete this control is, and the more definitely it is directed towards a particular desired end, the greater is the success of the breeder.

Man's needs or fancies have led to the production of many and diverse breeds of the domestic animals. In every civilized country special breeds and sub-breeds or varieties have been developed to meet the particular conditions prevailing there. In the number of such specialized and diversified races of animals, all of which must have come originally from a very small number of unspecialized ancestral forms, is perhaps to be found the most striking measure of the degree to which man has developed and extended his control over the natural processes of reproduction. Some idea of the extent to which this differentiation and specialization of animals for particular ends has been carried may be gained from Table I. This table shows the number of different breeds and varieties of farm live stock which are found in the British Isles.[2] Some are local varieties, but still distinct. All these are essentially native British breeds. Other countries, especially the older ones, show in greater or less degree the same conditions. They have developed breeds of live stock to suit their own special needs and fancies.

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[2]This table is compiled from "British Breeds of Live Stock," London (Board of Agriculture and Fisheries), 1910.

TABLE I.

Showing the Numbers of Different Breeds of British Live Stock.

Kind of Stock	Number of Distinct British Breeds and Varieties
Horses	17
Beef cattle	13
Dairy cattle	7[3]
Sheep	34
Swine	8

It is evident from this table that the skill of the English breeder has well justified the reputation it has created for the British Isles as one of the chief sources of the pure-bred live stock of the world.

To produce the world's supply of domestic animals, which we have seen to be the business of the animal breeder, is a task of great magnitude. Resort must be had to statistics[4] if any just conception is to be formed of the extent and importance of this breeding industry. We shall confine our attention to the United States, remembering that except in certain rather restricted lines, the animal-breeding industry in this country has as yet had no special or intensive development.

The following table shows the number of living domestic animals of various kinds which were on farms in the United States on January 1, 1912, together with their estimated farm value. The figures take no account of the vast number of horses, for example, which are not on farms.

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[3]Counting the Dairy Shorthorn as a distinct variety.

[4]The raw data on which the following statistical discussion is based are taken from the official returns of the U. S. Department of Agriculture, as published in the Yearbooks. The writer is, of course, responsible for the treatment of these figures here developed and for the deductions made.

The fact that the statistics here used are three years old in no wise invalidates the conclusions. Essentially the same conclusions would be reached from a survey of the stock-breeding industry in any normal year. Of course just at the present time industrial conditions of all sorts, including stock-breeding, are upset by war conditions. On that account, indeed, it is altogether probable that the facts as here presented give a much more nearly normal picture of the industry than would statistics for the years 1914 or 1915.

TABLE II.

Number and Value of Farm Live Stock in the United States on January 1, 1912.

Kind of Stock	Number	Value
Horses	20,509,000	$2,172,694,000
Mules	4,362,000	544,359,000
Milch cattle	20,699,000	815,414,000
Other cattle (chiefly beef)	37,260,000	790,064,000
Sheep	52,362,000	181,170,000
Swine	65,412,000	523,328,000
Total	200,602,000	$5,027,029,000

Each one of these two hundred million animals was produced by a definite breeding operation. Somewhere somebody, with more or less care and thought as to the result, mated together two animals to produce each one of the individuals or litters which lumped together give this enormous total. The mere statement of such large figures conveys little impression to the mind. Let us try by comparison to see what the figures really mean. If all the live stock on farms in the United States on January 1, 1912, had been sold at a price such as to realize the estimated farm value in cash, and then the money so obtained, had been equally divided, each individual man, woman and child in the country would have received as his share from this transaction $54.66. Furthermore the farm value of live stock represented an amount sufficient to pay the whole principal of the public debt of the United States (equal to $2,906,750,548.66 on October 1, 1913) nearly twice over.

This same sum of money would support the common schools of the United States for more than 12 years, assuming the same rate of school expenses as obtained in 1908-09. The mules or the swine each alone, if converted into cash, would pay all the common school expenses for more than a year, the cattle for four years, and the horses more than five years. The sheep of the country on January 1, 1912, were worth more than one and a half times as much as the entire property (lands, buildings, equipment, etc.) of all the colleges of agriculture and mechanic arts in the United States in 1910, the last year for which figures were available when this was written.

The figures given do not tell the whole story of the magnitude of the animal-breeding industry of the country. They deal only with the live stock actually on the farm. Besides this are the exports to be reckoned with. Table III gives the facts regarding exports.

TABLE III.

Number and Value of Live Stock Exported from the United States During the Year Ending June 30, 1911.

Kind of Stock	Number	Value
Horses	25,145	$3,845,253
Mules	6,585	1,070,051
Cattle	150,100	13,163,920
Sheep	121,491	636,272
Swine	8,551	74,032
Total	311,872	$18,789,528

Over against the exports are to be set the imports. Animals are imported into the United States for purposes falling into two general classes. On the one hand, are the imports, mainly from European countries, of superior animals to be used as breeding stock. The ultimate object of such importation is the improvement of the live-stock of the country. On the other hand, there are some importations of animals for purposes of slaughter and utilization in other ways than breeding. The live-stock imports of each of these classes for the fiscal year 1910-11 are given in Table IV.

TABLE IV.

Number and Value of Live Stock Imported into the United States During the Year Ending June 30, 1911.

Kind of Stock.	Why Imported.	Number.	Value.
Horses	For breeding purposes	6,331	$2,055,418
"	" other "	3,262	636,656
Cattle	" breeding "	2,441	362,220
"	" other "	180,482	2,590,857
Sheep	" breeding "	5,341	116,277
"	" other "	48,114	261,348
Total		245,971	$6,022,776

From the figures given in the preceding tables it is possible to make some calculations to show average individual values. These are of interest because they furnish some indications of the cash value which rewards attention and care devoted to the breeding of animals. Let us first consider the average values of the different kinds of live stock on the farm. These figures will furnish a base with which comparisons may be made. They measure in a crude way, but still a real one, the stage of development or progress which the live stock breeding industry of the country has attained. Table V gives the figures, calculated from the data given in Table II above.

TABLE V.

Average Values of Live Stock on the Farm.

Kind of Stock	Average Value of the Individual
Horses	$105.94
Mules	124.80
Milch cows	39.39
Other cattle	21.20
Sheep	3.47
Swine	8.00

It is to be expected that animals chosen for export will be on the average of somewhat better quality than those left on the farm. A part go out of the country for breeding purposes, and these will have a powerful effect in raising the average value of exported stock. In accordance with expectation, the average values for exported stock are seen in Table VI to be in every case somewhat greater than those for farm stock. The relative amount of this increase, shown as the percentage which the difference in values is of the farm value, is given for each class of stock in a third column of the table.

TABLE VI.

Average Values of Live Stock Exported.

Kind or Stock	Average Value of Individual	Percentage Increase in Average Value of Exported Over Farm Live Stock
Horses	$152.92	44.3
Mules	162.50	30.2
Cattle	87.70	216.7[5]
Sheep	5.24	51.4
Swine	8.66	8.2

While the relative increases of value seen here are respectable, considered by themselves, they are insignificant in comparison with these exhibited in the valuation of animals *imported* for breeding purposes. The figures for the latter are shown in Table VII, which is calculated in the same way as Table VI.

TABLE VII.

Average Values of Live Stock Imported for Breeding Purposes.

Kind of Stock	Average Value of Individual	Percentage Increase in Average Value of Imparted Over Farm Live Stock
Horses	$324.66	206.5
Cattle	148.39	435.8
Sheep	21.77	529.2

Taking these figures at their face value, for the moment, they indicate that the average horse imported into the United States for breeding purposes is worth three times as much as the average horse on an American farm. The average cow or bull imported is worth nearly five times as much as the average cow or bull on the farm; while the average imported sheep is more than six and a quarter times as valuable as the home product on the farm.

These figures furnish an impressive object lesson as to the value of paying attention to the breeding of live stock. Fundamentally the enhanced valuation of the imported animals rests on the fact that they are better bred than the average farm

[5]Calculated on the basis of weighted mean of the two classes of cattle distinguished in Table V.

stock here. Their qualities all approach the ideal more closely. But they have been brought to that condition by the practice of skilful, well-planned and carefully executed breeding.

The statistical data so far presented regarding the breeding industry have been drawn from official returns and cover the country as a whole. They suffer from the defects of such statistics. While they show the general relations in a substantially correct way, they tend to reduce to a minimum differences of all kinds. In the case of the last comparison made, the indicated difference in average valuation between farm and live stock and that imported for breeding purposes *is probably distinctly less than the true difference.* A better comparison, and one which not only shows what careful breeding means to the farmer and to the nation as a source of wealth, but also shows that the foreigner has no monopoly on the production of fine breeding stock, is between average farm values and the prices realized at auction dispersal sales of pedigreed stock in this country. Let us examine a few figures of this kind.

Table VIII[6] gives the average sale price of pedigreed beef cattle in all sales held in this country during the six years preceding 1913.

The increase of these prices over the $21.00 of the farm cattle is obvious. The same considerations apply to other kinds of stock. At a Guernsey cattle sale held in Oconomowoc, Wisconsin, March 20, 1912, 69 head were sold at an average price of $377.26. Mr. H. E. Browning of Hersman, Ill., sold 41 Duroc-Jersey swine "of his own breeding" on December 19, 1912, at an average price of $173 per head. The contrast of this price with the $8.00 average on the farm is sufficiently striking.

The live-stock breeding industry of the world rests on a foundation of pure-bred pedigreed stock. The constant aim of the breeder from the earliest time has been to produce differentiated types particularly adapted to his locality, conditions and needs. Having once found or developed such a type, the breeder wishes to keep it. This he can only do if it "breeds

[6]Compiled by the Breeders' Gazette and published in the issue of January 1, 1913.

TABLE VIII.

Average Prices Realized at Auction Sales of Pedigreed Beef Cattle.

Name of Breed.	1912.			1911.			1910.		
	No. of sales.	No. sold.	Average price.	No. of sales.	No. sold.	Average price.	No. of sales.	No. sold.	Average price.
Short-horn	45	1,882	$177 40	53	2,258	$162 50	49	1,999	$187 50
Hereford	15	957	180 40	19	1,203	160 50	20	1,214	146 20
Aberdeen-Angus	12	627	138 95	13	723	143 60	19	995	167 35
Galloway	.....	.....	.....	.....	.....	.....	1	67	83 30
Polled Durham	2	83	132 85	1	42	140 60	3	74	115 00
Red Poll	1	30	107 25	.....	.....	.....	1	41	185 00

Name of Breed.	1909.			1908.			1907.		
	No. of sales.	No. sold.	Average price.	No. of sales.	No. sold.	Average price.	No. of sales.	No. sold.	Average price.
Short-horn	78	3,308	$159 00	59	2,689	$146 50	84	3,608	$160 15
Hereford	25	1,398	127 05	15	936	116 15	29	1,358	123 70
Aberdeen-Angus	18	935	189 00	18	955	165 10	18	1,119	134 75
Galloway	2	69	128 05	3	136	84 50	3	123	139 05
Polled Durham	2	79	129 45	6	244	124 50	3	106	130 35
Red Poll	3	35	97 80	1	3	50 00	3	97	83 00

true." It obviously could not be expected to breed true if at frequent intervals it were crossed with other types. The breeding of individuals all of the same general type, and belonging to a few family lines, could be safely left to the individual breeder in the earlier days of the industry. With the wider development of the industry this was no longer possible. It became necessary to have an official registration of pedigrees, which should be beyond any chance of manipulation by the breeder. In this way one wishing to purchase an animal of a particular breed would have definite and objective evidence that the individual was, in fact, of the breed it was supposed to be.

Out of this need have grown the systems of pedigree registration in herd-books, stud-books and the like. In most countries at the present time these registry records have an enhanced official status, because they are under governmental control and supervision. In the United States the control of live-stock registration is in some degree supervised by the Bureau of

Animal Industry of the Federal Department of Agriculture, particularly so far as concerns the registration of imported animals.

The statistical data given in the foregoing discussion are by no means complete, but they serve sufficiently well the present purpose, which is simply to give some conception of the magnitude of the live stock breeding industry and its importance as a source of wealth to the nation. No account has been taken of other than farm live stock, and such obviously represents only a part of the animals which somebody has to breed to supply the needs of the people. Further, nothing has been said about poultry, which represents an important industry in itself. Altogether, however, the following statement by Heape,[8] in concluding a review of the value of the breeding industry in England, is as well justified by conditions in this country, as in the country for which it was written. He says:

All I have attempted is, to give such a broad idea of the number and value of live stock in the kingdom, as the careful consideration of evidence I have been able to obtain, permits. I have taken the utmost care to avoid exaggeration, and in this, at any rate, I have reason to think I have succeeded.

When it is recollected that the Board of Agriculture returns are below, may be 10 per cent or even more below the correct figures; when it is recollected what a large proportion of the people in the country, farmers, dealers, shopkeepers, farm-laborers, working men of various kinds, and gentlemen's servants, make their living in one way or another by means of stock; when it is recollected what a very large number of valuable animals there are in this country, as shown by a sale of yearlings at Newmarket, the prices obtained at the dispersal of a herd of Shorthorns or a flock of Southdowns, the value of a successful horse on the turf, of a good hunter, polo pony, pair of carriage-horses or car-horses, of a couple of pointers, a spaniel, a bull-dog or lap-dog, etc., when such facts are borne in mind I do not think there can be found justification for objection to the final figures I have arrived at on the score of excess; and yet they show a total sum of nearly £450,000,000 invested in live stock in this country.

When to this is added the capital necessary to provide both buildings to house the stock, land on which to grow their food, barns, machinery, vehicles, harness and attendance, the total becomes so gigantic that I am surely justified in asserting: We have here an industry of enormous importance to the country, and one which merits far more attention than has ever yet been accorded to it.

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[8]Heape, W., "The Breeding Industry," Cambridge, 1906.

Some Factors Which Make for Success in the Business of Breeding.

In the preceding section we have seen that the pecuniary rewards of success in the business of breeding animals are generous. But it also appears clearly from the statistics that the general average quality of the live stock on the farms of this country is deplorably low, and the returns to the breeder are correspondingly meager. What can be done to better this condition of affairs? Are there some obvious general principles which are being systematically neglected by the rank and file of the farmers? I believe that there are. Any farmer has it within his power to do certain things which will surely improve the quality of his stock, unless it is already of such high quality that further improvement is virtually impossible. And this last, we may be sure, is not a frequent condition of affairs. What then are some of these principles which we are neglecting?

THE TEST OF PROGENY PERFORMANCE AND ITS IMPLICATIONS.

For the practical breeder of any kind of animals one of the most significant results which has come from the modern scientific study of genetics is the demonstration of the importance of what I have elsewhere termed the principle of the progeny test in breeding for performance. This principle may be stated in the following way. *The only certain and sure test of the worth of an animal as a breeder is found in the actual performance of that animal's progeny.* The work of the last decade in genetics has led to a new conception of the mechanism of heredity which differs markedly from older views. The keynote to this conception is that it is the germ cell (egg or sperm) and not the body or soma which is the factor of primary importance in inheritance. What the individual is like in respect to its personal, somatic[9] characters is not determined by the

[9]For the reader not familiar with the technical terminology of biology, it may be said that "somatic" is used in designation of those characters of the organism which pertain to all parts except the reproductive or germ-cells. These reproductive cells are called "gametes." We then have the adjective "gametic," meaning "pertaining to the germ cells," in contrast to "somatic" meaning "pertaining to any or all parts of the organism other than the germ cells."

somatic characters of its parents, but by the composition or constitution of the parental gametes. Thus the size of a bean is determined not by the *size* of its parent bean, but by the gametic constitution of the latter.

In the principle above stated "performance" is used in the broadest and most inclusive sense. It may mean performance in the show ring, at the butcher's block, in the milk pail, at the shearing shed, in the trap nest, at the race track, in the pulling contest, etc. The essential point is that it is not possible to tell with any certainty by looking at a cow, for example, or its pedigree, whether the heifers from that cow will be good milkers. Nor does the fact that the cow herself is a superior milker ensure or prove that her heifers will be superior milkers. They may be or they may not. The only way to be sure about it is to *try them.* If they are good milkers then the use of that cow as a breeder is by just so much improving the quality of the herd. Again the fact that a bull's dam made a great record at the pail does not ensure that his daughters will be superior milkers. We can only know whether he possesses the ability to transmit dairy productivity by getting the actual records from some of his daughters. If these records are good the breeding worth of the bull is presumptively high. At any rate we know in that case that he is not lowering the average quality of the herd. Nothing else can furnish the sure and certain kind of information which the actual progeny test furnishes.

The principle of the progeny test carries with it a certain implication as to the age to which breeding stock should be retained. Obviously if we are to profit from our knowledge as to the breeding worth of a bull gained by the progeny test we must have the bull alive and in breeding condition *after* we have made the test. This means that we must keep him in the herd longer than bulls are usually kept by Maine breeders. If a herd bull is disposed of before any of his progeny have reached an age where their performance as milkers, for example, can be measured, then clearly this guiding principle of progeny test is playing no part in the breeding of the herd. Without this principle in active operation the breeder is in much the circumstances of a mariner without a compass. Pro-

gress towards a desired goal is *possible,* but it is likely to be by a very roundabout and haphazard route, and is sure to be very slow.

It is a matter of considerable interest to examine statistically the age of breeding bulls in the hands of progressive Maine farmers and breeders. Data on this point are presented in Table IX. It should be noted particularly that all ages recorded in this table are the ages of the animals *at the time when they were bred successfully.* Each entry in the table is based upon what we call a "completed record." Such a completed record comprises, on the one hand, a service record, and on the other hand a birth record, which sets forth the facts regarding the calf born as a result of the service accounted for on the service record. The ages tabled here are the ages at the time of service.

The more important biometric constants from this table are shown in Table X.

TABLE IX.

Showing the Age in Years of Bulls Used as Breeders.

Age in years	Absolute frequency	Percentage
1	213	22.03
2	252	26.06
3	209	21.61
4	149	15.41
5	52	5.78
6	53	5.48
7	24	2.48
8	8	.83
9	3	.31
10	—	—
11	—	—
12	4	.41
13	—	—
14	—	—
15	—	—
16	—	—
17	—	—
18	—	—
Total	967	100.00

TABLE X.

Showing the Chief Physical Constants for Variation in Age of Breeding Bulls.

Constant.	Bulls used as breeders.
Mean or average age	2.921 ± .037 years
Median age	2.589 ± .047 years
Third quartile age	3.844 ± .047 years
Standard deviation	1.722 ± .026 years
Coefficient of variation	58.94 ± 1.18%

From these tables we note that the average age of the herd bulls used to sire the 967 calves included in the statistics was just under three years. The median age of these herd bulls was approximately two and a half years. This means that one-half of the calves were sired by bulls *under* two and a half years old at time of service. Seventy-five per cent of all the calves (as shown by the third quartile age) were sired by herd bulls less than about three years and nine months old at time of service. Less than 15 per cent of the calves were sired by bulls five or more years old. Let us consider for a moment what these facts mean. A bull must be at least four years old before the breeder can possibly have had any opportunity to test adequately the milk producing capacity of his daughters. *But 85 per cent of all the calves covered in these statistics were sired by bulls under four years and 10 months of age.* In other words, in the breeding operations of a large number of Maine's most progressive and wide-awake breeders (for such the coöperators in this record scheme are) more than three-fourths of the calves produced in a given interval of time are sired by bulls about whose ability to transmit milking qualities absolutly nothing definite can by any possibility be known. It is doubtless entirely fair to assume that essentially the same conditions regarding cattle breeding methods obtain in other places generally. Is it remarkable that progress is so slow?

For comparison with these figures regarding Maine cattle in general let us examine the facts regarding the leading cows

in two of the leading dairy breeds, Jerseys and Holsteins. The facts regarding 32 of the leading cows of the Jersey breed are given in Table XI, which includes the name of the cow, the date when she was dropped, her sire's name, and the age of the sire at the time of conception of the daughter here dealt with. The ages of the sires are given to the nearest year.

TABLE XI.

Showing the Age of the Sires of some Leading Jersey Cows at the Time of Service.

Name of Cow.	Date dropped.	Sire's Name.	Age at time of service.
Dosoris Park Lily 233783	Dec. 15, 1908	Dosoris Park Golden Lad 76986	2
Passport 219742	Nov. 26, 1906	Interested Prince 58224	6
Beaudesert's Lass 211380	Nov. 4, 1907	Rearguard 70962	2
Lass 83d of H. F. 289023	May 26, 1911	H. F. Torono 60326	11
Golden Angela 225625	May 7, 1907	Golden Lad of Berlin 75310	2
Raleigh's Financial Hope 279450	Oct. 24, 1912	Queen's Raleigh 88232	2
Golden Maid's Rose of St. John 288003	May 16, 1907	Imp. Golden Maid's Prince 93538	7
Lily Martin Figgis 209529	Feb. 13, 1906	Marna's Figgis Tormentor69086	2
Jacoba's Loretta 251186	May 22, 1909	Irene's King Pogis 73182	3
Figgis 97th of H. F. 273502	July 22, 1910	H. F. Pogis 9th 55552	11
Karnak's Fontaine 250450	Dec. 1, 1910	Karnak's Noble 87952	2
Spermfield Owl's Victor Lass 238138	Dec. 20, 1909	Spermfield Owl 57088	10
Lass 73d of H. F. 277540	Mar. 14, 1911	H. F. Torono 60236	10
Lass 92d of H. F. 302072	Feb. 5, 1912	H. F. Torono 60236	11
Lass 89th of H. F. 300426	Nov. 3, 1911	H. F. Torono 60236	11
Lass 74th of H. F. 281203	Dec. 28, 1910	H. F. Torono 60236	10
Interested Jap's Rose 306053	Oct. 9, 1912	Meridale Int. Prince 86473	3
Eminent's Bess 209719	July 1, 1905	La Rilla's Eminent Lad 71770	2
Jacoba Irene 146443	Apr. 3, 1898	King of Corfu 50110	1
Sophie 19th of H. F. 189748	Jan. 24, 1905	Fort Hill Farm Chief 62859	4
Spermfield Owl's Temisia215982	May 1, 1907	Spermfield Owl 57088	7
Spermfield Owl's Dawson192935	Aug. 25, 1904	Spermfield Owl 57088	5
Lass 45th of H. F. 233488	Dec. 2, 1907	H. F. Torono 60326	7
Lass 40th of H. F. 223642	Mar. 5, 1907	H. F. Torono 60326	7
Lass 47th of H. F. 240327	Mar. 23, 1908	H. F. Torono 60326	7
Lass 30th of H. F. 214511	Mar. 26, 1906	H. F. Torono 60326	5
Landseer's Pacific Pearl 205097	Aug. 2, 1905	Landseer's N. Exile 54626	7
Gertie of Glynllyn 2d 206903	Feb. 9, 1906	Rosaire's Golden Lad 64554	4
Pride of Hillcrest 194087	Dec. 5, 1905	Mabel's Golden Sultan 70683	2
Mary of Golden Letta 240917	Jan. 19, 1909	Golden Lad of Greenwood 64956	6
Lass 38th of H. F. 223628	Jun. 10, 1906	H. F. Torono 60326	6
Pearly Exile of St. L. 205101	July 15, 1906	Landseer's N. Exile 54626	8

Upon analysis of the figures in Table XI we see that in round numbers, only one (or 3 per cent) of these very high producing Jerseys was sired by a bull under $1\frac{1}{2}$ years old at the time of service; 9 (or 28 per cent) were sired by bulls under $2\frac{1}{2}$ years old at the time; 11 (or 35 per cent) were sired by bulls under $3\frac{1}{2}$ years old. All the rest were sired by bulls $3\frac{1}{2}$ or more years old. The contrast between these figures

and those given above for Maine cattle in general is sufficiently striking. This result does not mean at all that old bulls will necessarily get better or more productive heifers than young bulls. Evidence that this is not necessarily so is seen even in the present table in the cases of Jacoba Irene, whose sire was only one year old at the time of this service, and Eminent's Bess, whose sire was only two years old. What the result does mean is that *those Jersey breeders who are breeding world's record animals in the great majority of cases are producing those animals with tested sires,* which they know from actual previous experience are transmitting to their offspirng high dairy qualities.

A graphic comparison of the facts as to age of sires of Maine cattle in general and of this group of high producing Jerseys is shown in Fig. 1. The cross-hatched areas above and below the four year line show in a striking way the proportionate number of offspring sired by old and young bulls in the two cases.

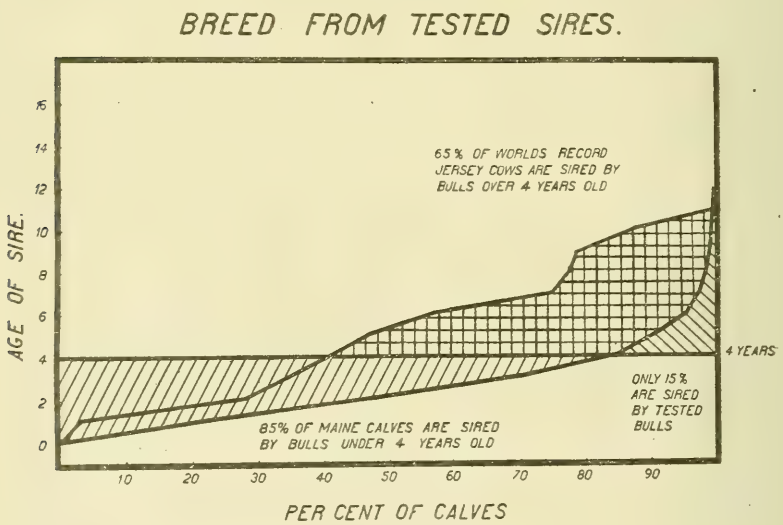

Fig. 1. For further explanation see text.

Similar data for Holsteins are given in Table XII. Here we have 25 cows of outstanding productive merit as evidenced by 12 month records. The arrangement of the table is the same as in the case of Table XI.

TABLE XII.

Showing the Age of the Sires of some Leading Holstein Cows at the Time of Service.

Name of Cow.	Date dropped.	Sire's Name.	Age at time of service.
Banostine Belle De Kol 90441	Jan. 2, 1906	Friend Hengerveld De Kol Butter Boy 29303	4
Pontiac Clothilde De Kol 2d 69991	Dec. 26, 1903	Pontiac Korndyke 25982	4
High-lawn Hartog De Kol 84319	Apr. 17, 1905	Friend Hengerveld De Kol Butter Boy 29303	3
Colantha 4th Johanna 48577	Oct. 30, 1898	Sir Johanna 23446	1
Daisy Grace De Kol 98228	Dec. 10, 1906	Friend Hengerveld De Kol Butter Boy 29303	5
Creamelle Vale 73357	Feb. 13, 1904	Paul De Kol Jr. 24762	5
Aralia De Kol 55194	Jun. 26, 1900	Ignario De Kol 23538	2
Caroline Paul Parthenea 77784	Sept. 21 1903	Aaggie Parthenea Byronia 29775	2
Belle Netherland Johanna 62304	Oct. 11, 1902	Johanna Rue 3d's Lad 26939	3
Woodcrest Meta Vernon De Kol 75866	Jan. 4, 1905	Prince Johanna De Kol 31168	2
Lunde Korndyke 75838	April 6, 1904	Korndyke Queen De Kol Prince 26025	4
Spotted Ann Daughter 100270	Oct. 23, 1906	Friend Hengerveld De Kol Butter Boy 29303	5
Riverside Sadie De Kol Burke 70708	Nov. 24, 1903	De Kol Burke 22991	7
Pontiac Artis 61114	July 11, 1902	Hengerveld De Kol 23102	5
Beauty of Plum 6th De Kol 2d 100889	Feb. 13, 1907	The Milk and Butter King41114	1
Sadie Vale Pietertje 79740	Oct. 29, 1904	Onions De Kol Paul 31341	1
K. P. Lilith Clothilde 110228	Nov. 17, 1907	King of the Pontiacs 39037	2
Vale De Kol Elliston 87448	Sept. 26, 1905	Onions De Kol Paul 31341	2
Pauline Queen Johanna 89407	Dec. 14, 1905	Johanna de Pauline 2d's Lad 28301	4
K. P. Manor Kate 126416	Feb. 18, 1909	King of the Pontiacs 39037	3
Queen Juliana Dirkje 97608	Dec. 12, 1906	Juliana King of Riverside 38446	2
Maple Crest Pontiac De Kol Lady 100410	Feb. 14, 1907	Pontiac Aaggie Korndyke 38291	1
Spotted Lizzie 3d 91567	Apr. 18, 1906	Johanna de Pauline 2d's Lad 28301	5
Alma Kuperus De Kol Pietertje 72609	Oct. 23, 1903	Duke De Kol Pietertje 29365	2
Pontiac Jewel 56976	July 24, 1901	Hengerveld De Kol 23102	4

The facts in regard to Holsteins, if somewhat less striking than those for Jerseys, are still widely different from the conditions found in the cattle breeding industry of Maine. Four (or 16 per cent) of these 25 leading producers of the Holstein breed were sired by bulls under $1\frac{1}{2}$ years old at the time; 11 (or 44 per cent) were sired by bulls under $2\frac{1}{2}$ years old; 14 (or 56 per cent) were sired by bulls under $3\frac{1}{2}$ years old. All the rest (44 per cent of the total) where sired by bulls $3\frac{1}{2}$ or more years of age at the time of service.

It is doubtful if there is any one thing which every breeder could do if he would, likely to work greater improvement in the average quality of the live stock of the state or nation than

the faithful following of the policy of keeping every sire until it was definitely known, by the performance records of the first of his progeny, whether he was adding to or substracting from the productive value of the herd or flock. *Prove the breeding worth of the sire.* If it is poor discard him at once and get another. If it is good keep him as long as possible and by the multiplication of his desirable qualities in his offspring make definite and sure progress.

CONTINUITY OF PURPOSE IN BREEDING AND ITS IMPLICATIONS.

The art of breeding is at once a conservative and a progressive matter. It is conservative in the sense that it holds steadfastly to certain definite and relatively fixed ideals as to what the perfect animal should be. It is progressive in the sense that it bends every effort towards the attainment of those ideals. While it is, I think, unquestionable that these statements are true as general propostions it is unfortunately equally true that many breeders of animals exhibit in their practice rather striking exceptions to them. To the true breeder it is unbelievable, and indeed unthinkable, that there should be so many men as there are who breed without any definite ideals whatever before them. Again there are the so-called breeders whose ideals are perenially subject to change "without notice and without doubt." Today one type or one family is the greatest, indeed the only hope of the breed to one of these men. Meet him a year hence and you will discover, somewhat to your astonishment and confusion, that a totally different type, or wholly foreign blood lines, offer the only chance to stay the rapidly progressing annihilation of the breed. It is a misuse of words to call such persons breeders. They belong mentally in precisely the same category as the colored gentleman of the story who averred that he didn't know where he was going, but that he was on his way. Success in breeding is possible *only* for the man who does know were he is going, that is who has a definite, and for him permanent, ideal as to the kind of animals which he wants to breed. This ideal is something which must be always in his mind as he makes his matings,

or studies pedigrees, or buys stock to add to his herd or flock, or sells stock from it. Lacking such a definite ideal the breeder is worse off than the mariner without a compass, because he not only lacks a means of guidance but also he has no notion of what port he would like to arrive at if he could.

If he is to be successful the breeder must not only have an ideal but must also stick to it, and not change it every time he makes a mating. This implies that the breeding must fall within definite and rather narrow blood lines. It may fairly be said that some degree of narrow breeding (line breeding or inbreeding) is an essential for the highest success in breeding.[10]

This may seem a radical statement, but a careful study of the history of the best improved strains of live stock of all sorts leaves no room for doubt that the attainment of the highest degree of excellence has always been associated with the practice of a very considerable amount of inbreeding, of rather close degree. It is a curious paradox of animal husbandry in general that while, as a matter of fact, every successful breeder of high grade stock practices inbreeding to a greater or lesser extent, a great many of these men are violent, even fanatical, opponents to inbreeding in theory. Most of them will deny stoutly that they ever practice inbreeding. They contend that they practice "line breeding," but never, never "inbreeding."

The distinction here is obviously verbal and not biological, being in its essentials precisely similar to that between Tweedledum and Tweedledee. What is called "line breeding" is simply a less intense form of narrow breeding than that which is called "inbreeding." The essential and important biological point is that what is actually done is to *purify* the stock in respect to all characters to as great degree as possible. What the successful breeder aims to do is to get his stock into such condition that he has only one kind of "blood" in it. Expressed more precisely, though unfortunately more technically, it may be said that the breeder endeavors to get his stock homozygous

[10]The following discussion of narrow breeding is based upon that contained in a paper entitled "The Biology of Poultry Keeping" by R. Pearl, published as Bulletin 214 of the Maine Agricultural Experiment Station, 1913.

with reference to all important characters or qualities. The quickest way, indeed the only way, practically to obtain this result is by the practice of some degree of inbreeding. Sometimes a great stride towards the desired end may be made by mating brother and sister or parent and offspring together.

That a mating of such close relatives will surely result in disaster is one of the carefully nursed superstitions of breeding, which has often been exploded, but will doubtless always be with us. It may be said that all the evidence which may be gleaned from the experience of stock breeders indicates that the results which follow inbreeding depend entirely upon the nature of the individuals inbred. If one inbreeds weak animals, lacking in constitutional vigor, and carrying the determinants of undesirable qualities in their germ cells, the offspring resulting from such a mating will undoubtedly be more nearly worthless than were their parents. If, on the other hand, one inbreeds in the same way strong and vigorous animals, high in vitality, and carrying the germinal determiners of desirable qualities there may be expected a corresponding intensification of these qualities in the offspring. The time has come when a vigorous protest should be made against the indiscriminating condemnation of inbreeding. It should be clearly recognized that if the experience of stock breeders extending throughout the world, and as far back as trustworthy data are available, means anything at all it plainly indicates that some degree of narrow breeding is an *essential* to the attainment of the highest degree of success in the breeding of animals.

This contention receives full support from the results of modern exact studies in genetics Such studies show that the personal bodily characters of the parents have no causal relation to the personal characters of the progeny. What the progeny shall be like is determined by the constitution of the germ cells of the parents. When by a proper system of selective breeding the point is reached where these germ cells are pure with reference to a particular character, or degree of a character, then that character will unfailingly appear in the offspring, in the degree of perfection in which it is represetned

in the germ cells. This is the highest goal of the practical breeder. But in sexually reproducing organisms like the domestic animals purity of the germ cells with respect to the determiners of any character is only to be obtained, in the hands of a practical breeder without special scientific training, by the practice of inbreeding.

It should be clearly understood that indiscriminate inbreeding without definite purpose or reason is not advised or advocated. What we do mean is this: all successful breeding is the working out of carefully made plans looking toward the attainment of a definite ideal. In those plans narrow breeding has a place.

Introduction of new blood for purposes of rejuvenation or reinvigoration is, as ordinarily done, one of the surest ways to prevent any real or permanent improvement of stock by breeding. The difficulty here is that when one introduces new blood he runs the risk of introducing a whole set of characters *inferior* in their degree of perfection to what he already has in his own stock. As a matter of fact the average breeder is usually much too ready to introduce now blood. If one is breeding in certain definite blood lines and getting good results he should be exceedingly conservative about introducing any new blood, and should only do so when he has absolutely sure evidence that it is actually necessary for one reason or another.

There are two main reasons which induce the breeder to go out after new blood. The first is a fear of the evil consequences of inbreeding. This fear is usually, *in the particular case,* absolutely without foundation in fact. Yet how widely prevalent is the idea among the cattle breeders of Maine that at least as often as once in every three or four years one must go out and buy a new bull. It passes all comprehension that any intelligent person could expect to make steady progress in breeding on such a system.

Again the careful breeder sometimes finds himself in this situation. He has by well planned and executed breeding brought his stock up to a particular level of excellence. There the improvement stops. His animals breed true to that particular degree of quality but cannot be made to attain a higher degree. In other words, he has substantially purified his stock

relative to the characters which interest him. But he sees that the stock of some other breeder is measurably better than his. If A is to get his stock up to the B level he must introduce some B blood. This has long been the breeder's procedure, and if done in the right way, it is found to be as successful in practice, as it is justifiable in theory in the light of modern ideas respecting inheritance. The danger in the matter in such a case as this under discussion all turns on the way in which the thing is done. If one feels it to be desirable, for the reason specified, to introduce "new blood" let him by all means do it gradually, and not swamp the whole stock with the new germinal combinations all at once. For if he does he may destroy in this way at one blow results which have taken years of careful breeding to build up.

THE SUPERIORITY OF THE PUREBRED.

The necessary, intrinsic expense involved in breeding and rearing a purebred animal is no more than that involved in breeding and rearing a grade or a scrub. The end product is worth a great deal more in the former case than in the latter, on the average. These considerations being true, and I think they cannot be successfully controverted, it would seem to be the most obvious of sound business principles to keep and breed only purebred, registered livestock. Yet the proportionate number of farm animals which are purebred must be very small indeed.

The chief reason for the relatively small proportion of purebred animals is fairly evident. Most farmers keep animals solely for their immediately productive or useful qualities. They are in no true sense breeders and make no attempt to realize the additional profits which would accrue from combining a breeding business, on however small a scale, with a producing business. The farmer of the sort mentioned is prone to compare in his mind the productive qualities of the best of his grades with the poorest purebreds he has ever seen or knows about, to the detriment of purebred animals in general. He is then apt to take the general position that it would not pay to buy purebred animals for a foundation stock to breed from.

The argument on which this extremely prevalent point of view is based is essentially a fallacious one, because it overlooks certain very pertinent considerations. In the first place while it is true that the best grades are much better than the poorest purebreds in productive qualities, and indeed may in some cases rank with the best, it is also true that the general *average* productivity of purebred animals is higher than that of non-purebreds.

In the second place there can be no comparison between purebred animals and non-purebred animals, considered as groups or on the average, in regard to extent to which they transmit good qualities to their offspring. The purebred animal is, on the average, narrow-bred or line-bred to a much greater extent than the grade or scrub. This means that the likelihood of any particular individual transmitting good qualities which it may possess to its progeny is by so much enhanced.

In the third place, the breeder of purebred animals is not depending, as is the breeder of grades, solely on their productive qualities as a source of income. If he is handling purebreds the offspring are a standard commodity to which a more or less definite rating as to value attaches automatically. If he is breeding scrubs or grades the offspring are apt to be more or less troublesome and unprofitable by-products of his manufacturing business. The dairyman for example who keeps only grade cows has no market whatever for his bull calves except as meat. When sold for this purpose he is sure to get small returns for them. On the other hand, the dairyman whose herd is made up of purebred animals at once has opened out before him the possibility of an additional and better market for his bull calves. He can sell them for breeding purposes and in this way realize much more than meat prices for them.

Finally, the breeder of purebred, registered live stock at once identifies himself with a large and powerful organization, namely that of the registered live stock interests of the country. The extent of these interests is indicated in Table XIII which is based upon a table published by Dinsmore.[11]

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[11]Dinsmore, W. "The registration of pedigrees." Breeders' Gazette. Vol. LXX, p. 881-882, 1916.

TABLE XIII

Data regarding the Magnitude of the Purebred Livestock Interests.

Cattle.	End of fiscal year.	Number of members.	Number of breeders recording.	New members during last year.	Number of registrations last year.	Number transfers last year.
American Shorthorn Breeders' Association	Oct. 31, 1915	800	18,000	.....	65,000	7,709
American Hereford Cattle Breeders' Association	Sept. 1, 1915	6,700	14,000	625	45,000	32,000
American Aberdeen-Angus Breeders' Association	Oct. 31, 1915	3,100	10,000	287	16,274	14,092
American Galloway Breeders' Association	Oct. 31, 1915	410	1,000	12	1,150	610
Red Polled Cattle Club of America	Nov. 20, 1915	1,000	1,800	81	3,628	1,669
Polled Durham Breeders' Association	Nov. 25, 1915	312	2,500	.....	2,267	.....
American Guernsey Cattle Club	April 30, 1915	472	5,000	52	11,114	9,036
Holstein-Friesian Association of America	April 30, 1915	7,676	23,000	1,345	67,680	66,776
American Jersey Cattle Club	Mar. 31 1915	554	23,000	43	33,006	30,874
Ayshire Breeders' Association	Dec. 31, 1915	776	.....	106	3,600	3,180
American Polled Hereford Breeders' Association	Nov. 30, 1915	506	1,750	106	1,737	973
Horses.						
Percheron Society of America	Oct. 31, 1915	7,336	17,000	916	8,492	6,831
American Clydesdale Association	Nov. 30, 1915	810	.....	150	1,000	950
American Association of Importers and Breeders of Belgian Draft Horses	Nov. 11, 1915	925	.....	150	1,128	1,420
American Shire Horse Breeders' Association	Nov. 25, 1915	910	410	54	632	478
National French Draft Horse Association	Oct. 17, 1915	240	.....	.....	1,213	574
American Suffolk Horse Association	Nov. 30, 1915	63	121	8	72	38
American Saddle Horse Breeders' Association	April 9, 1915	303	1,800	.....	1,475	300
American Shetland Pony Club	Oct. 31, 1915	486	250	30	1,109	800

Cattle.	End of fiscal year.	Number of members.	Number of breeders recording.	New members during last year.	Number of registrations last year.	Number transfers last year.
Sheep.						
American Shropshire Registry Association	Sept. 30, 1915	4,715	3,500	143	15,572	3,858
American Southdown Breeders' Association	Oct. 30, 1915	357	2,500	12	2,432	1,750
American Rambouillet Sheep Breeders' Association	Jan. 3, 1916	451	650	9	6,000	1,548
American Oxford Down Association	Nov. 30, 1915	504	2,000	16	3,169	700
American Cotswold Association	Dec. 31, 1915	240	350	.....	.....	.....
American Cheviot Sheep Society	Jan. 1, 1916	196	200	11	612	276
Continental Dorset Club	Dec. 1, 1915	183	200	17	1,215	787
American Hampshire Sheep Association	Nov. 24, 1915	851	1,250	54	10,415	2,916
National Lincoln Sheep Breeders' Association	Nov. 30, 1915	109	122	14	1,650	128
Standard Delaine Merino Sheep Association	Jan. 5, 1915	25	25	.....	112	2
Swine.						
American Berkshire Association	Oct. 30, 1915	642	15,000	192	14,940	14,118
American Poland-China Association	Oct. 31, 1915	2,035	11,700	76	25,350	.....
American Yorkshire Club	Nov. 30, 1915	336	800	14	1,808	175
National Poland-China Record Association	Jan. 31, 1915	885	1,200	36	5,000	500
Standard Poland-China Record Association	Dec. 22, 1915	1,232	10,000	93	22,675	1,000
National Mule-Foot Hog Record Association	Dec. 31, 1915	130	5,000	10	1,462	745
National Duroc-Jersey Record Association	Nov. 30, 1915	5,468	10,000	605	35,693	7,000
American Duroc-Jersey Swine Breeders' Association	Nov. 15, 1915	1,700	8,950	287	17,100	17,060
Totals	.....	53,468	193,078	5,554	430,782	230,873

From this table it appears that the number of purebred registered animals in this country is increasing at the rate of nearly half million a year. Nearly 200,000 breeders of such purebred live stock are recording their animals at the present time. All of these interests are united in the National Society of Record Associations. The purposes of this Society are stated in its constitution as follows:

"To advance the interests of all registry associations by devising and perfecting practical methods of preserving pedigrees of purebred animals; by united effort endeavoring to secure the enactment of equitable laws relating to record associations; by securing the adoption of just rates by the railroads on exhibition and breeding stocks, and also to do and transact such other business as will, in the judgment of such society, advance the interest of breeders of purebred stock through their respective registry associations."

Regarding the results which have been obtained by this National Society of Record Associations, and the significance of the Society for the breeder, the following statement by the Secretary, Wayne Dinsmore,[12] is of interest:

"In the five years that have elapsed the various associations, working through the National society, have defeated some hostile legislation, aided in shaping some that was favorable and given wider publicity to the work which the individual associations are trying to accomplish. They also took up existing abuses in the shipment of breeding animals in less than carload lots (L. C. L. shipments), and, after the failure of negotiations to secure proper concessions from the railroads, carried the case to the Interstate Commerce Commission."

The breeder of grade animals stands in a business way practically by himself. The breeder of purebred animals automatically become allied with an extensive and powerful organization. There can be no doubt, from a strictly buisiness point of view that in this regard alone the man with the purebreds enjoys an enormous advantage over the man who keeps only non-purebreds, grade or scrub, animals.

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[12]Dinsmore, W. Loc. cit. p. 882.

Conclusion.

In this paper I have tried to show, first, the importance of the live stock breeding industry as a business, and second, how the neglect of some rather obvious and easily remedied matters holds back the more successful development of that business in many particular cases. One must not, however, hastily draw the conclusion that if he attends strictly to the things which are pointed out in this paper as being commonly neglected, he will surely attain success in the breeding business. There are many more factors involved in the case than have been discussed here. Perhaps the most fundamental of all is the man himself. By no means everyone can become a successful breeder of live stock. The art of breeding demands personal qualifications which are rather rare. Bates, the great Shorthorn breeder, once said: "Hundreds of men may be found to make a Prime Minister for one fit to judge the real merits of Shorthorns." The man who is to be a real breeder and a successful one must start with a love for animals and a natural instinct for handling them. Without these qualifications he can never be a breeder in the highest sense of the word. Furthermore, the real breeder is always a student, with the instincts of the scientific investigator. He studies his animals and their pedigrees till he knows them thoroughly. He studies the pedigrees of all the leading animals in his breed. He attends live stock shows, fairs, and sales that he may study the best individuals of the breed.

Besides all these things the successful breeder must know how to feed, care for, and develop his animals properly. The most excellent individual may be ruined by improper care. So then along with knowledge and skill in the art of feeding must go an expert ability to recognize condition in an animal, to detect and correct the slightest impairment of health and vigor.

Altogether the real breeder must combine many and varied abilities with his natural love for good animals. And what is the reward? To the *real* breeder it is great and manifold. He will have the satisfaction and emoluments of a creator of some-

thing new and needed. The world will always need better animals and be prepared to pay for them. How well it will pay, everyone who reads live-stock journals knows. Prices for breeding animals numbered in five figures are of such frequent occurrence as to excite only passing comment. Furthermore the joy of creating these new and better animal types is the breeder's. In some degree he may justifiably feel that he is guiding the forces of nature to the working out of an ideal, which is his.

BULLETIN 259

PUPAE OF SOME MAINE SPECIES OF NOTODONTOIDEA.*

EDNA MOSHER.†

INTRODUCTION.

It is only in recent years that entomologists have realized the value of studying the immature stages of insects, although immature forms are responsible for more damage to crops than adults. Now that the need for such studies is felt, it is surprising how very little we really know about the subject. The pupae have rarely been considered even from the standpoint of the systematist, much less from that of the economic entomologist. Nevertheless it is important to be able to recognize an insect pest at any stage of its life-cycle, even if it does no damage while in that stage.

These studies of the pupae of some of the commoner forms found in Maine will, it is hoped, lead to the easy recognition of the species described, and awaken an interest in this stage of the insect's life history.

The pupae were, for the most part, obtained by collecting the eggs or larvae and rearing them to maturity in order to identify the species, as will be necessary until the larval and pupal stages are more carefully studied. This work was done during the summer of 1915, but the season was not a favorable one for rearing Lepidoptera, being very cold and wet. Many of the specimens died of fungous or bacterial diseases, the Geometridae being especially hard to rear successfully. In some

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The synonymy used is, for the most part, that of Dyar's check list.

cases the life history has been supplemented by material from the author's private collection. The adults were identified partly by Dr. T. H. McDunnough of Decatur, Illinois, and partly by the author, while Dr. W. T. M. Forbes identified larvae of several species.

MORPHOLOGY.

The pupae described here belong to the type known as obtected pupae because all of the appendages are firmly soldered to the body wall and have no power of independent movement. In order to understand the following descriptions, the terms used will be briefly described.

A hypothetical pupa is shown in Fig. 2, A and B to which reference will be made under the discussion of the different structures.

THE HEAD

Vertex. The vertex is found on the dorsal surface of the head. In the pupae described here, it is confined to a small, triangular area adjacent to each antenna (Fig. 2, B, v). The vertex is bounded cephalad by the epicranial suture (Fig. 2, B, es), but only a portion of each of the epicranial arms is visible.

Front. The front (Fig. 2, A, f) is the sclerite to which the antennae are attached. It is separated from the vertex, when this is present, by the epicranial suture. The fronto-clypeal suture is not present, but the front includes most of the ventral surface of the head.

Clypeus. This sclerite (Fig. 2, A, cl) cannot be definitely bounded in specialized pupae. The invaginations for the anterior arms of the tentorium (Fig. 2, A, at) which are always distinct, are located along its lateral margin.

Labrum. The labrum (Fig. 2, A, lb) is caudad of the clypeus and is not separated from the clypeus by a suture. Its other margins are always distinct.

Eye-pieces. These are situated mesad of the antennae and each is composed of two parts, a narrow smooth portion along the mesal margin called the glazed eye-piece (Fig. 2, A, ge) and a broader lateral portion called the sculptured eye-piece (Fig. 2, A, se). These are often hard to distinguish in smooth pupae.

Antennae. These are easily located (Fig. 2, A, a) being attached to the front and curving laterad along the margin of the head, extending on to the ventral surface of the thorax and abdomen along the edge of the mesothoracic wing.

Labial Palpi. Only a very small portion of the labial palpi is visible just caudad of the labrum (Fig. 2, A, lp).

Maxillae. The maxillae (Fig. 2, A, mx) lie adjacent on the meson and vary greatly in length. They are measured on the meson from the caudal margin of the labrum to their distal end, (Fig. 2, A, a). This length is compared with the distance on the meson from the caudal margin of the labrum to the caudal margin of the wings (Fig. 2, A, ac).

The parts of the head, exclusive of the appendages, are referred to as the face-parts.

THE THORAX.

Prothorax. This segment (Fig. 2, B, p) is normally about one-third the length of the mesothorax.

Prothoracic Legs. These lie adjacent to the maxillae (Fig. 2, A, l1). The legs are folded so that normally only the surface of the tibia and tarsus are exposed. In generalized forms, however, a portion of the femur is visible (Fig. 2, A, f1). These legs are about half the length of the wings in the great majority of pupae.

Mesothorax. The mesothorax (Fig. 2, B, ms) is the longest segment of the body, and is normally from two to three times the average length of the abdominal segments.

Mesothoracic Spiracle. The opening to this spiracle referred to in the text as the mesothoracic spiracle (Fig. 2, B, msp), is found at the cephalo-lateral angle of the mesothorax, between that segment and the prothorax. The real spiracle is down below the surface in the conjunctiva between the two segments.

Mesothoracic Legs. These are folded just like the prothoracic legs and lie adjacent to them, but their femora are never exposed (Fig. 2, A, l2). The part referred to as mesothoracic leg is in reality the outer surface of the tibia and tarsus. These legs are from three-fifths to three-fourths the length of the wings in the majority of pupae.

Mesothoracic Wings. The wings of the mesothorax (Fig. 2, A, wl) almost conceal those of the metathorax and are visible on both dorsal and ventral surfaces. In most pupae they are the only wings visible on the ventral surface.

Metathorax. This segment (Fig. 2, B, mt) is usually about as long as the first abdominal segment.

Metathoracic Legs. These legs (Fig. 2, A, l3) are never visible for their entire length, and are sometimes entirely concealed. The tips are often visible on either side of the meson near the caudal margin of the wings.

Metathoracic Wings. These are usually concealed by the mesothoracic wings except for a narrow strip along the dorsal margin (Fig. 2, A, w2). In Platypterygidae they are visible on the ventral surface.

ABDOMEN.

The abdomen consists of ten segments (Fig. 2, B, a1 to a10). The first three segments are only visible in dorsal view. The fourth usually shows a slight margin below the wings on the ventral surface and all of the other segments are visible on both surfaces. There is movement possible between the fourth and fifth, fifth and sixth, and sixth and seventh segments, and the fourth, fifth and sixth are said to be movable segments. The pupa is thus capable of expanding and contracting the body and can bend it from side to side. The movements possible between these segments enables the pupa to work its way out of the ground, or out of a cocoon. These movable segments generally fit over one another so that the transverse conjunctiva of one covers the cephalic portion of the next segment. This cephalic portion is referred to as the cephalic margin (Fig. 2, B, cm). The transverse conjunctiva differs from the remainder of the segment in texture and is usually lighter in color. Its cephalic boundary is indicated in the figures by a dotted line.

Tubercle Scars. The larvae often bear prominent tubercles or projections on the body and the scars (Fig. 2, B, ts) of these are nearly always visible on the body of the pupa.

Anal Opening. This is situated on the meson near the caudal margin of the tenth segment (Fig. 2, A, ao). It is usually slit-like and surrounded by prominent wrinkles or folds.

Genital Openings. The sexes may be easily distinguished by the position of the genital opening (Fig. 2, A, go). That of the male is situated on the meson of the ninth segment. That of the female is situated mostly on the eighth segment or on both eighth and ninth segments. The cephalic margins of segments eight and nine curve strongly cephalad in the female, and this alone is sufficient to indicate the sex. In generalized pupae there are two unpaired genital openings in the female, a condition retained by many of the specialized forms.

Abdominal Spiracles. These (Fig. 2, B, s) are present on the first eight segments but are never visible on the first segment, being entirely covered by the wings. The spiracle on the eighth segment is never functional and shows no distinct opening.

Spiracular Furrows. These are found on the cephalic margin of some or all of the movable segments just cephalad of the spiracles (Fig. 2, B, sf). In many genera they are only present on the fifth segment. In some genera there are a number of low ridges, in others a very distinct pocket-like invagination.

Cremaster. The cremaster (Fig. 2, B, cr) is a prolongation of the tenth segment. It is of various shapes and lengths and often separated from the tenth segment by a depression. Its length is measured on the ventral surface, from its junction with the curve of the tenth segment to the distal end. In Fig. 2, A, ab represents the cremastral length.

CLASSIFICATION.

The superfamily Notodontoidea, as considered in this paper, includes the families Geometridae, Notodontidae and Platypterygidae. The family Dioptidae also belongs to this superfamily but there are no species in the eastern states.

The pupae of this superfamily are not always easy to separate from those most closely related, the Noctuoidea and Bombycoidea. As in the case of the larvae and adults, there is no one prominent character by which they may be recognized, and it is only a careful comparison of several characters that enables us to recognize the pupae of the Notodontoidea. The labial palpi are seldom exposed, and then only a small triangular or polygonal portion caudad of the labrum, thus differing

from the great majority of the families Noctuidae, Liparidae, and Lasiocampidae in which they are often visible for one-fifth the length of the wings. There are no prominent setae on the body, which separates them from most of the Arctiidae, Liparidae, Lasiocampidae, and some Noctuidae. As a general rule only the prothoracic leg extends cephalad between the sculptured eye-piece and the antenna. Nearly all of the Noctuidae which do not show a large portion of the labial palpi and prothoracic femora, have both prothoracic and mesothoracic legs extending cephalad between the sculptured eye-piece and the antenna.

Briefly summarized the characters of the superfamily Notodontoidea are as follows: Epicranial suture very seldom visible; antennae separated from the face-parts by a distinct suture, always broadest at the proximal end, the greatest width about equal to that of the prothoracic legs, but never much broader; labial palpi seldom visible, and then only a small triangular or polygonal portion caudad of the labrum; prothoracic femora only exposed in the generalized families of Geometridae; mesothoracic leg very seldom extending cephalad between the sculptured eye-piece and the antenna; body surface never densely covered with setae or having prominent setae arranged in rings or around prominent oval areas; abdominal segments usually punctate; cremaster usually present, and setae at the distal end always hooked.

The dorsal surface of the abdomen frequently shows a deep furrow between the eighth and ninth abdominal segments. The caudal margin of this furrow is usually serrate or crenulate. There are also spiracular furrows found in many species. These vary in number and form, and are mostly found in the Geometridae. The families of Notodontoidea may be separated as follows:

a. Metathoracic wings never visible on the ventral surface of the body.

  b. Maxillae usually more than three-fifths the length of the wings, if not, then the caudal end of the body with hooked setae, or the spiracles of the third abdominal segment concealed by the wings and those of the sixth segment farther ventrad than those of the other segments; prothoracic femora sometimes exposed; a deep

furrow usually present on the dorsum of the abdomen between the ninth and tenth segments; caudal margin of mesonotum never with a row of deep pits with smooth tubercle-like areas between. *Geometridae.*

bb. Maxillae seldom exceeding three-fifths the length of the wings, if so, then the caudal margin of the mesothorax with a row of deep pits with smooth, elevated quadrangular, tubercle-like areas between them, or with the entire body surface coarsely punctate; abdominal spiracles of the third segment never concealed by the wings, and those of the sixth never farther ventrad than the remainder; prothoracic femora never exposed; a furrow never present on the dorsum of the abdomen between the ninth and tenth segments except in Datana where the cremaster is of the type shown in Fig. 5, E to H. *Notodontidae*

aa. Metathoracic wings meeting on the meson caudad of the mesothoracic legs, and visible along the caudal margin of the mesothoracic wings. *Platypterygidae.*

Family GEOMETRIDAE.

The pupae of this family are, with a few exceptions, less than an inch in length. The majority of species are about half an inch long. They are either found suspended from leaves with the cremaster fastened in a mat of silk, much as the chrysalids of butterflies, or they may be found in thin cocoons attached to a leaf, or in a cell in the ground. The legs are longer than is usual in lepidopterous pupae, the prothoracic legs usually three-fourths the length of the wings; the mesothoracic legs normally reaching the caudal margin of the wings, or only separated by a very short distance. This is the best single character to separate the pupae of Geometridae from those of the other families. The epicranial suture is present in a very few genera. The labial palpi are sometimes exposed as small triangular or polygonal areas caudad of the labrum. The prothoracic leg and occasionally the mesothoracic also, extends cephalad between the sculptured eye-piece and the antenna. The femur of the prothoracic leg is sometimes exposed, often only a very narrow portion, which might easily be overlooked. The

maxillae are always long, nearly always extending to the caudal margin of the wings. The antennae vary little throughout the family. They are usually about as wide as the prothoracic legs, measuring the proximal part of both, and are gradually narrowed to the distal end, which usually extends to the caudal margin of the wings. The metathoracic wings usually extend along the margin of the mesothoracic wings on the dorsal surface, but are not visible in ventral view. The mesothorax is very short in some genera and the entire thorax sometimes very short in relation to the remainder of the body. The mesothoracic spiracles often have a decided projection adjacent to their caudal margin. This may be a sharp ridge, or it may be a prominent tubercle which is often flattened and bears numerous short setae. The abdominal spiracles are sometimes produced and very often the spiracles on the sixth segment are considerably ventrad of the others. Spiracular furrows are frequently present, varying greatly in size and number. The dorsal furrow between the ninth and tenth abdominal segments is present in many genera. It often bends caudad near the lateral margin of the body and this lateral extension may reach to the base of the cremaster. A cremaster of some type is always present. In the pupae examined during this investigation only two types were found, the triangular type with hooked setae, and the bifurcate type, with or without hooked setae.

The coloring of the pupa varies considerably in this family. While the majority are chestnut or darker brown, in common with most lepidopterous pupae, there are some which are nearly white, others yellowish, and various shades of yellowish and reddish brown. Some are conspicuously marked with black or dark brown and one of the pupae described has a beautiful pearly luster. The genera described here may be separated as follows:

a. Cremaster with prominent hooked setae at the distal end, but never bifurcate.

  b. Cephalic end of body very blunt and each cephalo-lateral angle prominently produced; a large portion of the prothoracic femur exposed. *Cosymbia.*

  bb. Cephalic end of body rounded; the prothoracic femur never visible, or only a very narrow portion of it exposed.

c. Dorsal furrow never present between the ninth and tenth abdominal segments; antennae usually reaching the cephalic margin of the fifth abdominal segment. *Aplodes.*

cc. Dorsal furrow always present between the ninth and tenth abdominal segments; antennae seldom extending beyond the caudal margin of the wings.

d. Caudal margin of the dorsal furrow between the ninth and tenth abdominal segments with very small, inconspicuous projections; the two lateral setae adjacent to the mesal setae or spines on the cremaster larger than the others. *Ania.*

dd. Caudal margin of the dorsal furrow between the ninth and tenth abdominal segments with prominent projections; lateral setae of the cremaster all of the same size.

e. Abdomen never densely punctate, either smooth or with shallow impressed lines; color never brown.

f. Body white, conspicuously marked with black, never iridescent. *Cingilia.*

ff. Body pale yellow or green, always iridescent. *Sicya.*

ee. Abdomen densely punctate; color always brown.

f. A small portion of the prothoracic femur exposed; head never showing three small tubercles at the cephalic end. *Sabulodes.*

ff. Prothoracic femur never exposed; head always showing three small tubercles at the cephalic end. *Abbotana.*

aa. Cremaster always bifurcate at the distal end, often with hooked setae, but these weak and easily broken.

b. Prothoracic femur exposed.

c. Dorsal furrow never present between the ninth and tenth abdominal segments, nor a prominent dorsal furrow on the fifth abdominal segment.

d. Cephalic margin of fifth abdominal segment with a furrow over each spiracle; mesothoracic spiracle never with a prominent ridge adjacent to its caudal margin. *Cleora.*

dd. Cephalic margin of fifth abdominal segment with four or five shallow furrows over each spiracle; mesothoracic spiracle always with a prominent elevation adjacent to its caudal margin. *Diastictis.*

cc. Dorsal furrow present between the ninth and tenth abdominal segments, and a very prominent one on the dorsum of the fifth abdominal segment. *Hydria.*

bb. Prothoracic femur never exposed.

c. Dorsal furrow never present between the ninth and tenth abdominal segments; a prominent tubercle never present adjacent to each mesothoracic spiracle. *Paleacrita.*

cc. Dorsal furrow always present between the ninth and tenth abdominal segments; a prominent tubercle adjacent to each mesothoracic spiracle. *Erannis.*

Genus COSYMBIA Hübner.

Body much wider at the cephalic end and truncate, the cephalo-lateral angles distinctly produced; face-parts considerably elevated, a transverse ridge extending across the front on a line with the cephalic angle of the eye-pieces; labrum quadrate in outline; labial palpi not visible; maxillae reaching nearly to the caudal margin of the wings, the proximo-lateral angles not quite reaching the eye-pieces; prothoracic legs almost three-fourths the length of the wings, their femora exposed; the legs reaching cephalad between the sculptured eye-pieces and the antennae; mesothoracic legs reaching the caudal margin of the wings, always longer than the maxillae; tips of the metathoracic legs showing caudad of the maxillae; prothorax on the blunt cephalic end of the body, scarcely visible in ventral view, its mesal length one-third that of the mesothorax; mesothoracic spiracle with a large rounded tubercle adjacent to its caudal margin which form the produced cephalo-lateral angles of the body as seen in either dorsal or ventral view; mesothorax with a distinct lateral ridge which extends from the base of the spiracular tubercle caudad to near the anal angle of the wing; mesal length of metathorax one-fourth that of the mesothorax, the caudal margin curved slightly at the meson; abdominal segments smooth, never punctate; abdominal spiracles small, el-

liptical, those of the second segment covered by the wings; no spiracular furrows present; no dorsal furrow present between the ninth and tenth abdominal segments but a very distinct constriction or furrow at the base of the cremaster; cremaster triangular, longer than broad, the distal end with six strong hooked setae and two finer hooked setae just cephalad of these.

COSYMBIA LUMENARIA Hübner.

Fig. 2, C.

Color usually bright green with three interrupted, longitudinal white stripes on the dorsum, one of these on the meson and one on either side, a broader, less interrupted white stripe through the spiracles, the body more or less mottled between the stripes with either small black or white blotches; lateral ridge usually with a narrow white stripe on the dorsal side and a broader black stripe on the ventral; body often entirely white with the black stripe near the lateral ridge; head, thorax, and appendages smooth, or with very fine transverse striations, antennae at proximal end equal to greatest width of the prothoracic legs, but narrowing rapidly so that they are only one-third as wide at the distal end; abdomen smooth, the segments tapering gradually to the caudal end of the body.

Length 10 to 11 mm.; greatest width 2.5 to 3 mm.

The larvae were very abundant on sweet fern and were often found feeding along the edge of the leaf. Some of the larvae were about an inch long, pale green, with white dorsal stripes much as described for the pupae, with fine powdery white dots between, others were brown with indistinct white stripes and darker brown oblique lines or blotches, and seemed to be entirely different, while the pupae and the adults would be exactly alike, or at least appeared to be. Larvae were abundant all through July, and many pupae were collected the latter part of the month and in August. The larvae spin a little knot of silk and fasten themselves to it and then transform to pupae. They are suspended like many butterflies with the hooks of the cremaster fastened into the web of silk and a fine white silken thread around the middle of the body. There is never any trace of a cocoon. The moths emerged in August and many were seen flying about, but the egg-laying habits were not observed.

Genus APLODES Guenée.

Body of usual shape, blunt at the cephalic end, entire body surface roughened with deep, indeterminate, impressed lines; a small portion of the labial palpi exposed caudad of the labrum; antennae extending beyond the caudal margin of the wings, reaching the caudal margin of the transverse conjunctiva when the body is expanded, each distal end curved slightly towards the meson; maxillae never quite reaching the caudal margin of the wings, the tips of the metathoracic legs exposed just caudad of them and between the distal ends of the antennae; proximo-lateral angles of the maxillae not extending to the eye-pieces; prothoracic leg extending cephalad between the sculptured eye-piece and the antenna, about three-fourths the length of the wings, the femur never exposed; mesothoracic legs reaching the caudal margin of the wings and slightly longer than the maxillae; mesal length of prothorax two-thirds that of the mesothorax; opening of the mesothoracic spiracle on a slightly elevated tubercle; mesal length of the metathorax one-fourth that of the mesothorax; metathoracic wings showing a large triangular piece adjacent to the second and third abdominal segments and almost forming a right angle opposite the third abdominal segment; abdominal spiracles almost circular in outline; a dorsal furrow never present between the ninth and tenth abdominal segments; sutures between all of the abdominal segments very distinct; cremaster broadly triangular, continuing the outline of the body except for a slight constriction at its proximal end, armed with eight hooked setae, of which the two mesal ones are slightly longer.

APLODES MIMOSARIA Guenée

Fig. 3, E.

Body variously colored, usually grayish green, sometimes yellowish brown, often tinged with reddish or orange-shades, always with a darker dorso-mesal stripe, and dotted with black or dark brown, the bases of the setae conspicuously dark brown or black; cephalic end of body showing a small tubercle on the meson just caudad of the proximal ends of the antennae; proximal ends of the antennae slightly elevated and somewhat tuber-

culate, especially along the middle line; wings slightly elevated along the dorso-lateral margin; abdominal spiracles almost circular in outline, usually slightly elevated, the spiracle of the sixth abdominal segment considerably ventrad of the others; abdominal segments roughened with indeterminate transverse impressions and sparsely punctate; cremaster less than 1 mm. in length, the two caudal setae of each side curved cephalad, the remainder curved caudad.

Average length 12 mm.; greatest width 3 mm.

The larvae of this species were very abundant on sweet fern. They differ from the majority of geometrid larvae in having the lateral margins of most of the abdominal segments produced into triangular projections one on each side of a segment, which makes the lateral margin of the body very strongly toothed. These projections often curve slightly dorsad. The larvae were about an inch long and variously colored. Some were all green, others were tinted with yellowish and reddish colors like autumn leaves, while others were pale yellow tinged with red. The pupae were less variable in color, and no difference could be detected in the adults. The larvae were very difficult to locate as they fed along the edge of the sweet fern leaves, and the notches on their body corresponded in a general way to the notches in the leaves. Many of them were taken by sweeping. The first larvae were collected July 23 and they were abundant till the middle of August. By the third week in August practically all had pupated. The larvae spin a few threads of silk between two leaves and the pupa is held in place in the entanglement of the silk by the hooks on the cremaster.

Genus ANIA Stephens.

Body widest near the cephalic end; surface roughened with deep indeterminate impressed lines on head, thorax and appendages, densely punctate on the abdomen, never presenting a polished appearance; face-parts elevated, the head with a rounded, transverse ridge just caudad of the proximal ends of the antennae; a small portion of the labial palpi exposed caudad of the labrum; maxillae about seven-eighths the length of the wings, the proximo-lateral angles never reaching to the eye-pieces; prothoracic legs about three-fourths the length of the wings, their femora never exposed; mesothoracic legs longer than

the maxillae and meeting on the meson caudad of them, often separating to show a small portion of the tips of the metathoracic legs; both prothoracic and mesothoracic legs extending cephalad between the sculptured eye-pieces and the antennae; antennae reaching to the caudal margin of the wings and meeting on the meson; prothorax about half the length of the mesothorax; mesothoracic spiracles with the caudal margin elevated and somewhat flaring; abdominal segments 1 to 8 densely punctate; abdominal spiracles elliptical, slightly produced; spiracular furrows present on segments 5 to 7, the surface of the furrows punctate like the remainder of the segment; furrow present on the dorsum between the ninth and tenth abdominal segments, the edges very finely serrate; cremaster triangular in outline, rugose, with two large long hooked spines at the distal end, at the base of these two stout hooked setae, and cephalad of these two hooked setae near each lateral margin, forming a transverse row.

This genus consists of a single species in North America.

ANIA LIMBATA Haworth.

The Horned Span-worm. Fig. 2, E and H.

General color light brown, with darker brown markings, most of these small, irregular spots; antennae with dark brown inverted V-shaped markings; ventral surface of abdomen showing three broad stripes, the mesal one more distinct than those near the lateral margin; dorsal surface of abdomen with broad, indistinct, oblique bands of a lighter color; bases of the setae dark brown, and usually the distal portion of the cremaster; antennae slightly elevated, with a row of minute tubercles along the middle line; abdominal segments 1 to 8 finely, densely punctate, the ninth and tenth segments smooth; segments two and three with a more or less distinct tubercle on each side the meson indicating the scars of the larval filaments; segments five, six and seven with a distinct elevation along the cephalic margin; dorsal furrow between segments nine and ten with a lateral extension, the caudal margin (Fig. 2, H) notched on the meson and slightly serrate; cremaster 1 mm. long, slightly rugose, and showing a slight constriction on each lateral margin at the base.

Average length 9 mm.; greatest breadth 3 mm.

The larvae of this species are easily recognized by the group of four filaments that stand up on the back with their ends slightly curled. The first pair is attached to the second abdominal segment. They feed on various plants and were collected at Orono on sweet fern during the first week in August. The larvae pupated the fifth of August between the leaves of sweet fern, but did not form a cocoon.

Genus CINGILIA Walker.

Body slender, but of usual type; labrum quadrangular; a small polygonal portion of labial palpi exposed caudad of the labrum; antennae extending to the caudal margin of the wings, their greatest width greater than that of the prothoracic legs, their distal ends usually meeting on the meson; maxillae almost reaching the caudal margin of the wings, the proximo-lateral angles not extending laterad to the eye-pieces; prothoracic legs three-fourths the length of the wings, their femora never exposed; mesothoracic legs seven-eighths the length of the wings; only the prothoracic leg extending cephalad between the sculptured eye-piece and the antenna; mesal length of prothorax two-fifths that of the mesothorax; metathorax about half the length of the prothorax and slightly shorter than the first abdominal segment; abdominal segments with shallow, transverse impressed lines; dorsal furrow between the ninth and tenth abdominal segments present, the caudal margin crenulate; cremaster without a furrow at the base, ending in two long hooked spines with one short hooked seta on each side, a transverse row of four similar setae just cephalad of these.

This genus includes a single species in America.

CINGILIA CATENARIA Drury.

The Chain-dotted Geometer. Fig. 4, C and F.

Color white with conspicuous black blotches, the largest of these on the dorsum of the first five abdominal segments, the wing veins and some of the sutures lined with black; entire surface of body with shallow transverse impressed lines; antennae elevated, highest along the middle line, transversely lined with black; mesothoracic spiracles split-like; abdominal spira-

cles without any outer margin, the openings elliptical; cremaster (Fig. 4, F) with two large spines and six smaller ones.

Length 15 to 18 mm.; greatest width 3.5 to 4 mm.

The larvae of this species are pale yellow with some narrow dark brown or black stripes and marked with conspicuous black spots near the spiracles and on the lower part of the body. They feed on numerous plants, and specimens were collected from larch and sweet fern August 8. They pupated shortly after, spinning a very loose open cocoon through which the pupa could be easily seen. The cocoon was attached either to a leaf or a stem. The adults are white, and also conspicuously marked with black. They emerge in September.

Genus SICYA Guenée.

Body of usual type; surface smooth with a few punctures on the abdomen; labial palpi represented by a small triangular area caudad of the labrum; maxillae seven-eighths the length of the wings, the proximo-lateral angles scarcely reaching to the eye-pieces; antennae elevated, extending to the caudal margin of the wings, their greatest width slightly greater than that of the prothoracic legs, and meeting or approaching each other on the meson; prothoracic legs about two-thirds the length of the wings, extending cephalad between the sculptured eye-pieces and the antennae; mesothoracic legs nearly as long as the wings, meeting on the meson just caudad of the maxillae; mesal length of prothorax about half that of the mesothorax, while the metathorax is one-fifth of this length; mesothoracic spiracle slit-like, the cephalic margin slightly elevated; spiracular furrows not present; dorsal furrow present between the ninth and tenth abdominal segments, the caudal margin showing two large projections; cremaster triangular, longer than the tenth segment, two large hooked spines or setae at the end, with three smaller, but heavy hooked setae on each side just cephalad of the others.

SICYA MACULARIA Haworth.

Fig. 2, D and G.

Color pale yellow and green with silvery and pale green iridescence; surface smooth and polished, the setae rather con-

spicuous under the microscope and arising from small brown tubercles; median line of thorax brown, also a line indicating the suture at the base of each antenna, the spiracles, the glazed eye-piece, the margin of the prothorax, and the cremastral hooks; abdominal segments 1 to 7 with a few, very fine punctures which are scarcely apparent, segments 3 and 4 have a row of larger punctures along the cephalic margin of the segment, while segments 5 to 7 have a few larger ones scattered over the surface of the cephalic margin; abdominal spiracles almost circular, produced, the openings ovate in outline; cremaster (Fig. 2. G) with a distinct furrow at base, the dorsal surface depressed below the level of the tenth segment, and rugose with fine longitudinal striations; cremaster 1 mm. in length, the lateral hooks flattened and broader at the end.

Length 12 mm.; greatest width 4 mm.

The larva of this species was ready to pupate when collected, and therefore no description was obtained. It was collected July 2 on wild white spiraea. The larva first spun a very open web of silk which bent over the tip of the leaf and fastened it down. This web was drawn around the larva to form a sort of cocoon. The pupa at first was pale green with a brown median line on the thorax and brown around the spiracles. The dorsum of the body was lighter in color than the remainder, and had the appearance of being powdered. The body showed a beautiful iridescence even then, but in three days more it was fully hardened, a sort of yellowish-green in color and iridescent over the entire surface. The adult emerged July 16.

Genus SABULODES Guenée.

Body of usual type; surface always dull in appearance, considerably roughened with deep indeterminate transverse, impressed lines on head, thorax, and appendages, the abdomen densely punctate; labial palpi represented by a small polygonal area caudad of the labrum; proximo-lateral angles of maxillae never reaching the eye pieces; maxillae, antennae and mesothoracic legs normally reaching the caudal margin of the wings, sometimes falling a little short of it; prothoracic leg about two-thirds the length of the wings, a very narrow portion of the femur exposed; the prothoracic legs extending cephalad between the sculptured eye-pieces and the antennae; the mesothoracic

leg scarcely reaching the level of the glazed eye-piece in some species and extending farther cephalad in others; mesal length of prothorax one-half that of the mesothorax; metathorax one-fifth the length of the mesothorax and shorter than the first abdominal segment; mesothoracic spiracle slit-like; abdominal segments 1 to 8 punctate; furrow present on the dorsum between the ninth and tenth abdominal segments, the caudal margin coarsely toothed, the lateral extensions reaching almost to the base of the cremaster; cremaster longer than the tenth segment, bearing two stout curved spines at the distal end, with slender hooked setae along each lateral margin, the ventral surface with two deep parallel furrows, one near each lateral margin.

The species of Sabulodes may be separated as follows:

a. Face-parts with a prominent transverse ridge between the eye-pieces; body setae arising from small papillae; caudal margin of furrow between the ninth and tenth abdominal segments with small projections or teeth. *transversata.*

aa. Face-parts never with a prominent transverse ridge between the eye-pieces; body setae arising from small depressions; caudal margin of the furrow between the ninth and tenth abdominal segments with large projections. *lorata.*

SABULODES LORATA Grote.

Fig. 4, B and E.

Color yellowish brown, the spiracles, tenth segment, and cremaster always darker brown, an irregular dark spot on each side the dorso-meson of the first eight abdominal segments and one on the mesothorax at about the middle of its length, also fine irregular blotches on other parts of the body which are exceedingly variable; antennae more elevated than the other appendages, highest along the middle line, the surface covered with small tubercles; abdominal segments 1 to 8 densely punctate with medium punctures, the ninth and tenth segments smooth; body setae arising from small pits; abdominal spiracles with the openings elliptical; spiracular furrows never present; dorsal furrow between the ninth and tenth segments edged with black or very dark brown, with four prominent teeth on each side

the meson; cremaster (Fig. 4, E) 1.5 mm. in length, the dorsal surface with deep longitudinal furrows and a transverse furrow at the base, a hooked seta laterad at the base of each large curved spine and a transverse row of four hooked setae of the same size at about one-third the length of the cremaster from the distal end.

Average length 18 mm.; greatest width 4.5 mm.

The larvae of this species are slim brown loopers with three rather prominent tubercles and a ridge on the dorsum of the body. They were only taken from sweet fern. When full grown they attach themselves to the leaves with a few threads of silk and usually pull another leaf over it, so that the pupa is entirely concealed.

SABULODES TRANSVERSATA Drury.

The Large Maple Span-worm. Fig. 4, K.

Color usually yellowish brown, the head, thorax, and appendages of many individuals a much darker brown; the cremaster usually dark brown; surface of body roughened with impressed lines and striations and somewhat tuberculate, there being small distinct, whitish tubercles visible on the appendages and on the eye-pieces; face-parts with a distinct, high, rounded transverse ridge extending from just cephalad of the middle of each glazed eye-piece; antennae tuberculate, the proximal fifth elevated along the middle line and forming a ridge; setae of thorax and abdomen arising from small, dark brown papillae; abdominal segments with the punctures mostly obscured by the ridges, except on the seventh and eighth segments, the ninth and tenth segments smooth; abdominal spiracles usually edged with darker brown, those of the second, third and fourth segments touching the wings, the lips of the openings slightly produced and somewhat crescent-shaped; spiracular furrows indicated on the fifth segment; dorsal furrow between the ninth and tenth abdominal segments distinct, the caudal margin edged with black and finely toothed; cremaster with four longitudinal ridges and a transverse furrow at base, four of the hooked setae inserted on the dorsal surface, and two on the lateral margin.

Average length 17 mm.; greatest width 5 mm.

The larvae of this species were collected from maple, but they are found on other kinds of trees. They are two inches or more in length, dark grayish brown and the mesothorax somewhat swollen at the sides. They pupate by attaching themselves to the leaves with a few threads of silk and then folding the leaf over, or attaching another leaf to it with the silk. These threads of silk do not form a cocoon. The pupa fastens itself to the silk by means of the cremastral hooks. The larvae are found in July and pupate early in August.

Genus ABBOTANA Hulst.

Body of usual type; surface always dull in appearance with deep impressed lines on the head, thorax, and appendages, and densely punctate on the abdomen; cephalic end of body showing three small tubercles between the antennae; labial palpi represented by a small polygonal area caudad of the labrum, proximolateral angles of the maxillae never reaching the eye-pieces; maxillae and antennae reaching the caudal margin of the wings; prothoracic legs two-thirds the length of the wings, the femora never exposed; mesothoracic legs a little shorter than the maxillae and never reaching the caudal margin of the wings; both prothoracic and mesothoracic legs extending cephalad between the sculptured eye-piece and the antenna; mesal length of prothorax one-half that of the mesothorax; that of the metathorax shorter than the first abdominal segment; mesothoracic spiracles slit-like, showing a narrow very slightly elevated ridge along the caudal margin; abdominal segments 1 to 8 punctate, the tenth segment irregularly rugose; furrow on the dorsum between the ninth and tenth segments distinct, the caudal margin coarsely toothed, the lateral extensions never reaching to the base of the cremaster; cremaster longer than the tenth segment, bearing two very stout spines at the distal end and slender hooked setae along each lateral margin, the ventral surface with a deep furrow on each side.

This genus includes a single species *Abbotana clemataria* found throughout the eastern part of the United States.

ABBOTANA CLEMATARIA Smith and Abbot.

Color chestnut brown, variously mottled with very dark brown or black, the darker color always conspicuous around the

spiracles and on the cremaster; head, as seen in ventral view, with three small tubercles along the cephalic margin, one on the meson, and one on each side of it; face-parts and appendages not elevated, except the cephalic fourth of each antenna which shows a low ridge along the median line, the tubercles on the ridge causing the lateral margins of the head to appear serrate; antennae covered with minute tubercles; prothorax with a slightly elevated median ridge which is almost always lighter in color than the remainder of the segment; middle line of mesothorax usually marked by a pale yellowish line; abdominal segments 1 to 8 densely punctate, the ninth practically smooth, the tenth segment and cremaster irregularly rugose; spiracles ovate in outline, the openings elliptical; spiracular furrows of the fifth abdominal segment indistinct, very slightly elevated and interrupted by punctures; cremaster triangular, with two heavy curved spines at the distal end, each about 6 mm. long, and three hooked setae along each lateral margin.

Length 18 to 23 mm.; greatest width 7 mm.

The larvae of this species were the largest of any geometrid collected in Maine being about three inches long. They are dark brown to nearly black in color, with a prominent ridge on the mesothorax and one near the caudal end of the body. These ridges have a small orange tubercle at each side. Near the middle of the body is a very prominent brown tubercle on each side the meson, resembling the winter buds of the maple tree, so that when this larva mimics a twig, these tubercles pass for buds. They were collected from apple and maple, but are said to feed on a variety of trees. When ready to pupate, the larvae spin a few threads of silk and draw two leaves together and the pupa fastens the hooks on the cremaster into this silk. The larvae were most numerous the latter part of July, and the first one pupated August 10. The adults emerge in the spring. The pupae of this species resemble those of the genus *Sabulodes* very strongly, so no figure is shown. They differ, however, in the tubercles on the head and antennae, and in the irregularly rugose cremaster and tenth abdominal segment, and in never having any portion of the prothoracic femur exposed. The pupae of *Abbotana* never become hard and firm as most pupae do, but are always soft and yielding to the touch. They are normally much larger than those of *Sabulodes*.

Genus CLEORA Curtis.

Body of usual type; face-parts not much elevated; antennae reaching the caudal margin of the wings, the distal end of each curved slightly mesad; a small portion of the labial palpi exposed caudad of the labrum; maxillae reaching almost to the caudal margin of the wings, the proximo-lateral angles not extending quite to the eye-pieces; prothoracic legs three-fourths the length of the wings, their femora exposed; mesothoracic legs equal in length to the maxillae; mesal length of prothorax two-fifths that of the mesothorax, mesothoracic spiracle with an ovate tubercle adjacent to its caudal margin, the surface covered with fine setae; mesal length of metathorax one-fourth that of the mesothorax; first eight abdominal segments coarsely punctate; the spiracular furrow present cephalad of each spiracle on the fifth abdominal segment, the surface of the furrow very rugose; dorsal furrow never present between segments nine and ten; abdominal spiracles almost circular in outline; cremaster triangular at base, the distal half spine-like, and slightly bifurcate at tip.

This genus includes a number of species but only two are commonly found in Eastern North America. One of these *Cleora pampinaria* is described here.

CLEORA PAMPINARIA Guenée.

Fig. 2, F and I.

Color chestnut brown, usually without markings, sometimes with a few small dark spots on the appendages; face-parts and appendages almost smooth and appearing polished; prothoracic leg slightly elevated near the large exposed part of the femur; thorax smooth, or with very fine transverse impressions; abdomen densely punctate with medium punctures on the first eight segments; spiracles almost circular, the openings elliptical, that of the sixth slightly ventrad of the others; spiracular furrow (Fig. 2, I) with the surface deeply rugose, the outer edge heavily chitinized, almost black and apparently serrate; surface slightly concave between the furrow and spiracle, crossed by faint elevated lines; cremaster about 1 mm. long, the dorsal surface convex and rugose, the distal end spine-like and bifurcate.

Average length 12.5 mm.; greatest width 4 mm.

It could not be determined from the specimens whether or not there are hooked setae on the cremaster as they stayed in the soil until the moths emerged, and if present were broken off. The larvae of this species were collected from common yellow dock the latter part of June and pupated before a description was obtained. The moths emerged during September in the laboratory.

Genus DIASTICTIS Hübner.

Body of usual shape, widest in the region of the third and fourth abdominal segments; head, thorax and appendages comparatively smooth, the abdomen rather coarsely punctate; fronto-clypeal suture indicated at the base of the antennae; labrum rounded on the caudal margin; a small portion of labial palpi exposed caudad of the labrum; maxillae never quite reaching the caudal margin of the wings, the proximo-lateral angles not extending to the eye-pieces; antennae broader than the prothoracic legs, narrowed slightly at the distal end and sometimes touching on the meson; prothoracic legs three-fourths the length of the wings, their femora exposed; mesothoracic legs as long as the maxillae; tips of the metathoracic legs usually exposed caudad of the maxillae; mesal length of prothorax two-fifths that of the mesothorax; mesothoracic spiracle with a prominent ridge adjacent to its caudal margin, the edge curved slightly caudad and covered with white setae; metathorax one-half the length of the prothorax; abdominal segments 1 to 8 thickly punctate, the ninth and tenth sparsely punctate or smooth; abdominal spiracles elliptical; fifth abdominal segment with five or six shallow furrows over each spiracle, the margin of the segment cephalad of the spiracle with coarser punctures than the remainder of the segment; dorsal furrow never present between the ninth and tenth abdominal segments; cremaster rugose at base, bifurcate at the distal end.

Only two species of this genus were collected in Maine, but other species are known to occur in the State. These two species are very closely related and may be separated as follows:

a. Elevation along caudal margin of mesothoracic spiracle strongly elevated and visible in ventral view; spiracular

furrows indistinct and often resembling rows of confluent punctures. *ribearia.*

aa. Elevation along caudal margin of mesothoracic spiracle strongly elevated and not visible in ventral view; spiracular furrows narrow, but distinct, the edges sharp. *anataria.*

DIASTICTIS RIBEARIA Fitch.

The Gooseberry Span-worm. Fig. 3, F, and Fig. 4, I and J.

Color dark reddish brown; head, thorax and appendages usually smooth and polished, occasionally with indeterminate transverse striations, especially on the thorax; antennae with transverse impressions indicating the segmentation, usually as long as the wings but seldom meeting on the meson; a distinct, transverse furrow present between the invaginations for the anterior arms of the tentorium; eye-pieces almost equal in width; elevation caudad of the mesothoracic spiracle prominent, and visible in ventral view, the surface thickly covered with fine whitish setae; spiracular furrows of the fifth abdominal segment indistinct and resembling confluent punctures; cremaster 1 mm. in length, rugose and bifurcate for about one-fourth its length.

Length 10 to 12 mm.; greatest width 3.5 mm.

The larvae feed on leaves of gooseberry, currant and blueberry. They are more often found on the gooseberry and often become a serious pest. The larvae are whitish, irregularly spotted with black and have yellow stripes on the dorsal and lateral aspects. They are full-grown about the last of June and enter the ground to pupate, but do not spin a cocoon. The moths emerge from the pupae in two or three weeks and lay their eggs which hatch the following spring.

DIASTICTIS ANATARIA Swett.

Fig. 4. G and H.

Color dark reddish brown, head, thorax and appendages with fine indeterminate transverse striations, but giving a smooth and polished appearance; antennae as long as the wings and meeting on the meson at their caudal margin; a transverse furrow indicated between the invaginations for the anterior arms

of the tentorium, but not deep nor very distinct; eye-pieces difficult to distinguish; elevation caudad of the mesothoracic spiracle not prominent and not visible in ventral view, its surface sparsely covered with whitish setae and not very noticeable, a small furrow just caudad of the elevation; spiracular furrows of the fifth abdominal segment distinct, narrow, five or six in number and punctate at the bottom of the furrows; cremaster 1.3 mm. in length, with a distinct transverse furrow at base, rugose on the proximal half, the furrows deeper on the ventral surface, and bifurcate for one-fifth its length.

Length 10 to 12 mm.; greatest width 3.5 mm.

The larvae of this species were collected on gray birch and yellow birch. They were about an inch long, colored dull red, marked with black in an irregular marbled pattern with a whitish spot in front of each spiracle. They were collected the last week of June and were ready to pupate in about two weeks. In the laboratory they pupated on top of the soil without forming a cocoon, but would probably burrow in the soil out of doors. The adults emerged July 25.

Genus HYDRIA Hübner.

Head short, slightly narrower than the thorax; body surface slightly roughened with impressed lines and punctures, but presenting a polished appearance; epicranial suture present and distinct; labrum broader than long, rounded at the distal end; a small triangular portion of the labial palpi usually visible caudad of the labrum; maxillae sometimes reaching the caudal margin of the wings, but usually slightly shorter and exposing the tips of the metathoracic legs, the proximo-lateral angles never extending as far as the eye-pieces; antennae always reaching the caudal margin of the wings; prothoracic legs almost three-fourths the length of the wings, their femora always exposed; mesothoracic legs usually slightly shorter than the antennae; both prothoracic and mesothoracic legs extending cephalad between each sculptured eye-piece and the antenna; mesal length of prothorax two-fifths that of the mesothorax; metathorax about half the length of the prothorax and shorter than the first abdominal segment; mesothoracic spiracles slit-like; abdomen coarsely punctate, except on the ninth and tenth seg-

ments; dorsum of fifth abdominal segment with a deep furrow along the cephalic margin, invisible when the body is contracted and the movable segments telescoped; abdominal spiracles slightly produced, the openings elliptical; dorsal furrows present between the ninth and tenth abdominal segments, its caudal margin finely serrate, the lateral extension reaching caudad almost to the base of the cremaster; cremaster about twice the length of the tenth segment, a slight furrow at base, bifurcate at tip and with hooked setae near the proximal end.

HYDRIA UNDULATA Linnaeus.

The Scallop-shell Moth. Fig. 4, A and D.

Color reddish brown; ventral surface of head and appendages with shallow, impressed lines, labrum slightly elevated; thoracic segments with irregular, deeply impressed lines; metathorax and first abdominal segment showing a rather prominent ridge along the caudal margin; abdomen with the first four segments coarsely punctate except a narrow strip along the caudal margin; dorsum of fifth segment almost smooth caudad of the furrow which is edged with black; sixth, seventh and eighth segments like the first four, the ninth and tenth practically smooth; cremaster rugose at base, narrowing rapidly to a slender spine-like part which is bifurcate at tip, the arms of the bifurcation slender and divergent, lateral margin of cremaster with three slender hooked setae along each lateral margin.

Average length 9 mm.; greatest width 3 mm.

The larvae of the scallop-shell moth feed mostly on cherry. They are dark brown or nearly black on the back with some fine yellow lines, and yellowish white underneath. They make a sort of nest by webbing the leaves together at the end of a branch and adding more leaves as they need food. The larvae were collected August 26 and soon after entered the soil to pupate. They form an earthen cell in which the pupa passes the winter.

Genus PALEACRITA Riley.

Body of usual type, but usually strongly convex on the dorsum of the first three abdominal segments, so that the body

is very thick in this region; face-parts decidedly elevated at the proximal ends of the antennae, clypeal region, labrum and eye-pieces; a furrow present indicating the lateral parts of the fronto-clypeal suture; labrum almost semicircular in outline; antennae reaching the caudal margin of the wings, the distal end of each curved slightly mesad; maxillae reaching the caudal margin of the wings, their proximo-lateral angles not extending as far as the eye-pieces; labial palpi never exposed; prothoracic leg reaching cephalad between the sculptured eye-piece and antenna, and at least seven-eighths the length of the wings, their femora never exposed; mesothoracic legs sometimes reaching the caudal margin of the wings, but usually a little shorter; thoracic segments unusually short, the entire thorax less than one-fourth the total length of the body; mesal length of prothorax two-thirds that of the mesothorax, and the metathorax one-half of this length; mesothoracic spiracle with its caudal margin abruptly elevated, then a gradual slope towards the base of the wing; abdomen coarsely punctate, at least on eight segments; dorsal furrow never present between the ninth and tenth segments; abdominal spiracles strongly produced, the openings somewhat lenticular; one deep spiracular furrow present over each spiracle on the fifth segment, the outer margin strongly chitinized; cremaster longer than broad, slightly bifurcate at tip often showing a fine seta on each lateral margin near the proximal end.

This genus has only one common species, *Paleacrita vernatà* which is common in the eastern part of the United States and Canada.

PALEACRITA VERNATA Peck.

The Spring Canker-worm. Fig. 3, C and D.

Color yellowish or reddish brown; head, thorax, and appendages slightly roughened with indeterminate transverse striations; a portion of the front more strongly elevated than the remainder of the face-parts; antennae showing transverse impressions; abdomen coarsely punctate on segments 1 to 8, rarely on the remaining segments; abdomen considerably arched in the region of the first three segments giving the pupa a humpbacked appearance; spiracular furrows with their transverse

length twice that of the spiracles; spiracles usually black or dark brown and produced for a distance equal to their length; a prominent projection usually present on each side of the anal opening, probably the scars of the anal prolegs; cremaster less than 1 mm. in length, usually triangular at base narrowing rapidly so that the distal end is cylindrical and spine-like, slightly bifurcate at tip; lateral setae of the cremaster very fine and easily broken and not usually found on specimens.

Average length 8 mm.; greatest width 3.5 mm.; height at third abdominal segment 3 to 3.5 mm.

The larvae of the spring canker-worm are about an inch long and vary considerably in color from light brown to dull black. There is a yellow stripe running through the spiracles and a greenish yellow stripe underneath. They are ready to pupate about the first of June and enter the ground where they make an earthen cell and change to pupae. They live over winter in the pupal stage, the moths emerging in early spring. Although the female moths of this species are wingless, the pupae have the wings as well developed in the female as in the male.

Genus ERANNIS Hübner.

Cephalic half of body much thicker than the remainder, the dorsum of the first three segments convex as seen in lateral view; fronto-clypeal suture distinct for a part of its distance; clypeal and labral regions distinctly elevated, the labrum almost semi-circular in outline; labial palpi not visible; maxillae never quite reaching the caudal margin of the wings, the proximo-lateral angles never reaching the eye-pieces; antennae considerably broader than the prothoracic legs and only slightly narrowed at the distal end, always reaching the caudal margin of the wings and there curving mesad and normally touching; prothoracic legs at least seven-eighths the length of the wings, the femora never exposed, the cephalic end extending between the antenna and the sculptured eye-piece; mesothoracic legs as long as the maxillae and almost reaching the caudal margin of the wings; prothorax one-half the length of the mesothorax, the caudal margin not prominently curved at the meson; mesothoracic spiracles with a prominent ovate flattened tubercle adjacent to its caudal margin, the surface rugose and apparently covered with very fine, short setae, the tubercle extending at least

one-fourth of the distance between the margin of the antenna and the meson; mesothorax shorter than usual, the metathorax about one-fourth of its mesal length; abdominal segments 1 to 8, sometimes 1 to 9, punctate, the remaining segments smooth; abdominal spiracles almost circular in outline, the openings elliptical, the lips somewhat elevated; spiracular furrows present on the fifth segment, each with a strongly chitinized edge, the surface punctate, the area surrounding the spiracle having few punctures; dorsal furrow present between the ninth and tenth abdominal segments, the edges not strongly toothed; cremaster broad at base, and rugose, narrowing rapidly to a smooth spine-like distal half which is bifurcate at tip.

ERANNIS TILIARIA Harris.

The Lime Span-worm. Fig. 3, A and B.

Color usually bright reddish or yellowish brown, the head, thorax, and appendages often darker than the remaining surface; face parts with fine indeterminate striations, almost smooth, a few wrinkles or impressed lines between the proximal ends of the antennae; thorax with shallow impressed lines; abdominal segments 1 to 8 coarsely, thickly punctate; eighth segment somewhat swollen in the region of the spiracles and narrowing rapidly to the caudal margin; caudal margin of the furrow between the ninth and tenth segments finely serrate and somewhat crenulate in outline; cremaster with a transverse furrow at base, the proximal half rugose with a slight lateral projection on each side at the base of the narrow, smooth distal portion, which is bifurcate at tip, each half slender and somewhat seta-like, very easily broken.

Average length 12 to 15 mm.; greatest width 4 to 5 mm.

The larvae of the lime span-worm were collected this season from apple, cherry, Carolina poplar and the linden or lime tree, although most of them came from apple. The caterpillars are about an inch and a half long, and the markings vary considerably. They are generally dull dark red on the back, with a broad yellow stripe through the spiracles, and whitish underneath. They were most abundant the last two weeks of June and pupated the last of June and the first week in July. They burrow into the soil near the base of the tree to pupate and

make an earthen cell, but no traces of cocoons were found. The adults emerge late in the fall and lay the eggs, which do not hatch till spring.

Family NOTODONTIDAE.

The pupae of this family vary considerably, and there is no one character which will serve to separate them from those of the nearly related families. The prothoracic and mesothoracic legs are of the normal length for lepidopterous pupae, the prothoracic legs about half that of the wings and the mesothoracic legs slightly longer. The labial palpi often show a very small portion caudad of the labrum. The maxillae seldom reach the caudal margin of the wings and are usually less than three-fifths their length. The antennae are broadest at their proximal ends, and there the width exceeds that of the prothoracic legs. They seldom reach the caudal margin of the wings, and their tips often lie adjacent on the meson caudad of the other appendages. The mesothoracic leg never reaches cephalad to the eye-pieces, but the prothoracic leg always does. The latter seldom extends cephalad between the sculptured eye-piece and the antenna. The abdomen is usually punctate and only shows a dorsal furrow between the ninth and tenth segments in the genus *Datana*. The mesothoracic spiracles are usually slit-like and seldom, if ever, show an elevated ridge or tubercle adjacent to the caudal margin. The abdominal spiracles are seldom produced and always in a straight line. Spiracular furrows are never present. A few members of this family have no cremaster, but usually a short cremaster is present. The presence of hooked setae on the cremaster is the exception in the Notodontidae, as most of them pupate in the ground.

The colors vary but little in this family, nearly all being chestnut-brown, but a few are nearly black. None of the species known have prominent markings on the body. The genera of Notodontidae may be separated as follows:

a. Maxillae one-third or less the length of the wings; both prothoracic and mesothoracic legs meeting on the meson caudad of the maxillae; abdomen very finely punctate.

  b. Thorax and abdomen thickly covered with very fine short setae; cremaster a stout spine about one millimeter in

length with two short recurving hooks at the tip, each of which bears two or more very fine setae.

Melalopha.

bb. Thorax and abdomen never thickly covered with very fine, short setae; cremaster never as described above; sometimes absent.

c. Abdominal segments 2 to 7 with a slight ridge at both cephalic and caudal margins, the cephalic ridge interrupted by deep pits giving it the appearance of a row of square tubercles; face-parts and appendages not elevated, making a smooth even surface; cephalic end of body not elevated between the antennae; cremaster short. *Apatelodes.*

cc. Abdominal segments 2 to 7 never with ridges; appendages distinctly elevated; cephalic end of body elevated between the antennae; cremaster never present. *Harpyia.*

aa. Maxillae always more than one-third the length of the wings; never with both prothoracic and mesothoracic legs meeting on the meson; abdomen usually rather coarsely punctate.

b. Maxillae from one-half to three-fifths the length of the wings; mesothoracic legs meeting on the meson caudad of the maxillae; appendages roughened with deep indeterminate striations; abdomen coarsely punctate; a distinct, deep furrow on the dorsum between the ninth and tenth abdominal segments; cremaster short, bifurcate, each half with several short, spiny projections.

Datana.

bb. Maxillae more than three-fifths the length of the wings; neither prothoracic nor mesothoracic legs meeting on the meson caudad of the maxillae; appendages usually with shallow striations; a distinct furrow never present on the dorsum between the ninth and tenth abdominal segments; cremaster not as described above.

c. Entire body surface with coarse deep punctures; cephalic margin of the movable abdominal segments with large lunate punctures and a ridge with a row of large distinct punctures just caudad of it; cremaster short, rugose, slightly bifurcate; bearing six

long hooked setae; mesothorax never with a deeply pitted caudal margin. *Symmerista.*

cc. Body usually punctate on the abdomen but not on the appendages; movable abdominal segments sometimes with a slight ridge along the cephalic margin but never with a row of large punctures just caudad of it; cremaster bifurcate, but never with hooked setae; mesothorax with a row of deep pits along the caudal margin, with smooth quadrangular areas between and partly covering them.

d. Wings always touching on the meson; maxillae never as long as the wings; cephalic end of body sometimes with two sharp, heavily chitinized projections. *Schizura.*

dd. Wings adjacent on the meson but not touching; maxillae usually as long as the wings; cephalic end of body never with heavily chitinized projections. *Heterocampa.*

Genus MELALOPHA Hübner.

Body cylindrical, blunt at the cephalic end, the head scarcely visible in dorsal view; surface smooth, polished, covered with very fine setae which are only visible by the aid of a lens; epicranial suture present but only a small portion visible, the vertex being represented by a small triangular area adjacent to each antenna; labrum usually broader than long; sculptured eye-piece more than twice the width of the glazed eye-piece; antennae broader at the proximal end than the prothoracic legs and tapering gradually to a pointed tip; labial palpi usually entirely concealed, but occasional specimens show a small portion just caudad of the labrum; maxillae one-third or less the length of the wings, the proximo-lateral angles never reaching the eye-pieces; legs of the normal length, both prothoracic and mesothoracic legs adjacent on the meson caudad of the maxillae, and a very small portion of the metathoracic legs showing between the wings at their caudal margin; thorax relatively short, only about one-fourth the length of the body; mesal length of prothorax two-fifths that of the mesothorax; metathorax shorter than the first abdominal segment; spiracles all slightly elevated,

their openings elliptical; abdomen finely punctate; cremaster a straight spine with the distal end widened and bearing two or three recurving hooks on each side, each hook bearing minute setae on its mesal margin which are very easily destroyed.

MELALOPHA INCLUSA Hübner.

Fig. 5, C and I.

Color usually yellowish brown, with darker brown on the thorax, the cephalic margin of the abdominal spiracles, the cephalic margin of the movable abdominal segments and the cremaster; antennae smooth, ending opposite the prothoracic legs; maxillae one-third the length of the wings or slightly less; first three segments of the abdomen usually more elevated than the thorax and forming a distinct curve; abdominal segments finely punctate, the cephalic margin of each movable segment much more densely punctate, the ninth and tenth segments almost smooth; first abdominal segment with the scar of the larval tubercles apparent, in some specimens as a dark spot on each side of the meson, in others a small, but distinct tubercle in the same position; cremaster (Fig. 5, I) 1 mm. in length, with either two or three recurving hooks on each side.

Length 13 to 16 mm.; greatest width 5 mm.

The larvae of this species feed on poplar. Several of the larvae live together in a sort of tent formed by drawing two or three leaves together with threads of silk. They spin a loose cocoon, placing it among the leaves in captivity, but no cocoons were found during the summer's collecting.

Genus APATELODES Packard.

Cephalic half of body to the caudal margin of the wings wider and thicker than the caudal half, which tapers gradually to the short blunt cremaster; body surface highly polished, none of the face-parts or appendages prominently elevated so that the surface is smooth and even; epicranial suture present, but faint; vertex about twice as long at lateral margin as at meson; frontoclypeal suture sometimes indicated by an impressed line; cephalic margin of labrum about twice the width of the caudal margin; labial palpi represented by a small pentagonal area just

caudad of the labrum; antennae broader at the proximal end, where they slightly exceed the width of the prothoracic legs, and tapering gradually to a pointed tip; maxillae one-third the length of the wings, their proximo-lateral angles separated from the eye-pieces by almost the width of the latter; legs of about the usual length, the prothoracic legs adjacent on the meson caudad of the maxillae for a distance equal to the length of the maxillae; mesothoracic legs meeting just caudad of the prothoracic ones; wings adjacent on the meson for a short distance caudad of the mesothoracic legs; mesal length of the prothorax slightly more than half that of the mesothorax which is shorter than usual in the notodontids; metathorax equal in length to the first abdominal segment; abdomen very finely, sparsely punctate, some of the segments with a flanged plate or ridge along the cephalic margin which is interrupted by deep pits, segments 4 to 6 with a similar plate along the caudal margin not interrupted by pits; cremaster, if present, very short, rough, and usually blunt.

APATELODES TORREFACTA Smith and Abbot.

Fig. 6, G.

Color very dark reddish brown; head usually smooth and highly polished, sometimes roughened around the labrum; antennae ending slightly cephalad of the prothoracic legs; thorax with a few impressed lines and punctures; prothorax always with a small group of punctures in the caudo-lateral angle near the spiracle; mesothoracic spiracle with an elevated caudal margin and caudad of this a slight depression; abdominal segments 2 to 7 with an elevated cephalic ridge interrupted by pits, and sparsely covered with very fine punctures and a few striations in the spiracular region; segments 8 to 10 with a very few punctures; cremaster very short, less than 1 mm., rugose and scarcely bifurcate at tip.

Length 20 to 22 mm.; greatest width 9 mm.

The larva of this species has been taken in Maine on ash, beach, plum, oak, sassafras and various species of Rubus. It is very hairy, somewhat like a "woolly bear" and light grey in color with two long pencils of hairs on the thorax and one on the eighth abdominal segment. It enters the ground to pupate

and there makes an earthen cell. The pupa is easily recognized by the peculiar "bordered" appearance of the abdominal segments.

Genus HARPYIA Ochsenheimer.

Body distinctly depressed, elliptical in outline; front elevated at meson to accommodate the slight crest of the adult; fronto-clypeal suture indicated laterad by a slight furrow; invaginations for the anterior arms of the tentorium large and distinct; clypeo-labral suture indicated by a furrow; labrum nearly as long as broad, the caudal margin slightly narrowed; genae elevated; antennae elevated with the proximal half almost twice the width of the prothoracic legs, then rapidly narrowing to about one-fourth of this width, ending slightly caudad of the prothoracic legs; maxillae one-third the length of the wings; prothoracic and mesothoracic legs of the usual length and both meeting on the meson caudad of the maxillae; wings meeting on the meson caudad of the mesothoracic legs; mesal length of the prothorax slightly more than half that of the mesothorax, and that of the metathorax one-sixth that of the mesothorax; abdominal segments punctate; no cremaster present.

HARPYIA BOREALIS Boisduval.

Fig. 5, J.

Color reddish or yellowish brown; surface smooth and dull; head, thorax and appendages with fine striations more prominent on the prothorax and front; antennae with a row of minute tubercles along the middle line; maxillae with the proximo-lateral angles separated from the eye-pieces by a distance equal to the width of the eye-pieces; prothorax with a protuberance at each cephalo-lateral angle, probably indicating the scar of larval protuberances; mesothoracic spiracle slit-like; abdomen finely, sparsely punctate on the dorsum of the first eight segments, the remainder of the surface smooth; spiracles lenticular, usually margined by a black line.

Length 16 to 18 mm.; greatest width 7 mm.

The larvae of this species have been taken in Maine from poplar.

The larvae of this species belong to the group popularly known as horntails, on account of the long tail-like projections from the caudal end of the body. *Harpyia borealis* has two of these. The body is yellowish in color, the dorsal part nearly all dark brown. They feed on wild cherry. The larvae are found early in September and pupate about the last of the month. The cocoon is very thick and tough and usually spun against the side of the tree, where it resembles an excrescence on the bark.

Genus DATANA Walker.

Body always with an elevation at the cephalic end between the proximal ends of the antennae evidently to accommodate the crest of the imago; front prominently elevated, the elevation roughened with deep transverse striations and deeply punctate along the lateral margins; labrum also elevated, more prominently on the cephalic half; mandibular area sometimes elevated; glazed eye-piece always very narrow, scarcely more than a line along the mesal margin of the sculptured eye-piece; antennae at proximal end wider than the prothoracic legs and tapering gradually to a pointed tip, usually about two-thirds the length of the wings; maxillae from one-half to three-fifths the length of the wings, the proximo-lateral angles extending to the eye-pieces; labial palpi entirely concealed; legs of the usual length, the mesothoracic pair always meeting on the meson caudad of the maxillae; wings always adjacent on the meson caudad of the mesothoracic legs; mesothorax shorter than usual so that the thoracic segments are only one-fourth the total length of the body; mesal length of the prothorax one-half that of the mesothorax, the metathorax about one-sixth of the same length; thorax and abdomen always punctate; dorsum of abdomen always showing a deep furrow between segments nine and ten, its caudal margin serrate; cremaster short, bifurcate, each half bearing two or more short spinous projections.

There are at least four species of *Datana* found in Maine, and two of these *Datana ministra* and *Datana integerrima* may become serious pests. The other two species are comparatively rare as far as our records for the state show. While the pupae of this genus are very distinctive, the species are very closely related and the characters available for their separation are

somewhat variable. The teeth on the furrow between the ninth and tenth abdominal segments vary considerably, but in general follow the same arrangement. The following table may serve to separate the species:

a. Prothoracic legs always extending as far caudad as the maxillae, or meeting on the meson caudad of them; furrow between the ninth and tenth abdominal segments with the teeth on the caudal margin all short and approximately of equal length; pupae normally less than 20 mm. in length.

  b. Dorsum of tenth abdominal segment not punctate; caudal margin of the furrow between the ninth and tenth abdominal segments scarcely elevated; surface usually shining and polished. *angusii.*

  bb. Dorsum of tenth abdominal segment punctate as the remaining segments except perhaps a small area near meson; caudal margin of the furrow between the ninth and tenth abdominal segments always considerably elevated; surface dull. *integerrima.*

aa. Prothoracic legs not extending as far caudad as the maxillae, at least 1 mm. apart; furrow between the ninth and tenth abdominal segments with the teeth on the caudal margin uneven, and longer near the meson; pupae normally over 20 mm. in length.

  b. Crest on the front with a prominent longitudinal carinate ridge on the meson and a distinct furrow on each side; abdomen with medium punctures; each half of the cremaster with three projections. *major.*

  bb. Crest on the front without longitudinal ridges or furrows; abdomen with large shallow punctures; each half of the cremaster with two projections. *ministra.*

DATANA ANGUSII Grote and Robinson.

Fig. 5, D and E.

Color bright reddish brown; crest prominent, always rugose with deep transverse striations and punctures, and usually with two longitudinal furrows; face-parts and appendages with transverse striations, much shallower than those of the crest

and not noticeably punctate; antennae ending just cephalad of the mesothoracic legs; maxillae slightly more than half the length of the wings, usually about four-sevenths; prothoracic legs normally ending opposite the maxillae; cephalic margin of prothorax considerably elevated as seen in lateral view; prothorax with a distinct median carinate ridge, a similar but less prominent ridge on the metathorax; abdomen with medium punctures, larger along the cephalic margin of the movable segments; the surface irregular with fine ridges and some irregular depressions so that it does not appear even; first three abdominal segments broadly elevated along the meson; furrow between the ninth and tenth abdominal segments without prominent teeth, the teeth all about the same size; ninth abdominal segment with few punctures, the tenth smooth; each half the cremaster (Fig. 5, E) with a large, rather blunt mesal projection and a smaller, more pointed lateral one.

Length 15 to 18 mm.; greatest width 5 mm.

The larvae of this species feed on walnut and hickory. They pupate in the ground, each larva making a somewhat oval cell, without spinning a cocoon.

DATANA MAJOR Grote and Robinson.

Fig. 5, F.

Color bright reddish brown; crest very prominent with two longitudinal furrows and deep transverse striations, the lateral margins punctate; face-parts and appendages with irregular, transverse striations and depressions; antennae meeting on the meson caudad of the mesothoracic legs; maxillae slightly more than half the length of the wings; prothoracic legs much shorter than the maxillae; mesothoracic legs meeting on the meson just caudad of the maxillae; cephalic margin of prothorax not elevated; prothorax and metathorax very slightly elevated along the meson; abdomen rather coarsely punctate and with small indeterminate depressions, both transverse and longitudinal; furrow between the ninth and tenth segments edged with black, the caudal margin elevated and with uneven teeth; both ninth and tenth abdominal segments punctate like the remaining segments; each half of the cremaster (Fig. 5, F) with three equal projections.

Length 25 to 27 mm.; greatest width 8 mm.

The larvae of this species feed on certain species of Vaccinium, the common blueberries and deerberry, also on Andromeda. As its name implies it is the largest species of the genus. The method of pupation is probably the same as for the other species of *Datana,* but it has not been observed by the writer.

DATANA INTEGERRIMA Grote and Robinson.

Fig. 5, G.

Color dark brown; crest not very prominent, the longitudinal furrows not deep or well defined; face-parts and appendages very rough with impressed lines and other surface sculpturing; antennae never meeting on the meson nor extending as far caudad as the mesothoracic legs; maxillae about one-half the length of the wings and slightly longer than the prothoracic legs; mesothoracic legs meeting on the meson caudad of the maxillae;

median line of the prothorax and metathorax slightly elevated; thorax noticeably punctate among the transverse striations; abdominal segments rather finely punctate, with few other markings; furrow between the ninth and tenth segments edged with black, the caudal margin elevated and almost evenly toothed; both ninth and tenth abdominal segments punctate; each half of the cremaster with three short, almost equal projections.

Length 17 to 19 mm.; greatest width 6 mm.

The larvae of this species feed on walnut, hickory and oak. They are found in large companies and always keep together while feeding. They pupate in the ground.

DATANA MINISTRA Walker.

Fig. 5, H.

Color bright reddish brown, sometimes yellowish brown; crest on front seldom showing longitudinal furrows; face-parts and appendages rugose with indeterminate transverse striations, the appendages less rugose than the face-parts; maxillae three-fifths the length of the wings or a trifle shorter, always longer than the prothoracic legs; cephalic margin of prothorax slightly

elevated; median line of prothorax and metathorax slightly elevated but not carinate; abdomen coarsely punctate, the punctures larger along the cephalic margin of each movable segment, and with scarcely any other markings; furrow between segments nine and ten edged with black, the teeth coarse and largest near the meson; caudal margin of furrow elevated; eighth and ninth abdominal segments always punctate; cremaster usually with two short spinous projections on each half.

Length about 23 mm. varying but little; greatest width 7 mm.

Most larvae of *Datana ministra* have been collected from apple in this state, although it feeds on a variety of other trees. The larva enters the ground to pupate. It spins no cocoon, but forms an earthen cell in which silk threads are seldom present.

Genus SYMMERISTA Hübner.

Head distinctly narrower than the thorax; body surface punctate, even on the appendages, though presenting a polished appearance, and without impressed lines or other markings; clypeal region slightly elevated; invaginations for the anterior arms of the tentorium very distinct; labrum almost semicircular in outline; glazed eye-piece one-fourth the width of the sculptured eye-piece and bounded mesally by an impressed black line; maxillae about nine-tenths the length of the wings, the tips of the antennae meeting just caudad of them on the meson; antennae considerably wider at the proximal end, but their greatest width is not equal to that of the prothoracic leg; prothoracic and mesothoracic legs of the usual length, never meeting on the meson; wings meeting on the meson for a short distance caudad of the antennae; mesal length of prothorax one-third that of the mesothorax and the metathorax one-fourth of the same length; cremaster short, slightly bifurcate, and bearing hooked setae.

SYMMERISTA ALBIFRONS Smith and Abbot.

Fig. 6, A and B.

Color dark chestnut-brown; mesal half of the genae and a small area adjoining the cephalic margin of the prothorax

highly polished and without punctures; punctures on the front black, and more irregular in outline than on the remainder of the body surface; mesothoracic spiracles with both margins elevated, the caudal margin slightly more so than the cephalic, and black in color; movable abdominal segments with the cephalic margin more densely punctate than the remainder and with large lunate punctures; cephalic margin separated from the remainder of the segment by a distinct ridge, and just caudad of this a row of large black punctures; abdominal spiracles (Fig. 6, B) elevated along the cephalic margin, the openings somewhat crescent-shaped and directed caudad; cremaster less than 1 mm. in length, rugose with longitudinal ridges, each point of the bifurcation bearing three hooked setae.

Length 17 to 21 mm.; greatest width 5 to 7 mm.

The larvae of *Symmerista albifrons* are striped longitudinally with black and red and have a prominent red hump near the caudal end of the body. They spin a thin, tough cocoon between leaves, and are usually found on the surface of the ground under the tree on which the larvae fed. The larvae feed on oak and maple. They appear late in the season and pupate in September.

Genus SCHIZURA Doubleday.

Body of usual type, sometimes with a projection at the cephalic end; surface appearing smooth and polished; epicranial suture visible in some species; antennae with the greatest width greater than that of the prothoracic legs, narrowed rapidly and forming a long pointed tip, never quite reaching the caudal margin of the wings; maxillae always more than three-fifths the length of the wings, but never reaching their caudal margin, the caudo-lateral angles always reaching the glazed eye-piece, sometimes extending beyond; mesal length of prothorax one-half that of the mesothorax; mesonotum with a row of deep elongate pits along the caudal margin of the wings with smooth, square black areas between; metathorax with its mesal length about one-fourth that of the mesothorax; abdomen with the first eight segments punctate; cremaster entirely bifurcate, each half somewhat boot-shaped, the lateral margins of the cremaster subparallel.

The species of Schizura may be separated by the following table:

a. Maxillae always more than seven-eighths the length of the wings; cephalic end of body blunt and only slightly projecting between the antennae; abdominal segments 5 to 7 with the punctures distinctly larger and more numerous along the cephalic margin; body never with prominent tubercle scars on the dorsum of the mesothorax, metathorax, and first abdominal segments. *ipomeae.*

aa. Maxillae five-sixths the length of the wings; cephalic end of body with a prominent, slightly bifurcate projection; abdominal segments 5 to 7 with the punctures of approximately the same size and not much more numerous along the cephalic margin; body with prominent tubercle scars on the dorsum of the mesothorax, metathorax and first abdominal segment. *concinna.*

SCHIZURA IPOMEAE Doubleday.

Fig. 5, B.

Color bright yellowish brown; body with a slight projection at the cephalic end between the proximal ends of the antennae; epicranial suture visible for a short distance adjacent to each antenna in the majority of specimens; face-parts and appendages smooth and polished, with very few punctures or other surface markings; mandibular area slightly elevated; antennae ending just caudad of the mesothoracic legs, but never meeting on the meson; maxillae more than seven-eighths the length of the wings, the caudo-lateral angles always extending to the eye-pieces; sculptured eye-piece distinguished by its impressed lines and slightly wider than the other; thoracic segments with a few fine punctures; mesothorax without punctures as in *S. concinna*, but with short, transverse, impressed lines on each side the meson; caudal margin of mesonotum with seven pits and six square black polished areas between; abdominal segments sparsely covered with very fine punctures except for a band along the cephalic margin of segments 5 to 7, which is densely and rather coarsely punctate; first abdominal segment often with a small rounded tubercle, or at least a tubercle scar on the meson showing the location of the prominent larval pro-

jection; abdominal spiracles slightly produced, the openings somewhat crescent-shaped; eighth abdominal segment with a dark tubercle scar on each side of the meson; cremaster about 1 mm. in length, the lateral margins subparallel, the mesal margins with two projections.

Length 15 to 20 mm.; greatest width 4 mm.

The larvae of this species has been collected only on maple, although it is reported from oak, elm and several other trees. The larvae enter the soil to pupate and there spin a thin cocoon which is covered with particles of sand or soil. The pupae of this species closely resemble those of certain species of *Heterocampa* notably *H. bilineata.*

SCHIZURA CONCINNA Smith and Abbot.

The Red-humped Apple-worm. Fig. 5, A.

Color chestnut brown; body with a prominent median cephalic projection which is slightly bifurcate; face-parts and appendages smooth and polished, without markings except for a few transverse impressions; antennae not extending as far caudad as the mesothoracic legs, which are usually 1 mm. longer; maxillae five-sixths the length of the wings; scars of larval projections prominent on each side the meson of the mesothorax, metathorax and first abdominal segment, where they often show as distinct tubercles, less prominent scars on the fourth abdominal segment, and occasionally scars visible on the other segments but usually not distinct; caudal margin of mesonotum normally with nine pits and eight square, black, polished areas between; abdominal segments rather densely punctate with punctures of medium size, the punctures on the cephalic margin of segments 5 to 7 differing very little from those on the remainder of the segment; abdominal spiracles large, slightly produced, the openings elliptical, the margins very dark brown; cremaster about one-half millimeter in length, bifurcate, each half oblong with a very slight projection at each angle and another on the mesal margin about half way to the distal end.

Length 10 to 12 mm.; greatest width 4 mm.

The red-humped apple caterpillar is often a serious pest in apple orchards. It also feeds on other fruit trees and a number of forest trees. The larvae feed mostly at the ends of the

branches and live in colonies. They have fine black and white longitudinal stripes on the body and near the cephalic end some short black projections with a prominent reddish hump on the fourth abdominal segment. They usually pupate under dead leaves and sticks at the base of the tree and begin to pupate the last of August or in the early part of September. They spin a very thin cocoon which is usually fastened between two dead leaves or some small sticks. There is only one brood in Maine and adults emerge from these pupae the following spring.

Genus HETEROCAMPA Doubleday.

Body slightly wider at the cephalic half, tapering gradually from the fourth abdominal segment to the cremaster; fronto-clypeal suture faintly indicated; labrum somewhat triangular in outline, much narrower on the caudal margin; glazed eye-piece about one-half the greatest width of the sculptured eye-piece; antennae more than seven-eighths the length of the wings; maxillae usually as long as the wings, but sometimes a little shorter, the proximo-lateral angles extending laterad to the eye-pieces; prothoracic and mesothoracic legs visible and of the usual length; labial palpi never visible; wings adjacent on the meson below the maxillae but seldom touching; mesal length of prothorax about two-fifths that of the mesothorax; mesonotum with a row of deep pits along the caudal margin separated by smooth quadrangular areas; mesal length of metathorax one-fifth that of the mesothorax; abdominal segments punctate; cremaster bifurcate, each half somewhat boot-shaped.

HETEROCAMPA GUTTIVITTA Walker.

The Saddled Prominent. Fig. 6, C and D.

Color very dark brown, often almost black; surface smooth and polished; head, thorax and appendages slightly roughened with fine, rather close striations excepting the genae and glazed eye-pieces which are highly polished; maxillae slightly longer than the antennae but never quite reaching the caudal margin of the wings; pits along the caudal margin of the mesonotum normally eight, but occasionally with only seven; mesothoracic spiracle with a smooth, slightly elevated area adjacent to its

caudal margin which has a small semicircular depressed area in the middle; abdomen finely but not coarsely punctate, the punctures slightly larger along the cephalic margin of the segments; spiracles lenticular, slightly depressed; cremaster with the lateral margins subparallel, usually 1 mm. in length, sometimes shorter; a rugose area at base bounded cephalad by a narrow, irregular carinate ridge.

Length 18 to 22 mm.; greatest width 6 mm.

The larvae of this species feed on beech, maple, and many other trees. They often become very numerous and during the years 1908 and 1909 became a serious pest in Maine and New Hampshire. A description of the larvae and their life history is given in Bulletin 161 of the Maine Agricultural Experiment Station. The larvae when full grown pupate in an earthen cell, or among leaves at the base of the trees.

HETEROCAMPA BILINEATA Packard.

Color usually chestnut brown, sometimes darker; surface smooth and polished; head, thorax and appendages almost smooth, with a few slightly depressed lines; maxillae always reaching the caudal margin of the wings; pits along the caudal margin of the mesonotum usually eleven, occasionally only ten; mesothoracic spiracle with a very narrow elevation adjacent to the caudal margin, and caudad of this a slight depression; abdomen rather coarsely punctate on the cephalic margin, the punctures smaller and farther apart on the remainder of the segment; abdominal spiracles lenticular but not depressed; cremaster with the lateral margins distinctly converging to the tip, usually less than 1 mm. in length, never with a rugose area at base.

Length 16 to 20 mm.; greatest width 5 mm.

The larvae of this species have been collected in Maine from oak, elm and linden. The larva enters the soil to pupate, where it spins a loose web of silk to which the particles of soil adhere, forming a sort of earthen cocoon.

Family PLATYPTERYGIDAE.

This family consists of four genera, and pupae of only two of these have been seen. The larvae of *Oreta rosea* were col-

lected, but were not reared to maturity. The pupae of the two genera vary considerably in some respects, but are very similar in others. They have the maxillae very short, about one-third the length of the wings. The legs are of normal length, both the prothoracic and mesothoracic meeting on the meson caudad of the maxillae. The antennae are about the width of the prothoracic legs at their proximal end and are gradually narrowed towards the tip. They are slightly longer than the mesothoracic legs. The tips of the metathoracic legs are always exposed. The metathoracic wings are always visible on the ventral surface of the body. They meet on the meson caudad of the mesothoracic legs and then separate to show the metathoracic legs. They are also visible along the caudal margin of the mesothoracic wings. The thorax is of normal length and the mesothoracic spiracles are slit-like. The abdomen is punctate, with a dorsal furrow present between the ninth and tenth segments. This furrow is never as well-defined as in the Geometridae. The abdominal spiracles are usually quite large and in a straight line. No spiracular furrows are present. A cremaster is always present and may or may not have hooked setae.

So far as known the members of this family do not pupate in the ground, but in a thin cocoon, or attached to a web of silk by the cremaster. The genera described here may be separated as follows:

a. Cremaster with prominent hooked setae; prothorax with a prominent median ridge which shows as a median cephalic projection on the ventral surface; body densely covered with whitish bloom. *Falcaria.*

aa. Cremaster without prominent hooked setae; prothorax without a prominent median ridge, the front having two prominent cephalic projections; body never with bloom on any part of its surface. *Drepana.*

Genus FALCARIA Haworth.

Body of usual shape, and densely covered with a whitish bloom; face-parts slightly elevated, an irregular tubercle on the front adjacent to the proximal end of each antenna; caudal portion of the clypeal region distinctly elevated to form a large rounded tubercle; prothoracic leg extending cephalad between

the sculptured eye-piece and the antenna; antennae about seven-eighths the length of the wings, the distal end of each curved slightly laterad, widest at the cephalic end where they exceed the greatest width of the prothoracic legs and narrowed gradually to half this width at the distal end; maxillae slightly more than one-third the length of the wings, the proximo-lateral angles never extending to the eye-pieces; labial palpi entirely concealed; prothoracic legs three-fifths the length of the wings, the distal third of their length meeting on the meson caudad of the maxillae; mesothoracic legs about five-sixths the length of the wings, and meeting on the meson caudad of the prothoracic legs for about the same distance; tips of the metathoracic legs showing on the meson between the wings; metathoracic wings exposed on the ventral surface, meeting on the meson just caudad of the mesothoracic wings and extending along the mesal margin of the mesothoracic wings to their caudal margin, and visible most of the way across to the lateral margin; prothorax with a prominent ridge on the meson, visible in ventral view; mesal length of prothorax two-fifths that of the mesothorax; mesothoracic spiracles slit-like; metathorax shorter than usual, its mesal length one-sixth that of the mesothorax; abdominal segments 1 to 8 with medium sized punctures and sparsely covered with small curved spines which are more numerous near the spiracles and the scars of the ventral prolegs, the transverse conjunctiva covered with small spines or spinous processes; body setae arising from the bases of the larger spines; dorsal furrow present between the ninth and tenth segments; abdominal spiracles slightly sunken, lenticular in outline, the openings elliptical; cremaster triangular in outline, longer than broad and ending in a group of stout hooked setae.

This genus includes a single species, *Falcaria bilineata*, found throughout the Atlantic states.

FALCARIA BILINEATA Packard.

Fig. 6, F and H.

Color dark brown, but covered with dense, rather flocculent, whitish bloom; head, thorax and appendages considerably roughened with indeterminate, transverse impressed lines; labrum somewhat quadrangular, the caudal margin slightly notched;

clypeal region elevated to form a prominent quadrangular tubercle bearing two prominent setae; tubercle at the proximal end of each antenna also bearing prominent setae; antennae tuberculate, the three rows of tubercles arranged transversely; surface of thorax more roughened than that of the head and with a small, irregular tubercle at the base of each important seta; dorsal furrow between the ninth and tenth abdominal segments distinct, the caudal margin not more strongly chitinized and toothed as in the Geometridae; tenth segment (Fig. 6, F) with a distinct V-shaped depression at the proximal end of the cremaster, the triangular area between considerably more elevated than the remainder of the segment; cremaster triangular in outline, rugose, the lateral margins convex, and narrowed to a rounded tip, then flaring suddenly on each side to form a spiny process which is much shorter than the stout curved setae; four stout hooked setae inserted at the meson at the caudal end of the cremaster and one inserted on each side on the ventral surface just caudad of the lateral projections of the cremaster.

Length about 12 mm.; greatest width 4 mm.

The larvae of this species were collected on the leaves of gray birch June 26. They are peculiar in that they have no well developed anal prolegs. The last segment bears a cylindrical projection which sticks up and away from the surface of the leaf. The body is roughened and somewhat granular with some wart-like projections on the mesothorax and metathorax and the second abdominal segment. The colors are yellowish or golden brown, with darker brown markings. They spin a thin yellowish cocoon which is usually fastened to the under side of the leaf. Often the leaf is curled over the cocoon so as to conceal it. The pupae are at first a bright yellow brown, but after a day turn dark brown and the bloom appears. The adults emerged July 23.

Genus DREPANA Schrank.

Body of usual shape with two prominent cephalic projections; face-parts not prominently elevated, the labrum being slightly more convex than the remainder; eye-pieces reached only by the prothoracic leg which extends for a short distance between the sculptured eye-piece and the antenna; antennae about four-fifths the length of the wings, widest at the proximal

end, where they equal the width of the prothoracic legs; tapering gradually to a pointed tip; maxillae about one-third the length of the wings, the proximo-lateral angles never extending to the eye-pieces; labial palpi entirely concealed; prothoracic legs almost three-fifths the length of the wings, meeting on the meson caudad of the maxillae, for about two-fifths of their length; mesothoracic legs a little shorter than the antennae, meeting on the meson for about the same distance as the prothoracic legs; tips of metathoracic legs exposed between the metathoracic wings; metathoracic wings meeting on the meson caudad of the mesothoracic legs and extending along the mesal margin of the mesothoracic wings to their caudal margin, below which they are visible for the greater part of their length; mesal length of prothorax two-fifths that of the mesothorax; mesothoracic spiracles slit-like; metathorax short, its mesal length only one-third that of the prothorax; abdominal segments 1 to 8 punctate, the punctures thickest along the cephalic margin of the movable segments; abdominal spiracles lenticular in outline, the openings elliptical; cremaster triangular, the distal end widened out and somewhat spherical.

This genus includes but one eastern species *Drepana arcuata* which is found throughout the Atlantic States.

DREPANA ARCUATA Walker.

Fig. 6, E.

Color on head, thorax, and appendages dark brown except the tips of the cephalic projections which are reddish brown, the abdomen dull green mottled with dark brown, the coloring darkest on the dorsum; head, thorax and appendages considerably roughened with indeterminate transverse impressed lines; cephalic projections triangular, their tips slightly curved dorsad, situated on the front adjacent to the proximal ends of the antennae; glazed eye-pieces, clypeus and front smooth and polished; thoracic segments with a slightly carinate median line; abdomen with the first eight segments punctate, the remainder smooth; dorsal furrow between the ninth and tenth segments not distinct forming an indistinct V-shaped depression at the base of the cremaster; cremaster slightly rugose, the basal part triangu-

lar, then a narrow, cylindrical portion which expands into a wider, knob-like end with a row of inconspicuous projections on the dorsal surface.

A pupa of this species was collected from white birch, August 3. The cremaster was entangled in a web of silk on the underside of a leaf, but there was no cocoon present. The adult emerged August 15.

The larvae of these are dark red above and have a pair of prominent tubercles on the first abdominal segment.

LIST OF ABBREVIATIONS.

a.	antennae
a1-a10.	abdominal segments 1-10.
ao.	anal opening.
at.	invaginations for the anterior arms of the tentorium.
cl.	clypeus.
cm.	cephalic margin of an abdominal segment.
cr.	cremaster.
es.	epicranial suture.
f.	front.
f 1.	femur of the prothoracic leg.
ge.	glazed eye-piece.
go.	genital opening.
lb.	labrum.
1_1	prothoracic leg.
2_2	mesothoracic leg.
3_3	metathoracic leg.
lp.	labial palpi.
ms.	mesothorax.
msp.	mesothoracic spiracle.
mt.	metathorax.
mx.	maxillae.
p.	prothorax.
s.	spiracle.
se.	sculptured eye-piece.
sf.	spiracular furrow.
ts.	tubercle scar.
v.	vertex.
w 1.	mesothoracic wing.
w 2.	metathoracic wing.

Fig. 2, A to I.

A Hypothetical pupa, ventral view.
B Hypothetical pupa, dorsal view.
C *Cosymbia lumenaria,* ventral view, female.

D *Sicya macularia,* ventral view, male.
E *Ania limbata,* ventral view, male.
F *Cleora pampinaria,* ventral view, female.
G *Sicya macularia,* dorsal view of tenth segment and cremaster.
H *Ania limbata,* dorsal view of tenth segment and cremaster.
I *Cleora pampinaria,* spiracle and spiracular furrow.

Fig. 3, A to F.

A *Erannis tiliaria,* dorsal view.
B *Erannis tiliaria,* ventral view, male.
C *Paleacrita vernata,* ventral view, female.
D *Paleacrita vernata,* lateral view.
E *Aplodes mimosaria,* ventral view, female.
F *Diastictis ribearia,* ventral view, male.

Fig. 4, A to K.

A *Hydria undulata,* ventral view, male.
B *Sabulodes lorata,* ventral view, female.
C *Cingilia catenaria,* ventral view, female.
D *Hydria undulata,* dorsal view of fifth abdominal segment.
E *Sabulodes lorata,* dorsal view of tenth segment and cremaster.
F *Cingilia catenaria,* dorsal view of tenth segment and cremaster.
G *Diastictis anataria,* dorsal view of cremaster.
H *Diastictis anataria,* ventral view of cremaster.
I *Diastictis ribearia,* dorsal view of cremaster.
J *Diastictis ribearia,* ventral view of cremaster.
K *Sabulodes transversata,* dorsal view of tenth segment and cremaster.

Fig. 5, A to J.

A *Schizura concinna,* ventral view, female.
B *Schizura ipomeae,* dorsal view.
C *Melalopha inclusa,* ventral view, female.
D *Datana angusii,* ventral view, male.
E *Datana angusii,* dorsal view of tenth segment and cremaster.
F *Datana major,* dorsal view of tenth segment and cremaster.
G *Datana integerrima,* dorsal view of tenth segment and cremaster.
H *Datana ministra,* dorsal view of tenth segment and cremaster.
I *Melalopha inclusa,* cremaster.
J *Harpyia borealis,* ventral view, male.

Fig. 6, A to H.

A *Symmerista albifrons,* ventral view, male.
B *Symmerista albifrons,* abdominal spiracle.
C *Heterocampa guttivitta,* ventral view, female.
D *Heterocampa guttivitta,* dorsal view.
E *Drepana arcuata,* ventral view, female.
F *Falcaria bilineata,* dorsal view of tenth segment and cremaster.
G *Apatelodes torrefacta,* ventral view, male.
H *Falcaria bilineata,* ventral view, female.

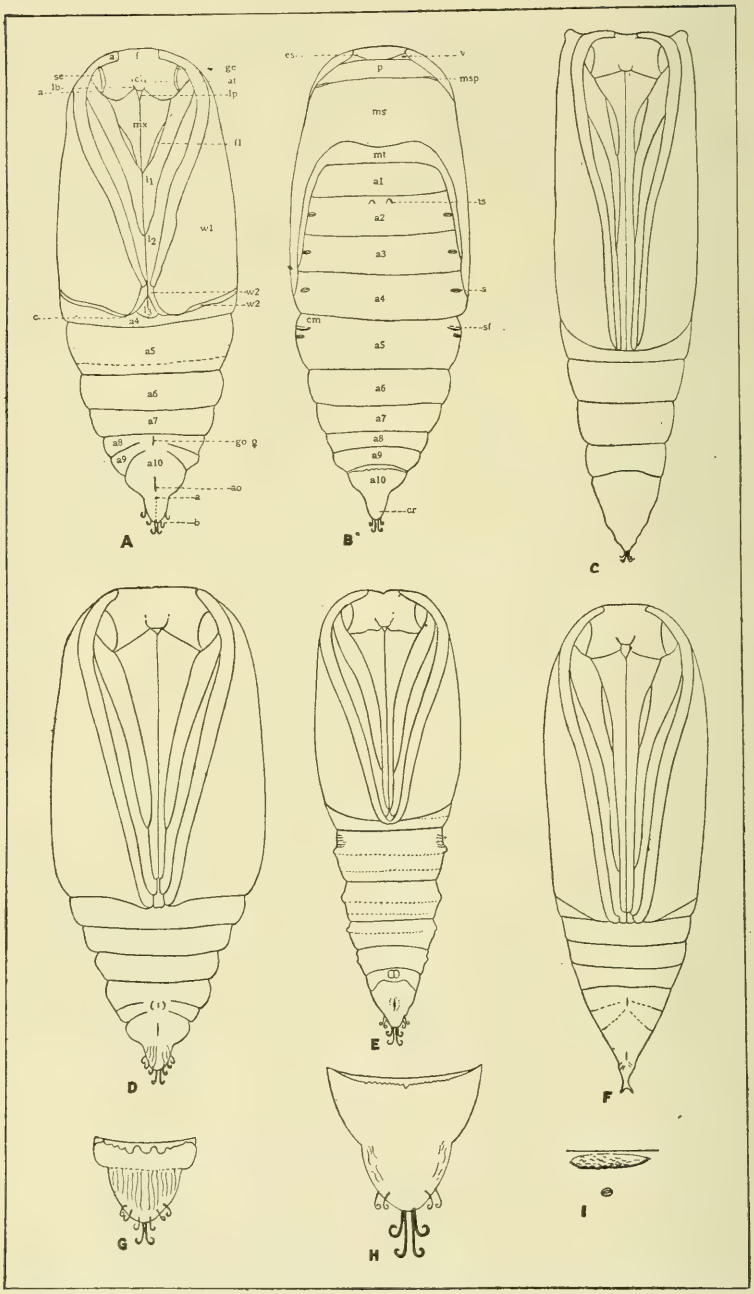
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Fig. 2.

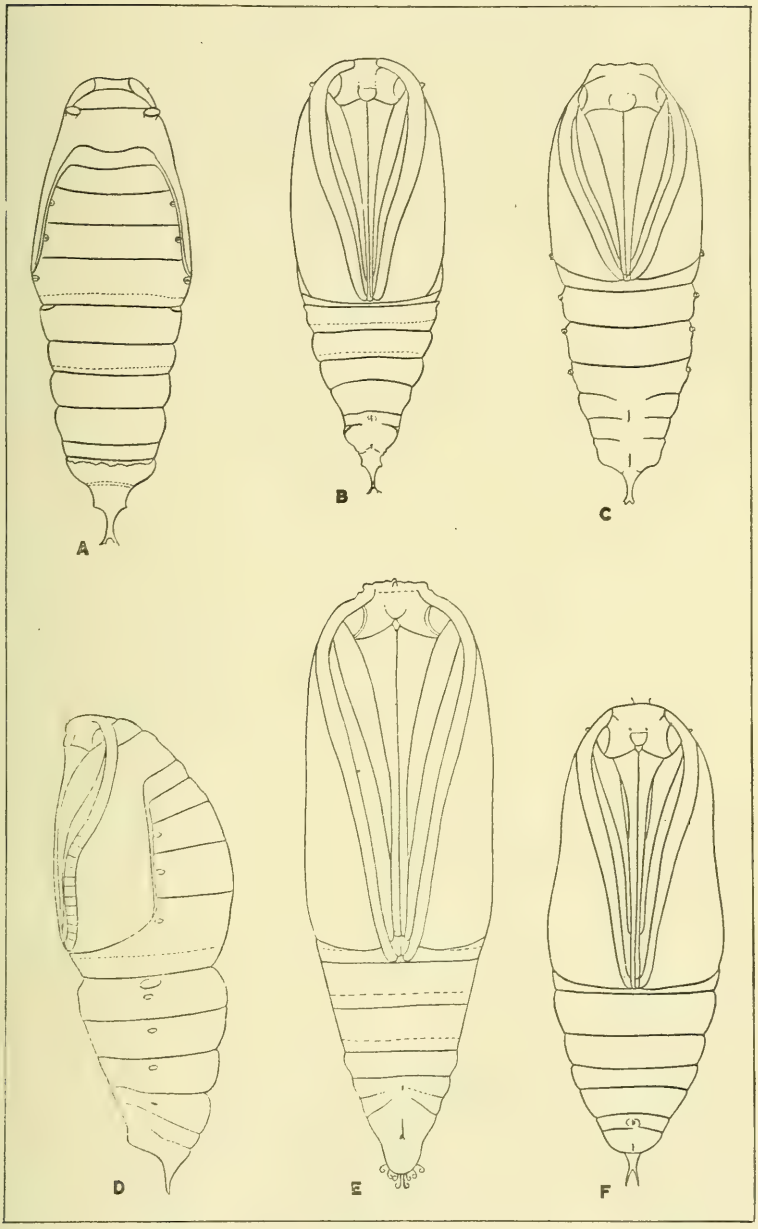

Fig. 3.

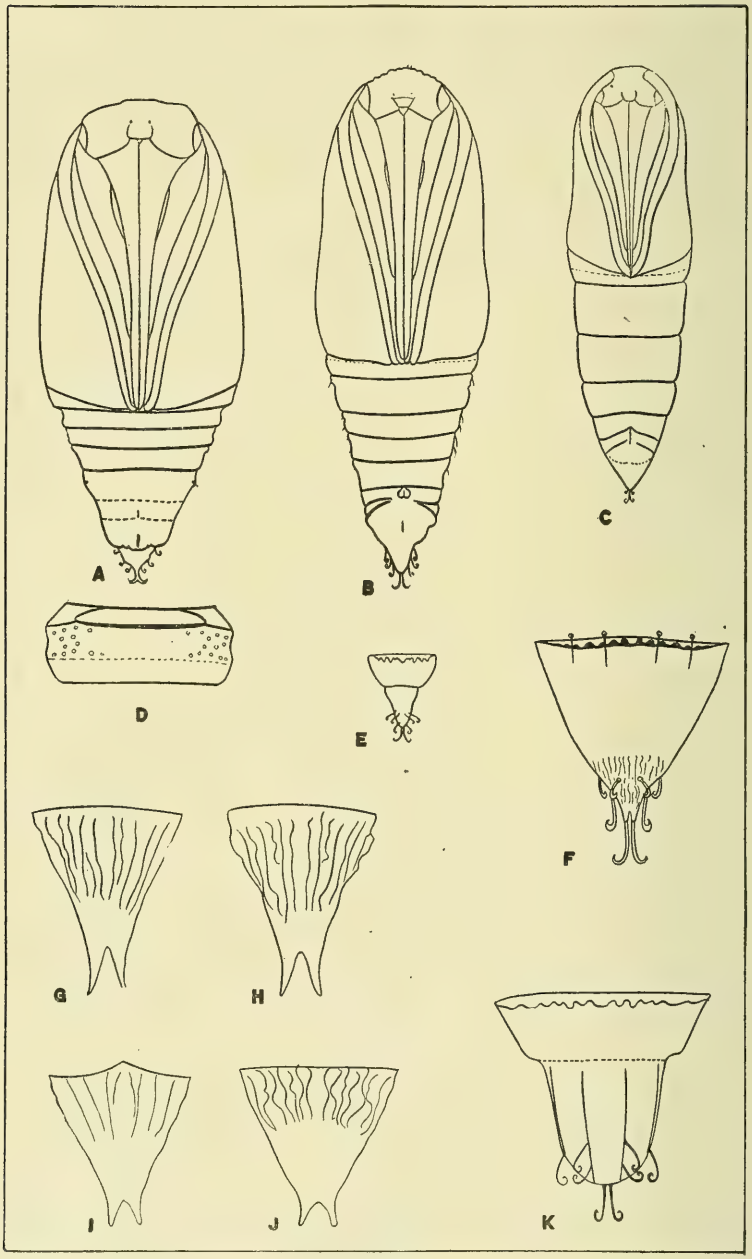

Fig. 4.

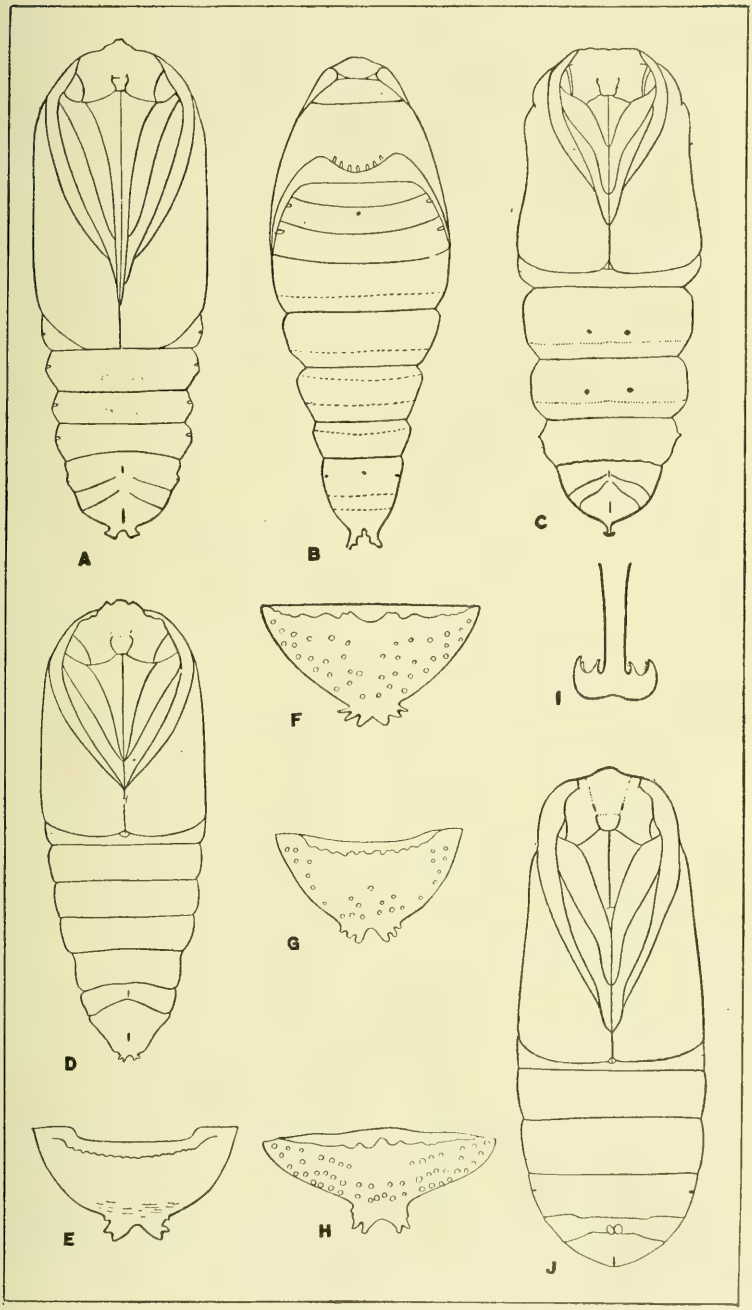

Fig. 5.

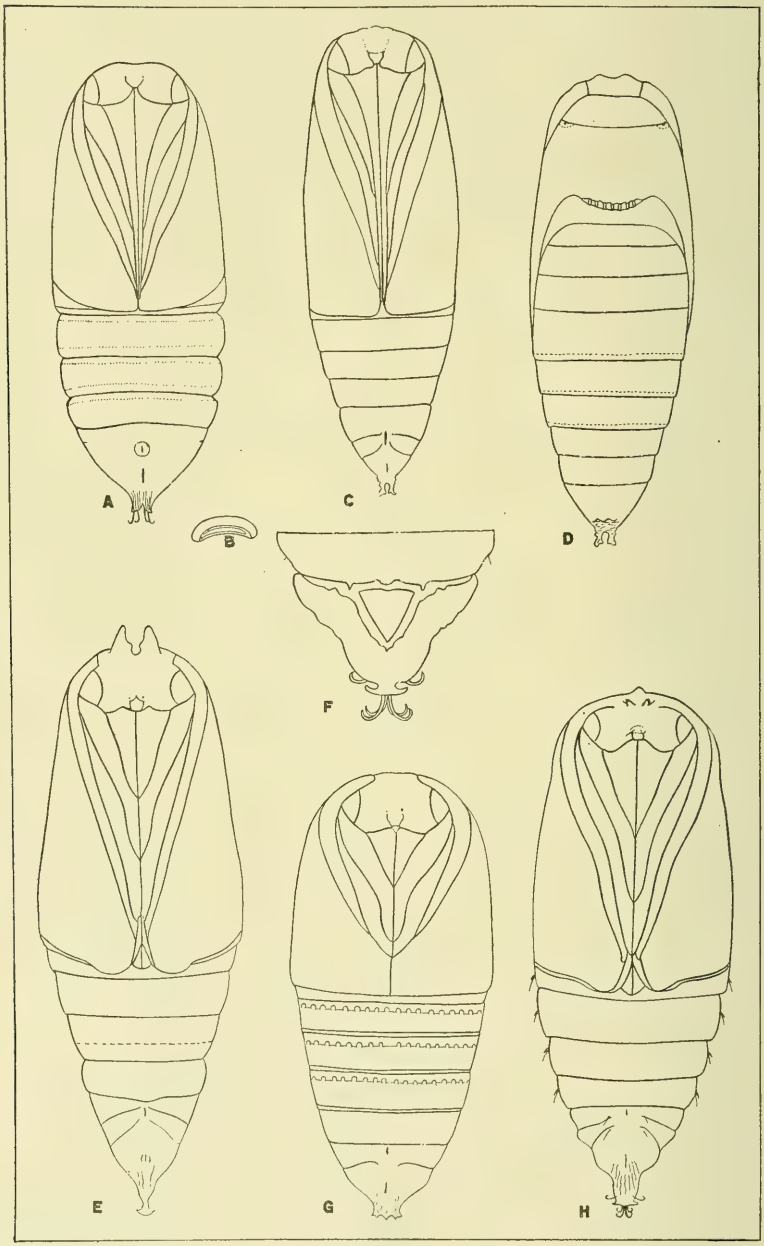

Fig. 6.

BULLETIN 260

BARN AND FIELD EXPERIMENTS IN 1916.

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.

DRAWING CONCLUSIONS FROM FIELD EXPERIMENTS

Field experiments at the best are somewhat uncertain because there are so many factors of soil, temperature, rainfall, and the like, that affect the results which are beyond the control of the experimenter. In like manner ordinary feeding and other experiments with animals are outside of laboratory control and are beset with uncertainties that render conclusions more or less uncertain. It is, therefore, always planned at this Station to carry the same experiment under as nearly as possible the same conditions through a series of years before attempting to draw any very definite conclusions. The results here reported should be considered more in the light of reports of progress than of completed studies. It may happen that the teaching that a single year's results seem to warrant may be reversed by the repetition of the experiment in other years under different climatic or other conditions.

ARE SHEEP PROFITABLE IN WINTER?

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. A year 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 accout 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 the 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 Bullentin 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 tabulations that follow give two years expenditures and receipts begining November 1, and ending October 31, for each year

*Sheep Account for Year Nov. 1, 1914, to Oct. 31, 1915**

Inventory and Expenditures.

73 ewes at $5	$ 365.00
22 ewe lambs @ $3	66.00
3 bucks at $25	75.00
Bran and middlings, 7000 pounds at $30 per ton	105.00
Oil meal, 800 pounds at $37 per ton	14.80
Corn meal, 2400 pounds at $32 per ton	39.40
Gluten feed, 100 pounds at $36 per ton	1.80
Ground oats, 44 bushels at 55 cents per bushel	24.20
Hay, 45,600 pounds at $12 per ton	273.60
Straw, 6,000 pounds at $5 per ton	15.00
Turnips, 515 bushels at 10¢ a bushel	51.50
Dips, etc.	10.96
895 hours man labor on sheep at 17½¢ per hour	156.62
3 hours horse labor at 15¢ per hour	.45
	$1,198.33

Receipts and Inventory.

Sheep and lambs sold	$ 115.69
Wool sold	170.09
Manure**	36.00
47 old ewes on hand Oct. 31, 1915, at $5	235.00
22 yearling ewes on hand Oct. 31, 1915, at $5	110.00
33 ewe lambs on hand Oct. 31, 1915, at $3	99.00
3 registered bucks on hand Oct. 31, 1915	75.00
Loss on operation for year	375.55
	$1,198.33

*Pasturage, use of land for crops and buildings for summer shelter and winter housing, interest on investment and other overhead charges are not included in this account.

**Manure as valued by farm superintendent's estimate when drawn from the barns and sheds.

*Sheep Account for Year Nov. 1, 1915, to Oct. 31, 1916**

Inventory and Expenditures.

47 original purchase ewes at $5	$ 235.00
22 yearling ewes (1914 lambs) at $5	110.00
33 ewe (1915) lambs at $3	99.00
3 registered bucks at $25 (Sold in January 1916)	75.00
2 registered bucks at $25 (Purchased in October 1916)	50.00
Bran, and mixed feed, 5,500 pounds at $27 per ton	74.25
Oil meal, 475 pounds at $40 per ton	9.50
Corn meal, 1900 pounds at $31 per ton	29.45
Gluten feed, 200 pounds at $36 per ton	3.60
Ground oats, 67.5 bushels at 65 cents per bushel	43.88
Hay, 48,135 pounds at $15 per ton	361.01
Rowen hay, 4,800 pounds at $12 per ton	28.80
Straw, 8,675 pounds at $5 per ton	21.69
Turnips, 570 bushels at 15¢ per bushel	85.50
Cull apples, 3 tons at $4 per ton	12.00
Dips, $6.00; Medicines, $1.50	7.50
Salt, 2 bushels at 35¢ per bushel	.70
853 hours man labor at 18¢	153.54
19 gallons gasoline at 27¢ per gallon	5.13
Total	$1,405.55

Receipts and Inventory

Wool		$ 255.91
Sheep and lambs sold		491.08
63 tons manure from pit 12 tons manure from sheds	See discussion	
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 at $25		50.00
1 Hampshire buck obtained in exchange for 2 ewe lambs		6.00
Loss on operation**		207.56
Total		$1,405.55

*Same as first foot note on page 88.

**This is the loss without allowing for value of manure. See discussion in text.

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 three 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 dos 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 are charged at what it costs to grow them without any overhead charges. The season of 1915 was not a favorable one at Highmoor Farm for growing turnips and they cost a half as much again as they did the preceding year. A lessened yield and greater labor cost due to the character of the season explains this increase in cost of production. In 1914-15 the sheep were fed about 120 pounds of grain, 460 pounds of hay, and 320 pounds of turnips per head, and about 60 pounds of straw were used per sheep. In 1915-16 they were fed about 100 pounds of grain, 500 pounds of hay and 390 pounds of apples and turnips. The grain cost about $1.90, the hay $2.80, and the turnips $0.55 per head in 1914-15. In 1915-16 the grain cost about $1.40, the hay $3.75, and the turnips and apples nearly $1.00 per head. The total cost of food and straw in 1914-15 was about $5.35 per head, and in 1915-16 it was $6.40.

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. The cost for labor per sheep was, in round numbers, $1.50 each year. The total cost per head, for maintenance, excluding inventory for the 98 sheep in 1914-15, was $7.06 and in 1915-16 it was $8.04 for each of the 104 head.

The losses from death and accident were slight in each year and were mostly lambs that were still born or weak at birth.

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. No attempt to market in any unusual way was attempted as that would have been contrary to the plan of the experiment. The sales per head in 1914-15 averaged a little under $3 and in 1915-16 a little over $7. This difference was due to a larger number of lambs, their higher selling price, a heavier clip of wool and its very high price. In the spring of 1915, 67 strong lambs were dropped by ewes and in the spring of 1916 there were 80 strong lambs. The clip averaged 5.7 pounds per head in the spring of 1915 and 6.4 pounds in the spring of 1916.

In 1914-15 the manure was left under the sheep during the winter, as is customary with all handlers of sheep the writer has knowledge of in the East or the Middle West. It is commonly supposed that the compacting of the manure by the sheep treading upon it and the moistening from the urine will prevent losses. The value of the manure in 1914-15 was from estimates by the farm superintendent as to what we would be willing to pay for the manure if we were buying it. It may be that the farm superintendent underestimated the value of the sheep manure from the barn and yard and that it was worth more than was credited. As it is not the fault of the sheep if faulty handling of the manure results in loss, the attempt to guard against loss was made in 1915-16. The methods used are given on pages 94-99 beyond.

In 1915-16 there were produced 75 tons of manure which contained nitrogen, phosphoric acid and potash worth, at the valuation used for commercial fertilizers in 1914 (before the war prices) about $300. The labor cost, teams and men, for moving the manure monthly to the manure platform for working over by swine, was about $25. The net value of the plant food in the manure at the barn was, therefore, about $275.

Without considering the value of the manure on the credit side, or any overhead charges such as interest on investment, depreciation of plant, pasturage and taxes, there was a net loss of a little over $200 for the year's operation. Allowing full credit for the manure and omitting overhead charges would show a credit balance of about $100.

Careful attention has been given to all criticisms that have been at all suggestive of better ways of handling the flock. Although there seems to be no reason to expect more favorable results than have been obtained in 1915-16, the experiment is being continued. The high prices for wool and lambs were favorable in 1915-16 and probably will be equally favorable this year. Hay is worth only about two-thirds as much as in 1915-16. Grain is some higher in cost, as also is labor. But on the whole if the prices that are likely to prevail this year were substituted for those that did prevail in 1915-16 the income would have prettly nearly equalled the outgo without giving any credit for the manure. Whenever an animal husbandry project will pay all costs of food and care from the sales and the manure is left as a profit it can be classed as a profitable enterprise. For the production and conservation of manure is as truly an asset in New England agriculture as for generations it has been reckoned to be in European countries.

ARE SWINE PROFITABLE IN WINTER ?

In the experiment on the care of manure discussed beyond it was necessary to keep it well worked over and at the same time compacted so as to prevent losses from heating. It was thought that swine might do the work at far less cost than man labor. As shown below this surmise was correct, for instead of having a labor bill to charge against the manure the swine made a profit.

A brood sow and 14 two-months old pigs were placed on the manure December 1, 1915, and were kept there until June 7, 1916. The swine were fed and handled as the superintendent found convenient. That is, there was no definite program for feeding decided upon and therefore it varied more or less from time to time. Although experiments conducted at the Maine Station 25 years ago make it doubtful if there is a profit in feed-

ing cooked roots, the swine were fed a mash composed of cooked turnips and ground feed as long as the turnips lasted. Some whole corn was scattered over the manure at times in order to keep the swine at work stirring the manure. During the rather more than 6 months the swine were fed 10,850 pounds of turnips, 1100 pounds of corn meal, 600 pounds of whole corn and 2100 pounds of middlings and bran. The bran was used only when there were no middlings available. It took 155 hours of the chore boy to cook the mash and feed and otherwise care for the swine.

The season of 1915 was not a good one in which to grow turnips at Highmoor Farm and it cost 15 cents a busel to grow them that year. In 1914 it cost 10 cents a bushel at Highmoor Farm, and in some cooperative experiments in Washington County turnips were grown that year for less than 8 cents per bushel. Grain and mill feeds were high during the winter of 1916, though the prices dropped as warm weather came on. Reckoning the turnips at 15 cents a bushel, the corn at $30 per ton, the corn meal at $31 and the middlings at $27 per ton, the feed used cost $81.53. Reckoning the time of the chore boy at 15 cents per hour the labor cost was $23.25. The sow was worth $15 and the pigs $2.50 each when the experiment began, a total of $50 for the cost of the swine. The total cost, for the swine, their feed, and care, at the above prices, was $154.78.

At the end of the experiment the sow weighed 270 pounds, and the pigs averaged 114 pounds each. None of these were fat, but were "store pigs" and were worth 8 cents a pound live weight in June. The total selling value of the swine at the end of the experiment was $149.28. It was planned to have the sow produce a litter of pigs in May. For some unexplained reason the pigs were, with one exception, born dead. This is no fault of the experiment, and hence in fairness the receipts should be increased by an average litter of 8 pigs worth $2 each. The plant food in the feed consumed at normal prices for nitrogen, phosphoric acid, and potash, was worth $27. The swine should be credited with at least half of that amount. The corrected, complete returns were, therefore, in addition to having the manure thoroughly worked and in excellent shape for application to the land, $178.46. This gave a profit of $23.68, a return of 15 per cent of the total expenditure. Winter

is not the time of the year in which it is supposed there is profit in swine in Maine. It is not claimed that these swine were handled in the best or the most economical way. Certainly turnips at 15 cents a bushel do not furnish protein and carbohydrates at a very moderate cost. Not taking into account the cost of getting the turnips from the storage and cooking them, the nutrients furnished by the turnips at a cost of $27 could have been purchased in the form of corn and middlings for two-thirds that price. That is, to compete with the price of mill feeds in the winter of 1916 turnips would need to be grown at a cost of about 10 cents per bushel in the celler. Bran is probably not an economical feed for swine.

This one trial would seem to indicate that swine may be kept in this State at a profit in winter. An all-the-year round experiment with swine, where the chief growth of the young pigs would be made on pasture—fall sown rye, rape, clover, etc.—would probably prove swine to be one of the most, if not the most, profitable kind of farm live stock in Maine.

THE WINTER HANDELING OF FARM MANURE.

While it is probably true that the quicker manure can be applied to the land the less is the waste, even though the application is made after the ground is frozen, the fact remains that in Maine it is usually necessary to store the droppings during the winter months. Also it is usually not practicable to apply manure to land during the height of the growing season. It is estimated that approximately 75 per cent of the plant food contained in the feeding stuffs used are in the dung and urine voided. As usually handled, much of this is lost. As pointed out in the report of the Sheep Husbandry experiment in Bulletin 246 there were apparently large losses from the stored manure. In examining the data it was found that the plant food in the feed consumed while the sheep were confined to their winter quarters was worth at ordinary fertilizer prices in the neighborhood of $200 and that the manure from the sheep was valued by the farm superintendent as worth about one-eight of that sum. The manure was left under the sheep in the same way that is practiced by farmers everywhere, so far as the wri-

ter knows, in the East and the Middle West. Inquiry among sheep men discloses the fact that they are not sure about the losses that may result from this method of handling sheep manure.

In order to study this question an experiment was started in the fall of 1915 which involved the construction of a suitable manure pit and led to a trial of winter feeding of swine, and an experiment in the care and handling of ordinary mixed manure from cows and horses as well as the handling of sheep manure for which the experiment was originally planned.

THE MANURE PIT.

The manure pit, if a structure above ground can be called a pit, is built beneath a shed. It is of cement construction; 33 by 30 feet, with walls of cement 18 inches high above the floor. A partition wall of the same height divides the pit into two equal parts. One-half was used for the experiment with sheep manure and the other half for that with the cow and horse manure. The sides above the concrete are temporary and made of rough boarding. It is not necessary to carry the walls higher than 18 inches as the liquid will never accumulate to that depth. The movable wooden sides make loading the manure from the pit easy. The cement floor is four inches thick and the cement walls taper from 8 inches at the bottom to 6 inches in thickness at the top. The floor inclines toward one corner at the middle partition where there is a partition so that if liquid accumulates too fast in the manure it will drain to these pockets. If the top is too dry the liquid from the manure can be readily pumped to the dry portions or if the top is too dry and no liquid has accumulated, the manure can be wet with water.

It took 15 horse days, chiefly drawing gravel and sand for the concrete work, 58½ man days and 120 bags (30 barrels) of cement to construct the pit. The cost for everything, at prices that prevailed in the fall of 1915, was a little less than $200.

THE EXPERIMENT AT HIGHMOOR FARM IN 1915-16.

As previously stated, in the experiment in sheep husbandry begun in 1914 an apparently large waste of the plant food contained in the feeds was observed when the manure was kept under the sheep during the winter. As the value of the manure is of great importance in the margin between profit and loss an experiment was planned and conducted during the winter of 1915-16 so that the manure would be stored under what seemed to be the best conditions practicable. The plan was to keep account of all food eaten, store the manure in a water-tight manure platform, keep it worked by swine so as to prevent fire-fanging. As there are two cows and three horses kept during the winter at the farm, the manure platform was built in two sections so that an experiment with this mixed manure could be carried on at the same time as that from the sheep.

The feed and bedding used by the about 100 sheep consisted of 52,575 pounds of mixed hay, 7,075 pounds oat straw, 6,000 pounds cull apples, 34,150 pounds rutabaga turnips, 4,700 pounds bran, 600 pounds middlings, 1,500 pounds corn meal, 2,160 pounds oats, 475 pounds linseed meal, and 200 pounds of gluten meal. The cows and the horses used 24,650 pounds mixed hay, 3,250 pounds straw, 1,000 pounds bran, 1,300 pounds corn meal and cracked corn, 4,625 pounds oats, 300 pounds gluten meal, 300 pounds linseed meal and 100 pounds middlings. A bunch of swine was kept on the manure so that they could go from one part of the manure platform to the other. They were fed 10,850 pounds rutabagas, 1,700 pounds corn, 1,600 pounds middlings and 500 pounds bran. As the droppings from the swine were from the most part made on the sheep manure part of the platform, the plant food in their feed was added to that of the sheep.

The feeding stuffs were not sampled and analyzed but their plant food content was computed from average analyses of similar materials. The manure was weighed when it was drawn to the fields and each load was sampled. The final composite sample of each kind of manure was analyzed, with the following results:

Composition of the manure as removed from the pit.

	Nitrogen Per Cent	Phosphoric Acid Per Cent	Potash Per Cent
Mixed Manure. (Cows, Horses, Hogs)	0.457	0.19	0.50
Sheep Manure (with Hogs)	0.74	0.29	1.04

The feed (including that of the swine) and the bedding for the sheep carried approximately 1177 pounds nitrogen, 564 pounds phosphoric acid and 1485 pounds potash. The sheep manure weighed 125,705 pounds and carried 931 pounds of nitrogen, 490 pounds of phosphoric acid and 1307 pounds of potash.

The feed and bedding for the horses and cows carried 529 pounds of nitrogen, 207 pounds phosphoric acid and 576 pounds potash. The mixed manure weighed 76,870 pounds and carried 351 pounds of nitrogen, 146 pounds of phosphoric acid and 384 pounds of potash.

Seventy-nine per cent of the nitrogen, 87 per cent of the phosphoric acid and 87 per cent of the potash in the feeding stuffs used were found in the sheep manure and 61 per cent of the nitrogen, 56 per cent of the phosphoric acid and 67 per cent of the potash in the food and bedding given the cows and horses was found in the mixed manure. In the case of the sheep the amount of plant food recovered in the manure agrees very well indeed with the experiments that have been made where the excreta have been collected, weighed and analyzed immediately. In the case of the mixed manure, the trough behind the cows was not water tight and there were not sufficient absorbents used to take up all the liquid excreta. Also the horses were used more or less upon the road and their droppings when they were out of the barn were lost.

On the whole, the manure platform described above has worked satisfactorily. It was not expensive to construct, the swine used to work the manure showed a profit after all food and labor were charged to them, and apparently the manure was kept with a very small loss of plant food. In Maine for the six months of the year when it is not practicable to draw the manure and apply it to the land as fast as it is made, this meth-

od affords a satisfactory and economical way of conserving the plant food in the feeds used. It is a conservative estimate, then, that the plant food in the manure annually voided by farm animals and poultry in Maine has a potential value of about ten millions of dollars and that it is doubtful if by present methods of care even one-half of this plant food is actually returned to the soil. These trials with the manure platform and swine indicate that by a little care most of this plant food can be conserved and that the profit on the swine will make good returns on the investment and the added plant food saved will all be clear profit. And this conserved plant food will in many cases be the difference between keeping livestock at a profit or keeping them at a loss.

WHAT IS FARM MANURE WORTH TO THE FARMER?

The Ohio Experiment Station has carried extensive comparative experiments with farm and commercial manures for many years. Recently Director Thorne wrote: "After more than twenty years' work in the comparison of manure and chemical fertilizers on many crops, the Station is not able to credit manure with any value beyond that of the nitrogen, phosphorus, potassium and lime which it carries." "When manure costs more than two dollars per ton spread on the land, it is wiser to use the chemical fertilizers mentioned than to buy manure."

In addition to the nitrogen, phosphoric acid and potash which farm manure supplies it also carries a large amount of organic matter which is important in increasing the productivity of the soil. As this vegetable matter breaks down in the soil the acid products thus formed helped to dissolve and make available to plants some of the otherwise insoluble plant food in the soil. Farm manures teem with bacteria of various kinds which cause chemical changes not only in the manure, but in the soil itself, converting insoluble plant food into forms available for the use of crops. The humus formed from the organic matter of farm manure improves the soil texture, helps retain moisture, and is valuable in many ways. Its plant food is not so quickly nor so completely available as in the better forms of chemicals. But after much balancing of the

pros and cons it has become generally accepted that the commercial value of the plant food contained is the only definite thing about a farm manure by which we can measure its agricultural and commercial value.

The sheep manure, together with the straw bedding as worked over by swine at Highmoor Farm carried .74 per cent nitrogen, .29 per cent phosphoric acid and 1.04 per cent potash. The mixed manure and bedding from three horses and two cows also worked over by swine carried .46 per cent nitrogen, .19 per cent phosphoric acid and .50 per cent potash. At the commercial values placed upon chemical fertilizers in 1914* the plant food carried by a ton of the sheep and swine manure was worth $4.16 and in a ton of the mixed manure $2.44.

Assuming that two men and one double team can load, draw to the (not too distant) field and spread eight tons of farm manure a day it would cost about 75 cents a ton to apply the manure to the land. Deducting the cost of application, a ton of the sheep and swine manure had a value at the barn of about $3.40 and of the mixed manure of $1.70, per ton. Each of these lots weighed about 3500 pounds to the cord. Therefore the sheep and swine manure was worth about 6 dollars a cord and the mixed manure about 3 dollars a cord at the manure pit.

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 twenty-five 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 orchards were annually fertilized at the rate of 1,000 pounds per acre of a commercial fertilizer carrying 4 per cent

*It has seemed fairer to use in this discussion the prices prevailing before the war.

of nitrogen, 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:

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 three 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 two 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 noticed. 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.

In experiments carried out at the New York State Experiment Station it has been 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 three preceding years and brought into good condition. About 400 trees were divided into three 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 acid and 7 per cent of potash.

Careful records of growth shown by measure, and of yields of fruit as shown by weight, are made of all of the trees in the orchards at Highmoor Farm. No person examining the twelve rows of apple trees, part of which have been fully fertilized, part partially fertilized and part not fertilized at all for the past three years, could detect differences whereby he would be able to pick out the treated from the untreated rows.

Each tree occupies 25x25 ft. or 625 sq. ft. This is about 70 (69.5) trees per acre. At the rate of 1,000 lbs. per acre this is 14.4 lbs. per tree. Fertilizer at $40 per ton costs 2 cents a pound, making a total cost of 28.8 cents per tree, not allowing for the cost of application.

The crop on this orchard was too small in 1913 to give results that could have any meaning on the apple bearing of the trees. In 1914 and in 1915 there were fair crops and while from observation no differences were apparent, the actual yields of fruit were larger on the fertilized plots. The yields are given in the table that follows, but it will apparently be necessary to wait a number of years before decisive results are obtained. The yields show consistent increase with the amount of fertilizer applied.

Orchard Fertilizer Experiment. About 130 Ben Davis Apple Trees in each Plot. Average yield of apples in pounds per tree.

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
1914	172.8	158.8	194.2
1915	121.1	131.8	157.4
1916	113.7	138.7	147.2
Average for 3 years	135.9	143.1	166.6

It is to be remembered that in all of these experiments nothing has been grown upon the land except apple trees and apples. An orchard cover crop of rye is sown in the fall, is plowed under early in the spring, and the land is kept cultivated until well into August when the cover crop is again sown. The plant food stored up in the wood growth and that which has been removed in the apple crop has been taken from the soil, but beyond that the soil has not been made to pay tribute to any other crop.

This experiment is to be continued for many years, or until decisive results are obtained and the unfertilized rows show evidence of need of plant food.

COMMERCIAL VARIETIES OF OATS AT AROOSTOOK FARM.

Experiments with oats were undertaken by the Maine Agricultural Experiment Station at Aroostook Farm in 1914. Two principal objects are in view in this work—first, to ascertain which of the more popular commercial varieties are best adapted to Aroostook conditions; and, second, to breed new varieties which will be still better adapted to those conditions than any now available. The work of breeding new varieties is under way, but is necessarily slow. It will be several years before any of the new varieties already produced will have been sufficiently tested to warrant distribution.

For several reasons the results obtained in 1914 were not entirely satisfactory. The farm was purchased very late in the fall of 1913 and there was little opportunity to learn anything by observation of the land until planting time was come. Because of everything being new to the staff it was impossible to get the oats planted as early as they should have been. The very loose character of the soil allowed the heavy disk drill used in seeding to put the seed too deeply in the ground. All of these things tended to lower the yields.

In 1915 the work at the Farm was very much better organized and more favorable results were obtained. Fifteen different varities were grown each in a single half acre plot. These varieties were all sown with a large disk drill. In order to prevent the seed going into the ground too deeply the land was rolled before drilling. The seeding was at the rate of 3 bushels per acre.

The detailed results of the experiment for 1915 were published in Bulletin 246.

In 1916 sixteen different varieties were tested. These included all the varieties grown in 1915 except Imported Scotch, and in addition two new varieties. One of these, known as Maine 340, was originated by the Maine Agricultural Experiment Station at Highmoor Farm. This variety has proven to be such an excellent oat for southern and central Maine that it was thought desirable to test it under Aroostook conditions. The other new variety is the Minnesota 26. This variety originated by the Minnesota Experiment Station has proven to be very good in the southern part of the State.

In the two preceding years each variety has been grown in a single plot of about one-half acre. Owing to the uneven nature of the land on Aroostook Farm the plot of one variety sometimes fell on very good soil and that of another variety on much poorer soil. In order to get around this difficulty each variety was sown in 1916 on 3 separate plots each located in a different part of the field. In this way there was much less chance of all the plots of the variety falling on very good or very poor soil. Each plot was 1-10 acre in area. The three plots thus making 3-10 of an acre for each variety. The yield of each variety is taken as the average of the 3 plots.

The yield of each variety expressed in bushels of oats and pounds of straw, and the average yield of grain for the two years 1915 and 1916 are given in the table which follows on page 104.

From this table it is seen that Maine 340 gave the best yield and for this season at least has shown itself superior to any of the other varieties. The Early Pearl and the Siberian have always been near the top of the list in our variety tests. The chief objection to these two varieties for Aroostook is their late maturity. These varieties are from 3 to 6 days later than Maine 340.

The early varieties such as Kherson and Daubeney will mature about a week or 10 days earlier than the others, but as shown by the table their yields are not so good as many of the others.

Varieties such as Garton No. 5, Swedish Select and Senator have been at the bottom of the list every year. We can be very

certain that these varieties are not well adapted to Aroostook conditions.

Yield Per Acre of Commercial Varieties of Oats Tested At Aroostook Farm 1915 and 1916.

Variety	2-year Average Bushels	1916 Yield	
		Grain Bushels per Acre	Straw Pounds per Acre
Maine 340		75.6	3868
Early Pearl	70.1	66.6	3268
Silver Mine	65.6	66.3	3267
Siberian	68.3	66.0	3389
Ligowo	63.1	64.3	3248
Minnesota 26		63.1	3177
Banner	59.2	62.5	3137
Prosperity	64.3	61.9	2970
Gold Rain	61.5	61.5	3757
Kherson	64.5	61.3	4091
Maine 346	60.4	59.5	2813
Irish Victor	55.4	57.3	3139
Daubeney	59.0	57.2	3979
Garton No. 5	54.9	56.9	3778
Swedish Select	53.0	56.5	3101
*Senator	47.8	*45.8	*3611
Average	60.5	61.4	3412

*One plot only, of Senator planted.

COMMERCIAL VARIETIES OF OATS GROWN AT HIGHMOOR FARM IN 1916.

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, and the results of the 1915 tests were published in Bulletin 246.

The season of 1916 was very unfavorable for oats at Highmoor. The yields recorded are the lowest obtained in the 6 years that the Experiment Station has had the farm. A very severe rain storm in which 4.1 inches of water fell in 24 hours occurred on May 18. The oats were just well started at that time. All of the plots were badly washed and in some plots gullies 12 to 18 inches wide and almost as deep were washed out. Again just before harvest a very severe rain storm with some hail beat the oats down so that the yields were very seriously affected. The areas which were actually washed out in each plot were measured and some allowance made for these, but in some

plots the plants were washed worse than in others, and yet it was not practicable to estimate the exact amount of damage done.

In all, 18 different varieties were tested. Seven out of these are standard commercial varieties which have been tested by us for several years past and found to be exceptionally good. These varieties with their 1916 yields in bushels per acre are Early Pearl 56.7; Irish Victor 52.6; Banner 51.1; Gold Rain 51.0; Minnesota 26, 47.8; Swedish Select 44.5; and Kherson 40.3. In addition, one other commercial variety, Dibbles Heavy Weight, were tested for the first time. This gave 43.8 bushels per acre.

Ten varieties of our breeding were also tested. Five of these were varieties which have been tested for the past four years. These varieties with their yields are as follows: Maine 340, 52.7 bushels; Maine 355, 51.4 bushels; Maine 281, 51.5 bushels; Maine 351, 51.1 bushels; Maine 337, 48.2 bushels. The other five varieties were new strains which were tested under field conditions for the first time this year. These varieties and their yields are No. 1054, 51.5 bushels; No. 891, 47.4 bushels; No. 1053, 46.7 bushels; No. 978, 46.5 bushels; No. 982, 45.0 bushels.

From these records it will be seen that all of the varieties yielded much lower than in the past. The highest yield obtained was from Early Pearl, 56.7 bushels. Maine 340 was second in yield, giving 52.7 bushels per acre. Two of the plots of Maine 340 were very seriously injured by the heavy rains, and this in a large measure accounts for its smaller relative yield. Several other varieties such as Gold Rain and Minnesota 26 which have usually stood near the top of the list yielded much lower relatively this year than in the past.

The 5 pure lines including Maine 340, Maine 355, etc., averaged to yield better than the majority of the varieties tested. Of the five new varieties tested for the first time only one—No. 1054—appears to be promising, but some of these will be tested again next year.

RATE OF SEEDING OATS IN AROOSTOOK COUNTY.

It is the prevailing custom in Aroostook County to seed very heavily with oats. Perhaps the majority of the farmers sow from 4 to 6 bushels to the acre. It has been the experience in other parts of the country and even in other parts of the State that this is too much seed for the best results. From 2 to 3 bushels per acre have given the best results in the southern part of the State.

In 1914 some preliminary rate of seeding experiments were carried out on Aroostook Farm. The results were reported in Bulletin 236. Injury to certain of the plots, however, made the interpretation of the results somewhat doubtful. In 1915 these experiments were repeated upon duplicate plots under much more favorable conditions. The results of these tests were published in Bulletin 246.

In 1916 the same experiment was again repeated, using triplicate 1-10 acre plots for each rate of seeding. The conditions under which the 1916 experiments were carried out were similar to those in 1915. Six different rates of seeding were used, ranging from 2 to 5 bushels per acre. The land was in potatoes in 1915. The seeding was done with a large disk drill. Owing to the loose texture of the ground the land was rolled before seeding and also immediately afterwards. This prevented too deep seding which sometimes occurs with the use of a heavy disk drill in the loose soil of Aroostook. Commercial fertilizer (5-8-0) was applied broadcast before seeding at the rate of 500 pounds per acre. The seed used in 1916 was the variety known as Maine 340. In the preceding year the Prosperity variety had been used.

The results of the experiment calculated to acre yields are given in the tables that follow.

Rate of Seeding Experiment, 1916.
Yields of grain and straw per acre.

Plot No.	Rate of Seeding Per Acre	Oats Bushels	Straw Pounds
464	8 Pecks	62.6	4532
470	8 "	73.9	5044
476	8 "	72.2	5697
Average		69.6	5091
465	10 "	64.0	3617
471	10 "	71.3	5343
477	10 "	77.3	3731
Average		70.9	4231
466	12 "	63.3	3775
472	12 "	81.4	3932
478	12 "	78.3	3668
Average		74.3	3769
467	14 "	70.4	3758
473	14 "	73.7	3965
479	14 "	82.9	3883
Average		75.7	3868
468	16 "	77.3	4172
474	16 "	77.3	3834
480	16 "	82.7	4760
Average		79.1	4256
469	20 "	84.8	5458
475	20 "	70.8	4434
481	20 "	80.0	4412
Average		78.5	4768

Rate of Seeding Experiment.
Average of the oat yields for two years.

Rate of Seeding Per Acre	Oats Bushels	Straw Pounds
8 pecks	61.5	3720
10 pecks	62.4	2870
12 pecks	67.6	3068
14 pecks	71.3	3187
16 pecks	70.2	3238
20 pecks	69.5	3334

These results indicate that there is really no significant difference in the yields when 14, 16 or 20 pecks are sown. There is, however, a distinct disadvantage in the higher rates of seeding. This lies in the greater tendency to lodge. With the heavier rates of seeding the straw tends to be smaller in diameter and never becomes so hard as in the more open growth

of a lighter seeding. In each year we have noted that the plots with 20 pecks per acre were more likely to lodge than the others.

It is expected that these experiments will be repeated next year since it is only from the average yields over a period of years that definite conclusions can be drawn.

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 two series of experiments were carried on at Aroostook Farm this year. In each series duplicate 1-40 acre plots of oats were grown with 5 different mixtures of fertilizer varying in potash from 0 to 8 per cent. Each mixture contained 4 per cent of nitrogen and 8 per cent available phosphoric acid. The fertilizer was broadcasted before seeding at the rate of 500 pounds per acre. The seed used was of the variety known as Maine 340, an oat bred by the Maine Agricultural Experiment Station and regarded as one of the best varieties so far obtained for Maine. Series No. 1 was grown on land which was in potatoes without potash in 1915 and Series 2 was on land which had potatoes with 7 per cent potash in 1915.

The yields are given in the tables that follow.

Yields Per Acre in No Potash Experiment with Oats, 1916. Series I, on Land with No Potash in 1915.

Plot No.	Amount of Potash 1916	Yield of Straw In Pounds	Yield of Grain In Bushels
412	None	4590	71.6
417	None	3180	65.6
Average		3885	68.6
413	None + common salt	4510	71.6
418	None + common salt	2980	59.4
Average		3745	65.5
414	2 per cent potash	4420	70.6
419	2 per cent potash	3300	61.9
Average		3860	66.3
415	5 per cent potash	4420	76.9
420	5 per cent potash	2824	57.5
Average		3622	67.2
416	8 per cent potash	3980	71.9
421	8 per cent potash	3360	66.3
Average		3670	69.1

Yields Per Acre in No Potash Experiment with Oats, 1916. Series II, on Land with 7 per cent Potash in 1915

Plot No.	Amount of Potash 1916	Yield of Straw In Pounds	Yield of Grain In Bushels
422	None	3424	63.8
427	None	4110	74.1
Average		3767	68.9
423	None + common salt	3930	67.2
428	None + common salt	3500	68.1
Average		3715	67.7
424	2 per cent potash	3280	68.8
429	2 per cent potash	2160	60.0
Average		2705	64.4
425	5 per cent potash	3370	72.2
430	5 per cent potash	2640	63.8
Average		3005	68.0
426	8 per cent potash	3380	74.4
431		2980	61.9
Average	8 per cent potash	3140	68.1

The average yield of grain in bushels per acre from the plots on the soil with the two different treatments in 1915 are as follows.

1916 Treatment	No Potash in 1915	7% Potash in 1915
No Potash	68.6	68.1
No Potash + salt	65.5	67.7
2 per cent potash	66.3	64.4
5 per cent potash	67.2	68.0
8 per cent potash	69.1	68.1

It is seen at once that there is no significant difference between any of these yields. The average yield of the plots on land without potash in 1915 is exactly the same as the yield on land with 7 per cent potash in 1915. The application of potash the year before, therefore, did not affect the yield of oats. Furthermore, in each series the yield of the plots without potash in 1916 is as high as that of the plots with 7 per cent potash. Some of the intermediate plots show slightly decreased yields but in no case is the difference great enough to be significant.

So far as the results of a single year are concerned, it would appear that on Aroostook soil potash is not a limiting factor in the production of oats. However, too much reliance cannot be placed on a single year's results. It is quite possible that under different seasonal conditions and on different soils quite different results would be secured.

The experiment is to be repeated in 1917.

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 1916 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 both in the newspapers and in Bulletin 246.

In 1916 these experiments were repeated on 2 different lots of land. The first series of plots was on land which had been in grass for 2 years. The second series was on land which was

in grain for the 2 preceding years, and in each year had received 500 pounds per acre of a fertilizer carrying 7 per cent potash. On account of the difference in treatment of the preceding crops these 2 series of plots will be considered separately.

Five different mixtures were used. In each case the fertilizers contained 4 per cent of nitrogen (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 but not in a form available for plant food. The fertilizer for the remaining three plots contained respectively 2 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.

Series I. The land on which this series of plots was located was in potatoes in 1912. It had been in grass for 2 years without any fertilizer. The following are the results obtained, expressed in yields per acre.

Yields per Acre in No Potash Experiment With Potatoes, Series I.

Plot No.	Amount of Potash	Merchantable		Culls	
		Bbls.	Bus.	Bbls.	Bus.
436	None	124.2	287	4.6	13
437	None + common salt	116.7	321	3.0	8
438	2 per cent	154.0	423	2.0	6
439	5 per cent	153.6	429	1.7	5
450	8 per cent	145.7	401	3.1	9

Series II. The land on which this series of plots was located was in potatoes in 1913. In both 1914 and 1915 this

field was in grain. In each year 500 pounds per acre of a 4-8-7 fertilizer was applied to the grain. In both years this field was laid out in experimental plots, involving a number of pathways. These pathways were kept culivated and it is probable that a considerable residue of phosphoric acid and potash remained in the soil. This year these plots were planted with the same mixtures and handled in the same way as those in Series I. The land, however, was not naturally such good potato soil as that in Series I. The following are the results expressed in yields per acre of merchantable potatoes.

Yield per Acre in No Potash Experiment With Potatoes, Series II.

Plot No.	Amount of Potash	Merchantable		Culls	
		Bbls.	Bus.	Bbls.	Bus.
450	None	119.9	330	5.8	16
451	None + common salt	120.5	331	3.2	9
452	2 per cent	116.9	321	2.9	8
453	5 per cent	118.3	325	2.4	7
454	8 per cent	137.3	378	3.3	9

The yield in barrels for the two years from the three series of trials are given in the following table.

No Potash Experiment with Potatoes, 1915 and 1916. Yield in Barrels per Acre.

Amount of Potash	1915	1916		Average
		Series I	Series II	
None	110	104	120	111
None + common salt	—	117	121	119
2 per cent	116	154	117	129
5 per cent	116	154	118	129
8 per cent	120	146	137	134

DISCUSSION OF RESULTS

The 1915 results showed that while there was a consistent increase of yield with the use of potash, nevertheless a profitable yield of potatoes was obtained without its use. Last year the plots without potash averaged to yield at the rate of 110 barrels per acre, while the plots with 8 per cent potash gave 120 barrels.

The yields on the different plots in Series I for 1916 show that the addition of potash has resulted in a very marked increase in yield. There are some irregularities in that the 8 per cent potash yielded slighly less than either the 2 or the 5 per cent. These differences are probably only random fluctuations due to irregularities of the soil. It must be remembered that field experiments of this kind are at their best very rough comparison. Such fluctuations are to be expected unless a series of replicate plots are used. A crude comparison of the effect of potash on this soil may be made by averaging the yield of the three plots which had potash and comparing with the average yields of the two plots which had no potash. The three plots averaged 152 barrels per acre, while the two no-potash plots averaged 110 barrels per acre. At the current prices of potatoes in Aroostook at harvest this means a difference of about $100 per acre. There seems to be no question but that the addition of potash to this kind of land was a very paying proposition under the seasonal condition of this year.

It will be noted that in the case of Series II, 1916, there is no such marked increase due to the addition of potash as was found in the former series. The first four plots show no significant difference in yield. The fifth plot on which an 8 per cent potash was used shows an increase of nearly 20 barrels per acre over the preceding. Whether this increase is due to the extra potash alone, or whether it is partly due to soil differences cannot be ascertained. It seems very probable that there was a considerable residue of potash in the soil from the preceding crops and that this amount was sufficient to obscure any possible differences in yield due to application of small amounts of potash in 1916.

From the results of these 3 trials in 2 seasons the following tentative conclusions may be drawn: First, that the addition of

as little as 45 pounds per acre of potash increased the yield of potatoes at least when grown on sod land. The amount of this increase depends upon the condition of the land and probably also upon the seasonal conditions. The results obtained this year on sod land indicate that it paid to use goods with 2 per cent potash even at the present abnormal price. Second, a profitable yield of potatoes can be obtained without the use of potash for at least one year. If it should happen that potash is absolutely unobtainable, growers may still plant on land that is in good heart with the prospect of obtaining a profitable yield.

SULPHATE OF AMMONIA COMPARED WITH NITRATE OF SODA AS A SOURCE OF NITROGEN IN POTATO FERTILIZERS AT AROOSTOOK FARM.

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 in-

creasing 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 4 per cent nitrogen, 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. The detailed results of the experiment for 1916 are given in the table which follows.

Sulphate of Ammonia and Nitrate of Soda Experiment.
Yield of Potatoes per Acre.

Plot No.	Treatment	Merchantable		Culls	
		Bbls.	Bus.	Bbls.	Bus.
441	$\frac{2}{3}$ nitrate of soda	130.6	359	27.5	21
455	$\frac{2}{3}$ nitrate of soda	150.1	412	2.6	7
Average		140.3	385	5.0	14
442	$\frac{2}{3}$ sulphate of ammonia	135.8	373	4.9	14
456	$\frac{2}{3}$ sulphate of ammonia	143.5	395	4.2	12
Average		139.6	384	4.1	13
443	$\frac{1}{3}$ nitrate of soda, $\frac{1}{3}$ sulphate of ammonia	131.0	360	6.1	17
457	$\frac{1}{3}$ nitrate of soda, $\frac{1}{3}$ sulphate of ammonia	143.7	378	1.8	5
Average		137.3	369	4.0	11.0
444	$\frac{1}{3}$ nitrate of soda, $\frac{1}{3}$ organic	136.6	376	4.7	13
458	$\frac{1}{3}$ nitrate of soda, $\frac{1}{3}$ organic	144.34	397	1.6	4.4
Average		140.5	386	3.1	8.6
445	$\frac{1}{3}$ sulphate of ammonia, $\frac{1}{3}$ organic	142.4	392.71	6.9	18.9
459	$\frac{1}{3}$ sulphate of ammonia, $\frac{1}{3}$ organic	144.1	396.22	1.1	2.9
Average		143.3	392.97	4.0	10.9

From the above table it will be seen that the yields from these different mixtures were exceedingly uniform. There is only 6 barrels per acre difference between the best and the poorest yielding mixture and in field experiments of this kind such a small difference has no significance.

The result for the 3 years of the experiment are given in the following table.

Sulphate of Ammonia and Nitrate Soda Experiment 1914, 1915 and 1916
Yield in Barrels Per Acre.

Treatment	1914	1915	1916	Average
$\frac{2}{3}$ nitrate of soda	120	113	140	125
$\frac{2}{3}$ sulphate of ammonia	110	120	140	123
$\frac{1}{3}$ nitrate of soda, $\frac{1}{3}$ sulphate of ammonia	116	119	137	124
$\frac{1}{3}$ nitrate of soda, $\frac{1}{3}$ organic	120	111	140	124
$\frac{1}{3}$ sulphate of ammonia, $\frac{1}{3}$ organic	110	109	143	121

From the results of these 3 years it appears that at least 2-3 of the total nitrogen can be supplied in the form of sulphate of ammonia without decreasing the yield. It is planned to continue these experiments in order to determine the effect of these different substances under a number of different seasonal conditions.

METHOD OF APPLICATION OF FERTILIZER UPON POTATOES AT AROOSTOOK FARM.

It has always been more or less customary in growing potatoes in Maine to apply the fertilizer in the drill or hill at the time of planting. This was largely the practice when farm manures were used in connection with potato growing and has been followed with commercial fertilizers. Although now when farm manures are used in connection with potatoes they are more likely to be applied broadcast and a smaller amount of fertilizer applied in the drill. There was little question in the minds of practical growers that when 500 to 1000 pounds of fertilizer were applied per acre that it was to the best advantage to apply it in the drill. With the increase up to 1,500 to 2,000 pounds per acre the question has arisen whether it may not be advisable to apply the fertilizer at different times. This led the Station to undertake a series of trials at Aroostook Farm.

In 1914 an experiment was started to extend over a period of years for the purpose of testing the method of applying fertilizer. Something over acre plots were used. Three plots were used in the experiment in 1914. To one plot all of the fertilizer was applied in the planter at planting. To another plot 1,000 pounds of fertilizer were applied at planting and 500 pounds when the potatoes were up. And to a third plot 1,000 pounds were applied broadcast before planting and 500 pounds in the planter at planting. The Lowell Strain of Green Mountain potatoes was used for seed. The crop was well cultivated and sprayed.

The experiment was repeated in 1915 and a plot was added to which all of the fertilizer was applied broadcast before plant-

ing. The experiment was again repeated in 1916, using duplicate plots of about one-half acre each.

The fertilizer used each year was high grade, carrying 4 per cent nitrogen, 8 per cent available phosphoric acid and 7 per cent water soluble potash. One-third of the nitrogen was in the form of nitrate of soda, and the remainder was high grade organic nitrogen. The yields are based upon weighings and not upon measure. The potatoes were clean, without adhering soil.

In potato experiments at Highmoor Farm the Station had found that when there was only a small amount of rainfall following the second application of fertilizer that apparently this added fertilizer was not well utilized. Each season, however, at Aroostook Farm there was ample water to dissolve and render the plant food in all of the fertilizer available. It has been estimated that it takes about 6 inches of water to successfully grow a crop of potatoes. The rainfall in each of the years 1914 and 1915 totaled over 12 inches in May, June, July, and August, and in 1916 over 11 inches in these months.

The results obtained in 1914 and 1915 are reported in detail in Bulletin 246. The yields per acre obtained in 1916 are as follows:

Yield per Acre Obtained in Method of Applying Fertilizer Experiment, 1916

Plot No.	Treatment	Merchantable		Culls	
		Bbls.	Bus.	Bbls.	Bus.
446	1500 lbs. in planter	141.8	390	5.7	16
460	1500 lbs. in planter	145.5	400	1.0	3
Average		143.7	396	3.3	9
447	1000 lbs. in planter, 500 lbs. when up	139.3	383	2.8	8
461		140.3	386	2.5	7
Average		139.8	384	2.7	7
448	1000 lbs. broadcast, 500 lbs. when up	130.4	358	0.6	2
462		129.7	356	1.5	5
Average		130.0	357	1.1	3
449	1500 lbs. broadcast	134.6	370	1.0	3
463	1500 lbs. broadcast	127.6	351	0.5	1
Average		131.1	360	0.8	2

These results indicate that the best yields are obtained when all or a large part of the fertilizer is applied in the planter. The results this year are much more marked than in the 2 preceding years. In fact, the results of the first two years indicated that there was little to choose between the methods so far as yield was concerned.

The yield of merchantable potatoes stated in barrels for the three years is given in the table that follows.

Method of Applying Fertilizer 1914, 1915 and 1916. Yield in Barrels per Acre.

Method	1914	1915	1916	Average
1500 pounds in planter	131	109	144	128
1000 pounds in planter, 500 pounds when up	124	113	140	122
1000 pounds broadcast, 500 pounds when up	123	109	130	121
1500 pounds broadcast	—	113	131	122

From these results it seems quite clear that fully as good, if not better, yields are obtained by applying all of the fertilizer in the planter. As this method is much cheaper and more convenient than any of the others it is the one to be recommended. It seems that at least up to 1500 pounds per acre nothing is to be gained either by broadcasting fertilizer before planting or by applying a part at the first cultivation.

SALT AS A FERTILIZER

In the experiments with oats (page 109) and potatoes (page 111) salt was used in connection with nitrogen and phosphoric acid without potash. No decisive results were obtained.

In cooperation with the county demonstrators in Hancock and Washington Counties, salt was tried on grass, potatoes and turnips. An experiment with M. S. Lyons of Calais on grass showed no effect from the use of salt in top dressing. Experiments with I. R. Sprague of Princeton, John Grasse at Lubec and Fred A. Tyler at Prescott with potatoes gave on the whole a slightly smaller yield in the plots where salt was applied than where there was no application. In case of Mr. Tyler, he had

quite a large percentage of rot, and there seemed to have been less rot and rather more sound potatoes on the plots where the salt was used. Hence, his experiments showed a gain in the use of salt, but nothing decisive.

Salt tests were made with turnips with C. L. Pottle, Perry; F. P. Washburn, Perry; and E. M. Scott, Perry. Mr. Scott's experiment was a failure because of the exceedingly wet weather. There was a gain from the use of salt of 48 barrels per acre in the case of Mr. Washburn, and 24 barrels per acre in Mr.Pottle's case. This is in accord with experiments running over a long series of years at the Rothamsted Experiment Station in England, where salt was found uniformly to be of benefit as a fertilizer for turnips. This does not seem to be due to the fact that it freed potash, but that common salt is an essential factor in the successful growing of turnips.

With oats, grass and potatoes no benefit has been found in the few trials made at this Station from the application of common salt. With turnips increased yields have been obtained from the application of salt. These experiments are not extensive enough or sufficiently carefully planned and carried out to warrant definite conclusions, but they do not indicate any appreciable effects of common salt as a liberator of potash of the soil.

BULLETIN 261

REPORT OF PROGRESS ON ANIMAL HUSBANDRY INVESTIGATIONS IN 1916[1]

BY RAYMOND PEARL.

As in former cases, this report will deal with the progress which has been made in the animal husbandry investigations carried on by the Maine Agricultural Experiment Station. It is a pleasure to be able to report that these investigations have progressed in a generally satisfactory manner during 1916. In the succeeding portions of this report we shall consider one by one the different lines along which these investigations are progressing.

1. COOPERATIVE BREEDING RECORDS.

The cooperative breeding record project, in which about 200 of the leading breeders of cattle in Maine, and a few outside of the State, have contributed for purposes of study, exact records of the breeding operations in their herds, has gone forward satisfactorily. A very large amount of new material has been collected in the year. It is expected that with the completion of the Service Records for the calendar year 1916 there will be in hand approximately 2000 complete and connected Service and Birth breeding records. This constitutes a wholly unique mass of material for the study of many vitally important problems in the physiology of reproduction in cattle. As the amount of material mentioned will be amply sufficient for the

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[1]Papers from the Biological Laboratory of the Maine Agricultural Experiment Station, No. 111.

This report of progress during the year 1916 of the work on animal breeding and related lines (exclusive of work with poultry) carried on in the Biological Laboratory of the Maine Agricultural Experiment Station, was in part presented as the report of the Committee on Breeding of the Maine Dairymen's Association, at the meeting held in Augusta on December 7, 1916.

study of the problem in hand, it is proposed to bring this breeding record project to a close at the end of September, 1917. No more Service Records will be asked for after January 1, 1917, and only such Birth Records as are needed to complete the Service Records already in hand.

We wish again to express our great indebtedness to the breeders who have so carefully, and conscientiously, and willingly aided in the prosecution of this phase of the animal husbandry investigations.

At this time it seems desirable to present a complete list of the breeders who have aided in this project. This is accordingly done in Table I. In addition to the name and address of each breeder the following facts are presented: (1) the number of females (cows and heifers) in each cooperator's herd; (2) the breed of the animals; (3) the number of herd bulls regularly kept; (4) whether the bulls are pure-bred or not; (5) what the breeder's regular practice is as to the mating of his animals relative to the period of heat in which they are at the time of breeding.

TABLE 1.

List of Cooperating Breeders.

Name.	Address.	No. of cows and heifers	Breed	No. of herd bulls	Are herd bulls pure-bred?	Breeding practice.
Allen, D. E.	Blue Hill	8	Ayrshire	2	Yes	Late.
Allen, Harry C.	Buckfield	8	Jersey	0	—	At most convenient time.
Ames, Bertram C.	Orono	5	Jersey	1	Yes	As early as convenient.
Ames, C. Lester.	Bridgton	5	Jersey	0	—	No fixed rule.
Andrews, Carl E.	Jefferson	6	Various	1	Yes	Late in general never early.
Austin, A. A.	Ridlonville	19	Holstein	1	Yes	Late.
Babb, Geo. H.	Sebago	6	Various	0	—	As soon as discovered.
Barker, A. W.	Easton	2	Jersey	0	—	Early.
Bean, C. S.	Wellington	9	Jersey	1	No	Late.
Bell, Harold M.	Islesboro	4	Holstein	1	Yes	Early.
Benn, Oscar A.	Houlton	12	Jersey	1	Yes	Serve twice when possible when first noticed; and about 6 hours later.
Bennett, J. B.	Dexter	11	Jersey	1	No	Late if possible.
Beyer, H. G., Jr.	Portland	100	Holstein	3	Yes	Late.
Bickford, E. F.	Dixmont	7	Holstein and Shorthorn	1	Yes	Prefer early.

List of Cooperating Breeders, Continued.

Name.	Address.	No. of cows and heifers	Breed	No. of herd bulls	Are herd bulls pure-bred?	Breeding practice.
Billings, F. H.	Brooksville	2	Jersey	0	—	Late.
Black, Elmer E.	West Baldwin	9	Jersey	1	Yes	Odd heat for female calves.
Blair, Lyman.	Greenville	20	Guernsey	1	Yes	Generally first; not always.
Boyd, D. C.	Ea. Newport	11	Holstein	1	Yes	Late.
Bradford, T. B.	Goldenridge	15	Jersey	1	Yes	No fixed rule.
Bradford, W. B.	Turner	5	Jersey	0	—	Early as possible.
Brown, H. J.	Portland	6	Guernsey	1	Yes	Early.
Buffalo Creek Farm.	Arlington Heights, Ill.	64	Holstein	2	Yes	Early.
Bumpus, Wm. E.	Mechanic Falls	40	Jersey	3	Yes	Early.
Burr, Leon T.	Winthrop	21	Holstein	1	Yes	When first noticed if possible.
Butters, H. E.	Exeter	12	Holstein	1	Yes	Late.
Cairns, A. W.	So. Paris	10	Holstein	1	Yes	Early as possible.
Call, Everett D.	Pittsfield	10	Guernsey	2	Yes	Late if served but once; prefer to serve night and morning.
Cathro, Ewen A.	Argentina, S. America	50	Shorthorn	1	Yes	Early.
Clark, C. F.	Clark's Mills	20	Holstein	1	Yes	Early.
Clark, R. C.	Lisbon	6	Jersey	0	—	Late, usually.
Clements, Chas.	Winterport	16	Jersey	1	No	No rule.
Cobb, C. F.	Lisbon Falls	12	Jersey	2	Yes	Early unless old cow; then serve twice.
Colburn, W. L.	Ashland	2	Jersey	0	—	Early.
Cole, R. F.	Winterport	10	Holstein	1	—	No fixed rule.
Cooley, Henry.	Solon	10	Jersey	1	Yes	Early if possible.
Coston, H. H.	Pittsfield	8	Guernsey	0	—	No rule.
Crocker, E. G.	St. Albans	18	Guernsey	2	Yes	No rule.
Cummings, A. D.	So. Paris	15	Holstein	1	Yes	Usually late.
Curtis, C. C.	Dexter	6	Jersey	0	—	Late.
Curtis, E. D.	Bantam, Conn.	15	Holstein and Guernsey	2	Yes	No rule.
Curtis, Norman.	Bowdoinham	8	Jersey	1	Yes	Late.
Dalbey, W. E.	Granville	12	Guernsey	1	Yes	Early.
Davis, A. C.	Harrison	5	Holstein	1	Yes	Early.
Davis, E. A.	Liberty	5	Various	2	Yes	Early.
Davis, E. L.	Harrison	7	Holstein	1	Yes	Early.
Davis, Herbert.	Eaton	5	Various	1	Yes	Bull allowed to run with cows.
Davis, J. Frank.	Hampden Highlands	14	Holstein	0	—	Late.
Davis, Tyler S.	Union	8	Jersey	1	Yes	Late.
Day, Harold S.	Lewiston	25	Ayrshire	1	Yes	Early.
Day, Jesse L.	West Kennebunk	10	Guernsey	0	—	Late.
Dean, J. L.	Waterville	17	Jersey	1	Yes	As soon convenient after noting her conditions.
Deering, A. M.	Bridgton	12	Jersey	1	Yes	When convenient.
De Land, Frank.	South Portland	20	———	1	Yes	Late.
Dingley W. M.	Gardiner	8	Various	2	Yes	Middle of heat.
Dow, Fred N.	Portland	56	Ayrshire	3	Yes	Early.
Dow, John H.	Mapleton	4	Various	1	Yes	Early.
Dunn, F. J.	Bangor	8	Jersey	1	No	Late.
Dunn, W. H. & G. H.	Norway	23	Ayrshire	2	Yes	Early.
Dyer, Isaac.	Gorham	12	Jersey	2	Yes	Early.
Eastman, W. H.	Corinna	3	Jersey	0	—	Usually late.
Eaton, H. D.	North Cornville	17	Hereford	4	Yes	Both early and late.

List of Cooperating Breeders, Continued.

Name.	Address.	No. of cows and heifers	Breed	No. of herd bulls	Are herd bulls pure-bred?	Breeding practice.
Ellis, A. H.	Fairfield	9	Shorthorn	2	Yes	No fixed rule.
Ford, J. H.	Anson	9	Jersey	1	No	Early.
Foster, G. E.	Skowhegan	20	Guernsey	5	Yes	Usually early.
Fuller, C. F.	Skowhegan	20	Guernsey	2	Yes	No rule.
Gardiner, R. H.	Gardiner	30	Various	1	Yes	———
Gerrish, H. W.	Cornish	11	Jersey	0	—	Late.
Getchell, Mrs. Ida.	Machias	2	Holstein	0	—	Early.
Goding, L. S.	Monmouth	10	Guernsey	1	Yes	Late.
Goodrich, M. B.	Brunswick	3	Jersey	0	—	Most convenient time.
Good Will Home Association	Hinckley	30	Ayrshire	3	Yes	Early.
Graham, J. L.	Ea. Corinth	12	Jersey	1	Yes	Early.
Griffen, S. F.	Alfred	10	Guernsey	1	Yes	Reckoned by time of day.
Hatch, E. J.	Augusta	3	Various	0		Most convenient time.
Hawes, S. H.	West Brooksville	11	Jersey	0	—	Early.
Hayford, Ralph.	Belfast	9	Guernsey	1	Yes	Late.
Higgins, B. W.	Levant	14	Jersey	1	Yes	Early if possible.
Higgins, H. H.	Mapleton	5	Jersey	0	—	Early.
Hilton, A. T.	Athens	9	Jersey	1	No	As soon after noticed as convenient.
Holbrook, E. A.	Vanceboro	12	Holstein	1	Yes	No rule.
Holston & Paine.	Cornish	30	Jersey	2	Yes	Early.
Hooper, Wm. H.	Biddeford	28	Holstein	1	Yes	No rule.
Harrison, H. A., M. D.	Utica, N. Y.	100	Holstein	4	Yes	No rule.
Ireland, G. F.	Dryden	6	Guernsey	1	No	Late.
Jackson, C. E.	Bryant's Pond	8	Holstein-Jersey Cross	1	No	Early.
Jackson, G. B.	Waterville	13	Various	0	—	Late.
Johnson, E. E.	Hebron	10	Holstein	0	—	No rule.
Johnston, E. L.	Easton	4	Jersey	1	Yes	Early.
Johnson, H. O.	East Sullivan	8	Guernsey	1	Yes	Late if possible.
Jones, C. L.	Corinna	9	Holstein	1	Yes	Sometimes twice, both early and late.
Jones, R. O.	Winslow	8	Jersey	1	Yes	Usually alternate heat theory.
Jordan, C. E.	Mechanic Falls	3	Holstein	0	—	Late.
Jubilee Dairy Farm.	Pekin, Ill.	75	Brown Swiss	1	Yes	Early.
Kent's Hill Seminary.	Kent's Hill	26	Holstein	2	Yes	Late.
Kilgore, E. K.	South Waterford	6	Jersey	2	Yes	Early.
Kimball, D. M., and Son.	Winterport	9	Jersey	2	No	About 7-10 hours after onset of heat.
Kuch, Wm. F.	Portland	2	Various	0	—	Late when convenient.
Lamkin, F. M.	Farmington	6	Various	0	—	As early as possible.
Larrabee, C. C.	Wells	12	Guernsey	1	Yes	Late.
Leach, E. R.	Newport	6	Holstein	0	—	No rule.
Leavitt, E. R.	Winthrop	12	Shorthorn and Jersey	2	No	———
Libby, P. W.	St. Albans	7	Holstein	1	Yes	As early as possible.
Lilley, S. O.	Gardiner	3	Various	0	—	Late.
Lincoln, N. M.	Corinna	16	Holstein	1	Yes	Usually late.
Longley, J. R.	Detroit	11	Holstein	1	Yes	As soon as noticed.
Loud, S. O.	Berwick	5	Various	0	—	When convenient.
Luce, R. T.	Carmel	12	Jersey and Holstein	1	Yes	As early as possible.
McCrum, Lemuel	Mars Hill	7	Ayrshire	1	Yes	Early.
McGlauflin, H. F.	Presque Isle	4	Various	1	Yes	Early.

List of Cooperating Breeders, Continued.

Name.	Address.	No. of cows and heifers	Breed	No. of herd bulls	Are herd bulls pure-bred?	Breeding practice.
McIntire, L. E. and Son.	East Waterford	29	Holstein	1	Yes	Early when possible.
Maine State Sanatorium Association.	Hebron	40	Holstein	1	Yes	Varies.
Merrill, Herman.	Lovell	9	Jersey	1	No	Early.
Millett, C. R.	West Minot	40	Holstein	1	Yes	Both early and late.
Moore, S. C.	Brooks	6	Jersey	0	—	Just before P. M. milking.
Moulton, H. M., M. D.	Cumberland Center	25	Jersey	3	Yes	Usually early.
Murray, Wm.	Hampden Highlands	3	Ayrshire	0	—	Early.
Nash, H. H.	Camden	17	Jersey and Holstein	1	Yes	Early.
National Soldiers Home.	National Soldiers' Home	60	Holstein	3	Yes	Serve just before feeding in P. M.
Neale & Dix.	Sewickley, Penn.	24	Ayrshire	2	Yes	Early.
Nelson, A. C.	West Minot	20	Holstein	1	No	Early.
Ness, John A.	Auburn	40	Ayrshire	1	Yes	No fixed rule.
Oakes, A. A.	Farmington Falls	6	Guernsey	1	Yes	No rule as to heat.
Ontario Agricultural College.	Guelph, Canada	60	Various	8	Yes	As early as possible.
Osborne, W. H.	Springfield	17	Holstein	1	Yes	No rule.
Packard, E. A.	Turner	9	Ayrshire	1	Yes	"At the zenith" (of heat)
Page, E. D.	Bangor	11	Jersey	3	Yes	Early if possible.
Page, Geo. E.	East Livermore	10	Holstein	1	Yes	No rule.
Palmer, J. F.	East Sumner	7	Jersey	0	—	Late.
Palmer, W. C.	Thorndike	20	Jersey	1	Yes	Late.
Parsons, M. C.	Hampden Highlands	9	Holstein and Durham	1	No	Usually when first noticed.
Parsons, O. J.	Patten	10	Various	1	No	Early.
Pastures, The.	Belfast	100	Jersey	2	Yes	Early.
Patten, R. T.	Skowhegan	20	———	1	Yes	No rule as to heat.
Paul, A. M.	Dexter	20	Holstein	2	Yes	Early, and when hard to settle late also.
Perkins, S. W.	West Kennebunk	12	Jersey	1	Yes	Just past middle.
Philbrook, F. W.	Greene	8	Various	1	Yes	No special time; as near middle as possible.
Pierce, I. C.	Bingham	22	Jersey	1	Yes	Sometimes early in morning and late at night.
Pike, J. M.	Lubec	15	Holstein	1	Yes	Prefer latter part of heat.
Piper, S. A.	Troy	29	Holstein	2	Yes	Early, usually.
Plant, Stewart.	Gardiner	6	———	0	—	As soon as possible after coming in heat.
Plummer, H. E.	North Whitefield	8	Hereford	1	Yes	Early.
Pope, Chas. S.	Manchester	50	Jersey	3	Yes	No rule.
Porter, E. L.	West Paris	8	Various	1	Yes	Early.
Potter, F. A.	Old Town	35	Holstein	1	Yes	Early.
Powers, A. J.	Ft. Fairfield	7	Brown Swiss	1	Yes	Early.
Pulsifer, C. L.	East Poland	12	Holstein	1	Yes	No rule.
Reed, J. H.	Waterville	12	Various	1	Yes	Early.
Ricker, J. F.	North Saco	14	Jersey	1	Yes	No rule.
Ricker, L. A.	Buckfield	6	Jersey	0	—	Late.
Rines, J. H.	Portland	34	Guernsey	2	Yes	When convenient.
Ring, Walter H.	Cambridge	8	Jersey	1	Yes	Late.
Rose, S. W. and Sons.	Greene	10	Holstein	1	Yes	Usually early.
Ryder, Murray.	North Newcastle	12	Holstein	1	Yes	Late.

List of Cooperating Breeders, Concluded.

Name.	Address.	No. of cows and heifers	Breed	No. of herd bulls	Are herd bulls pure-bred?	Breeding practice.
Salley, M. H.	Dexter	12	Ayrshire	2	Yes	Early.
Sawyer, L. E.	Hebron	2	Jersey	0	—	Late.
Schrumpf, W. E.	Farmington	3	Jersey	0	—	As soon as possible after coming in heat.
Sedgley, G. W.	Maranacook	4	Jersey	0	—	Late preferred.
Small, E. A.	Cornish	9	Jersey	1	—	Early—if any signs of heat after 12 hours serve again.
Smiley, Roy C.	Augusta	4	Various	1	Yes	Early.
Smith, Owen W.	Portland	10	Jersey	2	Yes	Early.
Smith, Ralph L.	Kennebunkport	8	Various	0	—	As soon as possible.
Smith, R. V.	Steuben	11	Jersey	1	Yes	Late.
Smith, W. G.	Dixmont	4	Jersey	0	—	Late.
Somerby, E. O.	Winn	6	Jersey	0	—	Early.
Soule, H. C.	Canton	20	Jersey	1	Yes	Late.
Stanchfield, Dura.	Easton	4	Jersey	1	Yes	Most convenient time.
Stanton, C. F.	South Paris	16	Holstein	1	Yes	Late.
Stetson F. B.	Los Banos, Cal.	100	Holstein	3	Yes	Early.
Stover, Austin.	Sullivan	3	Various	0	—	Medium to late.
Summit Lumber Company.	Davidson	30	Holstein	1	Yes	Just before feeding in P. M.
Tarbell, E. L.	Mapleton	5	Jersey	1	Yes	Alternate heat method.
Thaanum, P. A.	Winthrop	28	Jersey	1	Yes	Generally and preferably late.
Thayer, J. M.	Paris	10	Holstein	1	Yes	Early.
Thayer, W. C.	So. Paris	7	Holstein	1	—	Early.
Tibbetts, F. L.	Dexter	30	Holstein	1	Yes	Late.
Tingley, D. H., & Son.	Readfield	11	Hereford	1	Yes	No rule.
Towne, Don M.	Madison	28	Guernsey	2	Yes	No rule.
True, Nathan C.	Litchfield	9	Guernsey	2	Yes	Late.
Tucker, Benj.	Norway	21	Holstein	1	Yes	Late.
Tucker, H. M.	Canton	11	Jersey	2	Yes	No rule.
University of Maine.	Orono	71	Various	6	Yes	No rule.
Wadsworth, W. D.	Cornish	8	Jersey	1	Yes	Early.
Walker, E. A.	Vassalboro	3	Jersey	0	—	Late.
Wheeler, G. E.	Waterville	23	Jersey and Holstein	1	No	No rule.
Whitaker, E. H.	Albion	15	Jersey	1	Yes	Usually late.
Wilkins, H. M.	Livermore Falls	16	Jersey	0	—	Usually late.
Wilson, J. A.	Brunswick	11	Dutch Belted	1	Yes	Usually late.
Winslow, E. S.	North Berwick	6	Various	1	Yes	Late.
Winslow, L. V.	Larone	6	———	0	—	———
Wood, C. J.	Skowhegan	17	Jersey	1	—	Early.
Woodsum, A. G.	Oakland	6	Various	1	Yes	Middle of heat.
Woodward, S. R.	Sebec Station	8	Jersey	1	Yes	Early.

Total 3085 cows, 217 bulls of which 131 are pure bred

From the preceeding table it appears that this cooperative work has made available data on cattle breeding from 192 different herds, including 3085 cows and heifers and 217 bulls. These herds are distributed by breeds as follows:

Breed	*Herds*
Jersey	70
Holstein-Friesian	47
Guernsey	19
Ayrshire	11
Shorthorn	2
Hereford	3
Brown-Swiss	2
Dutch Belted	1
Various[2] and mixed	33
Not recorded	4
Total	192

[2]This means more than one breed in herd.

So far as may be judged from these figures it would appear that the Jersey is still the leading breed of cattle in Maine. It is equally clear, however, that the other breeds have made, and are making, large inroads on the popularity of this breed. From all the evidence at hand one would judge that during the last 50 years the proportionate number of Jersey cattle in the State has decreased, while other breeds, particularly in recent years the Holstein-Friesian, have increased.

It is interesting to note the large proportion of Maine breeders of cattle who use pure-bred sires. Out of 146 herds in which a bull is kept and for which information on this point is given, 131, or 89.7 per cent report the bulls used as pure bred. This is very gratifying and augurs well for the future of the live-stock industry in this State.

One of the most interesting features of the table is the last column, in which are given, in condensed form, the answers to the question "Do you make it a rule in breeding to have cows served early in heat or late?" Summarizing these data we find the following facts:

Time of Service	*Number.*	*Per cent.*
Early in heat	81	42.2
Middle of heat	6	3.1
Late in heat	52	27.1
Both early and late[3]	6	3.1
On basis of alternate heat theory	3	1.6
Bull runs with cows	1	0.5
In relation to feeding or milking time	3	1.6
No regular rule[4]	36	18.7
Not reporting on this point and unclassified	4	2.1
Totals	192	100.0

[3]Includes all cases where it is the rule to serve twice during the heat period.

[4]In this category are included all cases recorded as "when convenient" and the like.

The facts brought out by this list are interesting. It is evident that the great majority of this group of breeders follow, or attempt to follow so far as they can, some definite rule in regard to the time of the heat period at which the cow shall be served. There can be no doubt further that the primary object sought, in most cases at least, is the control of the sex of the offspring. Curiously enough, however, there is nothing like unanimity of opinion as to how such control is to be gained. While roughly 42 per cent of the breeders in the group think that early service is most likely to get heifer calves, about 27 per cent are just as strongly of the opinion that service late in heat is needed to bring about this end. It is curious that only 6 or 3.1 per cent of the breeders say that they breed in the middle of heat. An examination of the actual times of breeding in hours after the onset of oestrum, shows that really these same 192 breeders are having more of their cows served in what may fairly be considered the mid-oestral period than either very early or very late.

2. PHYSIOLOGY OF REPRODUCTION.

In all of its work the Maine Agricultural Experiment Station endeavors in every possible way to meet the most pressing immediate needs of the farmers of the State for practical information at the same time that it is carrying on fundamental investigations, having for their object the discovery of the underlying principles of science on which agricultural practice depends. A good index of the immediate practical needs of the farmer is found in the inquiries and requests for information which he sends in to the Station. Experience shows that a large portion of the correspondence of the Station relating in any way to breeding has to do with inquiries concerning one or another phase of the general subject of the *physiology* of breeding. There is a great dearth of information in the available agricultural literature regarding the biological or physiological processes concerned in reproduction and breeding.

As has already been pointed out in the preceding portion of this report, the Experiment Station, through its cooperative breeding record project, is in possession of a unique body of original material throwing light on many of the most puzzling of these biological questions relating to reproduction and breeding in cattle. In view of this fact, and because of the very evident interest in this subject, and desire for information about it, it has seemed wise to devote a considerable amount of time during the past year to the preparation of a comprehensive bulletin on "The Physiology of Breeding with Special Reference to Dairy Cattle." This bulletin is now nearly ready for the press. It is expected that it will be issued as an appendix to this report sometime in the year 1917. It is estimated that it will make a volume of about 150 printed pages. This will, of course, be distributed free to residents of Maine. It will not be distributed by the Station outside of the State of Maine. Instead, the same material composing this bulletin will be issued in book form by one of the large commercial publishing firms, from whom it may be obtained, on payment of the regular price of the book, by anyone not a resident of Maine.

3. THE CONTROL OF THE SEX RATIO.

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[5] appeared to indicate that there was a possibility of influencing the sex ratio by paying attention to this point. It was believed to be of such extreme importance as to justify the careful study of the matter on the basis of much more extended statistics. These statistics we have now collected and analyzed and shall publish as soon as possible. In the meantime it may be reported that, with the more extended statistics in hand, it appears to be conclusively established that there is no definite or permanent relation between the time in the heat period at which the cow is served and the sex of the offspring. The apparent relation between these two factors, which is believed by many breeders to exist and which our earlier statistics appeared to indicate, seems now to be purely accidental, and to have arisen only because of the comparative meagerness of the statistics on which the matter was discussed.

TABLE 2.

Showing the Sex of the Calves Following Service at Different Parts of the Heat Period.

Heat Period	Lapsed time in hrs. from appearance of heat to service.	Sex of Offspring		Per Cent of Males
		Males	Females	
Early	Under 3 hours.	200	192	51.0
Middle	Over 3 and under 8 hours	270	252	51.7
Late	Over 8 hours	187	212	46.9
Totals		657	656	50.0

[5]Cf. 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.

The summarized results of 1313 separate and distinct matings given in Table 2 will demonstrate this point. In each one of these 1313 cases the following facts were accurately known, and reported in such a way that any bias, conscious or unconscious, of the observer could not have influenced the result: (a) the time in hours from the first appearance of heat (oestrum), as noticed by the breeder, to the time the cow was successfully served; (b) the sex of the calf resulting from this service.

It is evident fromthis table that there is no significant preponderance of females when service is early in heat. There is not now known any method by which the sex ratio or proportion of the sexes in cattle may be effectively controlled by the breeder. A more detailed account of the results, together with further statistics will be published elsewhere.

4. THE ANALYSIS OF MILK RECORDS.

The intensive study of existing records of milk and butter fat production published in the Advanced Registry reports of the various breeds has been prosecuted energetically during the past year. As was pointed out in the last report, the necessary age correction factors for milk production have now been completely worked out for the three breeds,—Jersey, Holstein-Friesian, and Ayrshire. The necessity for these age corrections has been emphasized in former reports. Before it is possible to make any just comparison between the productivity of two cows it is necessary that a proper scientific correction be made for their difference in age at the time when the milk records were made. The working out of proper corrections has involved a great deal of extremely laborious mathematical work. This work, however, is now completed and we are able to use these correction factors in a constructive way.

As a first contribution in this direction we have considered in the Jersey breed the influence of certain advanced registry bulls on the productive qualities of the breed. A complete report on this phase of the work, which will include data corresponding to those for Tables 3, 4, and 5 for every Register of Merit bull of the Jersey breed having two or more daughters whose dams have records, will be issued as an appendix to this report as soon as it can be prepared for the press.

Tables 3, 4, and 5 show in abbreviated form the effect of 23 of the best known Jersey sires on the average milk, fat test, and net butter fat production of their daughters as compared with the dams of these daughters. It appears from these tables that about one-half of the bulls in this group got daughters which on the average were poorer producers than the dams of those daughters. In some cases the deleterious effect of the bull on the productive qualities of his offspring was extremely marked. On the other hand, certain of the bulls in this group, notably Hood Farm Torono, exercised an extraordinarily beneficial effect upon the productive qualities of the breed.

TABLE 3.

Showing the Influence of Certain Jersey Bulls on the Breed, as Indicated By the Average Yearly Production of Milk of Their Daughters as Compared With That of the Dams of These Daughters.

+denotes that daughter's average was *higher* than dams' average
—denotes that daughter's average was *lower* than dams' average

NAME OF BULL	LBS. OF MILK BY WHICH DAUGHTERS' AVERAGE IS DIFFERENT FROM DAMS'	
Group A. Bulls which significantly lowered the productivity of their daughters.	+	—
Hector Marigold 59121		3001.0
Hood Farm's, Tormentor 76311		1555.6
Irene's King Pogis 73182		1540.9
Lady Letty's Victor 65020		1396.2
Mabel's Raleigh 77913		965.7
Hood Farm Torono 21st 83413		800.5
Noble of Oaklands 95700		453.3
Hood Farm Torono 20th 82854		252.8
Mabel's Poet 65780		139.0
Group B. Bulls wihch neither lowered nor increased productivity significantly		
Tonona Pogis 78657	96.9	
Interested Prince 58224	70.1	
Gedney Farm Oxford Lad 71338	128.7	
Group C. Bulls which significantly increased the productivity of their daughters.		
Flying Fox's Victor 64768	285.0	
Lookout Torono 78593	385.7	
Hood Farm Pogis 9th 55552	464.3	
Mabel's Oxford Lad 66518	590.0	
Gamboge's Knight 95968	627.4	
Raleigh's Fairy Boy 83767	715.8	
Eminent's Raleigh 69011	1313.0	
Royal Majesty 79313	2138.6	
Hood Farm Pogis 34th 63300	2427.5	
Fontaine's King 65641	2880.0	
Hood Farm Torono 60326	2946.1	

TABLE 4.

Showing the Influence of Certain Jersey Bulls on the Breed, as Indicated By the Average Fat Percentage of the Milk of Their Daughters as Compared With That of the Dams of These Daughters.

+denotes that daughter's average was *higher* than dams' average
—denotes that daughter's average was *lower* than dams' average

NAME OF BULL	PERCENTAGE OF FAT BY WHICH DAUGHTERS' AVERAGE IS DIFFERENT FROM DAMS'	
Group A. Bulls which significantly lowered the fat percentage of their daughters	+	—
Eminent's Raleigh 69011		1.203
Raleigh's Fairy Boy 83767		0.637
Fontaine's King 65641		0.588
Lookout Torono 78593		0.288
Royal Majesty 79313		0.264
Group B. Bulls which neither lowered nor increased fat percentage significantly		
Hood Farm Torono 60326		0.144
Hood Farm Pogis 34th 63300		0.094
Hood Farm Torono 20th 82854		0.073
Gedney Farm Oxford Lad 71238		0.071
Interested Prince 58224		0.055
Mabel's Poet 65780		0.053
Mabel's Raleigh 77913	0.030	
Lady Letty's Victor 65020	0.118	
Gamboge's Knight 95698	0.140	
Group C. Bulls which significantly increased the fat percentage of their daughters		
Flying Fox's Victor 64768	0.221	
Hood Farm's Tormentor 76311	0.271	
Hood Farm Torono 21st 83413	0.272	
Hood Farm Pogis 9th 55552	0.282	
Mabel's Oxford Lad 66518	0.314	
Nobel of Oaklands 95700	0.386	
Tonona Pogis 78657	0.446	
Irene's King Pogis 73182	0.658	
Hector Marigold 59121	0.715	

TABLE 5.

Showing the Influence of Certain Jersey Bulls on the Breed, as Indicated By the Average Yearly Production of Milk of Their Daughters as Compared With That of the Dams of These Daughters.

+denotes that daughter's average was *higher* than dams' average
—denotes that daughter's average was *lower* than dams' average

NAME OF BULL	LBS. OF BUTTER FAT BY WHICH DAUGHTERS' AVERAGE IS DIFFERENT FROM DAMS'	
Group A. Bulls which significantly lowered the productivity of their daughters.	+	—
Hector Marigold 59121		106.55
Hood Farm S. Tormentor 76311		61.59
Mabel's Raleigh 77913		46.00
Eminent's Raleigh 69011		41.74
Irene's King Pogis 73182		35.12
Raleigh's Fairy Boy 83767		31.72
Lady Letty's Victor 65020		21.72
Hood Farm Torono 20th 82854		21.27
Hood Farm Torono 21st 83413		20.85
Mabel's Poet 65780		11.88
Group B. Bulls which neither lowered nor increased productiviy significantly		
Interested Prince 58224	0.41	
Gedney Farm Oxford Lad 71238	1.57	
Lookout Torono 78593	1.70	
Noble of Oaklands 95700	4.24	
Group C. Bulls which significantly increased the productivity of their daughters.		
Flying Fox's Victor 64768	33.94	
Tonona Pogis 78657	47.00	
Gamboge's Knight 95698	47.49	
Hood Farm Pogis 9th 55552	51.83	
Mabel's Oxford Lad 66518	60.76	
Royal Majesty 79313	81.34	
Fontaine's King 65641	101.37	
Hood Farm Pogis 34th 63300	140.48	
Hood Farm Torono 60326	148.56	

5. NEW COOPERATIVE PROJECT.

The Maine Agricultural Experiment Station wishes to call attention to a plan for a new cooperative project which it will take up with the breeders of Maine provided they are interested in the matter. The most important thing which a breeder of dairy cattle desires to know is whether his animals are transmitting productive qualities to their progeny. In particular this information is desired in regard to the herd bull, which constitutes one-half of the herd. If by chance he is exercising a deleterious effect on the productive qualities of the herd he may in a few years time do a great deal of harm. It would appear to be beyond doubt or question for practical purposes, that if a bull's daughters are on the average poorer milkers, or poorer in the quality of their milk, than the dams from which they came, then the bull which produced them is exercising a harmful effect upon the herd. On the other hand, if a bull's daughters are on the average measurably better than the dams from which they came in productive qualities, then that bull is exercising a beneficial effect on the herd. What the breeder wants to know at the earliest possible moment is which of these two categories his herd bull falls into. The writer has worked out a plan whereby it is believed that it will be possible to furnish this sort of information to the breeders of the State more quickly and in a much more definite and precise form than they have ever been able to acquire it hitherto.

The plan of cooperation involves the following points: Any farmer who will comply with certain conditions may at any time have made for him by the Experiment Station an Official Daughter-Dam test.

The conditions are:

(a). That he shall have in his herd at the same time both the dam and her daughter to be tested. Or failing the actual possession of the animals at the time he must be able to furnish satisfactory records of the milk production of the missing animal, either daughter or dam, together with the other necessary information for making the test.

(b). The breeder or farmer undertaking such a cooperative test under the directions furnished by the Expermient Station must agree to keep a careful and accurate record of the milk of the animals on test over a period of time mutually agreed upon (7 day; 14 day; 30 day; 90 day; or one year).

(c). Anyone desiring to take up such a test should write to the Director of the Maine Agricultural Experiment Station asking for an application blank form, which he should fill out and return at once. This form is given on page 138.

(d). Samples of the milk of the animals on test shall be regularly taken, according to directions which will be furnished, and sent to the Maine Agricultural Experiment Station. There an analysis of the milk will be made and the necessary calculations for making proper age corrections for the animals concerned will be carried out. An official report will then be rendered to the breeder as to whether in the particular case involved the sire produced a daughter which was a better or a poorer producer than her dam when both are compared on an equal age basis. The report will be in the form given on page 139.

(e). The only expense to the breeder involved in having such a test carried through is the expressage on the samples of milk to Orono, and postage on reports. This cooperative daughter-dam testing project will be open on precisely equal terms to owners of grade cattle as well as owners of pure-breds.

APPLICATION FOR DAUGHTER-DAM TEST.

(One blank should be made out for each daughter-dam pair to be tested).

I,———(*name of applicant*)———, desire hereby to make application for an Official Daughter-Dam Test. I agree to follow faithfully to the best of my ability any and all instructions, rules, and regulations regarding this Test which may be laid down by the Maine Agricultural Experiment Station through its officers. I agree that at any time during the Test my premises, including barns and herd, shall be open freely to inspection, without prior notice, by any properly accredited representative of the Experiment Station, and I further agree to give such representative any information which he may desire regarding the carrying out of the Test.

Signed.....
Address.....

The Following Questions Must be Answered Before the Test Can be Started.

1. Is the daughter to be tested now in herd?.....
2. Is the dam to be tested now in herd?.....
3. If answer to either 1 or 2 is "No," what record of past performance of the animal can you furnish?.....
4. Do you desire a 7 day, 14 day, 30 day, or 1 year test?..... (*A short test is recommended*).
5. Are the animals to be tested grades or pure-breds?.....
6. Has either an Advanced Registry Record?.....
7. To what breed do the animals to be tested belong?.....
8. Give the name, breed, and registry number (if pure-bred) of the sire of the daughter to be tested?.....
9. When was this bull born? Year....., Month....., Day.....
10. When did the dam freshen?.....
11. When did the daughter freshen?.....
12. When was the dam born? Year....., Month....., Day.....
13. When was the daughter born? Year....., Month....., Day.....
14. When do you want to start the test?
15. Do you agree to weigh accurately, and record the milk at each milking, and to take proper samples according to directions and ship them promptly to Orono for analysis?.....

This blank should be completely filled out and returned at once to Raymond Pearl, Orono, Maine, in the addressed envelope provided for that purpose.

OFFICIAL DAUGHTER-DAM TEST.

MAINE AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE
CHAS. D. WOODS, DIRECTOR.

This is to certify that an Official Daughter-Dam Test has been made by the Maine Agricultural Experiment Station on, the animals and with the results hereinafter set forth.

The cow.....(*Name of daughter*)..... sired by the.... ....(*Breed of bull*).... bull.....(*Name of bull*)..... out of the .....(*Breed of dam*)..... cow.....(*Name of dam*)..... made, in comparison with her dam, the following record in.....days, beginning.....

The daughter freshened.....

The dam freshened.....

Animal	Age at Test.	Actual milk yield.	Milk yield corrected for age and stage of lactation.	Actual average fat %.	Average fat % corrected for age and stage of lactation.	Actual net fat yield.	Net fat yield corrected for age and stage of lactation.
Daughter							
Dam							
Net gain or loss of daughter over dam.							

So far as this test indicates the bull..... the net fat yield of this daughter in comparison with the net fat yield of her dam.

Signed.....
Director.

.....
Biologist.

6. BREEDING EXPERIMENTS.

The experiments in cattle breeding which are being carried out with the University of Maine herd have proceeded satisfactorily during the year. These experiments are along the line of experimental hybridization. This is the only method now known by which one may hope to make an *adequate* analysis of the laws of heredity.

In view of these considerations we are endeavoring as rapidly as possible to build up an experimental herd of first generation crosses between low milking and high milking breeds, on the one hand, and between low testing and high testing breeds, on the other hand. It is gratifying to be able to report that this experimental cross-bred herd is now nearly completed. To February 9, 1917 a total of 42 animals have been produced of which some 14 will probably be permanently retained in the experimental herd. The remainder have been, or will be, sold as fast as they pass the age of 200 days when certain records are taken on them. To complete the herd, so that analytical experiments may go forward, there are now required only six heifers. Owing to the fact that a control of sex in the individual case is impossible, it is likely to take at least one or two years more to complete the experimental herd. After these six heifers have been obtained probably no more *first generation* crosses will be bred.

The breeds used in the formation of the experimental herd are the Jersey, the Holstein-Friesian, and the Aberdeen Angus. The Ayrshire and Guernsey breeds were used in some preliminary work, but will not be continued. It is interesting to note that one first generation hybrid animal is now in milk, having borne a heifer belonging to the second hybrid generation on April 10, 1916. Another heifer belonging to the second cross-bred generation was born August 17, 1915. It is the second cross-bred generation which yields the important results in Mendelian experiments.

A complete list of the calves born in the experimental herd between January 1, 1916, and February 9, 1917, is given in Table 6. In conjunction with the list given in the last report[6] this gives all the cross-bred calves obtained in the experiments.

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[6]Pearl, R. Report of Progress on Animal Husbandry Investigations in 1915. Me. Agric. Expt. Stat. Misc. Publ. 519, pp. 1-27, 1915.

TABLE 6.

Calves Which have been Produced in the Hybridization Experiments between January 1, 1916 and February 9, 1917

Calf No.	Sex.	Dropped.	Sire's Name and Registry Number.	Breed of Sire.	Dam's Name and Registry Number	Breed of Dam.
18	♂	January 1, 1916.	Kayan (167617).	Aberdeen Angus.	Ruth 8th (4457).	Jersey (M. S. J. H. B.).
19	♀	January 1, 1916.	Kayan (167617).	Aberdeen Angus.	Ruth 8th (4457).	Jersey (M. S. J. H. B.).
20	♂	January 10, 1916.	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian.	Maple Grove Netta (29307).	Ayrshire.
21	♂	January 14, 1916.	Kayan (167617).	Aberdeen Angus.	Dot Alaska (29353).	Ayrshire.
22	♀	February 22, 1916.	Kayan (167617).	Aberdeen Angus.	College Creusa (25661).	Guernsey.
23	♂	March 9, 1916.	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian.	Columbia Brown Bessie ( )	Jersey.
24	♂	March 20, 1916.	Kayan (167617)(0).	Aberdeen Angus.	College Creusa 2d (34227).	Guernsey.
25	♀	April 10, 1916.	F_1 Cross-bred (0).	Jersey x Holstein.	F_1 Cross-bred (1).	Jersey x Holstein.
26	♀	May 5, 1916.	Kayan (167617).	Aberdeen Angus.	Creusa of Orono 3rd (34228).	Guernsey.
27	♀	May 25, 1916.	Lakeland's Poet (102603).	Jersey.	Orono Madge (192781).	Aberdeen Angus.
28	♂	June 17, 1916.	Kayan (167617).	Aberdeen Angus.	Pauline Posch (81048).	Holstein-Friesian.
29	♀	July 19, 1916.	Kayan (167617).	Aberdeen Angus.	Creusa's Lady (53234).	Guernsey.
30	♂	August 29, 1916.	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian.	Orono Ellen (192783).	Aberdeen Angus.
31	♂	September 11, 1916.	Lakeland's Poet (102603).	Jersey.	Eventime 4th (155526).	Aberdeen Angus.
32	♂	September 25, 1916.	Kayan (167617).	Aberdeen Angus.	Canada's Creusa (44386).	Guernsey.
33	♀	October 9, 1916.	Lady Primrose's Governor of the Fountain (18328).	Guernsey.	Hearthbloom (147141).	Aberdeen Angus.
34	♀	October 17, 1916.	F_1 Cross-bred (0).	Jersey x Holstein.	Rosalie (4887).	Jersey (M. S. J. H. B.).
35	♂	November 10, 1916.	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian.	Flying Fox's Flora (274051).	Jersey.
36	♂	December 15, 1916.	Kayan (167617).	Aberdeen Angus.	Orono Netta (38832).	Ayrshire.
37	♀	January 5, 1917.	Kayan (167617).	Aberdeen Angus.	Dot Alaska (29353).	Ayrshire.
38	♂	January 13, 1917.	Kayan (167617).	Aberdeen Angus.	College Creusa (25661).	Guernsey.
39	♂	January 28, 1917.	Kayan (167617).	Aberdeen Angus.	Rue Victoria (273096).	Jersey.
40	♂	February 9, 1917.	Kayan (167617).	Aberdeen Angus.	College Creusa 2nd (34227).	Guernsey.
41	♀	February 9, 1917.	Kayan (167617).	Aberdeen Angus.	College Gem 2nd (53235).	Guernsey.

7. REPORT OF THE SECOND JERSEY SIRES' FUTURITY TEST OF THE AROOSTOOK JERSEY BREEDERS' ASSOCIATION.

The first of these sires' futurity tests was held at Aroostook Farm in the late autumn of 1915, and the results have been reported.[7]

The first test attracted a great deal of favorable attention both in the State and out. It was hoped that the second test, which was held at Aroostook Farm, Presque Isle, Maine, October 9-15 inclusive, 1916, would have a larger number of entries than the first, but this hope was not realized, for a variety of reasons which need not be gone into here. The second test was carried out under the same rules as the first (loc. cit. pp. 41-46) and with the supervision of a representative of the Experiment Station, Mr. C. Harry White.

ANIMALS IN THE 1916 TEST.

Heifer No. 1.—Irene. Owned by Mr. E. L. Johnston, Easton, Maine.
Sire.—Daisy's Pogis of Meadow Farm (98184).
Dam.—A grade cow.
Dropped.—July 29, 1914. Freshened—September 8, 1916.
Weight.—850 pounds.

Heifer No. 2.—Brownie. Owned by Mr. Peter Johnson, Easton, Maine.
Sire.—Daisy's Pogis of Meadow Farm (98184).
Dam.—A grade cow.
Dropped.—March 12, 1914. Freshened.—September 18, 1916.
Weight.—705 pounds.

Heifer No. 3.—Julia. Owned by Mr. George McNaughton, Easton, Maine.
Sire.—Daisy's Pogis of Meadow Farm (98184).
Dam.—A grade cow.
Dropped.—July 3, 1914. Freshened.—May 1, 1916.
Weight.—630 pounds.

Heifer No. 4.—Poet's Fanny Harper (312849). Owned by L. H. Denton, Caribou, Me.
Sire.—Brackett Farm Poet (77588).
Dam.—Fannie Harper 2nd (263451).
Dropped.—April 28, 1914. Freshened.—March 18, 1916.
Weight.—710 pounds.

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[7]Pearl, R. Report of the First Jersey Sires' Futurity Test of the Aroostook Jersey Breeders' Association. Me. Agric. Expt. Sta. Bulletin No. 247, pp. 37-52, 1916.

FAT PRODUCTION.

Table 7 gives the detailed production of butter fat of each of the animals in the test at each milking, after correction for age and stage of lactation. These corrections were made on the basis of the Dairy Efficiency Table published in a former report (p. 5).[8]

TABLE 7.

Net Corrected Butter-Fat Production of Heifers in 1916 Test.

	IRENE (No. 1)			BROWNIE (No. 2)			JULIA (No. 3).			FANNY HARPER (No. 4).		
Date	Morning	Noon	Night	Morning	Noon	Night	Morning	Noon	Night	Morning	Noon	Night
Oct. 9	.80	.75	.74	.36	.30	.29	.42	.41	.42	.50	.52	.56
10	.25	.92	.77	.33	.31	.36	.37	.34	.34	.52	.42	.52
11	.68	.69	.63	.32	.19	.10	.43	.37	.40	.50	.50	.47
12	.62	.59	.61	.10	.08	.12	.42	.39	.39	.50	.45	.46
13	.60	.65	.61	.14	.28	.21	.44	.40	.46	.51	.44	.55
14	.64	.57	.62	.19	.20	.21	.46	.43	.43	.51	.50	.60
15	.62	.67	.68	.20	.22	.20	.45	.42	.37	.51	.60	.50
Totals	13.71 lb.			4.71 lb.			8.56 lb.			10.64 lb.		

[8]Pearl, R. Report of Progress on Animal Husbandry Investigations in 1915. Me. Agric. Expt. Sta. Misc. Publ. 519, pp. 1-27, 1915.

From these figures it appears that the animals in the test stood in the following order:

Irene (No. 1) was the winner, with 13.71 lbs. fat in 7 days. Her sire, Daisy's Pogis of Meadow Farm (98184), was for the second time the winner of the American Jersey Cattle Club Cup.

Poet's Fanny Harper (No. 4) was second, with 10.64 lbs. fat in 7 days.

The records of the other two heifers were so poor as not to warrant the award of prize money.

BULLETIN 262

THE CHANGE OF MILK FLOW WITH AGE, AS DETERMINED FROM SEVEN DAY RECORDS OF JERSEY COWS.[1]

By Raymond Pearl and S. W. Patterson.

From the time of the earliest domestication of cattle it must have been realized that age was a factor influencing milk production. It is well known among dairymen and breeders that, other conditions being the same, a cow will produce more in a given length of time during her second lactation period than for the same time during her first period. She will produce more her third lactation period than her second; and so on until she reaches mature form, or the age for maximum production. She remains in this mature form for a few years; then each succeeding lactation period decreases in the rate of milk flow.

Opinions differ somewhat as to the average age at which a cow reaches mature form and as to the rate of increase with which she approaches that form. The general belief is that mature form is reached by the fifth year and that the curve representing the variation in milk flow by lactation periods up to that time is a straight line.

This latter opinion is evidenced by the requirements for advanced registry in the Ayrshire Breeders' Association rules—the only Association which has a milk requirement for advanced registry entry. Since the variation in the average percentage of butter fat in the total milk in different lactation periods is slight, the above opinion is substantially concurred in by the entry requirements, which are based on butter fat, in the rules of the other three dairy breeders' associations. The four associations are alike in fixing mature form at five years of age and in allowing nothing for decrease in productivity due to very advanced age.

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[1]Papers from the Biological Laboratory of the Maine Agr. Exp. Stat. No. 117.

Is this opinion right? Is this curve for changing rate of location due to age, correct in the form implied by advanced registry rules?

The purpose of this paper is to answer this question so far as concerns American Jersey cattle seven-day records. It is to ascertain from the data furnished by the seven day milk records in the book "Jersey Sires with their Tested Daughters"[2] first, the degree of correlation between age and milk production, second, the true curve for production at various ages for the seven day records of the Jersey breed, and then third, from these figures to determine the age correction for the seven day records so that they may be reduced to a common basis for comparison in future studies of the inheritance of milk production in the Jersey breed.

The character of the statistics in this volume—"Jersey Sires with their Tested Daughters"—is varied. About 90 per cent of them are taken from the private records of the earlier Jersey breeders, and 10 per cent are authenticated; that is each one of these latter was supervised by a representative from the office of the American Jersey Cattle Club, or by one from the office of the Agricultural Experiment Station in the State in which the test was performed in the same way that Advanced Registry tests are supervised today.

Though unauthenticated there is every reason to believe that the milk reports are true accounts of actual production, because butter was the part of the milk which the breeders wished to produce. To obtain this butter fat content of the milk it had to be skimmed and the cream churned as at that time the Babcock Test was not in general use. Consequently if there was any fraudulent work done, the incentive for it was in the making of the butter and not in the weighing of the milk produced. This idea is substantiated by the fact that no abnormally high averages of milk production for the different ages appear upon analysis of the records.

All the seven day tests in the volume cited, for which milk records were given, were the ones on which this paper is based, the total number used being 5821.

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[2]"Jersey Sires and their Tested Daughters". Published by American Jersey Cattle Club, New York, 1909.

Since these tests are arranged in the book alphabetically according to the names of the sires they give no comprehensive idea concerning the degree of relationship between the attributes age and weekly milk production. They were hence rearranged or classified in a table of double-entry or correlation.

In the arrangement of the table, age was chosen as ordinate and production as abscissa. The range of production was found by inspection of the data to be from 91 lbs., the record of Julia Landseer A. J. C. C. 56268, to 471 lbs. the record of Jimp A. J. C. C. 86488, or a range of 380 lbs. Obviously this is too large a range on which to use as a class unit a production of 1 lb., so 15 lbs. was chosen as this unit. For similar reasons as the range of age was from 1 year 4 months, the age for the test of Alexea Riotress King A. J. C. C. 176723 to 18 years 6 months, the age for the test of Jersey A. J. C. C. 3260, a class unit of 6 months was taken for the grouping of the cows—the first group being from 1 year to less than 1 year 6 months, etc., to 18 years 6 months and less than 19 years, or a total of 36 intervals.

The resulting correlation table is exhibited in Table 1.

By observation it is easily seen that there is a distinct variation in production with changing age. The correlation coefficient in this case is $r = .1925 \pm .0085$.

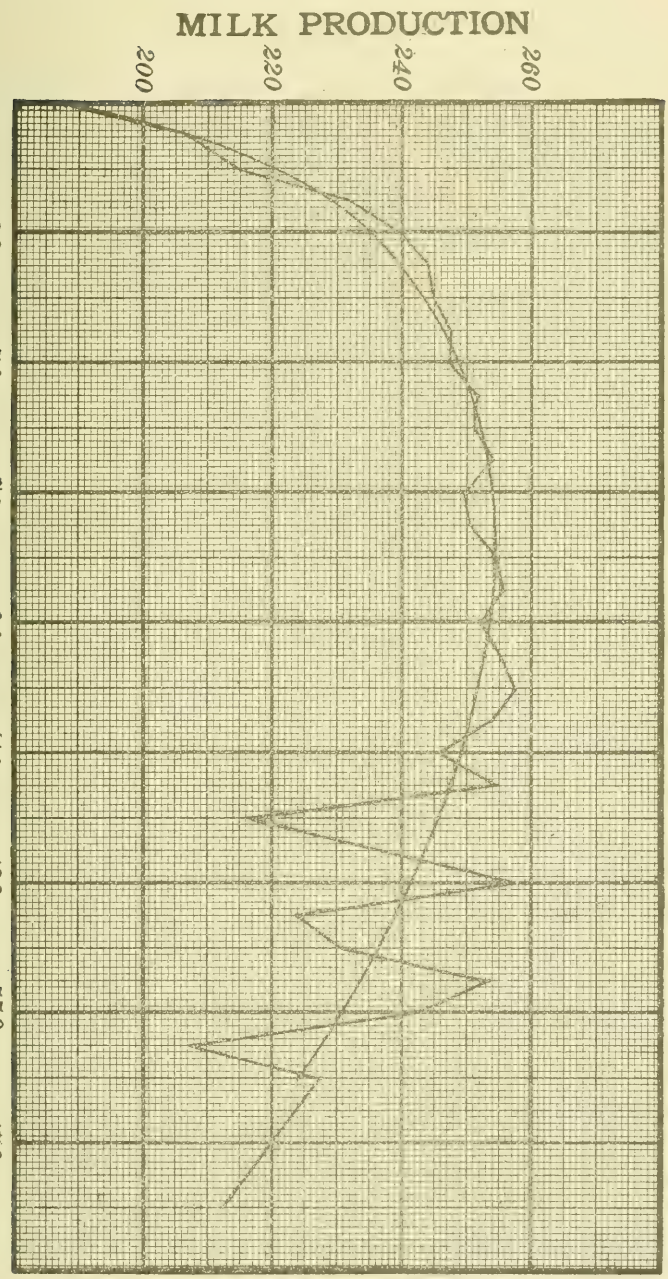
In view of the extreme skewness of the regression in this case, as will presently appear, no particular significance attaches to the correlation coefficient as such. Inasmuch as we are interested in the present connection only with the form of the regression curve we shall not develop further the purely correlational side of the matter.

The next step is to determine the curve of mean production with changing age. This was done by first plotting as one coördinate the mid-point of each age array, and as the other coördinate the mean production of the corresponding array. The resulting line is shown in Figure 7.

Table 1.

Correlation surface for the variables age and milk production in 7 days. Jersey cattle.

Age \ Milk	85—99	100—114	115—129	130—144	145—159	160—174	175—189	190—204	205—219	220—234	235—249	250—264	265—279	280—294	295—309	310—324	325—339	340—354	355—369	370—384	385—399	400—414	415—429	430—444	445—459	460—474	Totals
1:0— 1:5									1				1														2
1:6— 1:11	1	3	2	3	4	4	3	7	8	8	1	2	1														47
2:0— 2:5		4	9	10	19	14	26	40	44	50	21	19	11	3	1		1	1		1							274
2:6— 2:11		1	6	8	15	25	22	47	47	45	42	28	14	9	4	1		2									316
3:0— 3:5		1	4	9	14	19	28	50	82	98	75	67	39	24	19	14	3	2	1								550
3:6— 3:11		1	1	3	12	13	19	45	59	92	91	52	35	27	36	14	7	2	1	1	1						512
4:0— 4:5		2	1	5	9	14	23	51	97	113	98	88	66	59	29	35	9	6	2			1					708
4:6— 4:11				2	8	12	24	46	60	74	92	62	42	46	27	20	9	8	4		1						537
5:0— 5:5		2	1	7	7	7	15	33	54	78	89	88	51	51	27	27	8	4	4								553
5:6— 5:11		1	3	2	6	9	18	25	36	45	53	61	38	32	26	13	8	2	3	1		1	1				384
6:0— 6:5		1		2	5	9	16	23	41	57	55	51	47	44	32	10	9	7	1	2	2	1	1				416
6:6— 6:11			3	1	4	4	9	20	30	37	35	31	38	28	14	9	4	2	4		1	4	1				279
7:0— 7:5					1	10	9	14	26	31	41	44	43	22	14	12	10	3	5	4		1					296
7:6— 7:11				2	1	3	7	16	25	23	24	26	16	12	13	13	3	3		2	1						190
8:0— 8:5					2	6	8	12	18	26	19	13	22	14	10	11	1	4	2		1		1				170
8:6— 8:11				1	3	2	7	4	14	14	16	10	13	17	6	6	2	4	1	3							123
9:0— 9:5			1			3	4	6	10	14	15	15	6	17	8	6		1	1	1	1	1					110
9:6— 9:11		1			2	3	5	6	7	11	17	10	8	10	8		2	1	1	1		1	1	1			96
10:0—10:5			1				2	1	6	8	13	5	11	6	5	4		1									63
10:6—10:11		1		1		1	1	2	4	7	3	2	4	4	2	1	3	1					1	1			39
11:0—11:5		1		1	3	1	1	4	6	4	6	10	3	11				3			1					1	56
11:6—11:11							2	4	5	2	5	1	1	3	1		1	1		1							27
12:0—12:5					1			1	4	4	3		1	1	1		2		2								20
12:6—12:11						1	1	1	1	1	1			1													7
13:0—13:5							1		1	3		1		1	1	2											10
13:5—13:11		1								1	1	2	2		1					1							9
14:0—14:5							1	3	1		1	1			1												8
14:6—14:11			1							1		2		1													5
15:0—15:5											2	1	1														4
15:6—15:11											2																2
16:0—16:5					1				1			1															3
16:6—16:11						1				1	1		1														4
17:0—17:5																											—
17:6—17:11																											—
18:0—18:5																											—
18:6—18:11									1																		1
Totals	1	20	33	57	123	161	252	461	689	848	822	693	515	443	286	198	82	58	32	18	9	11	6	2	—	1	5821


MILK PRODUCTION
200
220
240
260
3.9
5.9
7.9
9.9
11.9
13.9
15.9
17.9
AGE

The observed curve shows itself at once to have the general shape of a logarithmic curve and not a straight line, as has been the general opinion of dairymen as stated earlier.[3] In graduating this curve the points determined by the coordinates of the first array and the arrays beyond the one whose mid-point is 16 years 9 months should be disregarded because of the paucity of observations in the original table. For the same reason too much weight should not be put on any of the points above 12 years 3 months. The first part of the observed curve, where the frequency of observations is large, is quite smooth and shows well the general type of curve which will best fit.

As a first approximation a curve of the form

$$y = a + bx + cx^2 + d \log x$$

where y=production and x=age was fitted by the observations. The value of the constants a, b, c, and d were determined by the method of least squares. This curve closely fitted the data at the points near the middle of the range, but it failed at the ends. The nature of the discrepancies was such as to indicate that better results would be got by a slight modification of this same general type of curve. This proved to be the case. The final curve, from which the smooth curve of Figure 7 is drawn is

$$y = 188.0224 - .0707\ x^2 + 69.8997 \log x$$

This curve obviously gives a practically perfect fit.

In Table 2 are given the theoretical average seven-day milk production as calculated from this curve for each month in age from 1 year 9 months to 16 years 9 months.

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[3]The fact that milk production age curves were generally of logarithmic form was first announced in a preliminary paper by Pearl (Proc. Soc. Exp. Biol. and Med. Vol. xii, pp. 18-19, 1914.) several years ago. The present paper furnishes the first detailed exhibition of the evidence on which the preliminary announcement was based. It was hoped that a series of several papers would immediately follow this one on the Jersey seven-day records, in which a large mass of evidence from the records of production of other breeds would have been presented. This has been rendered impracticable for the present by the fact that the senior author has been called to wholly other lines of endeavor for the duration of the war. In the meantime attention should be called to the fact that the Holstein-Friesian 7-day fat production curve worked out in this laboratory has been published, but without discussion. (cf. Miner, J. R. Jour. Agr. Research, Vol. 3, pp. 417-420, 1915.).

Table 2.

Mean milk production in 7 days, at each month of the cow's age, Jersey data.

Age in Yrs. and Mos.	Pounds Milk in 7-day Test.	Age in Yrs. and Mos.	Pounds Milk in 7-day Test.
1:9	187.95	5:11	249.67
1:10	192.61	6:0	249.99
1:11	197.62	6:1	250.29
2:0	200.17	6:2	250.58
2:1	203.34	6:3	250.85
2:2	206.18	6:4	251.12
2:3	208.78	6:5	251.37
2:4	211.17	6:6	251.61
2:5	213.35	6:7	251.84
2:6	215.40	6:8	252.06
2:7	217.30	6:9	252.26
2:8	219.07	6:10	252.46
2:9	220.74	6:11	252.64
2:10	222.31	7:0	252.82
2:11	223.78	7:1	252.98
3:0	225.19	7:2	253.14
3:1	226.52	7:3	253.29
3:2	227.77	7:4	253.41
3:3	228.98	7:5	253.54
3:4	230.12	7:6	253.65
3:5	231.21	7:7	253.76
3:6	232.25	7:8	253.85
3:7	233.25	7:9	253.94
3:8	234.20	7:10	254.02
3:9	235.10	7:11	254.09
3:10	235.99	8:0	254.15
3:11	236.83	8:1	254.20
4:0	237.64	8:2	254.25
4:1	238.41	8:3	254.28
4:2	239.15	8:4	254.31
4:3	239.87	8:5	254.33
4:4	240.56	8:6	254.34
4:5	241.22	8:7	254.35
4:6	241.85	8:8	254.34
4:7	242.47	8:9	254.33
4:8	243.06	8:10	254.31
4:9	243.63	8:11	254.28
4:10	244.18	9:0	254.25
4:11	244.70	9:1	254.20
5:0	245.21	9:2	254.15
5:1	245.70	9:3	254.10
5:2	246.17	9:4	254.03
5:3	246.62	9:5	253.96
5:4	247.06	9:6	253.88
5:5	247.48	9:7	253.80
5:6	247.88	9:8	253.70
5:7	248.27	9:9	253.61
5:8	248.64	9:10	253.50
5:9	249.00	9:11	253.39
5:10	249.34	10:0	253.27

Age in Yrs. and Mos.	Pounds Milk in 7-day Test.	Age in Yrs. and Mos.	Pounds Milk in 7-day Test.
10:1	253.14	13:5	243.07
10:2	253.01	13:6	242.70
10:3	252.87	13:7	242.33
10:4	252.72	13:8	241.95
10:5	252.57	13:9	241.57
10:6	252.41	13:10	241.18
10:7	252.24	13:11	240.78
10:8	252.07	14:0	240.38
10:9	251.89	14:1	239.98
10:10	251.71	14:2	239.57
10:11	251.52	14:3	239.15
11:0	251.32	14:4	238.73
11:1	251.12	14:5	238.31
11:2	250.91	14:6	237.88
11:3	250.69	14:7	237.44
11:4	250.47	14:8	237.00
11:5	250.25	14:9	236.55
11:6	250.01	14:10	236.10
11:7	249.77	14:11	235.67
11:8	249.53	15:0	235.18
11:9	249.28	15:1	234.72
11:10	249.02	15:2	234.25
11:11	248.76	15:3	233.77
12:0	248.49	15:4	233.29
12:1	248.22	15:5	232.80
12:2	247.94	15:6	232.31
12:3	247.65	15:7	231.81
12:4	247.36	15:8	231.31
12:5	247.06	15:9	230.81
12:6	246.76	15:10	230.29
12:7	246.45	15:11	229.78
12:8	246.14	16:0	229.26
12:9	245.82	16:1	228.73
12:10	235.49	16:2	228.20
12:11	245.17	16:3	227.66
13:0	244.83	16:4	227.12
13:1	244.49	16:5	226.58
13:2	244.14	16:6	226.03
13:3	243.79	16:7	225.47
13:4	243.43	16:8	224.92
		16:9	224.35

SUMMARY

1. Milk production changes with age in a definite manner.
2. This change follows a logarithmic curve of the form $y=a+bx^2+c \log x$ where y=production and x=age.
3. Maximum production is reached at approximately the age of 8 years and 7 months.

BULLETIN 263

SYRPHIDAE OF MAINE.
SECOND REPORT: LIFE HISTORY STUDIES.[1]

C. L. METCALF.[2]

The investigation of the biology, ecology, and economic status of the Flower-flies of Maine, the first report of which appeared as Bulletin 253 of this station, has been continued during the summers of 1916 and 1917. The data secured on the following species seems of sufficient interest to warrant publication at this time.

The species discussed below are all aphidophagous, depending for growth and development on aphids, which are ravenously devoured during the larval stage of the fly. They must therefore be recognized as beneficial insects and their presence in any locality must be looked upon as an agricultural asset of no mean importance. To illustrate,—in an experiment with one of the species described below (see page 156) the writer found that, in five hours less than two days, three larvae had devoured a total of 325 plant-lice, or an average of not less than 54 a day for each larva. There is no reason to believe that this record is in any way exceptional. In fact in this case the thoroughness with which the aphids were devoured indicated a still greater capacity of the larvae.

So far as I am aware no previous record has been made of the metamorphoses of these species.

The species, *Syrphus oronoensis,* appears to be an important predator of the aphids affecting stone fruits; the species *Xanthogramma divisa* and *Syrphus knabi* are, so far as observed, of more benefit to certain shade and forest trees; while the chosen food of *Platychirus perpallidus* has not been determined.

The latter species is of faunistic interest since it is not hitherto recorded outside of Britain. I have also taken the follow-

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[1]Papers from the Maine Agricultural Experiment Station: Entomology No. 94.

[2]Member of the Station Summer Staff.

ing European species of *Platychirus* in Maine: *P. scutatus* Meig.; *P. immarginatus* Zett.; *P. discimanus* Loew (Dr. Edith M. Patch, collector); and *P. angustatus* Zett.

It is of particular interest to record species of the two genera *Platychirus* and *Xanthogramma* as aphidophagus since they have each been recorded as having species which are scavengers in the larval stage. These two genera should be added to the list of ten genera given in the author's previous bulletin as aphidophagous, at least in part.

The Aphididae named in this bulletin have all been determined by Dr. Edith M. Patch, Entomologist. The writer is also indebted to Messrs. W. F. Pride, Geo. B. Newman and Robert K. Fletcher for assistance in collecting and caring for material.

XANTHOGRAMMA DIVISA Williston.

This is an aphidophagous species occurring sparsely in the larval stage among aphids on a number of our shade and forest trees, and occasionally increasing to abundance when a favorable infestation of aphids is available.

It is the handsomest larva of Syrphidae that I have seen and all stages present interesting structural characteristics.

Verrall[1] says of the genus: "Not much is known about the metamorphoses, but the larva has been reared from heaps of turf," so that the members of the genus have been believed to be scavengers. However, a report of the Hawaiian Sugar Planter's Experiment Station gives a photograph of the adult of a species of *Xanthogramma* among the predaceous insects of the island.

The records of the immature stages are as follows:

A well-grown brown larva collected by Mr. W. F. Pride, July 6, 1915, among *Aphis cerasifoliae* Fitch on choke cherry *(Prunus virginiana)*, succumbed in the laboratory after a long-drawn-out period of slow starvation, during which it failed to pupate.

A very small larva collected on *Cornus* sp. *(Aphis cornifoliae* Fitch), July 12, 1915 was ashy-gray in color instead of brownish. It was fed in confinement from *Aphis cornifoliae* and in about a week had attained full size and become a beautiful tan in color. It was fed every other day until July 31, when it

[1]Verrall, G. H., British Flies, Vol. VIII, Syrphidae, p. 448.

was placed out-of-doors on the original *Cornus* leaves, inside a cheese-cloth bag. Here it remained without striking change, gradually becoming dryer and more attenuated, until Sept. 12 when it was recovered but later died.

On July 24, 1916, Mr. G. B. Newman collected a nearly full grown, and three very small, larvae of this species among *Chaitophorus populicola* Thomas on poplar. The smaller ones were decidedly greenish in color, the large one tan. This green color gave place in the laboratory to an ashy- or faint-green which persisted for a week or more. On August 2, two of them were decidedly tan colored and by August 5 all had become so.

There was as yet no clue whatever to the identity of the larvae under consideration, and it proved a most difficult species to rear. Those kept in pint jars in-doors, even when most attentively supplied with their chosen food, fresh daily, fed and grew rapidly to full size, and then gradually became senescent, more and more sluggish, and after a time refused to feed or to move or to pupate, becoming more and more attenuated, thinner and dryer, and moving about only when disturbed until months later when they appeared finally to be lifeless. Sterile soil and decayed wood were provided in the bottom of the cages for pupation but without success. Much the same experience resulted from attempts to rear them in field cages or cheese-cloth enclosures on the living infested plants out-of-doors.

On August 8, 1916 a number of eggs were found in company with a dozen or so of larvae of various sizes scattered along the smaller twigs of willow trees infested with *Pterocomma smithiae* (Monell). These eggs began hatching on August 13 and at once disclosed the fact that they were conspecific with the flattened brownish larvae. The eggs, while of about the average size for this group, presented a microscopic spider-web sort of pattern on the chorion which was so characteristic that, in view of the difficulty of rearing adults from the larvae, the attempt was at once made to capture gravid females which should disclose the same kind of egg and so accomplish the determination of the species.

Finally on August 25, Mr. Newman captured about one of the infested trees a female of *Xanthogramma divisa*. She was confined indoors about 10 A. M. and by 2 P. M. had deposited a single egg, another by 2.45 P. M. and four more during the

next hour. She died over night without any further oviposition; but the few eggs were sufficient to establish the identity of the unusual larvae. These eggs hatched in the laboratory between 8 A. M. August 28 and 8 A. M. August 29, and speedily developed into larvae of the characteristic appearance.

The first puparium was formed August 24 in moist earth in the bottom of the jar confining larvae collected August 7 from willow; two others August 27 and two others August 29.

The first adult (from a puparium formed August 27) was disclosed Sept. 12; the others during shipment from Maine to Ohio between Sept. 13 and 20, the exact date not determined; except for one specimen which yielded a parasite (species undetermined) some days later.

Noting the voraciousness of the young larvae of this species the following tests were made of their capacity for destroying aphids:

Sept. 7, 9.30 A. M., three larvae were enclosed with 150 aphids of *Pterocomma smithiae*. At 8 A. M., Sept. 8, not a single whole aphid, living or dead, was found in the vial,—nothing but the cast-off skins. In other words each of the three larvae had devoured, on the average, 50 aphids in 22½ hours. At 11.40 A. M. of the same day the same three larvae were enclosed with 175 aphids of the same species, some of them actively reproducing. At 5 P. M. many of the aphids were still living, but by 8 A. M., Sept. 9, all had been devoured, most of the feeding in this case having taken place at night.

On August 31, another female was captured in the field about the infested willow but was slightly injured and died before ovipositing.

On Sept. 1, several full-sized larvae were found under loose pieces of dead bark on the infested willow trees, presumably seeking a site for pupation and possibly for hibernation. The larvae taken into confinement however died without pupating.

On my return to Orono, June 7, 1917, an examination of the trees, infested the previous season disclosed four puparia, three of them glued to loose pieces of bark on the trunk or principle branches of the tree, the other on the ground among fallen pieces of bark.[1]

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[1]It may be noted that the puparium found on the ground is the only one of the lot which failed to yield either a living fly or parasites; this specimen (a male) died without emerging.

From one of these puparia left out-of-doors, a female emerged June 18, another June 22, while a third disclosed 26 parasites (undetermined) July 8th, the entire lot emerging from a single small hole gnawed thru the anterior end of the puparium (Fig. 9, B). The exact date of pupation, i.e., whether the full-grown larvae passed the winter, pupating in spring, or whether pupation occurred sometime in autumn has not been determined,—probably the latter. Several full-grown larvae were collected by Mr.Fletcher among *Myzus cerasi* (Fab.) on cherry, July 18, 1917.

It appears likely that there are two more or less complete generations of this species, annually, though not occurring in very definite broods. Adults from overwintering larvae or pupae evidently giving rise to the larvae which have been found full sized by early July; and the adults from these larvae producing another generation, the larvae of which occur especially during August. A partial third generation from eggs deposited by females visiting the colonies of aphids the last week in August, seems probable.

Egg (Fig. 8, A). Lengths of seven eggs measured were 0.861, 0.8815, 0.89175, 0.9225, 0.9532, 0.975, and 0.9942 mm., respectively, the average 0.925 mm.; their greatest diameters were respectively 0.3075, 0.308, 0.315, 0.328, 0.3375, 0.3485, and 0.3485 mm., the average 0.3275 mm.

The egg is of about the usual sub-cylindrical shape, somewhat inflated in the middle and with the micropylar end a little smaller and more truncate than the opposite end; also with the ventral surface flattened somewhat to the twig on which it is deposited. Color white, glistening.

The characteristic thing is the sculpturing of the chorion the microscopic pattern of which (Fig. 8, B) suggests at first glance a very large number of minute, 8-rayed spider webs, or hexagonal wheels, contiguous to each other, with a very small elevated body in the center of each. Taking each "web" as a unit it may be described as consisting of a very small, sub-conical, elevated body in the center of the web (the hub) from which radiate eight, slender, slightly elevated arms arranged in four pairs. The two arms extending from the central elevation, or hub, toward either pole of the egg, radiate like the spokes of a wheel; while the two which extend in the transverse direction from either side of the hub (i. e. perpendicular to the long axis of the egg in a plane parallel to it) run practically parallel to each other. A series of these *parallel* arms, together with the hubs they connect make a ladder-like chain running almost transversely (sometimes somewhat obliquely) around the egg. The individual units are closely contiguous to each other so that each arm forms a spoke for two central bodies or hubs, and the rim of the imaged wheel is formed only by adapting the contiguous spokes of adjoining wheels. The pattern

is of such a size that about forty of the ladder-like chains are traversed in passing from one pole of the egg to the other, the elevated bodies being approximately 0.02 mm. apart.

The eggs have been taken in the field only on the small twigs of willow directly among the aphids, *Pterocomma smithiae* (Monell), in early August. They were also deposited in captivity from a female caught hovering about this infestation in late August. There is at least one other time of occurrence for the egg stage, those giving rise to the first generation of larvae in the spring probably being deposited in June. It is further probable that adults emerging in September, (as specimens in the laboratory did) may deposit eggs for a third generation; although it seems doubtful if these larvae could mature at this latitude before cold weather cut short their food supply.

The eggs are glued by the ventral surface to the bark of the young twigs, and occur singly.

The duration in the egg stage, from eggs deposited indoors, was between 2⅔ and 3¾ days, while some eggs brought in from the field on August 8 did not hatch until August 13, this stage exceeding five days. At time of hatching the micropylar end of the egg shell is pushed off as a roughly circular cap, leaving the rest of the shell intact.

Larva (Fig. 8, C to H). The newly hatched larva (Fig. 8, C) is elongate ovate in outline with the posterior end truncated or even excised. It measured 0.95 mm. in length by 0.39 mm. in its greatest width, a little caudad of mid-length. It thus appears, from the first, proportionately broader and is more flattened than the other described aphidophagous species. The color is pale yellow more or less blackened on the mid-dorsal line by the interrupted pulsating dorsal blood-vessel. The whitish longitudinal tracheal trunks also are faintly visible thru the integument. The young larva appears very bristly (cf. *Syrphus americana* Wied.[1]), the segmental bristles being quite conspicuous. There are eight transverse rows of twelve bristles each, besides additional ones on the terminal segment, the individual setae measuring about 0.0666 mm. in length,—of two segments, the basal one about 0.008 mm. long and of equal diameter, the distal one 0.06 mm. long and about 0.0035 mm. in diameter, tapering slightly to the tip. The integument is wrinkled transversely and the lateral margins are irregularly serrate.

The posterior respiratory tubes are well separated, fairly prominent, nodular; the slit-like spiracles short and situated near together. There is no integumental vestiture in addition to the segmental setae.

As growth continues the larva becomes more and more flattened so that by the time it is full grown it is more than half as broad as long,

[1]The Ohio Naturalist, Vol. VII, No. 5, p. 479, Mch. 1912.

measuring 10 to 11 mm. in length by 5 to 5½ mm. in maximum width, and only about 1⅓ mm. in height.

Very different in shape from the usual aphidophagous larva, suggesting somewhat the larva of *Microdon* and indeed forming a most interesting intermediate step, structurally, between the typical aphidophagous larva, such as *Syphus americana, S. torvus, Sphaerophoria cylindrica,* and others and the extremely specialized larvae which live in the nests of ants.

When the larva is resting its shape from above is broadly ovate, somewhat narrower and less truncate at the anterior end. The entire lateral and anterior margins are deeply serrate, there being three large and subequal and one much smaller serration to each of the seven principal segments (Fig. 8, F & H). The three larger serrations bear at their tips the lateral, posterior ventro-lateral and anterior ventro-lateral segmental spines; the median, dorsal and dorso-lateral ones retaining their normal positions on the dorsal surface of the somites. The fourth and smaller serration is nude of bristles. Each of these principle serrations, or lateral, cone-shaped processes, is covered with papillae similar to those over the entire dorsum of the larva, so that in outline they appear secondarily serrated with ten or a dozen papillae on each side. The segmental spines are pale, colorless, of the usual two segments, the basal one 0.035 to 0.04 mm. in length and of about equal width, the distal one peg-like, 0.055 to 0.075 mm. in length, by 0.015 to 0.0185 mm. in diameter, accuminate toward the tip. The median, dorsal, and dorso-lateral spines are considerably smaller, measuring not more than 0.05 mm. in length, and exceedingly inconspicuous, it being almost impossible to detect them in the dorsal view, though visible at good magnifications in profile (See Fig 8, D).

The anterior segments, retracted under segment four when the larva rests, are, when it is active, protruded as a blunt, cone-shaped projection bearing dorsally the anterior spiracles and, terminally, the retractile antennae and mouth parts. As seen in caudal aspect (Fig. 8, D) or in cross-section the larva is very broadly sub-triangular, the apex of the triangle being at the mid-dorsal line and the lateral margins bearing the fringe of serrations already described.

The length of the posterior respiratory organ of the larvae measured, (Fig. 8, E, G) varied from 0.8625 mm. to 0.9525 mm., with an average of practically 0.9 mm.; the width at the tip varied from 0.4875 mm. to 0.5025 mm., averaging 0.494 mm.; the height at the tip ranged from 0.2625 mm. to 0.285 mm., averaging 0.27 mm. The median, slit-like spiracle ranged in length from 0.1275 mm. to 0.1387 mm. (averaging 0.134 mm.) by 0.015 mm. in width. The diameter of the circular plate varied from 0.0675 to 0.075 mm. averaging 0.0712 mm.; and these are situated with their median margins from 0.08 to 0.09 mm. apart. The color of the respiratory tube is brown, its surface rugose, with a shallow impression on the median line and a very moderate incision between the stigmal plates. The dorsal spiracular spine is very inconspicuous but the other interspiracular spaces bear broad rugose carinae, somewhat more elevated than the slit-like spiracles.

The integument of the larva is glabrous, finely and regularly papillose, very thin and transparent. The colors of the larva which are therefore resident in the viscera, are during development either an ashy or yellowish green, or more often, a yellowish brown. The young larvae collected from poplar were at first a delicate pea-green but soon changed indoors to the pinkish buff; and all the larvae found on willow at whatever age, as well as those reared indoors from the egg were constantly tan-colored. The full grown larva in any case is "tan-colored," a salmon buff or pinkish buff or warm vinaceous, the dorsum being mostly covered with small, globular masses of adipose tissue of this color. Where these globules are wanting the color is black as follows: A faint, interrupted, black, mid-dorsal line; and an irregular, elongate, blackish spot, obliquely-placed on either side of each of the principle segments; about six such spots on each side of the body running from near the mid-dorsal line obliquely laterad and caudad to the lateral margin. Sometimes these black blotches are so large as to give the larvae a prominent, V-shaped, banded appearance, the apex of the Vs directed cephalad on the middle line.

Growth is rapid, the young larvae apparently reaching full size within ten days of hatching. They are quite active and voracious during this time, moving about over the willow twigs tirelessly if the aphids are scarce.

However the full-sized larvae are exceedingly sluggish and apparently pass thru a pre-pupal period, from a week to several weeks, during which there is little or no feeding or motion.

The larvae were found on the under side of the leaves of wild cherry, poplar and dogwood, but on willow almost exclusively on the young twigs, their location being determined of course by the position of the aphids attacked. They appear to be quite rare during the first half of the season but occurred in abundance during August, 1916 on willow.

It seems likely that this may be the species referred to by C. W. Johnson in Psyche Vol. XIII, p. 3, Feb., 1906, as follows:

"Figure 7 represents a larva found by Mr. Owen Bryant at Cohasset, during the latter part of September, among some "woolly" aphids on the wild lettuce (*Lactuca elongata*). The larva was very flat, about 7 mm., in length, slightly roughened, and of a dull yellowish color. It evidently belongs to the Syrphidae. I did not succeed in getting it to pupate."

Puparium (Fig. 8, I, J). Length 6.6 to 7.75 mm., average 7 mm.; including the posterior respiratory organ, 7 mm. to 8.2 mm., average 7.6 mm. Width 3.5 to 4.1 mm., average 3.87mm. Height 2.3 to 3 mm., average 2.75 mm. In outline elongate oval with nearly parallel sides, the margins prominently serrated with the somewhat shrunken lateral processes of the larva, slightly widest a little caudad of the middle. Similar to the larva but the anterior end somewhat narrowed and considerably inflated dorsad.

It is noticed that the anterior end of the larva is but little retracted caudad on the ventral line; the larval mouth-parts remaining near the anterior pole of the puparium.

As seen from the side the anterior face is a little less than perpendicular rounding dorso-caudad to reach the greatest height about the anterior third. The dorsal line continues convex to a little beyond mid-length whence it is usually more or less concave to the tip. The ventral line is gently concave in the anterior two-thirds, thence straight or convex. As seen from in front, the outline is considerably flattened on the ventral side.

Color and pattern at first similar to that of the larva but soon loosing the warm tan or vinaceous and becoming a colder, dull clay color. The pupal envelope becomes marked with six or seven prominent transverse blackish bands not reaching the side margins, expanding a little on the middle line and irregularly prolonged backwards, hooklike, at their outer ends. The anterior ones are broader, the posterior ones narrower,—without the lateral expansions, and stopping much short of the lateral margins.

Adult (Fig. 12, K). The specimens so far reared from these larvae are all females. Of the described species they fit most nearly the *Xanthogramma divisa*[1], of Williston though in some respects they agree rather better with *X. felix* O. S. If these should prove synonymous, as Williston thought possible, the species would take the older name *felix*.

I quote Williston's description with emendations to apply to the specimens reared:

"♀. Length 9 to 11mm. Face and cheeks yellow or reddish yellow" with an opalescent reflection. "Face nearly perpendicular, gently concave below the antennae, and with a large obtuse tubercle below," from which the face retreats, being not at all produced again to the upper mouth edge. Labellae yellow. "Front above metallic greenish black, continued as a broad stripe to the base of the antennae," (the stripe occupies only about one-third the width of the front) "somewhat expanded below; on the sides yellow. Antennae black; somewhat reddish below on the sides of the second, and of the third joint near the base." The yellow is more extensive in my specimens, occupying much of the first and second joints and a large area on the under side of the third. "Dorsum of thorax deep metallic green with rather ill-defined yellow lateral stripes. Pleurae with a large ill-defined spot. Scutellum a somewhat translucent yellow, its base" very "narrowly black."

Abdomen opaque black; first segment broadly yellow on the sides encroaching minutely on the anterior corners of the second segment.

"Second segment with an oval spot on each side," two-and-a-half to three times as long as broad, the outer end cut off parallel with and "not reaching the lateral margin, somewhat attenuated toward the inner end." The spots separated by two-thirds their maximum width, or about ⅓ mm. "Third and fourth segments with large rectangular spots" a little longer than those on the second segment and the posterior lateral and median corners both somewhat rounded off, these spots separated by a third to a

[1]Proc. Am. Phil. Soc., XX, 311.

half their width (those on the third segment are from 0.15 to 0.22 mm. apart, those on the fourth 0.23 to 0.27 mm.) "and not quite reaching the lateral margin." The anterior lateral corners of these segments are narrowly yellow, the posterior margin of the third narrowly so in the middle and of the fourth more broadly. Fifth segment with an arcuate black band reaching the anterior margin in the middle, leaving the posterior margin, more broadly in the middle, and the anterior corners yellow, which latter make with the yellow of the preceding segment an arcuate yellow band attenuated in the middle. Venter yellow except for small black patches at the posterior corners of the principle segments. Legs rather more yellowish than in Williston's specimens, the anterior and middle pairs being entirely yellow, the hind ones infuscated somewhat on the middle of the femur and from the basal third of the tibia outward. "Wings hyaline, with a slight smoky tinge; stigma yellowish."

In all my specimens the abdomen reaches its greatest width at the tip of the second segment, which Williston states is characteristic of his specimen of *felix,* but the yellow spots of the abdomen are much too widely and distinctly separated to fit Osten Sacken's description of *felix.*

No adults have been taken in the field except the two females mentioned above which were captured about aphid colonies. However I have an Ohio specimen which agrees with the Maine specimens in detail.

SYRPHUS ORONOENSIS n. sp.

Larva (Fig. 10, A). Length about 11 mm., width 2.5 to 3.5 mm., height 1.5 to 2.5 mm. In outline the larva may be described as very elongate, subtriangular; somewhat more flattened than the ordinary aphidophagous larva, being sub-triangular in cross-section. The lateral margins are serrated and the posterior end convex rather than truncate.

Conspicuously colored, the posterior two-thirds or three-fifths of the body being chalky white, except along the margins; the anterior third or two-fifths as well as the entire lateral margins and the terminal segments, bright tan, maroon, or even quite black, depending on the stage of development of the larva. This sharp contrast of colors gives to the larva an appearance quite suggestive of bird-droppings especially when found curled about small twigs.

A more detailed examination of the color and pattern, which appears to vary only in details, shows that the anterior segments of the body vary from dark greenish gray to black as a ground color, with a median narrow stripe of white in segments four, five and six, and more or less extensive mottling with clusters of globular adipose bodies which vary from tan to dark maroon, the lighter colors prevailing on the younger larvae. The darker colors which occupy all except the narrow, mid-dorsal line throughout the first six segments, become restricted to progressively narrower and narrower lateral margins throughout segments 7 to 11, but again occupy the entire dorsum in segment 12.

The chalky-white median line of adipose tissue, which is scarcely a third of a millimeter wide throughout the anterior segments, *ends abruptly between segments 6 and 7 where the body is always quite blackish in larvae of all stages. On the anterior part of segment 7, the white adipose mass begins again, quite as abruptly,* with two U-shaped loops opening caudad, and separated by the black heart-line; the white mass occupying perhaps a third or fourth of the body width in segments 7 and 8. In segments 9 to 11, inclusive, the white masses expand in laterally-directed, angular wings to occupy four-fifths or more of the width. The large mass is not uniformly white, but is interrupted in each segment from 9 to 11 by the pulsating black heart-line and at the sides of this by large irregular pockets and smaller areas of greenish gray where the body fluids are unobscured by the globular masses of white. In very young larvae, the whole mass above described as white may be more or less tinged with tan. The venter is maroon to black, the margins whitish.

The transparent integument is uniformly papillose but without integumental vestiture. The segmental spines are small, light in color, and only moderately elevated, 0.045 to 0.075 mm. long, of two sub-equal, sub-cylindrical segments, the basal one 0.025 to 0.03 mm. in diameter, the distal one half as broad. The body wrinkles are moderately prominent. The posterior respiratory organ (Fig. 10, D, E) is very characteristic, being considerably longer than in the described members of this genus. *About two-thirds the distance from the base is a prominent constriction,* the tube being much depressed and somewhat compressed at this point. The basal two-thirds is very rugose with rounded papillae and dark maroon or black in color, while beyond the constriction the tube is smoother, polished and light brown in color. The entire respiratory organ measured as follows: length 0.702, 0.756, 0.756, 0.878, 0.918, 0.922 mm., the average 0.822 mm.; width at base 0.41 to 0.54 mm., the average 0.485 mm.; width at tip 0.325 to 0.35 mm., the average 0.334 mm.; height at base 0.35 to 0.43 mm., the average 0.54 mm.; height at tip 0.164 to 0.189 mm., the average 0.173 mm.

The stigmal plates are somewhat divergent at the tip with a noticeable emargination between them, the slit-like spiracles only moderately elevated and short measuring 0.055 to 0.06 mm. in length by about 0.02 mm. wide.

The rugose, black, dorsal spiracular spine is rather prominent, elongate dorso-ventrad, somewhat crescent shaped and bending laterad somewhat over the circular plate. The latter is very inconspicuous and appears to be elongate dorso-ventrad and narrower at the ventral end, rather than round. In each inter-spiracular space is a slight ridge with a single, tiny, whitish hair about 0.015 to 0.02 mm. long arising from a minute circular crater.

These larvae are aphidophagous, having been taken first in early July, 1916 at Orono on a willow infested with *Pterocomma smithiae* (Monell). In captivity one pupated July 28, the adult emerging August 6. Another pupated a few days later and on August 12 a puparium was found in the field, glued to a small twig of willow near an infestation of this aphid; this specimen

emerged August 13. Full grown larvae were again found on August 27 among the same species of aphid.

In 1917, on June 29, Mr. R. K. Fletcher and the writer found a number of larvae among *Myzus cerasi* (Fab.) on cultivated cherry and among *Phorodon humuli* (Schrank) and *Rhopalosiphum nympheae* (Linné) on cultivated plum. These varied from larvae but recently hatched to full grown, all of which showed the characteristic pattern described above, the younger larvae however being lighter in color. Pupation of these larvae began July 8th. The type female emerged August 2 from a puparium formed July 24.

There thus appears to be at least two generations of this species annually, one occurring as larvae chiefly during June, the other occurring in the larval stage chiefly during August. A one-fourth grown larva was taken among *Myzus cerasi* (Fab.) on July 14, indicating that the generations are somewhat irregular.

The larva does not appear to be much restricted in its choice of food, the known hosts representing four different genera.

It is a species offering considerable possibilities in the control of aphids affecting the stone fruits and its ability to live on aphids of other hosts is at least an advantage in the maintenance of the species.

The larvae are to be found on the under, infested, side of the leaves of the trees mentioned and also on the smaller twigs. With the green of the leaf as a background or when removed from their natural surroundings, their colors make them quite conspicuous. But when surrounded thickly by aphids or, more especially, when wound around a small infested twig they are quite inconspicuous. When I first found the larva on an uninfested twig, in which situation they appear to pupate, I was strongly impressed with its resemblance to the droppings from a bird.

Puparium (Fig. 10, B). Length about 7 mm., exclusive of the posterior respiratory organ which may project half a millimeter farther or be directed more dorsad. Maximum width 3.25 mm., maximum height 2.75 mm. The anterior half is irregularly globose, the puparium somewhat suddenly depressed about mid-length, the posterior half remaining flattened much as in the larva. It is interesting to note that this depression, or lack of inflation, begins at the point on the seventh larval segment where the white adipose mass gives way to the black area of segment six. The pu-

parium is widest about 2 mm. caudad of the anterior extremity, or in the region of the fifth and sixth larval segments which are of about equal width in the puparium. Anterior to this point the outline from above is unevenly rounded. Cephalad of the fifth segment the puparium narrows noticeably to a width of 2.25 mm. in half that length and in front of this constriction the outline is semicircular. Caudad of the sixth segment, or widest point, is a similar constriction to a width of about 2.25 mm. at the beginning of the eight larval segment. From this point the body is more regularly attenuated; and the puparium, inflated a little at each segment, narrows to a width of 1.25 to 1.75 mm. at about half a millimeter from the posterior end. Thence it is rapidly attenuated to the respiratory organ, if this is terminal, or is more nearly truncate if the respiratory organ is directed dorsad. As seen from the side the ventral line beginning with the region of the larval mouthparts is at first gently convex downward, then more or less strongly concave to a point well caudad of the middle, thence again convex to the posterior end. The dorsal line is strongly and evenly convex dorsad and caudad to about the region of the seventh larval segment, about three millimeters caudad of the anterior end. It is then abruptly depressed or concave throughout segments seven to nine and finally gently convex to the posterior end. The shape as seen from in front is a short oval with the long axis transversely and spherical angles at the sides. The posterior half of the body retains the shape of the larva to an unusual degree and is sub-triangular except that in some specimens the lateral margins show moderate dorsal carinae.

The predominating color of the puparium is maroon to black, extensively mottled with patches of white and of pinkish brown. The dark mid-dorsal line of the larva is evident over the posterior half of the puparium, and is bordered with more or less extensive irregular masses of the white adipose tissue of the larva. In the region of larval segment six is usually a large dark area, while in front of this the color is quite dark, overlaid with irregular areas of lighter color. The posterior end of the puparium, including the base of the respiratory organ is almost black, the distal end of the latter brown.

Syrphus oronoensis n. sp.

Adult (Fig. 10, C). ♂. A small species, the abdomen with nearly parallel sides, the three principle segments opaque black and each with a pair of yellow sub-triangular spots, the first pair small and far apart, the others larger and more approximate.

Length about 8 or 9 mm. Head large, broader than the thorax or abdomen. Eyes bare. Frontal triangle somewhat swollen, bronze black, shining, with rather long black pile which continues somewhat thickly down the sides of the face to the mouth edge. Vertical triangle with long black pile. Face below the antennae at first convex then very slightly concave to the tubercle which is not prominent; mouth edge retreating, cheeks convex below. Face opalescent yellow, thinly whitish pollinose on the

sides, the yellow encroaching somewhat on the frons at the sides. No black stripe over the tubercle but the cheeks in front and narrowly margining the anterior mouth edge, metallic black; behind and across behind the mouth thickly whitish pollinose like the posterior orbits. Antennae chiefly reddish yellow but, in one specimen, considerably darkened on upper part of second and upper half and tip of third segment; short, the third segment considerably broader than its length beyond the tip of second segment; arista two-and-a-half times this length, black.

Mesonotum brilliant shining black, lateral stripes obscurely yellow and with the sides of the thorax pollinose; pile rather long, dusky white.

Scutellum opalescent yellow like the face, the extreme base and corners blackened; pile long, whitish yellow.

Abdomen narrow, with nearly parallel sides, a little widest near the middle of the third segment. The first, fifth and following segments shining metallic; elsewhere opaque black. The second segment with a pair of small, sub-triangular spots about mid-length, separated by a little more than half the length of this segment and distinctly separated from the lateral margins. Third and fourth segments each with a pair of larger, sub-triangular spots situated near, but distinct from, the anterior margin as well as from the lateral margins; at their widest point occupying nearly half the length of the segment; separated by a fourth or fifth the length of their respective segments. Pile of the abdomen abundant, whitish, very long at the base and decreasing regularly in length toward the genitalia. Length of wing 7 mm., exceeding the tip of the abdomen; most of the sub-costal cell infuscated; veins black, anterior cross-vein quite perpendicular. The fore and middle legs chiefly dull yellow, base of femora, coxae and trochanters infuscated; the hind pair chiefly brownish, lighter about the knees, the femora with rather abundant long delicate dusky pile. Squamae, plumulae and halteres whitish, the latter somewhat infuscated.

♀. Eyes bare, face without a black stripe; mesonotum with yellow lateral margins, scutellum with base and anterior corners very narrowly black. Abdominal segments 2 to 5, inclusive, with brilliant, shining, steel-blue bands on the anterior part which are largely occupied by yellow, sub-triangular spots, of which there are four pairs, going over the side margins in their full width but distinctly separated from each other; elsewhere opaque black.

Vertex deep blue-black, shining, continued as a broad, more coppery stripe, evenly of about half the width of the frons, almost to the antennae. The sides of the frons nearly to the vertex, the entire face, cheeks and occiput pale yellow. The sides of the pale frontal stripes, the face (except a pale yellow oval area on the tubercle and the jowls) and the occiput thickly covered with silvery white pollen and with delicate white pile. Pile of vertex and frons black.

Mesonotum brilliant metallic bronze, the lateral margins yellow from the humeri almost to the scutellum, as far as the suture the yellow obscured with white pollen. Pleurae whitish pollinose and with moderately abundant white pile. Scutellum golden yellow, the extreme base and corners

black. Pile of the mesonotum dusky, that of the scutellum short, sparse, yellow and black mixed.

First abdominal segment metallic, blue-black the antero-lateral margins broadly yellow. Second segment with an anterior, opaque, black band much attenuated toward, but reaching the extreme lateral margins; at the middle occupying about one-fourth the length of the segment; joining at the middle to a similar opaque band occupying the posterior three-fifths of the segment. Between these two bands an interrupted, metallic, steel-blue band, most of which is occupied with a yellow spot on each side, attenuated mesad and strongly bent forward about the lateral third, not reaching the anterior margin. Third segment with an entire steel-blue anterior cross-band occupying one-third the length of the segment and underlaid with a pair of sub-triangular, yellow spots, which reach the lateral margins in their full width but are distinctly, though narrowly separated from the anterior margin except at the extreme corners. The two spots are separated from each other by more than half their maximum width. Posterior three-fifths of the segment opaque black. Fourth segment similar. Fifth similar to third and fourth except that the posterior band is proportionately narrower and less opaque and the yellow spots only about half as long, reaching the anterior margin on their outer part and even encroaching minutely on the preceding segment. Remaining segments shining blue-black. Venter with a broad, black band on each of the principal segments . Pubescence at base of abdomen moderately long, delicate, whitish; elsewhere short, sparse, colored like the integument.

Fore and middle legs pale yellow except slight infuscation on basal half of femora and at tip of tibiae; hind femur black except broad base and tip, the tibia infuscated on outer part and the hind tarsi much so. Pile of legs whitish. Length 7 mm.

This species approaches the genus *Xanthogramma* but the indistinctness of the yellow on the thoracic margins and pleurae, and especially the slender abdomen with long pile at the base are sufficient to place it in *Syrphus*.

The *types* are in the author's collection. *Cotypes* in the collection of the Maine Agricultural Experiment Station. It should be stated that in these reared specimens the abdomens upon drying have shrunken and curled under so as to present a very different appearance (See Fig. 10, H) from that of the fresh specimens from which Figure 10, C and the description were taken.

PLATYCHIRUS PERPALLIDUS Verrall.

This British species described by Verrall in 1901, and not hitherto recorded from America, has probably been confused with *P. quadratus* Say, to which it is closely allied. The two species may be distinguished as follows:

P. quadratus Say. ♂	*P. perpallidus* Verrall. ♂
Front tibia on the inner side slightly but distinctly concave.	Front tibia on the inner side hardly at all concave or quite straight.
Middle femur with a cluster of long dense pubescence at the base.	*Middle femur entirely without a basal cluster of pubescence.*
The tip of middle femur with a somewhat denser clump of slightly finer hairs.	The tip of middle femur with fewer but heavier hairs.
Middle tibia more flattened and broader; and the first segment of the tarsus somewhat flattened.	Middle tibia less flattened and the first segment of middle tarsus entirely cylindrical.
Last two joints of hind tarsus black; the tip of the front tibia behind is indefinitely infuscated, the only black markings appearing as three or four broken transverse hair lines.	Last two joints of hind tarsus somewhat less blackened and the tip of the front tibia behind with a more distinct black spot.
Abdomen with a distinct median longitudinal black stripe .11 mm. to .17 mm. wide; i. e. roughly one-tenth to one-twelfth the width of the segment thruout segments two to four inclusive; *and a distinct, posterior black crossband of about equal width on each of these segments,* which occupies from one-sixth to one-ninth the length of the segment.	*Abdomen much less distinctly marked with black;* except the first segment and a median anterior triangle on the second segment, *nearly pure orange yellow, the black mid-dorsal line* on segments two to four *nearly or entirely obsolete and the hind margins of these segments very narrowly and inconspicuously black.* The yellow abdomen contrasts strikingly with the brilliant black thorax in a manner suggestive of *Pyrophaena* spp.

The females, as in this entire genus, are distinguished with difficulty. The specimens at hand have the median black line and the black crossbands narrower than in *quadratus*, the abdominal markings more yellow and less reddish than in *quadratus* and the fifth segment with the yellow not interrupted by the median black line and not excised with black behind.

A female of *Platychirus perpallidus,* taken about wild mustard and pea vine on August 3, 1916, deposited about 100 eggs in the laboratory August 4 and 5, which began hatching on August 7; the egg stage occupying about three days. The larvae were fed on *Aphis cornifoliae* Fitch which they took in preference to certain other species offered. They appeared to be full grown by August 21, but did not begin pupation until August 28.

This species was of particular interest because the genus seems not to have been definitely recorded as aphidophagous in the larval stage, although Professor J. W. Folsom[1] suspected from the presence of the adults of *P. quadratus* Say about clover aphids that they might have developed on them.

According to Verrall[2], *P. scutatus,* an European species of the genus, "is said to have been bred from rotten fungi."

I have recently taken males and females of *P. scutatus,* at Orono, about spirea infested with *Aphis spireacola.* The females oviposited in the laboratory and the larvae from these eggs are at the present writing feeding contentedly on these aphids. So that it may be doubted if the larvae of this species developed on rotten fungi.

Egg (Fig. 11, A). The length of a dozen eggs measured, ranged from 1.025 mm. to 1.085 mm., with an average of 1.046 mm.; the maximum width varied from 0.232 mm. to 0.256 mm. with an average of 0.244 mm. *An unusually elongate, straight-sided egg, almost cylindrical and more than four times as long as its greatest diameter,* instead of about three times, as is usual in this group. The sculpturing of the chorion is similar to that of such species as *Syrphus americana, Sphaerophoria cylindrica, Allograpta obliqua,* and others, consisting of irregular elevated bodies surrounded by irregularly radiating elevated arms. There are about forty such elevated bodies the length of the egg, each measuring from 0.025 mm. to 0.045 mm. in length and each surrounded by from 15 to 20 short, thick arms.

In captivity the female deposited the eggs in a somewhat characteristic manner, to some extent similar to that of *Melanostoma mellinum,*[3] three or four being ranked side by side; but also with a strong tendency to place the eggs end to end. As many as four were so placed in a line with the ends contiguous, suggesting very much in their arrangement a string of sausages. (See Fig. 11, A). Whether this same habit prevails in the field I am unable to say.

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[1]Univ. Ill. Agr. Exp. Sta. Bul. 134, 1909.

[2]British Flies, Vol. VIII, p. 263.

[3]Me. Agr. Exp. Sta. Bul. 253, p. 228.

Larva (Fig. 11, C). Length 10 to 11 mm., width at middle 1.75 to 2 mm., height about 1 mm. An elongate, slender-bodied, nearly parallel-sided larva more than five times as long as broad, with moderate transverse wrinkling and gently, irregularly-serrated margins. The color is a beautiful bright tan; the mid-dorsal blood-vessel forms a continuously black line throughout most of the length and is margined on each side with a broad, whitish stripe of adipose tissue, giving off at the sides irregular, slender, curved tongues of similar color which together form another, indefinite, narrow, irregularly curved and broken stripe of white. A third pair of whitish stripes, slender, broken and irregular, lie close to the lateral margins. The integument is finely and evenly papillose but is devoid of integumental vestiture. The segmental spines are light, concolorous and small,—of two segments, the basal one about 0.015 mm. long by 0.022 mm. broad, truncate-cone-shaped, the distal one 0.007 mm. in diameter and about 0.03 mm. long, tapering slightly but blunt at the tip. The anterior larval spiracles (Fig. 11, B) show five minute denticles arranged in a semicircle.

The stigmal plates (Fig. 11, H) are almost sessile, the respiratory tubes which bear them being about 0.18 mm. long by about 0.25 mm. in width by about 0.12 mm. in height. The circular plates or buttons are quite distinct and circular, 0.04 mm. in diameter, and each slit-like spiracle about 0.0375 mm. in length by about 0.0075 mm. in width, but its sides lined with a row of separate minute, rounded denticles which increase the apparent width to 0.015 mm. There are ten to a dozen such denticles along each side of each spiracle. I find no trace of interspiracular ornamentation except a very small rounded nodule, the surface of the stigmal plate appearing quite smooth except for the spiracles. The end of the respiratory organ is decidedly emarginated between the two stigmal plates and the plates turned outward giving the tubes the appearance of being somewhat divergent at their tips.

Puparium (Fig. 11, I, J,). Length 5.5 mm., maximum width 1.85 mm., maximum height 1.75 mm. The colors of the larvae are at first carried over into the pupa stage but are gradually transformed to a more uniform reddish brown although the black and white stripes of the mid-dorsum persist for a longer time. The integument becomes fairly smooth, much indurated and glazed.

The puparium is moderately inflated, globose in front, broadest about the anterior third thence somewhat irregularly and gradually attenuated to the posterior end. In side view (Fig. 11, I) the ventral line is seen to be gently convex, the dorsal line arising nearly perpendicularly from it, but soon rounding away to its maximum height about the anterior third. Thence it descends with a moderate hump over the posterior third to the posterior respiratory organ which is terminal.

Adult (Fig. 11, D, E, F, G). I quote in full Verrall's original description:[1]

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[1]British Flies, Vol. VIII, pp. 290-292.

"*P. perpallidus* n. sp. Face scarcely at all produced; front tibiae of the male gradually dilating from base to tip, front femora with moderate pale pubescence behind; abdomen and legs nearly all orange in both sexes.

"♂. Face and frons obscured by yellowish grey dust, which leaves only the central knob, the front mouth-edge, and the space above the antennae shining black; the hairs on the face are fairly abundant, rather short and mostly pale, but on the frons they are longer and partly black; the space before the jowls is blackish; the jowls themselves and the back of the head are yellowish grey, but more aenous towards the occiput; the pubescence on these is luteous, becoming longer on the upper part, and nearly all black on the raised shining aenous black vertex. Antennae entirely brownish black; arista dark orange to blackish, about as long as the antennae.

"Thorax and scutellum intensely shining aenous with rather abundant mostly equal tawny pubescence, which is however longer round the scutellum, and longer and more shaggy on the back part of the mesopleurae; there are a few black hairs about the lowest part of the sternopleurae.

"Abdomen all orange or tawny except at the black base which converges about the middle of the second segment to a narrow dorsal line which extends to the end of the fourth segment, while the hind-margins of the second, third, fourth, and fifth segments are very narrowly and inconspicuously blackish (but not quite so narrowly in the specimen from Kingussie). Pubescence nearly all yellow, and as usual longest about the basal corners; belly all orange. Genitalia small, mostly shining aeneous black.

"Legs all orange except on the black coxae and trochanters, while the hind tarsi are partly brownish on the moderately dilated basal joint and less distinctly so on the two last joints; the hind femora and tibiae bear a blackish ring about the middle in the specimen from Kingussie, and there are faint traces of such ring in the Sutton Park specimens. Front tibiae slowly and gradually dilated from soon after the base to the tip, which is the widest part; this tip is rather whitened and is a little obscured; the front tarsi are not so much widened as the tip of the tibiae and they very gradually diminish in width, being dilated even up to the tip; the basal joint is longer than the next two and more than twice as long as the second joint. The *pubescence behind the front femora* is moderate and is *all yellow* and inconspicuous, the long woolly white hair at the base behind being present as usual in this group; the front tibiae bear a slight fringe behind about the middle. Middle trochanters bearing some strong black bristles, while the middle femora bear a moderate pubescence which is nearly all yellow and amongst which are no small black bristles, but towards the front at the tip almost beneath are about five unusually long recurrent hairs, which form a peculiar distinctive character for this species; the tibiae are slightly dilated about the middle and bear a long dense fringe in front almost beneath and a slighter fringe behind; hind tibiae without any fringe; the tiny bristles on the legs are all yellow.

"Wings considerably brownish, but rather tawny about the base and the stigma. Squamae and their fringes brownish yellow. Halteres orange.

"♀. Rather similar, but even the hind tarsi are almost all orange being

only a little discolored above the base of the basal joint; the second, third, and fourth abdominal segments have black hind-margins which occupy about one-fifth of each segment, and the inner hind corners of the orange spots are more rounded than in the male, but less than in the female of *P. fulviventris*. Frons broad, being at the vertex about one-third the width of the head; it is shining blue-black there, but the side dust spots are so large as to leave only an indistinct middle line connecting to the indistinct shining black space above the antennae; the pubescence on the upper half of the frons is partly black.

"Length about 8 mm."

This species is much commoner in Maine than *P. quadratus,* being represented in the collections by about 50 males and an equal number of females. Especial abundance was noted at Orono the tenth and eleventh of August, 1915 and the thirteenth to the eighteenth of June, 1917. Other dates for Orono are July 31, Aug. 1, 6, 12, 15, 16, 19, and 25. Specimens were also taken at Fort Kent, July 5 and 6, Presque Isle, July 8, and Bar Harbor, July 25.

The adults are commonest in tall grass, seeming to show a preference for the proximity of open ditches where they hover about, alighting frequently on the grass blades or spikes, males as well as females teetering up and down with the abdomen as though about to oviposit. Examination of these sites has so far not revealed any other stage of the insect.

SYRPHUS KNABI Shannon.

(*Syrphus xanthostomus* Willist. of Metcalf in Ohio Nat., Vol. XIII, No. 5, pp. 81-83.)

In the Ohio Naturalist for March, 1913, I published a description of what was called the Pemphigus-Gall Syrphus-Fly, under the name of *Syrphus xanthostomus* Williston.

I was aware at the time that Williston's rather brief description did not fully cover the adults under observation, particularly in regard to the distinctly yellowish lateral margins of the thorax and the absence of the median, narrow, deep, emargination in the posterior margin of the second and third yellow abdominal bands. However as Williston's type was not examined, certain points of discrepancy were simply incorporated in the description of the adult and no new name created for the species discussed.

Mr. R. C. Shannon[1] has recognized and recently described this species as distinct from *xanthostomus,* under the name of *Syrphus knabi.* The Ohio specimens from Pemphigus galls agree quite closely with Shannon's description. The "Pemphigus-Gall Syrphus-Fly" therefore should be called *Syrphus knabi* and not *Syrphus xanthostomus. Syrphus knabi* has also been reared in Maine from the pseudo-galls formed of ash leaves by *Prociphilus fraxinifolii* Fitch. The galls of *Pemphigus oestlundi* Cockerell *(P. vagabundus* of authors) have never been recorded from Maine.

The metamorphoses of *Syrphus xanthostomus* Williston are also under observation at the present time; and, if there were any possible room for doubt as to the specific separation of these two species from examination of the adult alone, the immature stages and biology show them to be abundantly distinct.

These larvae were first taken in Maine on July 7, 1915, exactly the date on which, four years previously, they were found in the Pemphigus galls in Ohio. Additional specimens were collected July 16 and 21 and again on July 18, 1917. The larvae, at least when nearly full grown, are found in the rather tightly-curled parts of the leaves surrounded by numbers of empty skins of the aphids, an eloquent witness to their ravages during growth. In such situations they are only slightly less protected than in the Pemphigus galls.

The Pemphigus-gall larvae were described as follows:

"*Larva.* Length about 10 mm. (8 to 11.5), width 3.75 to 4 mm., height 2.5 to 3 mm. Fat, thick, grub-like, sluggish larvae, elongate oviform in outline, strongly arched dorsally (Fig. 12, B). Wrinkles prominent, produced laterally into an irregular, dorso-lateral carina; the ventral folds of the body in the principal segments serve as very imperfect prolegs. General color very pale, pinkish-yellow. Heart line not conspicuous. Skin bare, the segmental bristles short and light in color, very inconspicuous." About 0.07 mm. long, of the usual two segments, the basal one about 0.23 mm. in diameter by a little longer, the distal one less than half as broad at the base and accuminate.

"The jaws of the mouth-parts are unusually short, their width at base equal to their length, the lower jaw the heavier. Mouth-hooklets apparently three pairs: two near the jaws of which the ventral pair is the heavier, the third pair lateral in position, heaviest of all. There are a number of sensory papillae around the mouth-parts and antennae. The antennae are

[1]Proceedings of the Biological Society of Washington Vol. XXIX, p. 200, Sept. 22, 1916.

small, situated close together above the jaws, of the usual form (see Fig 12, A).

"The prothoracic spiracles are slightly elevated, blunt, short, horn-shaped as seen from the side (Fig. 12, A, g), the semi-circular slit apparently guarded by six, blunt teeth, one of the median ones emarginate or imperfectly divided (Fig. 12, C). The posterior respiratory appendage (Fig. 12, D, E) is" a little "longer than broad, testaceous brown, ringed about mid-length, thence slightly constricted. The spiracles (*a*) moderately long, somewhat elevated above the surface; the inter-spiracular spines (*b*) short" sharp ridge-like, "rather prominent. Dorsal spiracular spine (*c*) short compressed; its breadth about equal to diameter of the approximate circular plate (*d*).

"These larvae were found, full-grown, at Cedar Point, July 7, 1911. The larval stage continued indoors to July 11 and 12.

"They were collected on the Poplar or American Aspen (*Populus tremuloides Mx.*) in the well-known, characteristic galls on the ends of the twigs, made by the aphid, *Pemphigus" oestlundi* Cockerell.

The larvae taken from the Ash pseudo-galls, in correlation with the greater freedom of motion afforded them all during development, did not present such exceptional height and thickness. While unusually corpulent, they retained the typical *Syrphus* shape, as in *torvus* for example, and were less sluggish than those described above.

The length of the full grown larvae when extended exceeded 17 mm., their greatest width fully 4 mm. and their height about 2.5 mm. Cross-section semi-circular. The ground color of these larvae (the body fluids showing through the integument) is a dull ashy gray with areas of orange and black where viscera of these colors showed faintly. The ashy gray is overlaid extensively with ashy white adipose masses in the usual position; beginning at the anterior end with a narrow, mid-dorsal line which widens wedge-shaped caudad until in the posterior half of the body it occupies most of the width of the body. It is interrupted at each segment by a prominent emargination at each side and by an elongate, pulsating area on the middle line. The posterior respiratory organ is a warm brown in contrast with the whitish body.

While the respiratory tube is not elongate, the stigmal plates are noticeably more elevated than in *Syrphus torvus, ribesii,* etc. *The respiratory organ in knabi is at least as long as its width at the tip; in that of torvus the length does not exceed two-thirds the width.* The length of the tube is from 0.53 to 0.61 mm., its width from 0.49 to 0.57 mm., with an average of 0.525 mm. and its height 0.31 to 0.335 mm., average 0.325 mm. The transverse diameter of the circular plate is about 0.06 mm. its dorso-ventral diameter about 0.09 mm.; the inner margins of the two about 0.129 mm. distant. The median spiracle measures about 0.16 mm. in a straight line, its width about 0.012 mm.

The surface of the respiratory tube is only indistinctly and irregularly papillose, polished; with shallow grooves along the median line, dorsad

and ventrad, which meet across the tip in a moderate emargination between the two stigmal plates which are only a very little divergent.

The slit-like spiracles are a little elevated on carinae, are almost exactly straight in surface view, and about equi-distant and equally divergent from each other.

The interspiracular ornamentation consists of short, sharp, elevated irregular ridges, or carinae, (instead of nodules), much more elevated than the spiracles; hardly at all continued down the sides of the tube; pale brown in the larva, black during the pupal stage.

Puparium (Fig. 12, F, G). Average length 7.2 mm., height 3.5 mm., width 3.8 mm.

"These puparia (Fig. 12, G) are exceptionally inflated dorsally, the ratio of height to length being greater than in any of the other species I have examined. It is characteristic of them also that the posterior inflation is equal to, or greater than, that anteriorly; in outline, as seen from the side, the dorsal half of the puparium makes an almost perfect semi-circle," reaching its greatest height a little in front of the middle. "The ventral line is sinuate. The respiratory appendage (*a*) projects from the lower posterior part. From above, the outline is sub-ovoid, broadest in front of the middle, thence narrowing gradually to the posterior third; whence the puparium is strongly and unevenly compressed to the tip of the respiratory appendage.

"Color at first grayish brown, sometimes marked with oblique patches of black; posterior breathing appendage darker. As the pupa approaches metamorphosis the anterior end darkens to deep reddish-brown in the region of the eyes; while on the posterior half, the three principal, yellow abdominal bands of the adult become visible through the transparent wall." Color of the empty puparium light testaceous brown.

"The segmental spines remain, as in the larva, very inconspicuous. The posterior breathing appendage also retains its characteristics."

The larvae from Ash developed as follows:

One pupated	July 16th,		
One "	July 19th,	emerged	July 30.
Two "	July 20th,	"	July 30.
Three "	July 24th,	"	Aug. 1.

The duration in this stage under laboratory conditions was therefore from eight to eleven days. The pupation record for the Ohio specimens was seven to eight days.

Adult (Fig. 12, H, I). Shannon's description is as follows:

"Squamae with rather long, light yellow pile; ground color of the sides of thorax bright yellow, with yellow pile; bands on the third and fourth abdominal segments entire and extending over the margins almost in their full width.

"Male: Frons yellow with bluish green reflection, a black spot above each antenna, and with fine rather long, black hairs which continue a short distance down between the antennae and eyes. First two antennal joints reddish-brown, the third joint darker, reddish beneath and some-

what pointed apically (See Fig. 12, J); arista brownish, a little longer than antenna. Face and cheeks yellow and with light pile. Mesonotum greenish aeneous with two obvious median stripes and bright yellow sides clothed with light golden pile; pleurae a somewhat lighter yellow than the lateral stripes of dorsum, and with golden pile; scutellum yellow with a greenish sheen and with black pile, the sides with yellow pile. Band on the second abdominal segment interrupted and outwardly produced forward where it extends over the sides and up onto the sides of the first segment. The bands on the third and fourth segments run straight across, extending over the sides in almost their full width. Fore coxae and trochanters cinereous, the hind trochanters yellowish, front and middle legs entirely yellow; hind pair yellow, the femora with dark band beyond the middle, yellow posteriorly; hind tibiae darkened on outer side of apical half and clothed with black pile; last four tarsal joints darkened. Length about 11.5 mm.; wing about 11 mm.

"Female: Width of frons at vertex about equal to length of third antennal joint, but widening quite rapidly down to the antennae. Frons yellow, brightly so for about one-fourth its extent above antennae above this a region with a greenish-black reflection which has an ill-defined triangular mark; the last section, which includes the ocelli, is nearly as long as broad and is shining black; a black spot above each antenna.

"This species.....has been confused with *ribesii, grossulariae, and xanthostomus.* It differs from *ribesii* and *rectus* in its bright yellow mesonotal side margins; apically pointed third antennal joint; bases of femora in male yellow, and second and third yellow bands of abdomen but little narrowed laterally.....the small bristles on the under side of the middle tarsi yellow instead of black."

EXPLANATION OF FIGURE 8.

Immature stages of *Xanthogramma divisa* Willist.

A. Eggs of *Xanthogramma divisa*, the two above in dorsal view, the one below in side view, X 40.

B. Characteristic sculpturing of the shell of the egg as it appears at a magnification of 300 diameters.

C. Dorsal view of larva just after hatching, X 50.

D. View of full-grown larva from the caudal aspect, X 8, to show its unusual flatness.

E. End view of the posterior respiratory organ of the larva, X 115, showing circular plates, slit-like spiracles, and the irregularly-rugose inter-spiracular ridges.

F. Dorsal view of the larva, X 5, to show color pattern.

G. Dorsal view of the posterior respiratory organ, X 40.

H. A part of the marginal serrations of the larva more enlarged, showing the three large and one smaller serration occurring to each segment and the minute, integumental papillae.

I. Dorsal view of the puparium, X 8, showing shape and color markings.

J. Outline drawing of the puparium, X 8, showing shape from the side.

For other figures of *Xanthogramma divisa,* see 9 and 12 K.

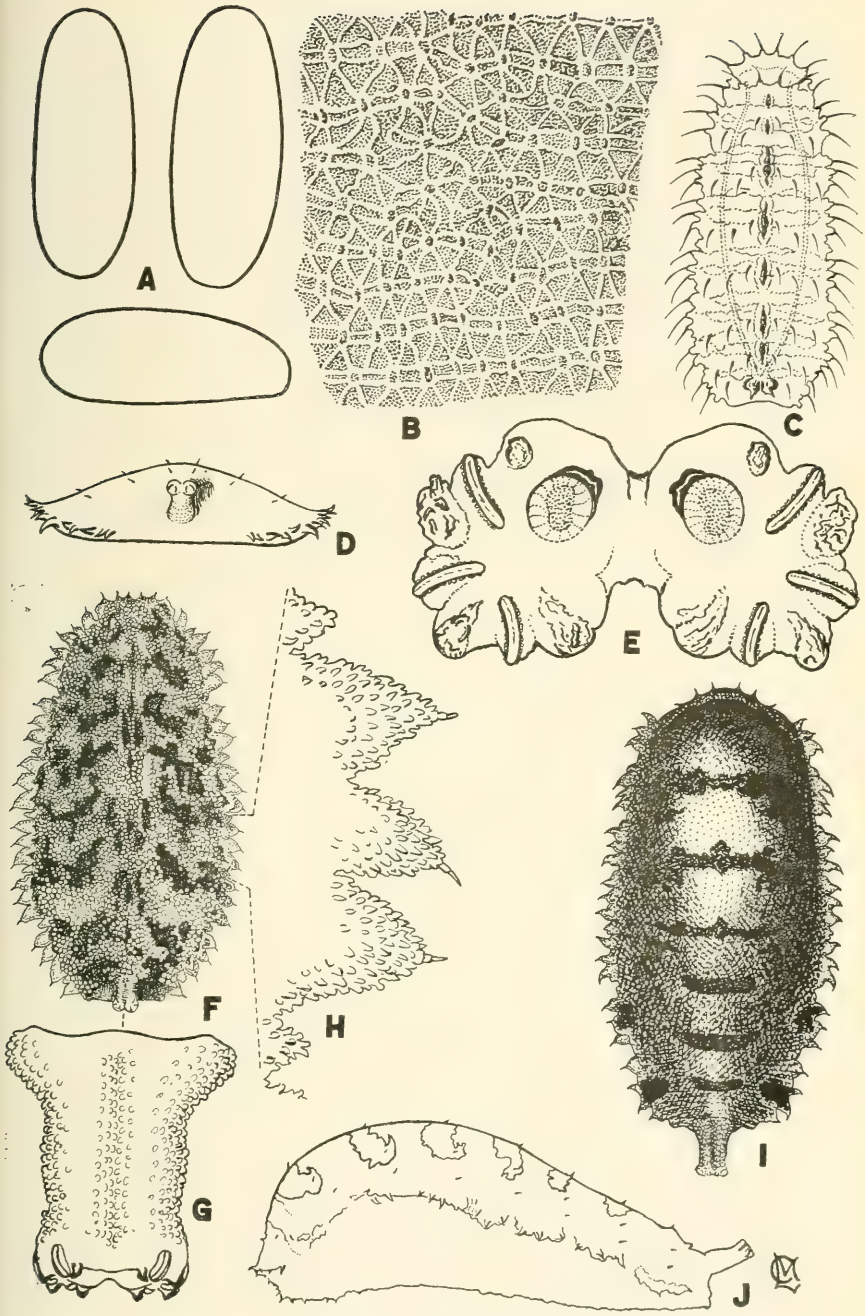

Figure 8. Immature stages of *Xanthogramma divisa*.

EXPLANATION OF FIGURE 9.

Life stages of *Xanthogramma divisa* Willist.

From photographs by R. L. Hammond; enlarged two diameters.

A. Larvae taken under loose bark of a willow tree in Autumn.

B. Puparia; the three above, found under loose bark and on the ground under the same tree in June. The one above the letter B shows an emergence hole from which 26 parasites (species undetermined) issued July 8. The one immediately below the letter B is an empty puparium from which the adult has emerged. The larval mouthparts may be seen as an anterior, ventral, black V.

C. Adult females reared from the larvae.

See also figures 8 and 12, K.

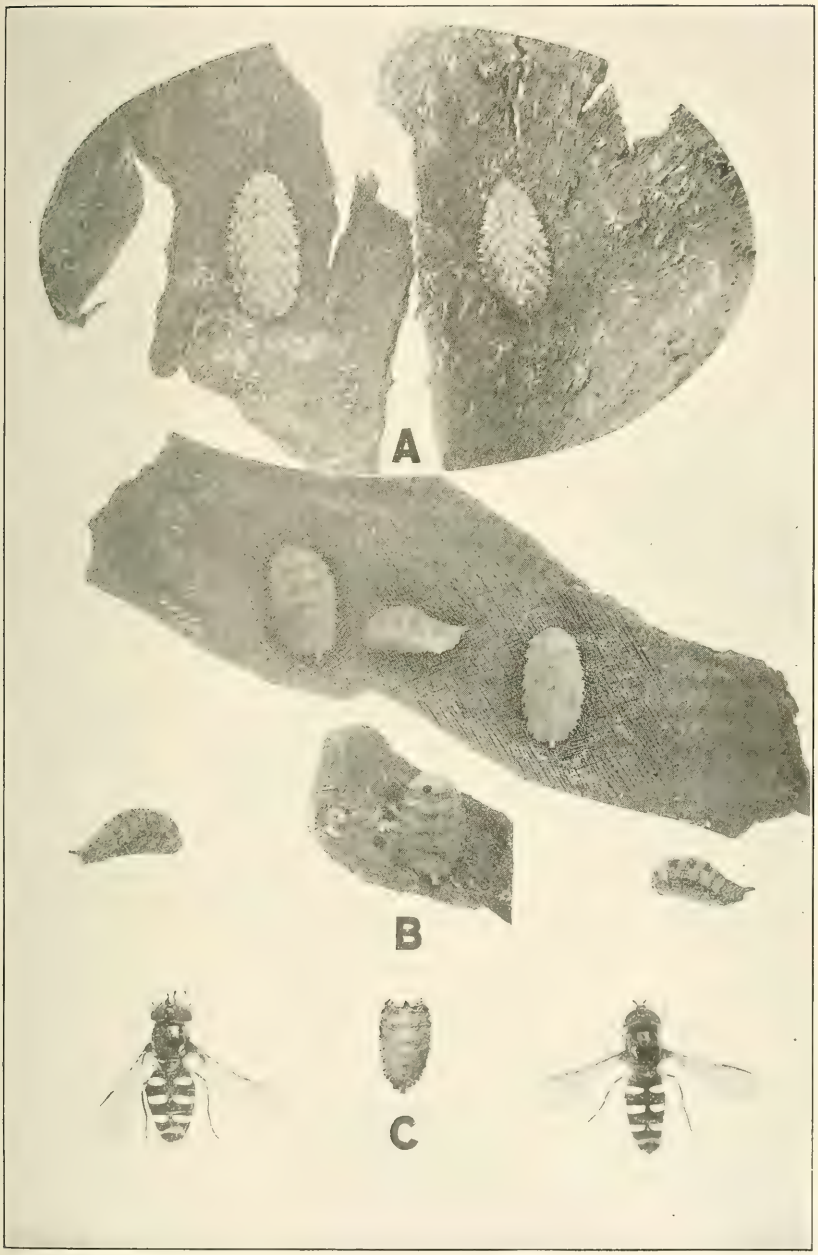

Figure 9. Life stages of *Xanthogramma divisa*.

EXPLANATION OF FIGURE 10.

Life stages of *Syrphus oronoensis* n. sp.

A. Dorsal view of larva to show color pattern; X 7.

B. Dorsal view of the puparium, X 8, showing shape and color pattern.

C. Adult male, X 9 (legs and right wing omitted). The abdomen is here shown as it appears during life (cf. fig. 10, H).

D. Posterior respiratory organ of the larva, dorsal view, X 40.

E. Posterior respiratory organ from the side, X 40. Note the characteristic constriction two-thirds the way from the base.

F. End view of the posterior respiratory organ X 170, showing median dorsal spiracular ridge, the irregular shape of the button or circular plate, the slit-like spiracles, and the minute inter-spiracular spines.

G. Puparium from the side, X 8.

H. Abdomen of the type male, X 6, as it appears after drying and shrinking.

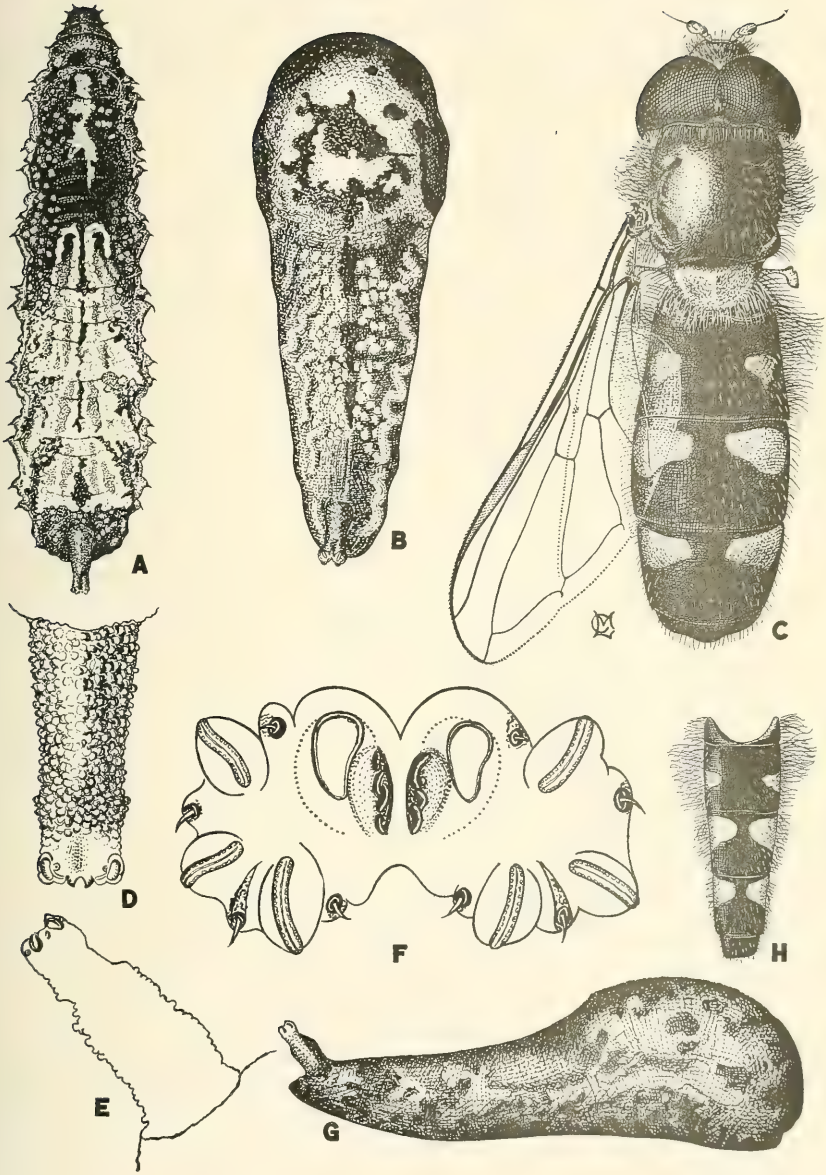

Figure 10. Life stages of *Syrphus oronocnsis*.

EXPLANATION OF FIGURE 11.

Life-stages of *Platychirus perpallidus* Verrall.

A. Three groups of eggs as placed by female in captivity, X 17.
B. Two views of the anterior larval spiracle, highly magnified.
C. Dorsal view of full-grown larva, X 8.5.
D. Front femur, tibia and tarsus of male, redrawn from Verrall on comparison of specimens.
E. Middle leg of male, redrawn from Verrall on comparison of specimens.
F. Part of thorax and abdomen of the female, X 10.
G. Part of the thorax and abdomen of the male, X 10.
H. End view of posterior, larval respiratory organ, showing circular plates, stigmal plates, slit-like spiracles and inter-spiracular nodules, X 300.
I. Outline to show shape of the puparium from the side, X 10.
J. Dorsal view of the puparium, X 10.

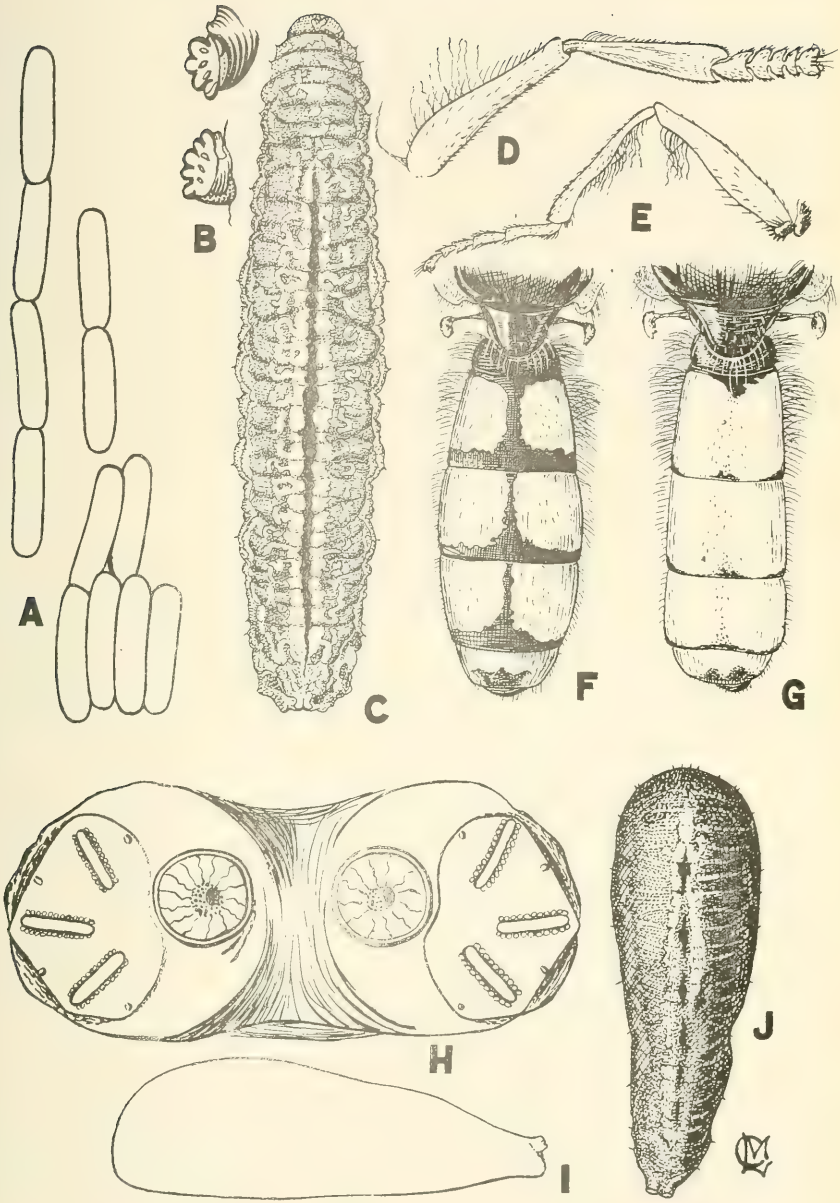

Figure 11. Life stages of *Platychirus perpallidus*.

EXPLANATION OF FIGURE 12.

A to J, inclusive, life stages of *Syrphus knabi* Shannon.

A. Antero-ventral view of head of larva much enlarged; *a,* sensory papillae; *b,* antenna; *c,* upper jaw; *d,* outer pair of mouth-hooks; *e,* other mouth hooklets; *f,* lower jaw; *g,* anterior spiracles or larval respiratory cornua; *h,* cephalo-pharyngeal framework within the body.

B. Lateral view of larva, X6; *a,* median segmental spines; *b,* posterior respiratory organ.

C. End view of anterior spiracle, highly magnified.

D. Dorsal view of posterior respiratory organ, X 40; *a,* one of the three pairs of slit-like spiracles; *b,* one of the inter-spiracular ridges; *c,* the median dorsal spiracular spur; *d,* the circular plate.

E. End view of the posterior respiratory organ, X 40. Lettering as in D.

F. Outline of the puparium, dorsal view, X 3; *a,* posterior respiratory organ.

G. Outline of the puparium from the side, X 3.

H. Scutellum and abdomen of adult ♀, X 5.

I. Wing, X 5.

J. Antenna of male.

(Figures A to I redrawn from the Ohio Naturalist).

K. Abdomen of *Xanthogramma divisa,* X 10, to show arrangement of the yellow markings.

For other figures of *Xanthogramma divisa,* see figures 8 and 9.

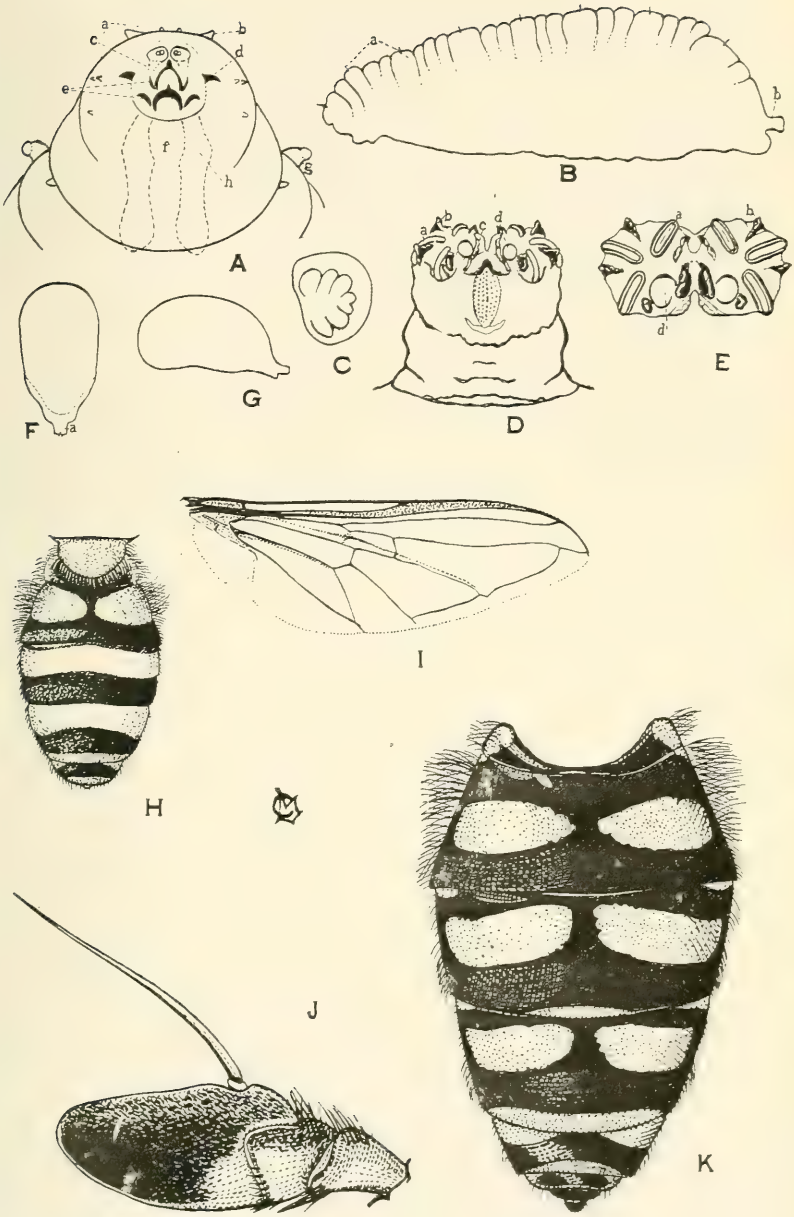

Figure 12. Life stages of *Syrphus knabi; K,* abdomen of *Xanthogramma divisa.*

BULLETIN 264

LIFE HISTORY, HABITS, NATURAL ENEMIES AND METHODS OF CONTROL OF THE CURRANT FRUIT FLY (Epochra canadensis Loew) [1]

HENRY H. P. SEVERIN.[2]

A number of naturalists have worked on the life history of the currant fruit fly *(Epochra canadensis* Loew) but the duration of all of the stages has never been determined. From a study of the life cycle of this insect, a number of scientists have suggested remedies for the control of this pest but most of these recommendations have not been previously put to a practical test. In our work we endeavored to determine the duration of all of the stages in the life history of the trypetid in the different fruits attacked under Maine conditions. Some of the different measures of control suggested by other workers were put to an experimental test, as well as other methods which we inaugurated. Observations were also made on the habits and behavior of the adults and on the natural enemies.

SYSTEMATIC POSITION.

The currant fruit fly belongs to the order Diptera, or two-winged flies. This insect is a member of the family Trypetidae. a large group of flies usually possessing prettily marked wings. Loew (1873, p. 238) established the genus *Epochra* and gave it the specific name *canadensis* after Canada.

Common name.—In the literature, *Epochra canadensis* is known under various names as follows: *Currant fly, Currant fruit fly, Currant fruit miner, Currant fruit worm, Currant maggot, Currant or gooseberry fruit fly, Currant or gooseberry fruit maggot, Currant or gooseberry worm, Currant maggot or goose-fruit fly, Fruit maggot, Fruit worm, Gooseberry fruit fly, Yellow*

[1]Papers from the Maine Agricultural Experiment Station: Entomology No. 96.

[2]Member of the Station Summer Staff.

currant fly, Yellow currant fruit fly, Yellow currant fly or gooseberry fruit fly, Yellow currant and gooseberry fruit fly.

The common name, currant fruit fly, has been adopted by the American Association of Economic Entomologists (1909, p. 15) and the pest should be so designated by writers in order that uniformity of common names of insects may be secured. This common name, however, is restrictive and misleading, as it naturally gives the impression that the fruit fly confines its attacks to currants; when, in reality, gooseberries are just as seriously infested. In all probability, the committee on nomenclature did not take into consideration the dark currant fly *(Rhagoletis ribicola* Doane) or a more distinctive common name would have been given to *Epochra canadensis.* The yellow currant or gooseberry fruit fly would have been a far more appropriate name for this trypetid.

DESCRIPTION OF ADULT.

Epochra canadensis is somewhat smaller than a house fly, and possess a more slender body. The body of recently emerged flies is pale yellow, but after the adults have been on the wing for a week or two the color changes to dark yellow. The legs are also yellow; the eyes are greenish irridescent and the wings are striped with brown crossbands (Fig. 17, A-E).

Harvey (1895, pp. 118–122) has published a technical description of the male and female fly, as well as of the egg, larva and pupa, and to these details those interested are referred.

DISTRIBUTION AND DESTRUCTIVENESS.

The distribution of the species in Canada and the United States was ascertained from literature and through correspondence with entomologists. A currant fruit fly was sent to nearly all Provincial entomologists, State entomologists and dipterologists accompanied with a letter asking for the locality record of any adults which might be found in their collections of insects or records from letters or notes. Records from letters when accompanied with infested currants or gooseberries or notes obtained from infested fruit observed in the field can not be considered reliable unless the imago is bred, for such fruit may have been attacked by the dark currant fruit fly *(Rhagoletis ribicola*

Doane) or possibly *Epochra rubida* Coq. if this is a distinct species.

North America is divisible into 7 transcontinental belts or life zones, each characterized by particular associations of animals and plants. These zones are: the Artic-Alpine, Hudsonian, Canadian, Transition, Upper Austral, Lower Austral and Tropical. The Transition zone is sub-divided into three faunal areas—an eastern humid or Alleghanian, a western arid and a Pacific coast humid division. The Upper Austral zone is divided into two faunal areas—an eastern humid or Carolinian and a western arid or Upper Sonoran area. The lower Austral and Tropical zones are likewise divisible, but since *Epochra canadensis* has not been recorded from any locality belonging to these zones, the divisions need not be considered.

Reliable information on the occurrence of *Epochra canadensis* from specific localities in Canada is exceedingly scarce, and the following discussion on the distribution of this pest is based mainly on doubtful records obtained from infested currants and gooseberries from which the imagoes were not bred. In Canada the currant fruit fly is distributed principally in the Canadian zone. From the data at hand, the northern limit of its distribution seemingly occurs between latitudes 53–54°. The most northern locality from which infested fruit has been reported is Edmonton, Alberta, at an elevation of 2,185 feet. The trypetid also occurs in the Alleghanian, western arid and Pacific coast humid areas of the Transition zone. St. Catherines (360 feet), Ontario, situated between Lake Erie and Ontario is located in the Carolinian area of the Upper Austral zone, but the record is based on "a single red currant fruit with a dipterous maggot in it."

The present known distribution of *Epochra canadensis* in the United States from reliable records, shows that it occurs in the Canadian, Transition and Upper Austral zones. In table I, an attempt was made to place the various localities into the faunal areas with the use of various maps and descriptions found in North American Fauna. The elevations of the cities were taken from Gannet's (1906, pp. 1–1072) "A Dictionary of Altitudes in the United States," except where the entomologist stated the elevation at which the currant fruit fly was collected.

TABLE 1.

Faunal Areas in Which Epochra Canadensis Occurs in the United States.

State	City	Elevation (feet)	Boreal	Austral region	
				Transition	Upper Austral
Maine	Orono	115— 129		Alleghanian	
	Waterville	112		Alleghanian	
New York	New York	7— 314			Carolinian
South Dakota	Rapid City	3196—3244		Western arid	
	Hot Springs	3425—3462		Western arid	
	Lead	5119—5320	Canadian		
	Spearfish	3637—3647		Western arid	
Colorado	Fort Collins	4984—4994			Upper Sonoran
	Boulder	5350			Upper Sonoran
	Ute Creek	9000	Canadian		
Montana	Bozeman	4753—4754	Canadian		
Utah	Richfield	5308		Western arid	
Idaho	Moscow	2569—2574		Western arid	
Washington	Canfield			Western arid	
	Pullman	2345—2550		Western arid	
	Almota	600			Upper Sonoran
	Wentachee	639— 669		Western arid	
	Bellingham	60		Pacific coast	
	Roche Harbor			Pacific coast	
Oregon	Freewater			Western arid	
	The Dalles	96— 116		Western arid	
	Gresham			Pacific coast	
	Russellville			Pacific coast	
	Ashland	1868—1940		Pacific coast	
	Salem	120— 163		Pacific coast	
	Forest Grove	169— 229		Pacific coast	
	Corvallis	227— 319		Pacific coast	
California	Anderson	428			Upper Sonoran
	Santa Rosa	165— 181		Pacific coast	
	San Mateo	22		Pacific coast	
	Redwood City	8— 12		Pacific coast	
	Palo Alto	63		Pacific coast	
	Mountain View	95— 124		Pacific coast	
	San Jose	81— 118		Pacific coast	
	Watsonville	23		Pacific coast	

The low summer temperature on the Pacafic coast permits this species to come as far south as latitude 37°. The most southern locality in which the currant fruit fly has been recorded in California is Watsonville, which is exposed throughout the year to the cold coast fogs. In reference to the vertical distribution, the pest has been captured at Ute Creek (Lat. 37–38°), Colorado, at an elevation of about 9000 feet.

To determine whether the currant fruit fly occurs in any country other than Canada and the United States, specimens of *Epochra canadensis* were sent to various fruit fly specialists who have travelled extensively in various parts of the world. Mr. Geo. Compere, chief quarantine inspector at San Francisco, who has spent nine years of almost continuous travelling over the world in search of fruit fly parasites has never met with *Epochra*

canadensis in any foreign country. He has visited Brazil, Spain, Italy, Island of Malta, Hawaiian Islands, Fiji Islands, Australia, Thursday Island, German New Guinea, Java, Philippine Islands, Japan, Malay State, China, India, Ceylon, Asiatic Turkey and Egypt.

Mr. W. W. Froggatt, Agricultural Museum, Department of Agriculture, Sydney, New South Wales, who spent over a year of continuous travel to inquire into the best methods of dealing with fruit flies and other pests and the value of parasites writes, "I have gone through my collection of Australian and foreign fruit flies and see nothing like your *Epochra canadensis*. I have a fairly large collection from various parts of the world both from the East, Pacific Islands and South America and Africa." In his trip he visited the Hawaiian Islands, United States, Mexico, Cuba, Jamaica, Barbados, Panama, England, France, Spain, Italy, Austria, Hungary, Asiatic Turkey, Cyprus, Egypt, India and Ceylon.

Dr. F. Silvestri, Portici, Italy, who has travelled in the Canary Islands and West Africa in search of natural enemies of fruit flies writes, "I have never seen in Italy or elsewhere *Epochra canadensis* and *Rhagoletis pomonella,* therefore, I am very sorry I can not give you any useful information about these species. A careful study of the fruit flies in China and in South America is necessary for being sure about the distribution of the species of some genera."

Dr. T. Miyake, Imperial University, Komaba, Tokyo, Japan, who has made an extensive study of the fruit flies of Japan writes, "As to your inquiry regarding the occurrence of *Epochra canadensis* I should answer the fly is not yet found in our country."

Although the currant fruit fly is said to be "widely distributed in Maine," reliable records are limited to the two following localities: Orono, Penobscot County and Waterville, Kennebec County. Doubtful localities in the various counties of the state of Maine, obtained from records of injury by apparently this same pest published in the Annual Reports of the Maine Agricultural Experiment Station and through correspondence are numerous.

NATIVE HOST PLANTS.

The native host plants of *Epochra canadensis* are probably the wild currants and gooseberries. The currant fruit fly was bred from the fruit of the wild gooseberry *(Grossularia oxyacanthoides* (L.) Mill.) which were growing in a pasture about a mile from Orono, Maine. On June 28, 1915, 39 per cent of the gooseberries on these bushes contained egg chambers of apparently this trypetid. The fruit of the wild red currant *(Ribes triste* Pall.) was also found to be infested, but it should be noted, however, that the bushes were growing on the banks of a stream at a distance of about 35 feet from some cultivated currant and gooseberry bushes with practically all of the berries wormy. Our observation on the wild black currant *(Ribes americanum* Mill.) was limited to one bush located about 10 miles from Orono, but not a single berry was infested.

The distribution of the wild currant and gooseberry which were found to be infested by *Epochra canadensis* in Maine is as follows:

> *Ribes triste* Pall. Newfoundland to Alaska, and south to New Jersey, Michigan, South Dakota, and Oregon; also in northern Asia. *Grossularia oxyacanthoides* (L.) Mill. Hudson Bay to Yukon, British Columbia, Alberta, Montana, North Dakota and northern Michigan.

Coville and Britton (1908, pp. 193–225) record 43 species of *Ribes* and 40 species of *Grossularia* growing, independent of cultivation, in North America. Within the range of *Epochra canadensis* as determined with cultivated fruits, are 15 species of wild currants and 8 of gooseberries occurring both in Canada and the United States; also 11 species of *Ribes* and 18 of *Grossularia* recorded only in the United States.

DESTRUCTIVENESS TO CULTIVATED FRUITS.

The currant fruit fly is so serious a pest in the state of Maine, that frequently the crop of currants and gooseberries is a total loss. In Orono, some people have dug up and burned their currant and gooseberry bushes, because the fruit was infested with maggots so that it could not be used. One person set

out some currant bushes in an isolated locality in the spring of 1913, and two years later the berries were so badly infested that the crop was not picked. The trypetid was also bred from the fruit of a cultivated shrub commonly called the flowering or mountain currant *(Ribes alpinum* Pursh).

LIFE HISTORY.

A brief historical account of the life history of *Epochra canadensis,* as determined by a number of entomologists in different localities, is herewith given. According to Harvey's (1895, p. 116) observations in the field, the time required for the eggs to hatch and the larvae to mature is about three weeks, while the pupal stage extends over a period of about eleven months under Maine conditions.

Piper and Doane (1898, pp. 5–6) have worked on the life histories of the dark currant fly *(Rhagoletis ribicola* Doane) and the yellow currant fly *(Epochra canadensis* Loew) in the State of Washington. These scientists make the following statements concerning the life history of the dark currant fly: "The eggs soon hatch into small whitish, footless larvae or 'maggots' which eat their way toward the center of the berries and there feed until fully grown. In about three or four weeks they are ready to pupate." The pupae "pass the rest of the summer and winter in this state, emerging as adult flies the following spring." The authors state that the habits and life history of the yellow currant fly are very similar to that of the dark currant fly.

Paine (1912, pp. 141–142) gives the following contribution on the life history of the yellow currant fly or gooseberry fruit fly *(Epochra canadensis* Loew) in the San Francisco Bay region: "After a period of incubation lasting, in the case of specimens taken into the laboratory, for 11 days, the minute larva or maggot hatches" ***. The larval period was not determined. The pupa remains in the ground for 10 months.

EGG AND LARVAL PERIODS UNDER LABORATORY CONDITIONS.

In 1914, the duration of the egg and larval stages of *Epochra canadensis* was determined by the writer, in the different fruits attacked by the pest in Maine under laboratory conditions. The method followed to induce oviposition, was to place a few twigs

of the host plant bearing unripe fruit, in a breeding jar containing fruit flies which had been captured in the field. The bottom of the jar was covered with about an inch of moist sand and in this was embedded, a small bottle of water containing the stems of the plants. The twigs were allowed to remain in the breeding jar for a day and were then transferred into another jar which did not contain flies. At the bottom of the second jar rested a bottle filled with water and in this, the ends of the stems were emersed. The duration of the egg and larval periods in cultivated and wild gooseberries, white and red currants, and the mountain currant *(Ribes alpinum* Pursh) under laboratory conditions is shown in table 2.

TABLE 2.

Egg and Larval Periods Under Laboratory Conditions.

Kind of Fruit	Date of Oviposition	Egg period (days)	Date larvae issued from fruit	Number larvae issued	Larval period (days)	Egg+larval periods (days)
Gooseberry	June 22	4—5	July 8	1	11—16	16—20
			9	2		
			10	2		
			11	6		
			12	3		
Gooseberry	June 23	4—5	July 9	1	11—15	16—19
			10	1		
			11	5		
			12	4		
Wild gooseberry	June 20	5—6	July 8	2	12—14	18—19
			9	1		
Wild gooseberry	June 21	4—6	July 7	1	10—16	16—20
			8	1		
			9	5		
			10	2		
			11	1		
White currant	June 21	4—5	July 7	5	11—14	16—18
			9	2		
White currant	June 28	4—6	July 15	3	11—16	17—20
			17	2		
			18	1		
White currant	June 30	4—6	July 17	1	11—15	17—19
			19	1		
Red currant	June 23	4—5	July 9	1	11—16	16—20
			10	3		
			11	2		
			13	3		
Red currant	June 29	4—6	July 15	2	10—17	16—21
			16	5		
			17	2		
			18	2		
			20	1		
Mountain currant	June 18	7	July 9	1	14—16	21—23
			10	5		
			11	1		
Mountain currant	July 6	5—6	July 28	1	16—18	22—23
			29	1		

It is evident from this table that the egg period required from 4–7 days; the larval stage from 10–18 days and the egg plus the larval periods from 16–23 days in the different fruits.

EGG AND LARVAL PERIODS UNDER FIELD CONDITIONS.

In 1915, the duration of the egg and larval periods was determined in gooseberries and red curants under field conditions. No trouble was experienced in causing the trypetids to oviposit in confinement in the field. On June 22, at 6 A. M. 100 female currant fruit flies, which had been captured in the field, were liberated in a cage enclosing a gooseberry bush, and by 6 P. M., all of the specimens had been removed. On June 25, 150 females were set free in a cage covering a red currant bush and at the end of the day the insects were removed. As the minimum larval period under laboratory conditions required 10 days, it was decided to allow the fallen fruit to remain on the soil below ground cages until the tenth day after the eggs had hatched. The drops were then placed in sanitary fruit jars which rested on the ground in the shade but were protected from rains. All fruit which dropped on or after the tenth day was placed in jars immediately. In the containers the fruit soon became covered with fungi and few maggots completed their development compared with the number of infested berries. The duration of the egg and larval periods is shown in table 3.

TABLE 3.

Egg and Larval Periods Under Field Conditions.

Kind of Fruit	Date of Oviposition	Egg period (days)	Date larvae issued from fruit	Number larvae issued	Larval period (days)	Egg+larval periods (days)
Gooseberry	June 22	7—8	July 11	1	11—25	19—32
			12	6		
			13	11		
			14	25		
			15	33		
			16	37		
			17	24		
			18	33		
			19	10		
			20	5		
			21	4		
			22	3		
			24	6		
				198		
Red currant	June 25	6—7	July 15	2	13—25	20—31
			16	4		
			17	6		
			18	12		
			19	17		
			20	4		
			21	3		
			22	2		
			23	2		
			24	1		
			26	1		
				54		

A total of 198 maggots issued from gooseberry drops and of this number 178 completed the larval development in two to three weeks, seven required 11–13 days and thirteen, 21–25 days. Fifty-four maggots emerged from the red currant drops, of which number 48 completed the larval period in two to three weeks, two required 13 days and four, 21–25 days.

PERIOD BETWEEN DROPPING OF FRUIT AND EXIT OF LARVAE.

A method of control recommended is to frequently gather and destroy fallen infested fruit. The length of time between the dropping of the berries and the exit of the larvae has an important bearing on the frequency of collecting drops. A daily record was therefore kept of the gooseberries which dropped from the bush and the dates of the exit of the larvae. The egg chambers in gooseberries which dropped from June 27–July 1,

were opened to determine the egg period and hence no data were obtained on the emergence of the larvae from these berries. Table 4, shows the results.

TABLE 4.

Dates of Dropping of Gooseberries and Exit of Larvae.

Dates of exit of larvae	Dates in July of dropping of gooseberries																				Total number larvae
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	22	24	
July 11		1																			1
12		6																			6
13		8	3																		11
14		5	17		2	1															25
15	3	5	19		3			1		1			1								33
16	5	3	12			4				1	3	2	2	1	4						37
17	3	3	9		3	1				2		1	1		1						24
18	3	4	7	4	6	3	1	1			2				2						33
19		2	4	2				1										1			10
20					1	1		1				1					1				5
21	1								1						1	1					4
22						1						1				1					3
24						1	1							1	1				1	1	6

Similar records obtained with currants are given in table 5.

TABLE 5.

Dates of Dropping of Currants and Exit of Larvae.

Dates of exit of larvae	Dates in July of dropping of currants															Total number larvae
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
July 15				1	1											2
16		1					3									4
17	1		2	1		2										6
18			1	1		4		3	3							12
19	2			1	1	2	2	2	2	5						17
20							1	1			2					4
21						1		1				1				3
22					1	1										2
23														2		2
24													1			1
26															1	1

If the laborious task of picking up fallen infested fruit has any practical value, it is evident from tables 4 and 5, that the drops must be picked up daily. With this method of control the

first issuance of the larvae from the fruit must be determined. In 1895, Harvey (1895, p. 116) writes, "the larvae began to emerge on June 20." In 1915, the first larvae issued on June 30, but in all probability, the dates would vary in different seasons. We began to pick drops on June 14, 1914, and June 13, 1915, and continued to gather the fallen fruit at least twice a week until the crop was harvested. The results obtained by the destruction of fallen infested fruit are discussed under methods of control.

Cracked fruit.—From the same bush a record was obtained of the number of egg chambers in each gooseberry drop and the number of fallen cracked fruit with or without egg cavities. The results are indicated in table 6.

TABLE 6.

Dates Gooseberries Dropped, Number of Egg Chambers, and Cracked Berries With or Without Egg Cavities.

Date	Number of gooseberry drops with egg chambers						Total Drops	Drops With No Egg Chambers	
	1 Egg Chamber		2 Egg Chambers		3 Egg Chambers				
	Fruit cracked	Not cracked	Fruit cracked	Not cracked	Fruit cracked	Not cracked		Fruit cracked	Not cracked
June 27		1					1		
28		1		1			2		
29		1		1		1	3		
30		5					5		
July 1		3		2			5		
2	8	65	3	50	4	12	142		1
3	16	99	5	27	1	7	*156		10
4	23	79	6	24		3	135		3
5	20	40	3	10	2	1	76	1	5
6	14	13		2			29		3
7	11	16	2	3			32	1	1
8	23	18		1			42		1
9	3	2		3			8		1
10	1	5					6		1
11	18	7	2	1			28		1
12	17	6		1			24		1
13	12	2		1			15		1
14	4	4					8		2
15	2	1					3		
16	4	12					16		
17	8	12					20		
18	4	5					9		2
19	6	10					16		
20	2	3					5		
21	2	3					5		
22	6	8					14		1
23	2	3					5		
24	1	7					8		
	207	431	21	127	7	24	818	2	34

* Included in the 156 was one cracked gooseberry with four egg chambers.

From table 6, one can readily comput that 29 per cent of the total number of drops having egg chambers were cracked compared with 6 per cent fallen cracked fruit without egg cavities. Gooseberry drops with one egg receptacle showed that 32 per cent were cracked. Similar data were also obtained in checking up the effectiveness of the poisoned bait spray. Drops with egg chambers obtained from a gooseberry bush treated with the poisoned bait showed that 7 per cent were cracked compared with 1 per cent fallen cracked fruit without egg cavities. Gooseberries picked at the end of the season from a check or control bush, showed that 23 per cent of the berries with one egg receptacle were cracked. Cracked currants with egg punctures were also observed among the drops and picked fruit. In all probability, the cracking of the fruit was due to the fact that the tissue had been killed in the formation of the egg chamber and in the further development of the berry cracking resulted due to the interference of this dead tissue to uniform growth.

The first gooseberry dropped from the same bush 5 days after oviposition had taken place and 11 berries dropped before the eggs hatched. The maximum period of dropping occurred on July 2–5, when the larvae which were less than a week old, caused 62 per cent of the fallen fruit. Before the exit of the first larva 78 per cent of the total number of drops containing egg punctures had fallen.

Currants and wild gooseberries may also drop before or after the egg hatches, or the currants may remain on the bush throughout the larval development. The exit hole of the larva (Figs. 14, H. 15, G.) was occasionally found in currants and cultivated gooseberries which were still adhering to the branches.

INFESTED UNFERTILIZED BERRIES.

Among the first drops of the season are a large number of unfertilized berries in which the currant fruit fly sometimes deposits its eggs before the fruit falls. Unfertilized gooseberry drops become shriveled, dried and turn black on the ground in about ten days and the larva is unable to complete its development in such berries.

PROCESS OF OVIPOSITION.

After the process of oviposition was observed with the naked eye in the field, we decided to see with a binocular microscope, the formation of the egg chambers or receptacle in which the egg is deposited. Accordingly, about 100 fruit flies captured in the field, were confined in a large breeding jar which contained currant branches bearing green fruit. After the female fly alights on a berry, it usually walks about as if seeking a suitable place in which to oviposit. Finally the insect comes to rest, cleans off the egg-laying apparatus with its hind legs, and then the last three segments of the abdomen are bent beneath the body at an angle of about 30 degrees (Fig. 17, F). The berry with the trypetid in this position was now cut off with a pair of scissors, and held below the objective of a binocular microscope. One could readily see the telescoped ovipositor move up and down within the seventh tube-like segment. The distal end of the tube-like segment is applied to the fruit, while the teeth-like projections (Fig. 13, G.) at the end of the ovipositor begin to rasp the epidermis of the berry. The puncturing apparatus often slips on the peel of the currant but apparently the tactile bristles (Fig. 13, G.) near the end of the egg-laying organ assist the pest in locating the scraped area. The claws of the middle and hind legs also slip on the berry and as the legs approach the median line of the body, the fly grasps a new hold. During this rasping period, the mouth-parts are constantly protruded and retracted. Finally the teeth-like projections have scraped a small elliptical hole through the epidermis. The adult now endeavors to force the end of the ovipositor beneath the thin skin of the currant, and as the peel is pried loose in the small hole, the abdomen moves up and down. Next the entire length of the ovipositor is forced beneath the epidermis. A small drop of liquid exudes from the hole. In loosening the cuticle the piercing instrument is thrust in different directions, while the abdomen moves from side to side. The membrane between the egg-laying organ and the tube-like segment becomes swollen at the end of each thrust of the ovipositor.

After the egg chamber is completed the imago raises its body on its legs, the abdominal segments become distended, and sometimes the proboscis is protuded stiffly. As the muscles of

the oviduct and oviductus communis expel the egg into the ovipositor, a peristaltic movement of the abdominal segments occurs. The egg can be seen gliding through the membrane connecting the tube-like segment with the egg-laying organ and again, when it passes out of the opening near the end of the ovipositor into the egg receptacle. The ovipositor is then withdrawn, and with the abdomen still bent, the fruit fly walks around on the berry, stops a moment to clean off the egg-laying apparatus with the tarsi of the hind legs and then takes flight.

TIME REQUIRED IN PROCESS OF OVIPOSITION.

The time required to rasp through the epidermis of the currant, the time spent in forming the receptacle and depositing an egg and the total time of the entire process of oviposition of ten specimens, which were captured in the field in the morning and allowed to oviposit in the afternoon, is shown in table 7.

TABLE 7.

Time Required in Process of Oviposition.

	Time required to rasp through epidermis	Time required to form receptacle and deposit egg	Total time of oviposition
	(minutes)	(minutes)	(minutes)
	2	1	3
	2.5	1.5	4
	3.5	1.5	5
	4.5	1.5	6
	5	3	8
	8	1	9
	8	2	10
	8.5	3.5	12
	7.5	4.5	12
	11.5	2.5	14
Average	6.1	2.2	8.3

The time required to puncture the epidermis depends upon the toughness of the peel, and the general activity of the insect. One female was unable to rasp through the skin of a hard, green, mountain currant and finally deposited several eggs on the outside of the berry at the calyx end. On cold, cloudy days the fruit flies are not active and the process of oviposition is rare and often prolonged. Adults near the end of their natural life were frequently observed rasping the epidermis of currants and

gooseberries for half an hour or more and then failed to break the cuticle. Such specimens were occasionally seen to move the end of the ovipositor against the side of the glass jar.

When a fine needle is used to puncture the epidermis at the region where the fruit fly is rasping the peel, the ovipositor is forced immediately into the hole, a receptacle is formed and an egg deposited. If the needle is thrust into the pulp, the female may push its ovipositor into the hole, but often does not lay an egg.

EGG CHAMBER.

It is not difficult to locate the egg cavity containing the egg immediately after oviposition has taken place. Two days after the egg is deposited in a gooseberry, faint indications of brown discoloration appear around the semi-circular mouth of the receptacle. Later the peel over the entire egg chamber becomes brown and very conspicuous. Finally, in some cases after the egg hatches, the epidermis may turn black (Figs. 14, A. 15, C.).

An examination of gooseberries "stung" by the pest but which failed to drop, showed that if an egg did not hatch, or the young larva died, then the brown or black epidermis of the egg cavity usually cracked around all or a part of the margin of the egg chamber or around the shriveled egg. Sometimes the peel ruptured through the center of the egg puncture but in some gooseberries the epidermis remained intact. A corky growth may develop in the pulp beneath the receptacle.

Number of eggs in egg chamber.—As a general rule, one egg is deposited in an egg chamber. On a number of occasions two eggs were found in one receptacle in gooseberries. An egg cavity is sometimes formed and yet no egg may be laid within the same.

Number of egg chambers in fruit.—The number of egg chambers in a single berry may vary in the different fruits and probably depends upon the abundance of flies. In white, red and mountain currants the usual number of eggs deposited in a single berry is one, but in some cases two were found. In Chautauqua gooseberries from one to six egg punctures were counted, the average being three (Fig. 14, C.) Without exception every berry on two Chautauqua gooseberry bushes was stung by the pest. An inquiry was made concerning previous condi-

tions. The owner informed us that several years ago he had about 50 currant and gooseberry bushes, but as his entire crop had been maggoty for years, he had pulled up and burned all except the two Chautauqua bushes. In all probability, this accounts for the abundance of the pest and the numerous egg cavities in the fruit.

PREMATURE RIPENING.

A green currant which had been "stung" repeatedly at 8 A. M., showed indications of red or premature ripening at 6 P. M. A green currant in which one egg was deposited showed a patch of red at the region of the egg chamber two days after oviposition (Fig. 15, B). When two eggs were deposited in a green berry, two patches of red appeared (Fig. 15, A.). When a little pressure was exerted on a prematurely ripened, white currant, in which an egg had been laid four days previously, a small drop of liquid exuded from the mouth of the egg receptacle. Wild gooseberries also show evidence of premature ripening when they are punctured by the pest. A wild gooseberry in which an egg was deposited, turned red at the region of the egg cavity three days after oviposition had taken place.

An attempt was made to determine whether or not the fruit fly injects into the egg chamber, a secretion which causes premature ripening. Although many specimens were observed during the process of egg-laying under a binocular microscope, no liquid was noticed leaving the opening near the end of the ovipositor and entering the egg cavity. As already stated, the membrane between the egg-laying organ and the seventh tube-like segment becomes swollen at the end of each thrust of the ovipositor. However, a small amount of clear secretion ejected with each thrust of the piercing apparatus probably could not be seen passing from the opening of the ovipositor into the egg receptacle.

MORTALITY OF EGGS AND LARVAE.

A mortality occurs among the eggs and larvae. The percentage of mortality occurring among eggs and larvae in the egg chambers of gooseberries picked on July 14, from two bushes growing in the sunshine was 36 and 48 per cent. The percent-

ages given do not include the mortality of the eggs and larvae in gooseberry drops and no accurate statement can be made of the mortality in the fallen fruit. Our observations on mortality were confined to the egg cavity and hence only dead larvae of the first instar were found. We frequently observed that the eggs of the currant fruit fly were covered with a fungus growth, but this may have been secondarily developed after the eggs failed to hatch. In opening one egg receptacle below a binocular microscope, two small mites were found near an egg. Although natural enemies may attack some of the eggs, the primary cause of the mortality of fertile eggs and larvae in gooseberries is unknown.

FEEDING HABITS OF LARVAE.

The minute larva, upon hatching from the egg in the egg chamber, may either penetrate toward the interior of the fruit leaving no external visible trail, or bore beneath the peel forming a tiny winding tunnel which, at its maximum length, may extend almost completely around a currant or half way around a gooseberry (Fig. 14, D). At first the trail is light colored but later it turns brown and becomes quite conspicous. A dissection under a binocular microscope of the tunnel leads to the region where the larva is feeding. The recently hatched larva may feed for a time in the pulp between the peel and seeds, but later it may partly or entirely eat its way into a seed.

As the larva grows the seeds become too small to hold the maggot and the larger larva is commonly found partly within or between the seeds or in the pulp. After a larva has devoured the embryo of a currant seed, the posterior end of the body may remain within the seed coats while the mandibles (Fig. 13, G) of the protruding anterior end gnaw holes in the neighboring seeds, or the body may be withdrawn from the seed coats and the larva may then be found with the head region buried in a seed and the caudal part protruding (Fig. 13, A). In other cases, both ends of the body may be within two currant seeds, the posterior portion being within the empty seed coats and the anterior part within a hole of another partly devoured seed.

An examination of currants after the exit of the larva showed that in some cases the embryo of every seed was con-

sumed, but in other instances, some of the seeds were not injured. In one currant 9 empty seed coats were counted and in addition, the embryos of two seeds were partly devoured. As a general rule, however, less than half a dozen seeds are destroyed in each currant. Within some of the seed coats brown particles may be found and these apparently are the excrement of the maggot. In the pulp, these particles are glued together. The brown mass sometimes contains the exuvia of the larva, the black molted mandibles being conspicuous under a binocular microscope.

RESPIRATORY PORE.

Sometimes a small hole is present in the peel of currants (Fig. 13, R) and gooseberries which is apparently used for the purpose of respiration by the maggot. A larva was frequently found in berries with the posterior spiracles near the respiratory pore. This breathing pore is absent in fruit containing larvae in the early stages of development. When the maggot issues from the fruit it usually bores through and enlarges the respiratory hole, so that berries which show the exit hole usually do not show the breathing pore. Within the respiratory hole of a Chautauqua gooseberry six small oval eggs were found, evidently of some parasite.

EXIT HOLE.

When the larva is full grown it forces its way through the pulp, either cuts a hole through the peel (Fig. 13, E) or enlarges the respiratory pore (Fig. 14, H), and issues from the berry. This exit hole is partly enclosed by the ragged edges of the epidermis (Fig. 15, G) which was severed by the larva. A tunnel with the wall composed of brown particles can be traced to the exit hole in gooseberries.

JUMPING HABIT OF LARVAE.

After burrowing out of the fruit, the mature larva often exhibits a peculiar jumping habit. The maggot first slowly arches its body in a circle (Fig. 13, B); the posterior spiracles are next invaginated while the pair of hooked mandibles (Fig.

13, G) attach to a fold at the lower end of the body; the curled body then leans back as far as possible (Fig. 13, C); the jaws suddenly loosen their hold and finally the larva springs into the air. Often the maggot arches its body but may experience difficulty in attaching its jaws to the fold; the larva may then fall over on its side, and although the body is straightened out suddenly, it does not raise from the substratum. Instead of falling on its side, the maggot may topple on its back, and in this case, the larva immediately rights itself.

The maximum height of the jump is 2½ inches and the maximum distance 6 inches. Fifteen different larvae jumped the following distance; 1, 1½, 2, 2, 2½, 2½, 2½, 2½, 3, 3, 3, 3, 3½, 4 and 6 inches, or an average of 2.8 inches.

An experiment was performed to determine the effect of a wet and dry substratum on the jumping reaction. Soil could not be used, for many of the maggots would burrow into the ground, and hence filter paper was employed instead. A dozen mature larvae were placed on wet filter paper and another dozen on dry filter paper. The number of jumps during five minutes were as follows: wet filter paper 22, dry filter paper 8. This experiment was repeated with the same number of different maggots with the following results: wet filter paper 6, dry filter paper 4.

The above experiment was repeated, but after a record was taken of the number of jumps during five minutes, the 12 larvae on the wet filter paper were transferred to the dry and vica versa. The following figures indicate the results: wet filter paper 26, dry filter paper 5; transferred from wet to dry filter paper 0, from dry to wet filter paper 12. This experiment was repeated with the same number of different maggots with the following results: wet filter paper 16, dry filter paper 3; transferred from wet to dry filter paper 0, from dry to wet filter paper 14.

It is evident that a wet substratum such as was used in these experiments increased the number of jumps of the larvae. Mally (1904, p. 10) of South Africa, noticed that when a Mediterranean fruit fly larva jumped out of a collecting box and struck the ground at a temperature of 142° F., the maggot began to jump at a lively rate and in five minutes it was dead.

PUPAL PERIOD.

After the larvae emerge from the fruit they enter the ground to a depth of from one to three inches to pupate. The pupal period may vary between 10 and 11 months.

EMERGENCE OF ADULTS.

Shortly after the adult emerges, the wings are small curled masses projecting from the thorax. While the organs of flight are expanding the fly strokes them on the upper and lower surfaces with the hind legs and at times separates the two wings. In 15–20 minutes, after the insect has come to rest, the wings are expanded. The opaque appendages first show faint indications of markings which later become more conspicuous as they dry. At this time the wings are held parallel to the long axis of the body and not in the characteristic trypetid manner. The ptylium may still be inflated after the wings are expanded. Normal flight occurs about an hour and a half after the first appearance of the fruit flies above the ground.

Adults with deformed wings were sometimes reared under laboratory conditions. On May 29, 1914, several flies with one or both wings not fully expanded were taken on the ground below currant bushes.

While the wings are expanding, the segments of the abdomen are pushed out as far as the membrane connecting the metameres will allow. The abdomen of both sexes projects beyond the tips of the recently expanded opaque wings at this time, but does not after the wings are dry. At first the abdomen of the female is curled down so that the seventh tube-like segment containing the ovipositor rests against the substratum, but after the wing pattern becomes more marked, the tube-like segment is turned upward. Finally the membranes between the metameres become invaginated, thus pulling the segments into their normal position. The female may now draw the end of the ovipositor along the substratum and expel a trail of liquid from the egg-laying organ. A red spot on each side of the fifth abdominal segment is present in the male upon emergence but this is absent in the female.

Dates of emergence of adults.—To ascertain the dates of emergence of *Epochra canadensis,* a cage (height 38, length 60,

width 38 inches) with top and sides of wire netting of the mesh used for mosquito screen was placed over a white currant bush. Soil was banked and tamped around the bottom of the cage to prevent the escape of any of the flies but the ground under this bush had not been disturbed. Table 8, shows a daily record of emergence of male and female currant fruit flies in 1914. The weather records were copied from the weather bureau reports taken at the University of Maine.

TABLE 8.

Dates of Emergence of Adults in 1914.

Date	♂	♀	Total	Maximum temperature	Minimum temperature	Precipitation
May 21	0	1	1	82	42	
22	0	1	1	78	57	
23	0	0	0	74	54	.50
24	0	0	0	71	44	
25	3	9	12	74	48	
26	6	15	21	86	54	
27	8	21	29	88	61	
28	16	40	56	88	59	
29	62	77	139	78	40	
30	25	29	54	69	46	—
31	32	34	66	78	38	
June 1	38	37	75	79	55	.11
2	14	6	20	73	45	
3	14	1	15	66	37	
4	*	*	*	67	40	.31
5	4	2	6	61	42	1.20
6	7	3	10	70	42	
7	18	6	24	63	38	—
8	2	1	3	78	45	.14
9	2	0	2	72	34	
10	0	0	0	75	46	.10
11	1	0	1	84	61	
	252	283	535			

* No record was taken due to heavy rains. — Indicates a trace of rain.

In the season of 1915, the dates of emergence of the adults under natural conditions was again determined by placing cages over or under currant and gooseberry bushes. Six cages covering 85 square feet of soil enclosed four red currant, one white currant and one gooseberry bush. Eighteen ground cages with top of screen wire and board sides covered 39 square feet of ground below currant and gooseberry bushes. Table 9, gives a daily record of the emergence of male and female currant fruit flies in these cages:

TABLE 9.

Dates of Emergence of Adults in 1915.

Date	♂	♀	Total	Maximum temperature	Minimum temperature	Precipitation
May 22	1	1	2	68	47	.28
23	0	5	5	76	56	
24	4	6	10	77	49	—
25	34	31	65	77	43	
26	*	*	*	76	52	.93
27	27	29	56	61	25	
28	14	5	19	57	35	
29	10	14	24	56	36	
30	43	43	86	71	32	
31	79	66	145	76	49	
June 1	44	46	90	83	42	
2	21	37	58	84	41	
3	25	13	38	70	31	
4	12	12	24	72	37	
5	43	28	71	82	42	
6	14	12	26	80	46	
7	16	11	27	81	60	—
8	19	3	22	77	57	.04
9	5	6	11	74	49	
10	1	2	3	75	48	.87
11	1	2	3	73	44	.10
12	4	1	5	72	51	—
13	1	2	3	73	44	
14	2	1	3	77	50	
15	0	0	0	81	51	.16
16	1	0	1	77	49	
17	0	0	0	79	52	.30
18	0	1	1	81	56	.03
	421	377	798			

* No record was taken due to heavy rains. — Indicates a trace of rain.

A comparison of the data in tables 8 and 9, shows that the flies began to issue on May 21, 1914, and May 22, 1915, reached the maximum period of emergence on May 28–June 1, 1914, and May 30–June 1, 1915, and the emergence gradually diminished from June 2–11, 1914, and June 2–18, 1915. The period of emergence covered about three weeks in 1914, and four weeks in 1915.

Records were taken to determine whether the kind of soil effects the dates of the first and last emergence of the adults. Table 10, shows the details:

TABLE 10.

Dates of First and Last Emergence of Adults With Different Soils.

Dates, first and last emergence	Kind of soil	Kind of fruit	Bush in shade or sunshine
May 22—June 18	Loose soil covered with manure	Red currant	Sunshine
May 30—June 14	Loose soil covered with manure	White currant	Sunshine
May 27—June 13	Loose soil covered with manure	White currant	Sunshine
May 25—June 12	Loose soil covered with manure	Gooseberry	Sunshine
May 22—June 5	Loose soil	Red currant	Sunshine
May 27—June 2	Soil covered with coal and wood ashes	White currant	Sunshine
May 25—June 9	Sod	Red currant	Sunshine
May 27—June 4	Sod	Red currant	Partial shade
May 31—June 5	Clay	Red currant	Shade

If the dates of emergence of the adults are compared in the cases where loose soil was covered with manure, it is evident that there is a difference of 3–8 days between the first issuance of the flies and 1–6 days between the last emergence. The maximum emergence occurred on May 31–June 2, in each instance. The records were obtained in the same garden, the cages were within a few feet of one another and the kind of soil, conditions of moisture and sunshine were apparently the same. It may be possible that from puparia which are near the surface of the ground the flies issue first while from those deeper in the soil the trypetids emerge later in the season. Again, early and late maturing larvae may have some effect on the duration of the pupal period. Data on such factors are necessary before definite conclusions can be drawn.

SEXUAL MATURITY.

Of 35 trypetids which issued on May 20, one pair was observed in copula (Fig. 17, E) on May 30, 10 days after emergence under laboratory conditions. To determine how soon mating takes place under natural conditions, currant fruit flies were marked by amputating part of a leg and then set free in a currant and gooseberry garden. A specimen which issued on June 3, was marked and liberated on the same day and was taken

in coition on June 8, five days after emergence. The average maximum temperature was 77° F. and the average minimum temperature was 42° F. for the five days. Males which are sexually mature can usually be recognized by the lateral expansion of the abdomen, but later in the season this is not always a reliable characteristic.

MATING PERIOD.

Under natural conditions, the period of mating was determined in a commercial currant and gooseberry garden, consisting of 100 bushes. On June 7, 1914, 38 specimens were collected on the outside of two cages enclosing currant bushes and of these, three pairs were copulating. Three hundred trypetids were taken under scantlings of fences on June 9–10, and 21 pairs were noted in coition. One pair was caught in copula on a limb of a poplar tree 30 feet above the ground. A single pair of fruit flies in coition were taken in the field as late as July 10. From these observations it is evident that mating extended over a period of 33 days.

In 1915, mating commenced in the same currant and gooseberry garden on June 7, and ceased on July 6, thus covering a period of 29 days (Table 18). In another currant and gooseberry patch at a distance of about a mile from the commercial garden, mating began on June 6, and the last pair in coition was captured on July 15, a period of 38 days.

PREOVIPOSITION PERIOD.

An attempt was made to determine the number of days required before fully developed eggs appeared in the ovaries, after the adults issued from the pupae. Fruit flies upon emerging were consequently confined in glass jars, the bottom of which was covered with about an inch of sterilized sand and the top enclosed with cheese cloth. The insects were fed daily on diluted corn syrup and fresh bananas. Several times during each day, water was applied to the cheese cloth with a small sponge fastened to a stick. After the trypetids had been kept in captivity for a period varying from 7–16 days, the flies were dissected, the ovarioles were mounted *in toto,* and a record was

taken of the number of ripe eggs found in the ovaries. Table 11, indicates the results:

TABLE 11.

Period After Emergence Before Eggs are Developed.

Date of emergence	Date of dissection	Days flies were kept in jars	Number of flies dissected	Number of ripe eggs in ovaries	Number of flies without ripe eggs in ovaries
May 14	May 30	16	10	1	8
16	30	14	10	2	9
20	30	10	10	2	8
June 1	June 8	7	25	2	22
				6	
				1	
				1	
				3	

In all probability, the effect of confining the insects in breeding jars, as well as the food material employed, plays an important part in the rapidity and number of eggs developed.

An attempt was made to determine the duration of the preoviposition period under field conditions. On the day that the adults emerged in cages under natural conditions they were removed, marked by amputating part of a leg, and liberated in a currant and gooseberry garden. Two hundred females were released in six different marked lots on May 31–June 5. During the season, twenty marked insects were captured from the 200 that had been set free.

The shortest preoviposition period required 6 days under field conditions but from the data at hand, no conclusions can be drawn as to the maximum and average periods. As already stated, a specimen which issued on June 3, was marked and liberated on the same day and was taken in copula on June 8, five days after emergence. On June 9, six days after the female issued, she deposited 29 eggs in gooseberries. The average maximum temperature was 77° F. and the average minimum temperature 46° F. for the six days. On the other hand, a marked trypetid which issued on June 1, was not at the egg-laying stage on June 8, when it was captured, seven days after emergence. In this case the average maximum temperature was 79° F. and the average minimum temperature was 44.5° F. for

the 7 days. The last marked fly was caught 25 days after liberation.

EGG-LAYING PERIOD.

In the season of 1914, female fruit flies were captured in the field and dissected to ascertain when ripe eggs appear in the ovaries, and thus a clue might be obtained as to the date that egg-laying is likely to begin under natural conditions. No fully developed eggs were found in the internal reproductive organs of specimens captured during the last week in May. On June 6–7, 80 per cent of the females collected contained full grown eggs in the ovarioles. Females which are at the beginning of the egg-laying stage can usually be recognized by the expansion of the abdomen.

Since the earliest date that egg-laying is likely to begin under natural conditions has an important bearing on when to apply the first application of the poisoned bait spray, female flies were again captured in the field in the season of 1915, and dissected to determine when mature eggs appear in the ovaries. Table 12, shows the data.

TABLE 12.

Dissections of Flies Captured in Field to Determine When Ripe Eggs Appear in Ovaries.

Date flies were captured	Number of flies dissected	Number of flies with ripe eggs in ovaries	Number of flies without ripe eggs in ovaries
May 25	12	0	12
30	13	0	12
31	13	0	13
June 1	5	0	5
2	16	0	16
3	11	0	11
4	20	0	20
5	41	12	29
6	8	1	7
7	37	24	13
8	50	36	14

Ten female currant fruit flies captured in copula on June 17, 1914, and 12 females on June 11, 1915, were dissected and fully developed eggs were found in the egg tubes of all of them.

During the season of 1914, the first oviposition observed in the field was on June 6. Numerous flies were seen depositing eggs on the warm days of June 11, 12 and 13. The last female laying eggs was captured on July 10. The egg-laying period therefore, covered 34 days.

In 1915, the first oviposition in currants under natural conditions occurred on June 9, and the last on July 15. The deposition of eggs in this year extended over a period of 36 days.

NUMBER OF RIPE EGGS IN OVARIES.

Ovarian tubules mounted *in toto* dissected from currant fruit flies which were copulating in the field early in the season, show that there were usually five eggs present in each tubule. The lowest egg in each ovariole was considered mature when no nurse cells were present. When the egg tubes were treated with hot carbolic acid or clove oil and mounted in balsam on a slide, an unripe egg became clear, while a full grown egg appeared opaque under a microscope by adjusting the mirror and shutting off some of the light. Above the second proximal egg in each tubule is a nutritive or yolk chamber which is filled with a mass of nurse cells. The eggs anterior to the second one, however, are surrounded by nurse cells. The average number of full grown eggs in the two ovaries of 10 specimens captured mating in the field on June 7–8, 1915, was 7. The largest number of fully developed eggs counted in the two ovaries of one female was 17 and the smallest number in another specimen was three (Table 13).

NUMBER OF OVARIOLES IN OVARIES.

Each ovary is made up of a variable number of egg tubes, there being usually between 15–18. Table 13, shows the number of ovarioles and ripe eggs in 10 specimens which were copulating in the field early in the season.

TABLE 13.

Number of Eggs and Ovarioles in Ten Currant Fruit Flies.

Date, flies were mating in field	Ovarioles in right ovary	Left ovary	Total in both	Number of ripe eggs in ovaries
June 7	16	16	32	4
7	17	17	34	17
8	16	15	31	3
8	15	16	31	10
8	17	15	32	10
8	16	17	33	5
8	17	17	34	5
8	17	17	34	7
8	17	18	35	8
8	18	18	36	4
Average	16.6	16.6	33.2	7.3

If the five eggs present in each of the 33 ovarioles were to reach maturity, the female would be able to deposit 165 eggs; but since many more eggs may be developed in the terminal chamber, the question of the number of eggs that a fly may lay remains doubtful.

DAILY RATE OF OVIPOSITION.

An attempt was made to ascertain the daily rate of oviposition under laboratory conditions. Three pairs of currant fruit flies in coition were confined in three glass jars. The bottom of each container was covered with about an inch of moist sand, in which was embedded a small bottle of water containing the stems of gooseberry twigs heavily laden with fruit. At the end of each day the twigs were removed and replaced by others cut from a screened gooseberry bush. The trypetids were fed daily on diluted corn syrup. Several times during each day water was applied to the cheese cloth enclosing the top of the jars. Table 14, shows the daily rate of oviposition.

TABLE 14.

Daily Rate of Oviposition.

Date	Fly No. 1	Fly No. 2	Fly No. 3
June 12	*		
14	2	*	*
15	8	4	
16	33	23	5
17	5	14	0
18	4	8	0
19	5	4	4
20	5	2	1
21	2	5	29
22	4	2	13
23	0	0	0
24	1	0	0
25	0	0	3
26	2	3	5
27	0	0	0
28	6	3	7
29	0	0	3
30	2	1	2
July 1	0	0	2
2	1	1	2
3	1	1	0
4	0	0	1
5	0	0	1
10	1	0	0
12	0	0	2
13	0	0	1
18	+	0	0
20		+	0
Aug. 1			+
	82	71	81

* First mating. + Died.

One or two days after the first mating, the females began to oviposit and within a week they reached the maximum egg-laying stage, depositing as high as 23–33 eggs in a day. After this period was reached the number of eggs laid decreased and on many days no eggs were deposited. Frequently the flies formed an egg cavity but did not deposit an egg. One specimen formed 31 chambers from July 14–28, and during these two weeks not a single egg was laid. In all probability, the effect of confining the currant fruit flies in jars and also limiting the food material to corn syrup and water, had a marked effect on the egg-laying capacity.

LONGEVITY OF ADULTS.

According to tables 8 and 9, the first flies emerged on May 21, 1914, and May 22, 1915, in a commercial currant and goose-

berry garden, and the last specimens issued on June 11, 1914, and June 18, 1915. During two seasons, the last trypetids were captured on July 10, in this commercial garden, and if these insects emerged on June 11 and 18, the longevity of the adults would have been 29 days in 1914, and 22 days in 1915. In another currant and gooseberry patch at a distance of about a mile from the commercial garden a male currant fruit fly was captured as late as August 12, 1915. The last date of emergence was June 18, making the longevity of this imago apparently 55 days. Under laboratory conditions, however, a few specimens of *Epochra* were kept alive in jars for a period of 9 weeks.

An experiment was performed to determine the longevity of marked male and female currant fruit flies under natural conditions. Trypetids were removed from cages in the field, marked with different colored waterproof inks, and were set free in a currant and gooseberry garden on the same day that they issued. One hundred thirteen male and 74 female flies were released in two differently marked lots. No attempt was made to capture any flies during the first two weeks. During the third week 15 males and 14 females were caught in shady localities in the currant and gooseberry garden and during the fourth week three males and two females were taken. The last male was captured 29 days after liberation, and two females were collected after 30 and 31 days of freedom.

ONE BROOD ONLY.

According to Paine (1912, p. 142) "the only evidence that suggests a second brood, is the report of a single specimen of *Epochra canadensis* collected at Redwood City late in summer." A male currant fruit fly was captured by the writer as late as August 12, 1915, at Orono. This specimen was caught in the shade on a limb of an apple tree which was growing among currant and gooseberry bushes.

During the season of 1914, 121 quarts of infested gooseberries were taken into an insectary of the enclosed type to determine whether a second brood of flies would emerge. This building was provided with a glass roof sprayed with whitewash, a number of windows in the two sidewalls and two screen doors, one in each endwall. The fruit was allowed to remain within the insect-house until the larvae completed their development.

From a portion of the infested berries, 12,154 puparia were obtained. The puparia were placed in moist sand in glass jars with cheese cloth covering the mouth of each container. The jars were transferred from the insectary to a laboratory and were kept out of direct sunlight. On August 9, two female currant fruit flies emerged and by the end of the month 17 trypetids had issued. Of this number 11 specimens were apparently normal but 6 were abnormal due to the fact that the wings did not expand properly. This abnormality may have been caused by the loss of moisture from the sand. A few adults emerged also during September.

If a second brood of flies issued under natural conditions, one would expect an infestation of such berries as were overlooked by the pickers after the crop was harvested. Accordingly, currants and gooseberries were gathered on August 15, and placed on sand in breeding jars. One month later the sand was sifted but no puparia were found.

In view of the fact that conditions were not normal under insectary and laboratory conditions, it was decided to determine whether a second brood occurred under field conditions. During the season of 1915, 101 quarts of infested gooseberries were distributed in four large cages (height 35, length 36, width 31 inches) with top and sides made of mosquito wire. The varying soil conditions with reference to sunshine and shade under which the cages were placed over the infested gooseberries in the field are indicated in table 15. The cages were visited daily except on heavy rainy days. In none of the cages did a single adult emerge. There is no evidence of a second brood under natural conditions at Orono, Maine.

TABLE 15.

Soil Conditions Under Which Cages Were Placed Over Infested Gooseberries to Determine Whether a Second Brood Occurs.

Cage	Location	Soil	Sunshine or shade	Infested gooseberries	Dates drops were gathered
No. 1	Adjacent to barn	Sod removed from rich black soil	Partial shade	31 qts.	June 13—26
No. 2	Hay field	Sod	Sunshine	32 qts.	June 27—July 3
No. 3	Forest	Plowed clay	Shade below alder tree	22 qts.	July 4—10
No. 4	Orchard	Tufts of grass growing in clay	Shade below apple tree	16 qts.	July 11—17

SUMMARY OF DURATION OF STAGES IN LIFE HISTORY.

The duration of the different stages in the life history, the mating, preoviposition, egg-laying periods and the longevity of the adults as determined under laboratory and field conditions are summarized in table 16.

TABLE 16.

Summary of Duration of Stages in Life History Under Laboratory and Field Conditions.

Stages in life history	1914 (days)	1915 (days)
Egg period	* 4— 7	6— 8
Larval period	*10—18	11—25
Pupal period (months)	10—11	10—11
Mating period	33	38
Preoviposition period	* 7—16	6
Egg-laying period	34	36
Longevity of adults	?29	29—31

* Laboratory conditions.

HABITS AND BEHAVIOR OF ADULTS.

FEEDING HABITS.

The only observation on the feeding habits of *Epochra canadensis* made in 1914, was that of a single female fly which was seen feeding on a currant flower on May 25. During the following season, the adults were frequently noticed lapping up honey-dew from plant lice infesting currant leaves.

STARVATION EXPERIMENTS.

A series of experiments were performed to determine the number of days that currant fruit flies would live in captivity on water and without water. Shortly after emerging from pupae, one lot of trypetids was confined in a glass jar with the top enclosed by cheese cloth. On the same day another lot of specimens collected in shady localities in the field was placed in captivity in a similar glass container. Four times daily either distilled or lake water was sprayed through the cheese cloth into

the jars with atomizers. The jars were kept out-of-doors in the shade and were protected from the rain. The daily death rate is indicated in table 17.

TABLE 17.

Daily Death Rate of Currant Fruit Flies Fed on Water and Without Water.

Adults confined after emerging	Adults captured in field	Access to distilled water	Access to lake water	No water	Daily Death Rate					
					1	2	3	4	5	Days
49		49			6	14	17	12		Flies
	38	38			3	15	18	2		Flies
28			28		2	5	15	5	1	Flies
	21		21		2	9	5	3	2	Flies
21				21	5	12	4			Flies
	28			28	9	16	3			Flies

It is evident that the currant fruit flies can not subsist on water alone.

INACTIVENESS ON COLD DAYS.

It was observed in the field that currant fruit flies are so numb on cold cloudy days that they are unable to take wing. When disturbed on such days the trypetids would hop and then drop to the ground. During the night of May 27, 1915, the minimum temperature registered 25° F., and during the next two cold days (Table 9, May 28, 29) the adults were sluggish and inactive.

ADULTS SEEK SHADE.

Currant fruit flies seek shady localities in the field. Large numbers of specimens were captured in the shady parts of a wood pile, beneath the scantlings of fences, on fence posts, on trunks and branches of trees, and on branches of raspberry, blackberry, currant and gooseberry bushes. It was frequently observed that during the morning hours, the pest could be collected in certain shady places, and yet when the hot sunshine struck these same localities toward noon or afternoon, not a single trypetid could be found.

In the season of 1915, a daily record was kept of the number of trypetids which were captured in shady localities of a commercial currant and gooseberry garden. After mating commenced in the field, data was taken on the number of male and female flies caught during the morning and afternoon and also on the number taken in copula. Our records are not complete, however, as we were unable to visit the garden on some mornings, as indicated by a vacant space in the column of figures in table 18. An asterisk (*) in a space indicates that no specimens were captured due to heavy rains and an asterisk preceding a figure, that collecting was discontinued on account of rain.

TABLE 18.

Male and Female Currant Fruit Flies Captured in Shady Localities and Number Mating.

Date	♂	♀	A. M. ♂	P. M. ♂	A. M. ♀	P. M. ♀	Mating A. M.	Mating P. M.	Total
May 23	1	3							4
24	*0	*4							*4
25	3	8							11
26	*	*							*
27	0	1							1
30	9	9							18
31	22	32							54
June 2	19	16							35
3	12	13							25
4	12	20							32
5	35	25							60
6	16	8							24
7			*	87	*	47	*	6	140
8			*20	38	*12	44	*8	8	*130
9			47	43	21	27	8	8	154
10			*	3	*	11	*	6	20
11			4	*26	7	*106	0	*24	*167
12			*	56	*	63	*	22	141
13				24		58		2	84
14				28		63		14	105
15			13	*0	13	*1	4	*	*31
16			64	34	24	55	4	18	199
17			*	*3	*	*14	*	*0	*17
18			*	23	*	39	*	12	74
19				22		58		8	88
20			*	*	*	*	*	*	*
21			44	25	16	27	4	18	134
22			43	18	9	30	14	4	118
23			*	0	*	1	*	0	1
24				0		1		0	1
25			11	32	11	34	0	0	88
26			27	11	3	9	4	16	70
28			15	7	10	12	0	6	50
29			12	11	2	13	2	2	42
30			11	2	3	4	4	0	24
July 1			*	*	*	*	*	*	*
2				*1		*2		*4	*7
4				0		1		0	1
6			2	4	0	3	0	2	11
7			0		0		4		4
8			*	*	*	*	*	*	*
9			*	*	*	*	*	*	*
10			2	0	0	0	0	0	2
	129	139	315	498	131	723	56	180	2171

If one compares the total number of male and female currant fruit flies captured in shady localities during the morning and afternoon on the dates when no rain fell, it is evident that more males were caught during the forenoon (278♂ A. M., 187♂ P. M.), but more females were collected during the afternoon (99♀ A. M., 214♀ P. M.). A similar comparison of the number of specimens taken in copula on these dates shows that 20 pairs were captured in the forenoon and 37 pairs during the afternoon.

EFFECT OF SUNSHINE.

On several occasions currant fruit flies which had been captured in phials in the field were left accidentially in the sunshine and the exposure usually resulted in the death of the specimens. In order to obtain accurate data on the effect of temperature on the trypetids, five male and five female flies were exposed to sunshine in corked phials at 100° F. and within 10 minutes all of them were dead.

DEATH FEINT.

The recently emerged trypetids with wings not yet expanded can be induced to feign death. To bring about this inert condition, the fly was suddenly turned upon its back with a camel's hair brush or when disturbed the insect may hop, drop to the ground and feign death. Some specimens could be placed in 6 successive feints. The duration of the successive feints varied from a few seconds to three minutes. The termination of this immovable state was preceded by a twitching of the legs. A gust of wind or a breath of air caused an immediate awakening.

MARKING FLIES.

A number of different methods were used in marking currant fruit flies so that they might be recognized in the field. As already mentioned one method employed was to amputate part of a leg. A phial containing one adult was turned with the open end down and the bottle was then tapped with the finger over a small tablet of white paper coated with diluted corn syrup upon which the insect usually began to feed. The tablet was then turned in the desired position and a leg was snipped in two

through either the tarsus or tibia with a sharp spear-pointed needle. After part of the leg was severed, many flies continued to feed and showed no external indication of pain; others, however, flew to the windows, apparently from the shock effect of the operation. Every specimen was then captured in a phial and examined under a binocular microscope to determine whether the same leg was cut in each lot of trypetids.

Another method of marking currant fruit flies was with the use of different colored waterproof inks. A droplet of ink was applied with a small camel's hair brush to the thorax between the wings, while the adults were at rest on a mosquito screen wire enclosing an open window, where the ink dried quickly. Each specimen received at least three coats of ink. Higgin's scarlet, yellow and indigo blue waterproof inks formed an even coating, and gave better results than black or india ink. The difference in color between scarlet and yellow, indigo blue and black could not be distinguished with certainty after marking the flies. In some experiments the insect were doubly marked; first by amputating part of a leg, and second with the use of a waterproof ink.

The adults were handled before and after marking in a manner so that they were not injured. The flies were captured by holding a wide-mouthed phial over each trypetid and then the bottle was corked. After each specimen was marked, it was again captured in a phial and transferred through a hole in cheese cloth covering the top of a jar. The hole was plugged with cotton. The bottom of the container was covered with about an inch of moist sterilized sand.

FLIGHT OF MARKED FLIES.

Marked flies were set free in the field in order to determine how far they might travel, and also what effect winds may have on the flight. In releasing the specimens, the jar was placed on the ground, the cotton plug was removed and the hole was enlarged with a pair of scissors until the mouth of the container was free from the cheese cloth. The orientation of marked trypetids with reference to winds was carefully noted with the liberation of each lot of insects. When a heavy wind was blowing, the marked diptera flew and were carried by the wind with

extreme rapidity. In no case did the adults attempt to orient themselves against even a light breeze. During a calm spell no orientation took place and the fruit flies darted off in all directions.

Three hundred trypetids were liberated in four different marked lots, containing from 50–150 specimens. Each lot was set free from a different locality at a varying distance from a commercial currant and gooseberry garden consisting of 100 bushes. One person collected currant fruit flies daily in shady localities in this garden. During the season 2188 adults were caught and of this number 17 were marked individuals from the 300 that had been released. All of the 17 marked insects were captured during the first 15 days after the experiment had been started.

Table 19, shows the dates on which the fruit flies were released, the number of doubly marked trypetids in each lot, the direction of the wind at the time of liberation, the distance from the point of liberation to the commercial currant and gooseberry garden and the dates on which marked specimens were captured:

TABLE 19.

Data on Experiments With Marked Currant Fruit Flies.

Dates of liberation	Number of flies liberated	Leg cut; color of ink	Direction of wind	Distances flies were captured	Dates marked flies were captured
June 13 P. M.	115♀ 35♂ 150	Right middle leg; yellow	Heavy S. W.	3290 ft.	June 16, 1♀ 18, 1♀ 2
14 P. M.	50♀	Left hind leg; scarlet	Light S. E.	2650 ft.	16, 1 29, 1 2
14 A. M.	50♀	Left middle leg; indigo	Light N. W.	1115 ft.	15, 1 16, 1 21, 1 25, 1 26, 1 5
18 P. M.	50♀	Right hind leg; indigo	Calm	300 ft.	19, 1 22, 3 23, 1 25, 2 28, 1 8

The first lot of 150 fruit flies were set free on an island during a moderate southwest wind which blew toward the commercial currant and gooseberry garden. An examination of the vegetation on this island showed the presence of a few wild gooseberry bushes. As indicated in table 19, two marked females were captured in this garden at a distance of 3290 feet from the point of liberation. These specimens were forced to fly across a bay of the Penobscot River, varying from 200–500 feet in width.

The second lot of 50 marked trypetids were released on the side of a hill at an elevation of about 50 feet, during a light southeast wind which blew directly away from the commercial currant and gooseberry garden. Two marked females were captured in this garden at a distance of 2650 feet from the place of liberation. The two adults were collected after 2 and 15 days of freedom. These specimens may have been caught up by changes of winds which carried them towards this currant and gooseberry patch, or they may not have made a continuous flight but a series of short flights which finally brought them into this garden without the influence of the wind.

The third lot of marked adults were freed on a level stretch of country with no barriers, such as rivers or hills between the point of liberation and the commercial currant and gooseberry garden. At the time that the specimens were released, a light northwest wind was blowing toward the garden. Within 12 days five marked fruit flies were captured in this garden at a distance of 1115 feet from the place of liberation.

In the last experiment we endeavored to determine whether marked fruit flies when liberated in a gooseberry patch located in a yard in the residential section would travel to the commercial currant and gooseberry garden. This problem is a matter of much concern economically, if control measures are adopted in a non-isolated currant or gooseberry patch. Fifty marked females were set free by placing the jar containing the specimens on the sod in tall grass under a gooseberry bush. The flies gained their freedom during a perfectly calm spell. Within ten days eight marked specimens were captured in the commercial currant and gooseberry garden at a distance of 300 feet from the place of liberation.

NATURAL ENEMIES.

To determine whether a parasite checks somewhat the multiplication of the pest, 500 puparia were picked from soil under several currant bushes on May 1–2, and were placed in breeding jars under laboratory conditions, but not a single parasite emerged. An examination of nearly 2000 puparia gathered in the spring, showed that some of these were seemingly attacked by some predaceous enemy. As already stated, six small white oval eggs, apparently of a Hymenopterous parasite, were found in the respiratory hole of the fruit fly larva in a Chautauqua gooseberry.

SPIDERS.

A number of different species of spiders prey upon the adults (Fig. 16, C.). On June 9, 1914, when the fruit flies were noticed especially abundant in shady localities, the remains of four specimens were found in a web on an apple tree and the spider was devouring a fifth fly. A trypetid was also found in a spider's web which was spun on a currant leaf.

TOADS.

In a commercial currant and gooseberry patch, numerous toads were observed partly buried in the ground during the daytime. It is a well known fact that toads feed principally at night, but they sometimes emerge from their shelter before sundown or after a shower. To determine whether the currant fruit fly is snapped up by toads, it was decided to examine the contents of the alimentary canal of several toads. Accordingly, three toads were captured under gooseberry bushes late in the afternoon on June 19, and two were taken during the morning of June 23, 1914. A single female specimen of *Epochra canadensis* was found in the stomach of one toad captured on June 23. The adult sawfly of the imported currant worm *(Pteronus ribesii* Scop.) which often strips the foliage of currant and gooseberry bushes, was also found in the digestive canal of a toad. A gooseberry was found in the stomach of one of the toads.

As the toads were collected after the period of emergence of the adults in 1914, it was decided to again examine the con-

tents of the alimentary canal of toads captured during the period that the currant fruit flies issued in 1915, for it was believed that the trypetids which emerged from the soil with wings not expanded, would be devoured in larger numbers by these natural enemies. One toad was caught on June 4, and three on June 7, during the early mornings while hopping about under gooseberry bushes; whereas, two were captured on June 7, and one on June 11, during cloudy afternoons after light showers of the mornings had aroused them to activity. A glance at table 9, shows the number of adults which emerged on the dates that the toads were captured, and table 18, indicates the number of specimens taken in shady localities. Dissections of the toads did not show a single trypetid in any part of the digestive canal.

FUNGUS DISEASE.

Ninety fruit flies captured in the field on June 17, 1914, were confined in a breeding jar, and of this number one male died of a fungus disease on the following day. A successful attempt was made to spread this disease to healthy specimens under laboratory conditions. Trypetids were confined with the diseased insect for several hours in a vial plugged with moist cotton. These flies were then transferred to a breeding jar containing about an inch of moist sand. The disease was contracted by a number of the adults. Healthy individuals were now placed in the jar and numerous specimens succumbed to the effects of the fungus. The dead flies were found glued with the end of the proboscis to the sides of the jar, and the legs were usually bent beneath the body. We attempted to remove one of the imagoes from the glass jar by seizing the abdomen with a pair of forceps and gently pulling, but the mouth-parts were glued so tightly to the glass that the body was torn in two parts.

Diseased trypetids were scattered in shady localities of a currant and gooseberry garden. A single fruit fly which died of the fungus, was found attached to a currant leaf (Fig. 16, A.), but this specimen may not have contracted the disease from the dead infected insects introduced in this garden.

An attempt was made to transfer the fungus to other species of fruit flies confined in breeding jars with diseased currant fruit flies. Four sun-flower flies *(Straussia longipennis* Wied.) died of the fungus (Fig. 16, B.) at the end of 10 to 12 days. The

adults of the apple maggot *(Rhagoletis pomonella* Walsh), however, did not contract the disease.

METHODS OF CONTROL.

DESTRUCTION OF INFESTED FRUIT.

A measure of control recommended, is to frequently gather fallen infested fruits and burn them. As other writers have already pointed out, this system can not be relied upon to destroy all of the flies, for some of the larvae issue from the fruit before it falls to the ground.

The tedious task of picking up drops presents a number of difficulties. If currant bushes are grown in grass, it is practically impossible to find all of the infested berries. Gooseberry branches heavily laden with fruit, when not propped up, hang close to the ground, and one experience in picking up infested berries will probably be sufficient with most persons not to repeat the performance again, for the thorns scratch and break off in the hands, arms and body. When currants and gooseberries are grown on a commercial scale, the expense of labor for gathering drops would consume most of the profits. Few, if any farmers would have time to practice this means of control.

During the past two seasons, the remedial measure of frequently gathering fallen infested fruit was put to an experimental test in a commercial currant and gooseberry garden under town conditions. Since lack of coöperation of citizens has been shown to defeat horticultural sanitation methods of controlling other species of fruit flies under residential conditions, it was decided to pick up drops not only in the commercial garden but also in adjacent dooryards. Cheese cloth was fastened to the ground below currant bushes in the commercial garden, so that infested berries could be found more easily on a white background. One man was stationed in the field to collect drops daily under favorable weather conditions from the middle of June until the crop was harvested. He was able to pick up all of the fallen fruit at least twice per week. A weekly record of the fallen infested gooseberries obtained in the commercial garden during each season is given in table 20.

TABLE 20.

Weekly Record of Gooseberry Drops in Commercial Garden.

1914	qt.	1915	qt.
June 14–20	8	June 13–19	5
June 21–27	42	June 20–26	26
June 28–July 4	12	June 27–July 3	32
July 5–11	26	July 4–10	22
July 12–18	15	July 11–17	16
	103=3 bu. 7 qt.		101=3 bu. 5 qt.

It is evident from the results recorded in table 20, that the frequent destruction of fallen infested fruit can not be relied upon as a measure of control under town conditions. The explanation may be due partly to the fact that some of the larvae issue from the berries before they fall to the ground. It is evident from certain phases of the work on the life history of the pest, that infested berries must be collected daily. In all probability, currant fruit flies from outside sources invaded the locality in which horticultural sanitation methods were adopted.

One objection may be raised against this experiment due to the fact that 274 marked female currant fruit flies were liberated in the commercial garden, to determine the preoviposition period and longevity of the adults. It must be noted, however, that 220 females emerged in cages in this garden and that these same specimens were marked and released. During the season, 139 unmarked female flies were captured in shady localities of the commercial garden before mating commenced, and 972 unmarked females were caught after egg-laying began as indicated in table 18.

The effect of gathering fallen infested fruit during one season showed a decrease in the number of currant fruit flies which emerged in a cage during the following season. In the spring of 1914, a cage was placed over a white currant bush in the commercial garden and 535 trypetids issued as indicated in table 8. No infested fruit was gathered in the season of 1913, but the drops were picked up at least twice per week in the season of 1914. In the spring of 1915, 180 adults issued in a cage enclosing a white currant bush which was adjacent to the one used in the previous season.

During the picking of the crop one commercial grower, sorted out the maggoty gooseberries. As the harvesting of the crop extends over a period of several weeks, the daily destruction of infested fruit by burning is not always a convenient method. A number of experiments were performed to determine whether a more simple means of destroying infested fruit could not be adopted.

To determine the number of larvae which would pupate when maggoty fruit was submerged in water, infested currants and gooseberries were placed in pans or pails of water. At the end of one, two, three and four days, the fruit was removed from the containers and placed on sand. The figures in table 21, indicate the number of larvae which pupated.

TABLE 21.

Number of Larvae Which Pupated After Infested Fruit was Submerged in Water for a Period of One to Four Days.

Quantity of infested fruit	Days submerged in water	Number larvae pupated
Currants		
100	1	15
100	2	8
100	3	0
100	4	0
Gooseberries		
100	1	1
100	2	0
100	3	0
100	4	0
1 qt.	1	45
1 qt.	2	39
1 qt.	3	0
1 qt.	4	0

As all of the maggots in the infested currants and gooseberries used in the previous experiment were immature at the time that the fruit was emersed in water, another experiment was performed to determine the number of mature larvae which would pupate when submerged in pans of water. At the end of one, two, three and four days, 100 maggots were removed from each container and placed on sand. The figures in table 22, show the results.

TABLE 22.

Number of Mature Larvae Which Pupated After Being Submerged in Water for a Period of One to Four Days.

Number of larvae	Days submerged in water	Number pupated	Number dead pupae
100	1	95	28
100	2	30	29
100	3	2	2
100	4	0	0

It is evident from these experiments that maggoty fruit or mature larvae when submerged in water for a period of two days failed to give rise to living pupae. Infested currants and gooseberries sorted out during the harvesting of the crop or gathered from the ground could be dumped daily into a pail, barrel or tank of water. The size of the container to be used would depend upon the quantity of drops. When a sufficient amount has accumulated, two days must elapse, after the last addition of infested fruit to the container, before burying or plowing the fruit in the soil.

REMOVAL OF SOIL UNDER BUSHES.

A remedial measure frequently recommended is to remove the surface soil to a depth of one to three inches under the bushes and to deposit it on a road or some other exposed place or to bury it deep. These three different methods were put to experimental tests.

In the first experiment the ground was removed from under 12 of 13 currant bushes growing close together in a single row. It was not difficult to work below the shrubs for they were propped up with wooden railings and the earth had been hilled from 7–12 inches above the surrounding substratum. A gardener's trowel was used to scrape off at least three inches of the surface soil, but difficulty was experienced in removing the dirt beneath the net-work of rootlets. Many of the roots were exposed and some were injured. As soon as a sufficient amount of ground had accumulated, it was loaded on a wheel-barrow,

dumped and spread out on the street. At some distance from the currant bushes, new soil was loaded on the wheel-barrow and replaced around the shrubs. One man removed and replaced the earth in half a day.

The soil spread out on the street was soon converted into dust. Two weeks after the ground was dumped on the street, the dusty soil was transferred into breeding cages in an insect-house. Not a single fly emerged from this material.

A cage, with sides and top made of wire netting used for mosquito screen, was placed over the thirteenth currant bush. On May 15, 1915, the soil within the cage was treated with one part of carbolic acid emulsion to fifty parts of water at the rate of one-half gallon per square foot. On May 29, a number of currant fruit flies were found in the cage and a second application of the formula was given. A few specimens of this insect continued to emerge until June 11.

The currants were examined from time to time and it required a search to find a maggoty fruit, even though the infested prematurely ripened red berries are very conspicuous in the bunches of green currants. It must be noted, however, that no data could be obtained as to the infestation of the currants during previous years. Twenty-one quarts of currants were picked from the 13 bushes. This short crop was probably due to the fact that the bushes had been neglected for years, and all of the old wood and also branches containing borers had been pruned. The shrubs were not isolated, for in one of the dooryards at a distance of about 200 feet, were currant and gooseberry bushes with practically all of the fruit infested.

Another method of control suggested as already stated was to remove and deposit the surface soil around currant and gooseberry bushes in some exposed place. In the second experiment 50 puparia were exposed to the sunshine on the surface of the ground below a cage on May 8, 1914. Fourteen adults emerged from May 25–June 6, under these conditions.

In the removal of the dirt under the bushes, one method suggested, as already mentioned, was to deeply bury this soil. A third experiment was performed to determine the distance that the fruit flies upon issuing from puparia, are able to burrow through ground under field conditions. Holes, one-half, one, two, and three feet deep were dug in clay soil. Fifty puparia

were put at the bottom of all of the holes, except the hole three feet deep, in which 100 puparia wre placed. The insects were ready to emerge from these puparia, for some of the adults had already issued in the breeding jars a few days before burying them. Clay was tramped into the holes one-half and one foot deep. Another hole one foot deep, was filled with loose wet clay, while loose dry clay was placed in the pit two feet deep. The hole three feet deep was filled with large lumps of clay. Directly over the filled holes cages were placed, so as to capture any flies which would burrow through the earth. Not a single specimen was found in any of the cages. The clay became hard and compact due to rains, and the surface soil baked into a hard crust, and these conditions probably prevented the imagoes from burrowing completely through the ground. It should not be assumed, however, from this experiment that the pest would not be able to burrow through other kinds of soil. We (1914, pp. 198–199; 1915, pp. 78–83) found that other species of Trypetidae worked their way through two feet of filled earth and four feet of dry sand.

SIFTING PUPARIA FROM SOIL.

An attempt was made to sift the puparia from the soil under four currant bushes instead of removing and replacing the ground. The earth was first sifted through a one-quarter inch mesh wire netting, so as to break up the lumps and to remove the roots and grass, then as much of this soil as possible was passed through a mosquito wire. The dirt which failed to pass through the mosquito wire sieve, was spread on white paper in the laboratory and 1927 puparia were counted. After removing as many puparia as could be found, the ground was placed in breeding cages in the insect-house and 60 male and 57 female fruit flies emerged from May 16–28. A cage was placed over one of the currant bushes and 221 adults,—114 males and 107 females—issued from May 25–June 11. It was discovered later that the smaller puparia pass through the meshes of the mosquito wire and this gives a reasonable explanation for the emergence of the 221 specimens in the cage. Sifting the soil through wire netting with meshes smaller than screen wire would be an exceedingly laborious task.

STIRRING THE SOIL.

To determine, what effect stirring the ground would have on the pupae, 50 puparia were placed in clay soil, which had been previously loosened to a depth of three inches under a cage. Several times a week, the clay was stirred with a rake. Nine fruit flies emerged from May 25–June 3.

EFFECT OF CHEMICALS ON OR IN SOIL.

It is claimed that "as the larvae find fine dry dusty substances prejudicial to their transformation a heavy dressing of coal ashes placed under the bushes in June would destroy many of the larvae***." One hundred maggots after issuing from currants were dropped into a jar containing six inches of sifted wood ashes. Several weeks later 61 perfectly formed puparia were counted and 39 dead pupae and shriveled larvae were found in the ashes. Under field conditions the maggots probably would have burrowed through the ashes and entered the ground to pupate, and it is questionable whether the death rate would have been as high as in the jar of ashes.

One farmer had placed coal and wood ashes on the ground below currant and gooseberry bushes for several years each spring and the ashes had formed a hard crust. An examination of the crop, however, showed the presence of maggoty fruit, but the infestation was not so severe as in the case of currant and gooseberry bushes which had not been treated in this manner situated in dooryards about 315–565 feet distant. In the following season, 26 trypetids issued from May 27–June 2, in 5 ground cages covering 11 square feet of ashes which had been hoed below white currant bushes. A ground cage, two feet square, was placed over compact ashes between two gooseberry bushes, but not an adult was found in the cage during the season.

A method to control the Mediterranean fruit fly suggested in Malta in 1889, was to strew "the surface of the ground with one part of sulphate of iron to 24 parts of sand, the ground to be subsequently watered." In our experiment one quart of infested gooseberries was placed on the surface of one part of finely-powdered sulphate of iron mixed with 24 parts of sand, the mixture being subsequently watered. Several weeks later,

the mixture was sifted, and six perfectly formed puparia and three shriveled and discolored puparia were found.

Three experiments were performed to ascertain the effect of lime on the larvae in gooseberries. The details are given in table 23.

TABLE 23.

Effect of Lime on Larvae.

Quantity of infested gooseberries	Quantity of lime to two square feet of soil	Number larvae pupated	Number of dead pupae
1 qt.	5 lb. unslaked, stirred in soil	22	7
1 qt.	15 lb. unslaked, on berries	76	13
1 qt.	10 lb. slaked, on berries	61	20

A number of preliminary experiments were performed with other chemicals placed on or in ground to ascertain their effect on pupae buried three inches below the surface of clay soil and possibly on the adults upon emerging. The area of land treated varied from one and one-half to two or three square feet. Immediately after the application of the chemical, cages with top of screen wire and board sides, were placed over the areas treated. Earth was banked and tamped around the bottom of each cage to prevent the escape of any of the flies. Some of the pupae were probably not killed by the chemicals, but the flies undoubtedly were not able to burrow completely through the clay soil, for this had become hard and compact and the surface was baked into a hard crust. It was impossible to make a daily visit to these cages, and the records in table 24, of the number of flies which emerged are not complete, for the wings of dead flies devoured by Carabids and ants were found under the cages.

TABLE 24.

Chemicals on or in Soil and Their Effect on Pupae and Adults Upon Emerging.

Square feet of soil treated	Number of puparia buried	Dates of application	Treatment	Number of adults emerged
2	50	May 11	1 lb. sulphate of iron mixed with 24 lb. of sand on soil	5
2	25	11	5 lb. unslaked lime stirred in soil	5
2	25	11	15 lb. unslaked lime on soil	1
2	25	11	10 lb. lime slaked on soil	2
2	50	12	¼ lb. potassium cyanide in soil	0
2	50	13	4 tablespoons carbon bisulphide in soil	16
2	50	12, 22	2 gal. 1 pt. formaldehyde to 30 gal. water	14
1 ½	25	11, 22	1 ½ gal. 2 pt. formaldehyde to 50 gal. water	9
1 ½	25	12, 22	1 ½ gal. 1 part Nikoteen to 100 parts water	2
1 ½	25	12, 22	1 ½ gal. 1 part Nikoteen to 400 parts of water	2
1 ½	25	13, 22	1 ½ gal. 1 part Black Leaf 40 to 600 parts water	0
1 ½	50	13, 22	1 ½ gal. 1 part Black Leaf 40 to 800 parts water	6
1 ½	50	12, 22	1 ½ gal. 1 part stock solution kerosene emulsion to 12 parts water	0
1 ½	25	12, 22	1 ½ gal. 1 part stock solution kerosene emulsion to 20 parts water	1
2	50	11, 22	2 gal. 1 part stock solution carbolic acid emulsion to 35 parts water	1
2	50	12, 22	2 gal. 1 part stock solution carbolic acid emulsion to 50 parts water	0
1 ½	25	11	None (check)	12

In view of the fact that no adults emerged from 50 puparia buried with potassium cyanide as indicated in table 24, a number of experiments were now conducted to determine the effect of potassium cyanide on wild gooseberry bushes growing in sod and on cultivated currant bushes. Different quantities of this poison were buried in holes three inches deep at various distances from the origin of the branches above the soil as indicated in table 25. Several weeks after the treatment, all of the wild gooseberry and cultivated currant bushes had shed their leaves, but the next spring all of the shrubs "leafed out" again.

TABLE 25.

Quantity of Potassium Cyanide Buried in Soil at Various Distances from Bushes.

Quantity of potassium cyanide (oz.)	Number of holes, poison was buried	Distance from bush poison was buried (inches)	Kind of bush
1	4	6	Wild gooseberry
2	6	4	Wild gooseberry
3	8	8	Wild gooseberry
4	8	12	Wild gooseberry
4	8	18	Red currant

No fruit flies emerged from 50 puparia buried in clay soil treated with two applications of one part carbolic emulsion to 50 parts of water, at the rate of one-half gallon per square foot; but in the experiment previously described in which a cage was placed over a currant bush and the ground was treated with the same formula, flies emerged after each application of the insecticide.

USE OF OILS TO TRAP ADULTS.

Recent investigations have shown that certain vegetable and petroleum oils attract enormous numbers of male fruit flies of different species. Pans containing pure oil or a few drops of oil poured in water which partly filled the pans were placed upon the ground under currant and gooseberry bushes. Each oil was tested out separately so that there was no possibility of the volatile parts of different oils interfering with one another. The number of pans used, the number of days each oil was tested and the results obtained are stated in table 26.

TABLE 26.

Number of Male and Female Currant Fruit Flies Captured in Oils.

Oils	Pans	Days	♂	♀
Aniline	1	14	0	0
Balsam (Gurycen)	4	9	0	0
Bay leaves	2	13	1	0
Bergamot	3	17	0	1
Cajeput	1	13	0	0
Camphor	5	10	1	0
Caraway	5	4	0	0
Castor	1	14	0	0
Cedar	1	14	0	0
Celery seed	1	14	0	0
Clove	1	14	0	0
Cinnamon (Cassia)	4	3	0	0
Citronella	3	9	1	2
Cubarb	1	13	0	0
Cumin	2	13	0	0
Eugenol	3	7	0	0
Hemlock	4	3	0	0
Horsemint	5	10	0	1
Isoeugenol	3	7	0	0
Juniper (Savin)	4	10	0	1
Kerosene	7	11	1	5
Kuromoji from Japan	4	3	0	0
Lavender	3	13	0	0
Marjoram	1	13	0	0
Methyleugenol	3	7	0	0
Origanum	1	13	0	0
Paraffin	1	14	0	0
Peppermint	3	7	0	1
Phenolpthaline	1	13	0	0
Pine (Turpentine)	1	14	0	0
Pycnischennum lanceolatum	5	4	1	0
Sassafras	6	10	0	0
Spearmint	7	3	1	0
Tansy	3	13	0	0
Thyme (red)	4	9	0	0
Thyme (white)	3	17	0	0
			6	11

In all probability, the currant fruit flies that were found in the pans were not attracted to these oils but came within the sphere of influence by accident, became stupefied and dropped into the oils.

FOWLS.

It is claimed that fowls, when allowed to run at large under currant and gooseberry bushes, will destroy many larvae and puparia. One grower who had tried this method raised the objection that the hens scratched large holes below the bushes and exposed the roots. He also stated that the hens ate the fruit from the lower parts of the bushes. To determine whether

fowls relished the berries, hens were called together at their regular feeding time, and a quart of ripe red and white currants and gooseberries were thrown on the ground. The flock of hens tasted the fruit and seemed to prefer the currants but they soon departed leaving some of the currants and most of the gooseberries on the ground. To avoid loss of fruit, fowls could be placed in the berry patch after the crop is harvested and in early spring before the fruit is set.

Hens were fed on currant fruit fly puparia to determine whether any pupae would survive after having been taken into the digestive canal. A caged hen with an empty crop was offered 200 puparia and in 15 minutes she discovered the puparia and swallowed all of those that rested on the surface of the sandy soil. An hour later another 100 puparia were thrown into the cage and in a few minutes she began to feed on these. After the fowl had remained in the cage for two hours, she was dissected, and the contents of the alimentary canal were examined. Four puparia were found in the oesophagus, 6 in the stomach, 71 in the crop and 8 in the gizzard. Of the total number of puparia found in the oesophagus, stomach and crop, 12 had been injured by the bill. Seven puparia had been found up in the gizzard, but one was intact.

As none of the puparia had reached the intestine in the previous experiment, 200 currant fruit fly puparia were placed at the rate of 50 at intervals of an hour, into the mouth of a hen with an empty crop. Six hours after the first lot of puparia had been fed to the fowl she was dissected, and it was found that the puparia had been converted into a paste-like substance in the intestine. It is evident that no currant fruit fly puparium can pass through the digestive canal of fowls and issue as flies.

LATE PICKING TO AVOID MAGGOTY FRUIT.

One person picked his crop of currants and gooseberries late in the season to avoid maggoty fruit. From time to time currants and gooseberries with egg punctures were picked from his bushes and the last larvae issued on July 30, from the former and July 28, from the latter. During the previous year out records show that the last maggot emerged on July 29. To determine whether any larvae would issue later in other localities of Orono, one pint of currants and three quarts of goose-

berries were picked from bushes on July 30, in the commercial garden but not a single maggot bored out of the fruit. In one garden where currants were so badly infested that the crop was not harvested, all fruit still adhering to the bushes and also drops were gathered on July 30, but no larvae emerged. If picking could be delayed until August 1, practically all fruit which remains on the bushes would be free from maggots. In 1914, the commercial grower picked his crop from July 14–23, and in 1915, from July 19–28. If late picking is adopted, the danger of losing some of the sound fruit through sun scald must be taken into consideration.

POISONED BAIT SPRAY.

Lovett (1911–'12, pp. 135–136) attempted to control the currant fruit fly with the poisoned bait spray in Oregon, using a formula which Mally (1909, p. 6) employed to combat the Mediterranean fruit fly in South Africa. No conclusive results were obtained, but the following brief summary of the season's trials is given:

"1. The sweetened poison does attract the fly, *Epochra canadensis.*"

2. Frequent rains during the period of experimentation made numerous applications necessary.

"3. Granulated sugar is rather expensive; it crystallizes quickly and is not so satisfactory as a cheaper brown sugar would probably be."

"4. The crop was injured one-half in many localities and in a few cases the fruit, due to the maggot's attack, was not worth gathering."

"5. It is not considered that the amount of poison which would incidentally fall on the fruit is sufficient to endanger human life. The foliage spray is more effective for the flies."

The effectiveness of different kinds and amounts of poisons added to diluted molasses was tested on fruit flies confined in cages enclosing currant or gooseberry bushes in the field. After the poisoned bait had been applied to the bush with a bucket pump provided with a Bordeaux nozzle, 50 or more trypetids were liberated in the cage. The ground below each bush was covered with cheese cloth, so that the flies which succumbed to the effects of the poison could be found more easily on a

white back ground. The results with each formula of the poisoned bait used in the various experiments are given in detail as follows:

In the first experiment we endeavored to determine what effect arsenate of lead (paste) without molasses would have on the pest. After a light application of the spray was made to the foliage of a gooseberry bush, 50 fruit flies were liberated in the cage. Many of the specimens rested on the sides and top of the cage. The formula employed and the daily death rate of the flies are given in table 27.

TABLE 27.

Death Rate of Adults Confined in Cages Enclosing Gooseberry Bushes Sprayed With Arsenate of Lead or Poisoned Bait.

Molasses (pt.)	Arsenate of Lead (oz.)	Water (gal.)	Death Rate of Flies				
			1	2	3	5	Days
.	1	1	1	7	3		Flies
½	1	1	14	12	3	1	Flies
½	2	1	19	5	8		Flies

As ants were found in the cage devouring and carrying away dead fruit flies, the daily record of the death rate is probably not correct. Living flies were found within the cage at the end of 5 days, when the experiment was discontinued.

To determine whether the fruit fly would feed on arsenate of lead after the water had evaporated, a twig was cut from the sprayed bush, three days after the application of the insecticide, and the stem was emersed in a bottle of water within a glass jar. One fly died at the end of one day, but 24 specimens were still alive at the end of 6 days, when the experiment was discontinued. During the 6 days the cheese cloth covering the top of the jar was moistened with diluted corn syrup and water, several times a day. It was evident that arsenate of lead when dry on the leaves had no marked effect on the fruit flies in captivity under laboratory conditions.

In the next two experiments different quantities of arsenate of lead were added to diluted molasses and the different formulas of the poisoned bait were then tested under field conditions. To prevent the ants from entering the cages through the mos-

quito wire, a layer of pyrethrum was placed on the ground around the bottom of the cages, and kerosene oil was poured on the soil outside of the layer of pyrethrum. Table 27, shows the results with each formula.

It was found that ants were coming into the cages around the base of the branches which the cheese cloth did not cover. Besides the dead trypetids which were devoured or carried away by ants, there were others which did not drop on the cheese cloth. Some of the poisoned flies fell between the branches, then worked their way under the cheese cloth and died, others died on the leaves. The daily record of the death rate of the fruit flies is therefore, not complete.

Small quantities of sodium arsenite added to diluted molasses were tested under field conditions. As many of the fruit flies rested on the sides and top of the cages in the previous experiments, it was decided in this test to spray the remedy through the mosquito wire of the cages on to the foliage of the enclosed currant and gooseberry bushes. Table 28, indicates the results obtained.

TABLE 28.

Death Rate of Adults Confined in Cages Enclosing Bushes Sprayed With Sodium Arsenite in Diluted Molasses.

Molasses (pt.)	Sodium Arsenite (gr.)	Water (gal.)	Death Rate of Flies			
			8 hours	1	2	Days
½	2	1	9 flies	4	16	Flies
½	1	1	29 flies	3		Flies

Too much emphasis, however, should not be attributed to any of the experiments carried on under field conditions, because the fruit flies were in captivity and in feeding were forced to consume the poisoned bait. Again, some of the trypetids may have died due to the exposure to sunshine and not to the effect of the poison.

Three currant bushes not enclosed in cages were sprayed with the poisoned sweet, using one gram of sodium arsenite, one-half pint of molasses and one gallon of water. Cheese cloth was spread on the ground below the bushes, but not a single

dead fruit fly was found. The leaves showed no evidence of burning.

An experiment was performed in the field to compare the attraction of the adult for the poisoned bait applied to the lower branches of a red currant bush with honey-dew of plant lice present on the foliage. On June 22, the lower branches of the currant bush were baited, and then 100 male currant fruit flies were liberated in a cage enclosing the bush. A week later, a few trypetids were found alive in the cage and at the end of two weeks a single specimen was still alive.

In 1914, the poisoned bait spray was tested in a commercial currant and gooseberry garden consisting of 100 bushes. This garden was not isolated, for currant and gooseberry bushes were present not only in three adjacent dooryards but also in other yards in the vicinity. To isolate this commercial garden as much as possible, it was decided to spray all of the currant and gooseberry bushes found in this locality. A total of 142 bushes consisting of 18 currant and 124 gooseberry bushes were sprayed; these were distributed in 8 different gardens. This entire area had a natural isolation on three sides,—by the Stillwater and Penobscot Rivers and by a bay of the Penobscot.

Inquiry was made as to the infestation of the currants and gooseberries during previous years. Some of the owners stated that in some years practically all of the fruit had dropped to the ground, but in other years the infestation was not so severe and only about one-half of the crop was lost. The most reliable data were obtained from the commercial grower, who kept a record of the yield of the currant and gooseberry bushes during the previous five years (Table 30). No attempt had been made by any of the gardeners to control the fruit fly and all of the infested drops had been allowed to remain on the ground in prior years.

In order to avoid any complication of results, it was decided that none of the gardeners were to use their remedial measures against the imported currant worm *(Pteronus ribesii* Scop.). On May 26, we sprayed the foliage of the 142 currant and gooseberry bushes by using 30 gallons of water mixed with 30 ounces of arsenate of lead (paste).

Throughout the season the same formula of the poisoned bait was sprayed on the foliage of 100 bushes in the commercial

garden and on 33 bushes in six dooryards, but on 9 bushes in one garden the same amount of arsenate of lead mixed with water without the molasses was used. The insecticide was applied with a bucket pump, provided with a Bordeaux nozzle. The following proportions of the ingredients were used:

Molasses	½ pt.
Arsenate of lead (paste)	2 oz.
Water	1 gal.

Eight applications of the poisoned bait were made during the season. After a rain and as soon as the weather became settled, the insecticide was renewed. The number of gallons of the poisoned sweet used in each application of the spray on 100 bushes in the commercial garden, on 33 bushes in the six neighboring dooryards and on 9 bushes in the garden treated with arsenate of lead without molasses is shown in table 29. The data on the precipitation were copied from the weather bureau reports taken at the University of Maine.

TABLE 29.

Quantity of Poisoned Bait Used, Dates of Applications of Spray and Weather Records.

Quantity of poisoned bait			Dates of applications of spray	Days spray remained on bushes without rain	Dates of rainfall	Precipitation
Commercial garden 100 bushes (gal.)	Six gardens 33 bushes (gal.)	One garden 9 bushes (qt.)				
6	3	2	May 29	1	May 30	—
					June 1	.11
3	2	2	June 2	2	4	.31
6	3	2	5		5	1.20
3	2	2	6	1	7	—
					8	.14
4	3	2	10		10	.10
					12	—
3	2	2	13		13	—
					15	—
					16	.96
3	2	2	17	2	19	—
					20	.55
3	2	2	22	7	29	.34
31	19	16		13		

— Indicates a trace of rain.

After four applications of the spray had been made, it was found that many fruit flies sought shady localities in the neighborhood of the currant and gooseberry bushes. Male and female flies were found in the shade, at a distance of about 200 feet from their breeding grounds. As soon as we became acquainted with this habit of the pest in the field, it was decided to spray the vegetation and shady places adjacent to the commercial garden. Apple and poplar trees, raspberry and blackberry bushes and truck crops were treated with the same formula of the poisoned bait as was used on the currant and gooseberry bushes. Three gallons were used in each application on June 10, 13, 17 and 22. Grass, fence posts, scantlings, a wood pile, in fact, all shady places wherever the trypetid was found, were sprayed on the above dates with three gallons in each application of the following formula:

Molasses	½ pt.
Sodium arsenate	1 oz.
Water	1 gal.

A record of the crop harvested in the commercial garden in the seasons of 1909–1913, without control measures, compared the yield in 1914, after spraying, is shown in table 30. It must be noted, however, that two of the nine currant bushes were enclosed by cages in the season of 1914, thus protecting the fruit from the attacks of the pest, and hence increasing the yield of the crop. This table also shows the crop harvested in 1914–1915, after picking up fallen infested fruit during the two seasons, compared with the yield in 1916, when no remedial measures were used. A weekly record of the gooseberry drops gathered in the commercial garden during the seasons of 1914–1915, is given in table 20.

TABLE 30.

Record of Crop Harvested in 1909–1916, in Commercial Garden.

Year	Gooseberries		Currants	Method of control
	bu.	qt.	qt.	
1909	22		35	None
1910	12	3	0	None
1911	8	7	2	None
1912	8	27	26	None
1913	12	2	12	None
1914	10	1	17	Poisoned bait spray; destruction of fallen infested fruit
1915	16	0	8	Destruction of fallen infested fruit
1916	7	6	2	None

To check up the effectiveness of the poisoned bait spray, all of the gooseberry drops were gathered from the ground. A weekly record of the fallen infested gooseberries in the commercial garden in 1914, is given in table 20. As the drops during the first three weeks were not full grown, the actual loss is greater than the number of quarts recorded in table 20. The berries were ripe during the fifth week and the owner began to pick his crop on July 14.

The results of the season's spraying in the commercial garden and the three neighboring dooryards compared with the infestation of gooseberries on two untreated bushes used as a check at a distance of about 2000 feet from the commercial garden, are indicated in table 31. No record was taken of the infestation of currants.

TABLE 31.

Results of Season's Spraying in 1914.

Number of gooseberry bushes sprayed	Non-infested gooseberries	Gooseberry drops	Infested gooseberries	Check infested gooseberries
	qt.	qt.	%	%
91	321	103	24	100
3	7	5	41	100
8	4	5	55	100
7	5	9	64	100

In three gardens the gooseberry drops were not gathered because the bushes were growing in high grass. As these bushes had been neglected for years the yield of fruit was very low.

The seven currant and two gooseberry bushes treated with arsenate of lead without diluted molasses resulted in a total loss of all of the gooseberries and only four quarts of currants were picked.

After the bushes had received 7 applications of the poisoned bait spray, some of the currant and gooseberry leaves began to show evidence of spray injury on June 20. Some of the leaves turned yellow, speckled with small brown areas (Fig. 15, H) and later dropped from the bushes. On the other hand, the currant and gooseberry bushes sprayed on the same dates with arsenate of lead mixed with water without diluted molasses, showed no evidence of spray injury.

The following formula of the poisoned bait spray with the use of a so-called "quick killing di-plumbic arsenate of lead" burned the foliage of currant and gooseberry bushes so that many of the leaves turned yellow and dropped:

Arsenate of lead	3 oz.
Molasses	1 gal.
Water	2 gal.

The cost of the insecticide for eight applications of the spray to 100 bushes not including labor amounted to $.65. The additional cost of four applications of the bait to the vegetation surrounding the commercial garden and to the shady localities amounted to $.46.

There was some evidence to show that the fruit fly was attracted to the poisoned bait. During the application of the spray an occasional trypetid was observed feeding on the bait which was spattered on the outside of the bucket. In a number of instances, after reaching down to the bottom of the bucket to determine whether the arsenate of lead was in suspension and upon withdrawing the hand, a specimen alighted on the arm to feed on the poisoned liquid.

In the season of 1915, the poisoned bait spray was tested in a currant and gooseberry patch located on a farm. Twenty-two gooseberry bushes were in an orchard and 13 currant bushes

were situated along the margin of a vegetable garden. At a distance of about 315–565 feet from this farm, currant and gooseberry bushes were present in 5 door-yards.

The farmer informed us that the bushes had been growing in the same place for a period of 15 years, and that in some years he had lost about one-half of his crop due to insect pests. As a remedial measure during a number of years, he had placed coal and wood ashes on the surface of the ground under the bushes. The ashes had formed a hard crust under some of the gooseberry bushes.

On May 25, the foliage of the currant and gooseberry bushes were sprayed with two gallons of water mixed with two ounces of arsenate of lead (paste) to control the imported currant worm *(Pteronus ribesii* Scop.).

The proportions of the ingredients of a poisoned bait spray recommended by Winter (1913, p. 11) to control the Mediterranean fruit fly in Bermuda, was used in our work, but sodium arsenite was substituted for arsenate of lead. The following formula was used:

Molasses	2 qts.
Sodium arsenite	1 oz. (dissolved in 1 qt. of boiling water).
Water	1 gal.

The poisoned bait was applied to the lower branches of the currant and gooseberry bushes and to the grass under the bushes with a bucket pump, while the upper branches were baited with a paint brush. The trunk and lower limbs of the fruit trees near the gooseberry bushes were also sprayed.

Four baitings were made during the season. Table 32, shows the quantity of insecticide used, the dates of applications of the spray and data on precipitation:

TABLE 32.

Quantity of Poisoned Bait Used, Dates of Application of Spray and Data on Precipitation.

Quantity of poisoned bait (gal.)	Dates of applications of spray	Days spray remained on bushes without rain	Dates of rainfall	Precipitation
3	May 29	8	June 7	—
			8	.04
			10	.87
			11	.10
3	June 12	0	12	—
			15	.16
			17	.30
			18	.03
			20	.65
3	21	2	23	.06
			24	.07
			26	—
			27	—
			28	.15
			29	—
			30	.04
			July 1	.35
			2	.03
			3	.11
3	July 3	2	5	.61
			8	.32
			9	4.00
12		12		

— Indicates a trace of rain.

In checking up the effectiveness of the poisoned bait spray all of the gooseberry drops were gathered from June 13–July 14, below two baited bushes and also under two check or control gooseberry bushes located at a distance of 525 feet. A baited and check gooseberry bush were growing in the shade of apple trees and the other two were situated in the sunshine. On July 14, all of the gooseberries from the four bushes were picked. Table 33, shows the results:

TABLE 33.

Infested Fruit on Baited and Check Gooseberry Bushes Including Drops in 1915.

Baited bush in shade	Baited bush in sunshine	Check bush in shade	Check bush in sunshine
33%	17%	79%	23%

The cost of the insecticide for four applications of the spray to 33 bushes not including labor amounted to $.575.

ARE HONEY BEES POISONED?

A serious objection to the adoption of the fruit fly remedy would be the poisoning of the honey bees. Honey bees visit the currant and gooseberry blossoms in enormous numbers and if the bushes were sprayed during the flowering period there is a possibility that the bees may be poisoned through feeding in spray-poisoned blossoms. The first application of the spray, however, was applied after the maximum period of emergence of the currant fruit fly had commenced, at the time when all of the gooseberries and most of the currants had set.

Are honey bees attracted to the poisoned diluted molasses applied to currant and gooseberry bushes after all of the fruit is set? On June 22, 1914, one hundred currant and gooseberry bushes in the commercial garden were baited, when honey bees were visiting the flowers of raspberry and blackberry bushes in large numbers. The raspberry and blackberry bushes were growing between or near the currant and gooseberry bushes. An entire day was spent in watching the honey bees, but the bees paid no attention to the film of poisoned sweet on the leaves. The next morning the raspberry and blackberry bushes were sprayed and a half day's observation failed to show that a single bee deserted the flowers for the poisoned diluted black strap molasses.

SUMMARY.

A summary of the different methods of control is herewith given:

The destruction of fallen infested fruit can not be advocated as a method of control in commercial currant and gooseberry gardens, for the expense of labor employed in gathering the drops would consume most of the profits. Fallen infested berries must be gathered daily. This system can not be relied upon to destroy all of the flies, as some of the larvae issue from the fruit before it falls to the ground.

The daily destruction of all infested fruit by burning or boiling is not always a convenient method and is somewhat

expensive on account of the kerosene and fuel consumed. Submerging fruit in water for a period of two days will destroy all of the larvae. When a sufficient amount of submerged fruit has accumulated, two days must elapse after the last addition of infested fruit to the container has been made before burying or plowing it in the soil.

In view of the fact that the pest winters over in the pupa stage in the ground below currant and gooseberry bushes, the removal of the surface soil to a depth of three inches, dumping and spreading it out on the road destroys the pupae. The soil must be carefully removed below the network of rootlets. New soil at some distance away from the bushes should replace that removed. Few infested fruits were found in the currant patch thus treated but it must be noted, however, that no data could be obtained as to the infestation during previous years in this garden.

Sifting the puparia from the soil instead of removing and replacing the ground under the bushes proved to be an unsatisfactory method. The earth was first sifted through a one-quarter inch mesh wire netting, so as to break up the lumps and to remove the roots and grass, then as much of the soil as possible was passed through a mosquito wire. It was found that the smaller puparia passed through the meshes of the mosquito wire. Sifting the soil through wire netting with meshes smaller than screen wire would be an exceedingly laborious task.

Stirring the soil with a rake several times a week during the spring so as to expose the puparia to the natural enemies and sunshine did not prevent the emergence of some of the flies.

For several years each spring a farmer had placed coal and wood ashes upon the surface of the soil below currant and gooseberry bushes. Currant fruit flies issued in cages placed over hoed ashes but none emerged from compact ashes. An examination of the crop showed the presence of maggoty fruit but the infestation was not so severe as in currant and gooseberry gardens situated at a distance of 315–565 feet.

Various proportions of the following chemicals placed on or in the ground to destroy the larvae, pupae or adults upon emerging, did not give promising results as a method of control: sulphate of iron; unslaked lime stirred in soil; unslaked lime on infested berries or on soil; lime slaked on infested fruit or on

soil; carbon bisulphide; formaldehyde; Nikoteen; Black Leaf 40; kerosene emulsion and carbolic acid emulsion. No adults emerged when various quantities of potassium cyanide was added to soil containing puparia but defoliation resulted.

The currant fruit fly was not attracted to vegetable and petroleum oils used in traps.

Fowls when allowed to run at large under currant and gooseberry bushes, are said to destroy many puparia. To avoid loss of fruit, fowls should be placed in the berry patch after the crop is harvested and in early spring before the fruit is set. An objection raised against this method, is the fact, that the hens scratch large holes below the bushes and expose the roots. No puparia can pass through the digestive canal of fowls and issue as flies.

If the picking of the crop is delayed until August 1, at Orono, Maine, practically all fruit which remains on the bushes would be free from maggots. If late picking is adopted, the danger of losing some of the sound fruit through sun scald must be taken into consideration.

In 1914, the results of spraying the foliage with arsenate of lead added to diluted molasses showed a loss of 24 per cent of the crop of gooseberries in a commercial garden consisting of 100 currant and gooseberry bushes. In three adjacent dooryards 41, 55 and 64 per cent of the gooseberries were infested. The cost of the insecticide for 8 applications of the spray to 100 bushes not including labor amounted to $.65.

In 1915, a baited gooseberry bush growing in the shade showed a loss of 33 per cent of the berries compared with 79 per cent of infested fruit on the check or control bush similarily located while a treated and untreated gooseberry bush in the sunshine showed an infestation of 17 per cent and 29 per cent respectively. The poisoned bait, consisting of sodium arsenite and diluted molasses, was applied to the lower branches of the bushes with a bucket pump, while the upper branches were baited with a paint brush. The cost of four baitings applied to 35 currant and gooseberry bushes without labor amounted to $.575.

If currant and gooseberry bushes are sprayed during the flowering period there is a possibility that the bees may be poisoned through feeding in spray-poisoned blossoms. The first application of the spray, however, should be made at a time

when all of the gooseberries and most of the currants are set. Not a single honey bee was ever observed feeding on the poisoned bait, sprayed on the foliage or branches after the flowering period.

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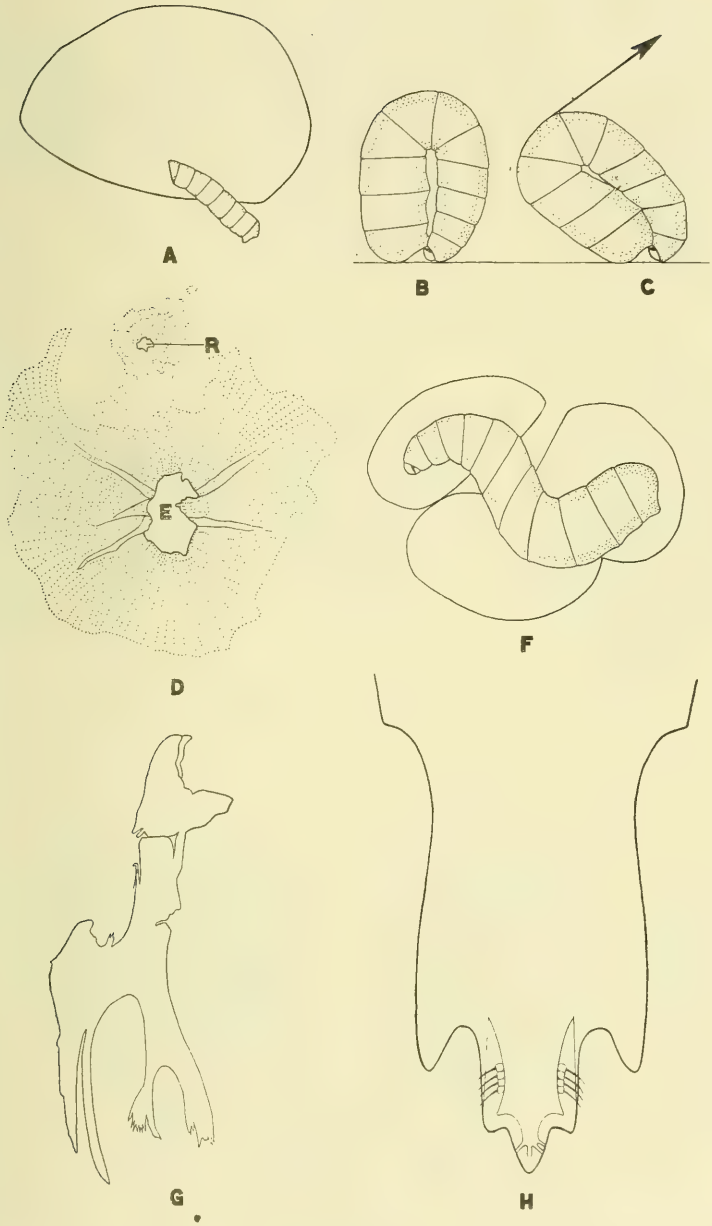

Figure 13.

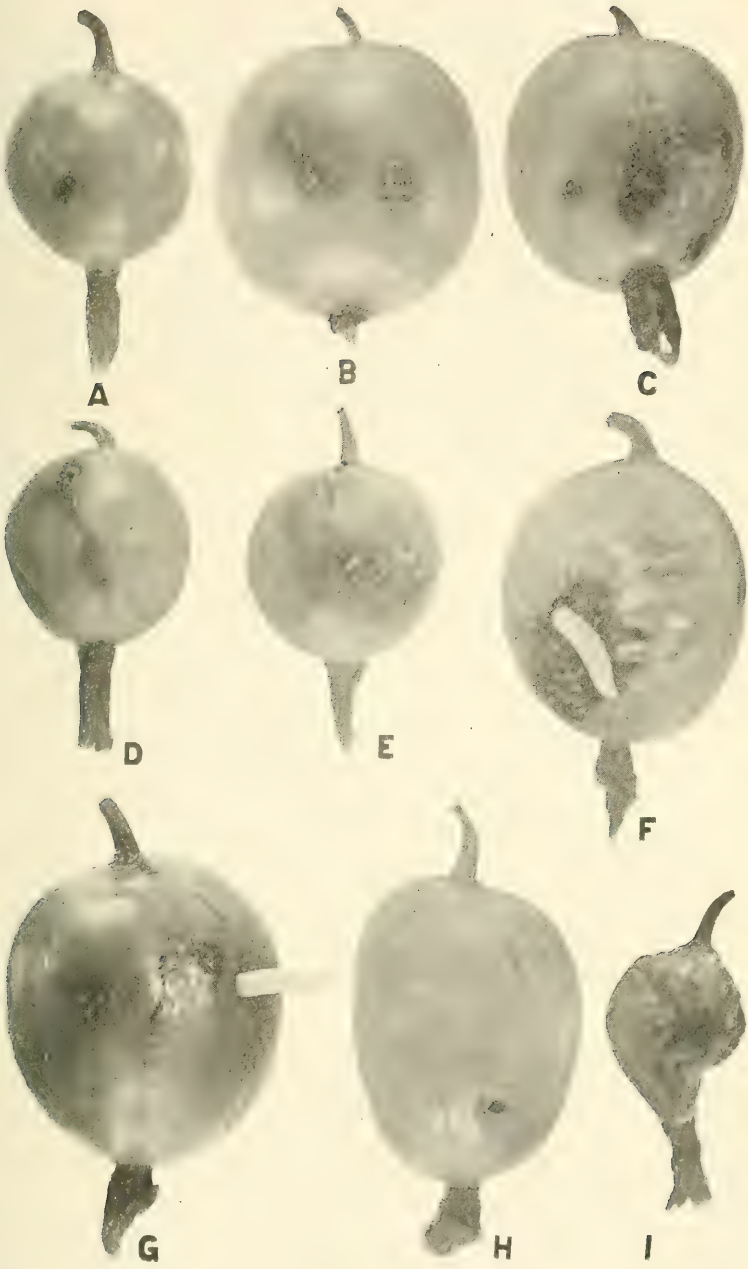

Figure 14.

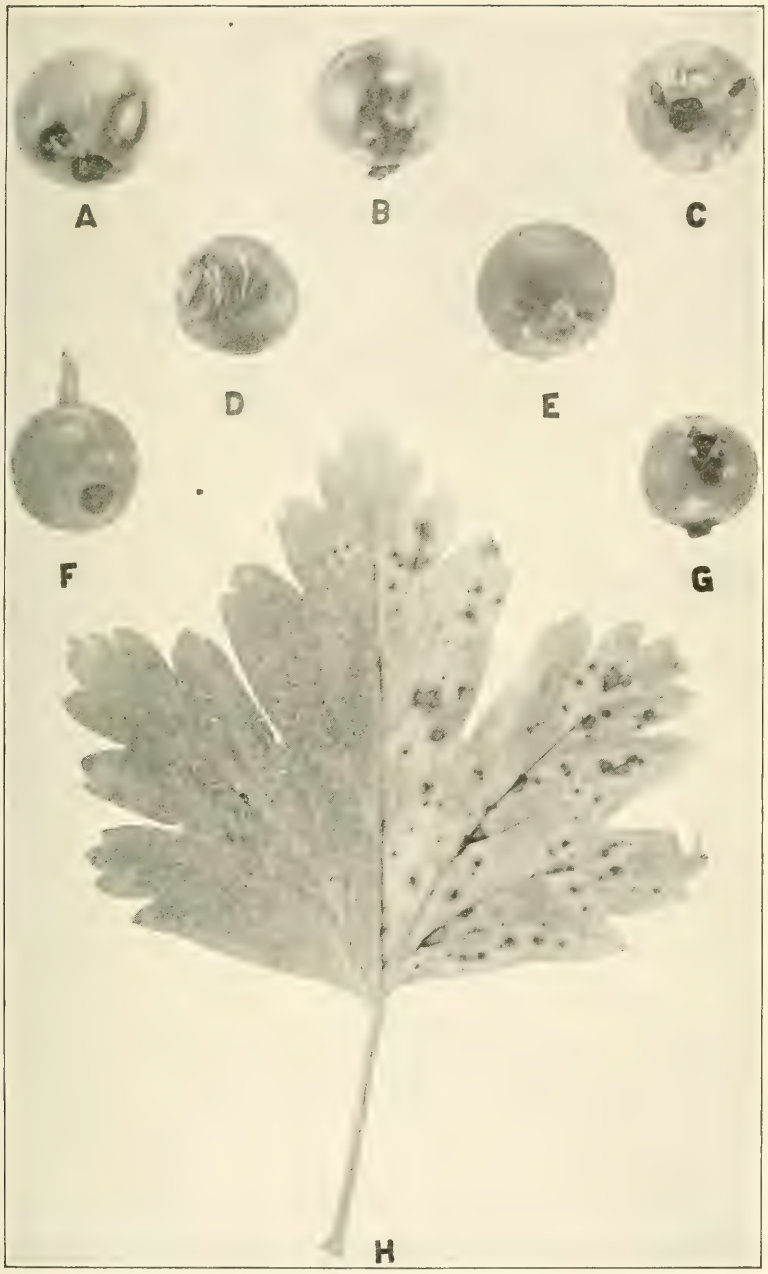

Figure 15.

Figure 16.

Figure 17.

BULLETIN 265

THE BIOLOGY OF THE ALDER FLEA-BEETLE, *Altica bimarginata* Say.[1]

WILLIAM COLCORD WOODS[2]

OCCURRENCE AND DISTRIBUTION.

Almost one hundred years have passed since Thomas Say (1842) first described the alder flea-beetle, *Altica bimarginata* Say,[3] but although periodically this insect appears in enormous numbers, no detailed work on its life history has yet been published, despite its wide distribution.

In the United States this beetle occurs from Maine to California, and it has also been reported from Canada. The following list includes all of the published distributional records which the writer has found: Maine (Packard 1890, Johannsen 1912); New Hampshire (Harris 1869, Packard 1890); New York (Linter 1887, Felt 1905, Britton 1911); Minnesota (Lugger 1899); Iowa (Sturm 1843); Missouri (Say 1824); Nebraska (Bruner 1893); Kansas (Le Conte 1859, 1860); New Mexico (Le Conte 1859); Oregon (Le Conte 1860); California (Mannerheim 1843, Le Conte 1857, 1860, Essig 1915); Mackenzie River Region, Canada (Le Conte 1860, Gibson 1913); British Columbia, Canada (Gibson 1913); Alberta, Canada (Gibson 1913); Nova Scotia, Canada (Gibson 1913).

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[1]Papers from the Maine Agricultural Experiment Station: Entomology No. 93.

Contribution from the Entomological Laboratory of Cornell University.

[2]Member of the Station Summer Staff.

[3]*Altica bimarginata* Say. Jour. Acad. Nat. Sci. Phila. 1824. V. 4, p. 85.
alni Harris. Ent. cor. ed. Scudder, 1869, p. 267.
ambiens Le Conte. Col. Kans. 1859, p. 25.
carinata Sturm. Cat. 1843, p. 282.
plicipennis Mannerheim. Bul. de Moscou, 1843, p. 310.
prasina Le Conte. Rept. Pac. R. R. Survey. 1857, p. 67.
subplicata Le Conte. Col. Kans. 1859. p. 25.

Altica[1] is the type genus of Alticini, one of the tribes into which the family Chrysomelidae, the leaf-beetles, is commonly divided. The members of this tribe are popularly known as flea-beetles because of their extraordinary powers of leaping, due to the strong muscles enclosed in the greatly enlarged femora of their hind legs. While Geoffroy (1762) stated that these insects could "jump with the agility of fleas", the first writer who actually referred to them as flea-beetles, seems to have been DeGeer (1775) who wrote "In Sweden they are known under the name Lopp-mask, that is to say, flea-beetle."

Among the European species of *Altica,* the injurious turnip-fly, *A. nemorum* Fab., is the best known, and of our American forms the destructive grape-vine flea-beetle, *A. chalybea* Ill., is a familiar example. Besides *A. chalybea,* at least two other species of *Altica* in addition to *bimarginata* Say occur in this state, the biology of which will be discussed in a forthcoming bulletin of this Experiment Station.

Although the alder flea-beetle is usually rather scarce, it may occur more or less periodically in enormous numbers, as has been intimated above. The first recorded outbreak was noted by Harris (1869) while he was traveling in New Hampshire, near Conway. Lintner (1888) gave an interesting account of the depredations caused by this species near Elizabethtown, N. Y., in 1877, and around Lake Pleasant, N. Y., in 1887. Packard (1890) mentioned this species as very abundant in Maine and New Hampshire in 1886 and 1887.

Similar outbreaks occurred in the State of Maine during the years from 1912 to 1915, and the observations recorded in this paper were made during those summers. The first specimens which were referred to the Experiment Station were sent in from Pan's Hill, Maine, in mid-July 1912. Later in the season, the beetles and their larvae were found working extensively on the alders in the Bangor Bog, near Orono. In 1913 they were extremely abundant all through the township of Orono and in many other parts of the state. The writer observed them in the townships immediately east of Orono, as far north as Mattawamkeag, and as far west as Oakland. They were not

[1]A discussion of the synonymy of the genus *Altica* Geoffroy, with the reasons for changing the name from *Haltica,* will be found on page

found in Lewiston, nor in Hancock and Washington Counties. Mr. John D. Tothill informed me that the beetles were present and abundant in New Brunswick, and Dr. Robert Matheson, in Nova Scotia.

So far as Maine is concerned, the year of maximum abundance was 1914. Even in the single township of Orono, the individuals of this species must have numbered many millions. The leaves were riddled by the attacks of the hibernating adults even before the larvae appeared. By the middle of August practically all of the leaves of every alder bush in the township had been skeletonized by the larvae, and the trees looked brown and bare, as though they had been swept by a fire. Many of the leaves had dropped from the trees, forming a mat half an inch or more thick under alder clumps. Some idea of the abundance of these insects may be obtained from the following data, which represent typical cases, illustrative of the condition of all of the shrubs in an alder copse covering several acres: on a twig selected at random, on which only the three last leaves were left, were found 115 larvae, 31 on the terminal leaf, and 56 and 28 respectively on the other two; on a single large leaf close by were counted 77 larvae. By the first of September the trees were practically leafless. The majority of them had put out new leaves which were eaten by the beetles as fast as they were produced. Such a serious infestation killed many of the trees even in a single season.

In the summer of 1915, there was a great reduction in the number of the beetles, and although they were still common locally, their range was so much restricted, that the writer knew but few localities in the whole township where he could obtain these insects. They were so rare in 1916 that even with diligent searching the writer found no larvae and only a single adult in Orono, and this condition seemed to be typical of that prevailing all over the state.

The writer can offer no satisfactory explanation of this extraordinary disappearance. It certainly was not due to any failure of the food supply through over-population, nor was it due to the activities of natural enemies, for the parasitic forms preying upon these insects were not sufficiently abundant to cause a wholesale destruction, and they are but little troubled by birds. Climatic conditions in the winter of 1914–15 were

far from favorable, yet this can hardly be postulated as the cause of their disappearance, as it seemed to have little if any effect on the abundance of other species of *Altica*. The summer of 1915 was a favorable one for the growth of fungi, and many larvae and some adults were killed in this fashion, but the alder flea-beetle is not more suspectible to fungous attacks than other members of the genus whose numbers remained undiminished. However this species was much more abundant than any of the others, and on that account fungus could work much more effectively. Undoubtedly the fungus played a large role in checking the outbreak.

There is one peculiar circumstance which should be noted in this regard, as it seems to be correlated with the disappearance of *A. bimarginata*. As is pointed out under another heading, most of the eggs of these flea-beetles are deposited within the leaf-rolls of an alder caterpillar,*Acrobasis rubrifasciella* Packard. So far as the writer has observed, the abundance of this larva on the alder almost parallels that of the alder flea-beetle. It was abundant in 1912 and 1913, and very abundant in 1914; it was somewhat less common in 1915, and scarce in 1916. Whatever may have been the complex of conditions acting as determinative factors, the same conditions which acted as a check on the abundance of *Altica bimarginata* Say apparently acted also as a check on *Acrobasis rubrifasciella* Packard, and the abundance of the two species was evidently closely correlated.

Fortunately these beetles are not yet of great economic importance. The alder is not used commercially, and so long as the depredations are confined to it, the beetles cause no great injury, except where the alders have been used for ornamental planting in landscape gardening. But as is pointed out later, they can live on willow and probably on balsam poplar; and whenever this species is abundant, there is always the possibility that it may become a serious pest, should the beetles transfer their ravages either to the willow or to the poplar, both of which are of commercial importance.

THE LIFE HISTORY OF THE INDIVIDUAL.

SUMMARY OF THE LIFE HISTORY.

The adult *Altica bimarginata* is a dark shiny steel blue flea-beetle, which can be distinguished from all other species in our fauna by the longitudinal plica or fold on the side of the elytra. Like the greater number of other chrysomelids, these beetles hibernate as adults; in Maine they seek winter quarters in late September, and emerge in the spring as soon as the alder leaves, on which they feed voraciously, are well expanded. Pairs may be taken in copulation from the first of June until early July. From mid-June until late July the females deposit clusters of yellow eggs on the foliage which hatch in a few days into grubs or larvae which skeletonize the leaves. The larval life extends over a period of about 25 days, during which they molt twice; there are, therefore, 3 larval instars. When the grubs are full grown, they enter the ground and construct a rude cell, in which they pass about 6 days as prepupae and 10 days as pupae. At the end of that time the adults appear. Before they seek hibernating quarters, the beetles feed freely on the leaves of the alder, which is the preferred food-plant of this species. There is but one generation each year.

SEASONAL HISTORY AND BIOLOGICAL DATA.

DURATION OF THE EGG STAGE.

A record which was kept of 476 eggs deposited between June 16 and July 20, inclusive, may be tabulated as follows:

87 hatched in 7 days; 207, in 8 days; 157, in 9 days; 25, in 10 days; average 8.3 days.

LENGTH OF THE FIRST LARVAL INSTAR.

A record which was kept of 425 larvae which hatched between July 13 and July 28 inclusive, may be tabulated as follows:

182 molted to the second instar in 5 days; 115, in 6 days; 31, in 7 days; 18, in 8 days; 73, in 9 days; 6, in 10 days; average 6.3 days.

LENGTH OF THE SECOND LARVAL INSTAR.

A record which was kept of 340 larvae which molted to the second instar between July 18 and July 30 inclusive may be tabulated as follows:

65 molted to the third instar in 7 days; 210, in 8 days; 65, in 9 days; average 8.0 days.

LENGTH OF THE THIRD LARVAL INSTAR.

A record which was kept of 95 larvae which molted to the third instar between July 27 and August 30 inclusive may be tabulated as follows:

5 entered soil in 9 days; 11, in 10 days; 3, in 11 days; 11, in 12 days; 4, in 13 days; 38, in 14 days; 11, in 15 days; 12, in 16 days; average 13.2 days.

LENGTH OF PREPUPAL PERIOD.

A record which was kept of 215 prepupae which entered the soil between August 7 and August 30 inclusive may be tabulated as follows:

9 pupated in 4 days; 19, in 5 days; 82, in 6 days; 56, in 7 days; 11, in 8 days; 11, in 9 days; 6, in 10 days; 8, in 11 days; 6, in 12 days; 3, in 13 days; 2, in 14 days; 0, in 15 days; 1, in 16 days; 0, in 17 days; 1, in 18 days; average 7.0 days.

LENGTH OF THE PUPAL STAGE.

A record which was kept of 34 pupae which transformed between August 11 and September 6 inclusive may be tabulated as follows:

2 adults emerged in 8 days; 7, in 9 days; 1, in 10 days; 18, in 11 days; 5, in 12 days; average 10.2 days.

VARIATIONS IN THE REQUIRED TIME.

It was observed that whether the eggs were deposited early or late in the season had no bearing on the number of days occupied by the different instars, nor did the length of any given instar affect the length of the next instar. However, if the third instar were of short duration, the prepupal period tended to be longer than normal, and conversely. The principal factors causing variation were the conditions of temperature and moisture.

Nevertheless there is great variation in the length of time which different individuals require for reaching maturity. This is true even in the case of larvae hatching from a single egg cluster, or from different egg clusters but on the same day. For example, from eggs which hatched on July 17, 11 prepupae were obtained on August 11, 25 on August 13, 4 on August 14, and 11 on August 15; 9 pupae were removed on August 17, 5 on August 19, 4 on August 20, 1 on August 21, and 1 on August 22.

The following is cited as a typical life-history:
6 eggs which were deposited on July 22 (1914) hatched on July 30.
The larvae molted to the second instar on August 11.
The larvae molted to the third instar as follows:
1 on August 19; 1 on August 21; 2 on August 23; 2 on August 24.
The larvae entered the soil as prepupae, as follows:
1 on August 27; 1 on August 28; 1 on August 31; 3 on September 1.
Pupae were formed as follows:
3 on September 3; 2 on September 5; 1 on September 6.
Adults emerged as follows:
1 on September 13; 1 on September 14; 1 on September 15; 2 on September 16; 1 on September 17.

SEASONAL HISTORY IN MAINE.

The earliest date on which the writer has found eggs of the alder flea-beetle in Maine is June 16 (1915), but since he has collected recently hatched larvae on June 18 (1915), eggs must be deposited at least as early as June 10. The maximum period of egg deposition is early July. The latest date on which eggs were deposited in the laboratory is July 29 (1915), when only three eggs were obtained from many females which had been ovipositing freely. No unhatched eggs were found in the field at a later date. The oviposition period extends over a period of about a month and a half: from mid-June until late July.

Just hatched larvae were common on June 20 (1915). Larvae may be found commonly in the field as late as mid-August in years when this insect is abundant. No larvae have been found in the field later than August 24 (1914), although the writer has had them in the laboratory as late as August 30 (1914). The great majority of the larvae become full grown in late July or the first half of August.

The earliest date on which the writer has obtained pupae of this species is August 5 (1914). Without doubt this is much

too late to be representative. Larvae entered soil in the laboratory on July 25 (1914), and if they had been allowed to develop should have formed pupae on July 31. Eggs deposited on June 10 should produce pupae on July 21 since 41 days is the average length of time required between the deposition of the eggs and the pupal transformation. This estimate is probably not far from correct, as eggs deposited on July 4 (1915) yielded pupae on August 13 (40 days). The majority of these insects pass through the pupal stage in August; the extreme records which the writer has for just-formed pupae are August 5 (1914) and September 6 (1914). As was pointed out, July 21 would doubtless be nearer the range of possibilities than August 5.

Nearly all of the hibernating adults are dead by late July. The latest date to which one lived in the laboratory is August 17 (1914). Adults become common again about the middle of August, and this undoubtedly represents the appearance of a new generation of the beetles. No adult which was bred in the laboratory emerged earlier than August 20 (1914), but pupae formed on July 21 should give adults on August 1. The extremes of emergence are probably represented by August 1 and September 7.

There is only one generation each year. There is no tendency to pair among the individuals of the new generation, and there is no indication that any of the pupae live over in the soil until the following summer. Since they pupate very near the surface in only the rudest sort of a cell, and since the pupal life normally lasts but a few days, one would not expect any of them to winter over. In the laboratory it was clear that all of the pupae which did not transform were unhealthy.

The writer was not able to make personal observations as to the time when the beetles seek winter quarters in the fall, and come out from their hibernating places in the spring. From the data to which he has access, it seems probable that in Maine the adults enter their winter hiding places early in October, and desert them in the spring as soon as the leaves of the alder are well expanded. Both in the fall and in the spring, the beetles feed freely on the foliage.

DESCRIPTION OF THE STAGES; MOLTING HABITS AND COLORATION.

THE EGG.

Description. Pale orange; ovate-oblong; average length 1.25 mm., average width 0.45 mm.; surface densely marked with fine pits. The egg is shown in figure 23.

Manner and place of deposition. Whenever it is possible, the eggs of this beetle are deposited within the larval tubes of *Acrobasis rubrifasciella* Packard, a leaf-rolling caterpillar of the family Pyralidae, which is often very common on the alders in Maine. The eggs are laid in the innermost part of the folded leaf, so that they are completely hidden and the leaf must be unrolled to expose them. Usually the eggs of *Altica* spp. are streaked with excrement by reason of an instinct which probably has arisen in connection with concealing them; occasionally the eggs of *A. bimarginata* are so streaked, but usually they are not, probably because, since the eggs are already so well protected, such an instinct is unnecessary and has been lost. In a few instances the writer has found the eggs deposited on the under side of a leaf; in such a case they were always placed next to one of the larger veins. In the laboratory, the beetles deposit eggs freely without any attempt at concealment. When first deposited, the eggs are soft and in color dark yellow, but they become bright orange as they harden, and by 24 hours they become the characteristic pale orange. Usually but not always the eggs turn dull gray 24 hours before they hatch.

The eggs are always deposited in clusters, never singly; a count of 90 clusters gave the following data (v stands for variant, or the number of eggs per cluster, and f for the frequency with which that variant occurred):

v	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
f	6	7	12	9	16	10	7	9	5	3	3	1	1	0	0	0	0

(v)	19	20	21	22
(f)	0	0	0	1

This shows 6 as the mean of the species, and gives 6.6 as the real average.

Hatching. Before the egg is ready to hatch, the shell becomes very brittle, and usually the egg turns grayish 24 hours previous to the emergence of the larva, although this is not always the case. Always, however, the lateral tubercles of the

mesothorax and the metathorax show prominently through the egg shell as 4 black spots 20 hours before the egg is ready to hatch. When the larva is ready to emerge, it makes 2 longitudinal slits near, but not quite at, the anterior end of the egg. The only chitinized portions of the cuticula at the time of the emergence are the dorsal halves of the lateral tubercles of the last 2 thoracic segments, and the writer believes that they are the instruments used in rupturing the egg shell. These tubercles show up very prominently in a newly hatched larva, as the chitinized portions are jet black, while all the rest of the body is bright yellow. The explanation offered above would account for this peculiar appearance, which is characteristic of the newly hatched larvae of all of the Alticini which the writer has observed.

The thorax is arched out through one of these longitudinal slits, sometimes the right one, sometimes the left. The presence of the second slit doubtless lessens the rigidity of the egg shell, and makes it yield more readily to the efforts of the larva in the process of hatching. This is accomplished merely by the regular contraction and relaxation of the body muscles. The mesonotum is the first part to protrude through the opening, then the metanotum and the pronotum, giving the larva a sort of hunch-backed appearance. After a long, hard process of similar, slow, regular, alternate contraction and relaxation of the body muscles, the larva finally succeeds in withdrawing its head from the opening. In 5 minutes, or even less time, after the head is free, the legs are drawn out, all almost simultaneously, and the larva walks out of the shell.

This process was observed several times. The time required from the appearance of the first break in the shell until the larva was entirely free varied from 28 to 39 minutes; it usually occupied about 30. The following example is cited as a typical case: 10.05 first break in the egg shell; 10.10 second break in the egg shell; 10.20 metanotum and mesonotum exposed; 10.25 pronotum exposed; 10.31 head free; 10.33 prothoracic legs drawn out; the other legs freed almost simultaneously; 10.35 larva entirely out of the shell.

THE LARVA.

Description of the 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 1 cm.

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; *labrum* moderately large, rounded in front, shining black; *mandible* dark brown, moderate in size, with notched teeth at the apex; *trochantin* present at its base, non-chitinized; *maxilla,* with the cardo completely, the stipes incompletely, chitinized, bearing anteriorly a palifer with a 3-segmented conical palpus, and a very small nodule which probably represents the lacinia; *labium* with a large slightly chitinized basal piece, the fused mentum and submentum, bearing a ligula, unchitinized except at its base, from which arise a pair of small 2-segmented palpi; *antennae* inserted on the side of the head near the base of the mandibles, 3-jointed, white, the basal segment much larger than the middle segment, and the distal segment very small; *ocelli* wanting, the large sclerite between the labium and the prothorax (figure 18 B and C) is the *gula.*

Body wall of thoracic and abdominal segments brownish, densely beset with dull black cuticular nodules; prominent dull black dorsal, dorso-lateral, and lateral tubercles; ventro-lateral and ventral tubercles dull brown.

Abdominal segments 1 to 8 bear setiferous tubercles, segments 1 through 7 being identical; on the first 7, the setae are arranged in a mid-dorsal row of 2 tubercles on each segment (the anterior the larger), an upper and a lower row of dorso-lateral tubercles above the spiracle (each row composed of 2 small tubercles on each segment), a lateral row of prominent tubercles just below the spiracle (one tubercle to each segment), an upper and a lower row of ventro-lateral tubercles (a single tubercle each, on each segment), and a median ventral row (a single tubercle on each segment); on the 8th, the arrangement of the tubercles is the same except that the posterior of the mid-dorsals is the larger, and the upper and lower posterior dorso-lateral tubercles have united into a single one.

Abdominal segment 9 is modified dorsally into a strongly chitinized anal shield; ventrally it bears a large median tubercle, not clearly homologous with the other abdominal tubercles.

Abdominal segment 10 is very small; it has no setae nor tubercles, but bears ventrally the orange-yellow anal proleg (which probably represents the fusion of a pair of prolegs); the anal opening is shaped like an inverted Y, and lies in the middle of the proleg.

Metathorax and mesothorax. Mid-dorsal tubercles are present, homologous with those of the abdominal segments; they are broken along the mesal line (to provide a thin place where the cuticula can yield to strain,

and split at the time of molting); of the dorso-lateral tubercles, the 2 posterior have fused into one, the upper anterior is non-setiferous, and the lower anterior has fused with the lateral tubercle; the mid-ventral tubercles are present and homologous with those of the abdominal segments; but no other homologies can be drawn.

Prothorax. Modified dorsally into a strongly chitinized cephalic shield; the mid-ventral tubercle is the only tubercle which the writer can homologize with those of the abdomen.

Spiracles. There are 9 pairs of spiracles, 8 abdominal and one thoracic; the abdominal spiracles are borne on little tubercles located just above the lateral tubercles on segments 1 to 8; the thoracic spiracle is borne on a tubercle just above the base of the mesothoracic leg; an homologous tubercle, present on the metathorax, shows no indication of a spiracular opening.

Legs. The legs are composed of 5 segments, with an anterior and a posterior sclerite externally, at the base; the anterior sclerite is setiferous in the prothorax, and non-setiferous in the mesothorax and the metathorax; the posterior sclerite is setiferous in all 3 thoracic segments; the proximal segment is incompletely chitinized ectad, and almost not at all entad; it fits closely into a socket formed by the infolded body wall, with which it is continuous; 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 segment; 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 ental surface of the mesothoracic and metathoracic legs. There is no homology between the segments of the larval legs and those of the imago.

Figures. The arrangement of the setae and tubercles of the full grown larva is shown in the following figures: dorsal aspect, figure 18 A (head, thorax, abdominal segments 1, 8, and 9); ventral aspect, figure 18 B (head, thorax, abdominal segments 1, 8, 9, and 10); lateral aspect, figure 18 C (head, thorax, abdominal segments 1, 8, 9, and 10). The structure of the larval legs is shown in the following figures: ectal aspect, figure 20 A; ental aspect, figure 20 B (both drawings were made from mesothoracic legs). The structure of the larval mouth parts is shown in the following figures: labrum, figure 19 A; mandible, figure 19 B; maxillae and labium, figure 19 C. A first instar larva is illustrated in figure 24; a second instar, in figure 25; and a third instar, in figure 26.

Color changes of the larva during growth. The body wall of these larvae 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 bright orange yellow, as no pigment has yet been formed, and the yellow 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 tubercles and the 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 of *Altica* 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; they become gradually lighter throughout the instar, and the coloration of the early and late part of the same instar is quite different in some species.

Description of the newly hatched larva. The coloration and setal arrangement (with the exceptions noted below) is the same in the newly hatched larva as it is in the mature larva; however the tubercles are proportionately much larger, and the cuticular nodules much closer together. The setae are distinctly capitate all through the first instar.

There are only 3 setae on the lateral tubercles of the mesothorax and the metathorax, instead of 4, as in the full-grown larva; and only 2 on the lateral abdominal tubercles instead of 3; and only one on the posterior dorso-lateral tubercles of the 8th abdominal segment instead of 2.

This condition is characteristic of the second instar larvae as well as those of the first instar; and not infrequently this same condition prevails in a full grown larva.

Head measurements of larvae.

1st instar.

Minimum	.38 mm.	
Maximum	.43 mm.	
Mean	.43 mm.	(21 specimens.)
Average	.42 mm.	(42 specimens.)

2nd instar.

Minimum	.64 mm.	
Maximum	.71 mm.	
Mean	.64 mm.	(5 specimens.)
Average	.67 mm.	(10 specimens.)

3rd instar.

Minimum	.86 mm.	
Maximum	1.05 mm.	
Mean	1.00 mm.	(29 specimens.)
Average	1.00 mm.	(81 specimens.)

Ratio of measurements: 1.6.
Theoretical measurements: .42; .67; 1.07.
Actual average measurements: .42; .67; 1.00.
Actual mean measurements: .43; .64; 1.00.

Coloration after hatching. When the larva hatches from the egg, it is entirely bright shining orange yellow, except for the lateral tubercles of the mesothorax and the metathorax, which show up very conspicuously in contrast to the rest of the larva, as 4 black dots. As has already been pointed out, there is no pigment in the cuticula except in these tubercles, and the general color of the fat-body shows through. It is a general rule in the coloration of *Altica* larvae of all species that those parts which are darkest in the fully colored larva, are the last to show signs of coloration in a recently molted specimen.

The coloration of the larva after it emerges from the egg is typically that outlined below: 20 min. abdomen darkish, head somewhat dull; 30 min. mesothorax and metathorax darkish above like the abdomen, head and pronotum still quite bright shining yellow; 45 min. head and pronotum blackish; 60 min. body all blackish and duller, lateral tubercles of the mesothorax and the metathorax less conspicuous; 75 min. body uniformly dull and darkish above, the tubercles darker than the body, and the head and legs darker than the tubercles; 90 min. no change; 120 min. head and legs darker, somewhat shining; 135 min. legs deep shining black, body decidedly dark, tubercles black but not shining, head and prothorax deep shining blackish yellow; 150 min. head and pronotum deep shining black. The lateral tubercles of the mesothorax and the metathorax continue darker than the others for about 24 hours.

Color description of a first instar larva, early.

Head, prothoracic and anal shields, and legs, shining black; general body color dark brownish black dorsally, somewhat lighter ventrally; dorsal and lateral tubercles black, not shining; ventral tubercles dark brown.

Color description of a first instar larva, late.

Head, prothoracic and anal shields, and legs, shining black; general body color dark golden yellow dorsally, lighter ventrally; dorsal and lateral tubercles dark brown; ventral tubercles golden yellow.

The molt to the second instar (first molt).

This molt is performed in exactly the same way as the molt to the third instar, and the process is described in detail under that heading. Numerous larvae were observed as they underwent the first molt; it required from 35 to 50 minutes to complete it.

Coloration after the first molt (second instar).

The coloration of the larva after the first molt does not differ from the coloration after the second molt, and is described in detail under the latter heading.

Color description of a second instar larva, early.

Head, prothoracic and anal shields, and legs, shining black; general body color brownish black dorsally, lighter ventrally; dorsal and lateral tubercles dull black; ventral tubercles but little darker than the body.

Color description of a second instar larva, late.

Head, prothoracic and anal shields, and legs shining black; general body color very dark golden brown dorsally, somewhat lighter ventrally; dorsal and lateral tubercles dark brown; ventral tubercles same color as the rest of the underparts.

The molt to the third instar (second molt). As is the case with arthropods in general, when the larva is ready to molt, a new cuticula is formed underneath the old one, and late in each instar, the old cuticula becomes very brittle. In the process of molting, it cracks first along the mid-dorsal line of the metathorax, the slit extending cephalad along the mid-dorsal line of the other thoracic segments, and the V-shaped epicranial suture of the head. During this time the larva is firmly attached to the leaf by the legs of the skin which is being shed, the tarsal claws of which are securely imbedded in the tissues, and by the anal proleg, which projects out a little beyond the old cuticula. By slowly and regularly contracting and relaxing the body muscles, the larva works its way out of the old skin; first the thorax is arched out and then the head is freed. The legs are drawn out almost immediately after the head, but as they are soft and weak, they are held closely appressed to the body, and the larva makes no attempt to walk for about half an hour. The insect is now attached to the leaf only by the anal proleg, and the old cuticula is left as a ring around 3 or 4 of the abdominal segments. This ring is finally pushed off over the anal proleg, mainly by the activities of the body muscles, although the legs are used a little at the end.

This molt was observed several times; a typical example is given below: 11.05 skin cracked along the metathorax; 11.15 head free; 11.17 legs free; 11.25 old cuticula left like a ring around the abdomen, which is about two-thirds free; 11.40 begins to walk; 12.05 entirely out of the old cuticula.

Coloration after the second molt (third instar). At the beginning of the molt, the larva, as it emerges from the old skin, is a pure orange yellow, except that the mandibles are reddish

brown and the setal punctures dark. In about 20 minutes the setal punctures show up black, and the cuticular nodules are just beginning to be pigmented, although a hand-lens is necessary to observe this. In about 40 minutes the body has a general dullish cast, but the head, legs and prothoracic shield are still bright yellow. (The legs are always a paler and more translucent yellow than the rest of the body, probably because they contain less adipose tissue.) In about 50 minutes the distal segments of the legs have a dark cast.

The following figures refer to the time when the larva was fully free from the old cuticula, and the molt complete: 10 min. body and prothorax darkish, the tubercles not darker than the rest of the body, head still yellow, legs duller; 20 min. no change; 30 min. body not quite as dark as the prothoracic shield, distal segments of the legs blackish and the other segments dull, head somewhat dull; 40 min. body about the same color, head as dark as the body but not as dark as the prothoracic shield; 50 min. prothoracic shield blackish at the sides, head dull darker than the body, legs still light except the distal segments; 65 min. prothoracic shield dark brown; head, legs, and tubercles brown; general aspect of the body dark yellow brown; 95 min. little if any change; 110 min. head black, legs dark brown the distal segments black, prothoracic shield black, tubercles dark brown; 140 min. normal coloration;

Color description of a third instar larva, early.

Head, prothoracic and anal shields, and legs shining black; general body color very dark brown, almost black (aspect black dorsally and dark dull golden yelow ventrally); lateral and dorsal tubercles dull black; ventral tubercles brown.

Color description of a third instar larva, late.

Head, prothoracic and anal shields, and legs shining black; general body color very dark brown, almost black, dorsally, very dark golden yellow ventrally, much darker than earlier in the instar; dorsal and lateral tubercles black; ventral tubercles brown.

THE PREPUPA.

Formation of the pupal cell. In all insects which undergo a complete metamorphosis, the wings are developed internally in the larva, as hypodermal invaginations; then a part of this invagination evaginates, forming the wing-bud proper; just before the formation of the pupāl cuticula, this wing-bud pushes out so as to lie outside the hypodermis; finally the pupal cuticula is secreted around it, and thus it is brought about that the internal wing-bud of the larva is external in the pupa. 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 the alder flea-beetle, 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 fixed at this time show clearly that the entrance into the soil closely corresponds with the outpushing of the wing-buds.

In nature, as Lintner (1887) pointed out, the insects prefer to pupate under the mossy edge of a half-sunken rock, and the majority of the pupae are probably to be found in such situations. But even under natural conditions they will enter any fairly loose soil, pupating about an inch below the surface of the ground. The larvae 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 entirely wanting in this species, 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 the legs. This is due to the degeneration of the larval muscles, for, as has been pointed out already, there is no relation between the larval legs and the imaginal legs. The latter are developed as knobs or pads at the bases of the larval legs, and do not project down into them, so that when the larva molts to the pupa, the larval legs are simply hollow shells.

Color changes of the prepupa. In several species of this genus, there is a distinct prepupal color cycle, the insect first becoming darker and then very much lighter in color. So far as the writer has observed, there is no change in the coloration of the prepupa of the alder flea-beetle.

THE PUPA.

The molt from the prepupa to the pupa. When the prepupa is ready to molt to the pupa, the larval cuticula cracks along the thorax as in an ordinary molt (beginning at the mid-dorsal line of the metathorax and extending forward) and the pupa gradually wriggles out by slowly contracting and relaxing the body muscles. The larval skin passes off over the caudal end of the body, where it may hang for several hours. 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 to lie

in the position normal to the pupa. The wings and elytra lie pushed ventrad beneath the old larval skin in about the same relations that they show in the pupa. The pupa is always formed with the ventral aspect uppermost, and it remains in this position throughout this period.

Description. The general appearance of the pupa is that typical of the chrysomelids: wings and elytra pushed ventrad; the femora extending away from the middle line, the tibiae toward it, and the tarsi caudad along the mesal line; the metathoracic legs passing under the wings; the antennae extending caudad, bent under the mesothoracic legs.

There are 9 abdominal segments (unless the anal plate may be counted as a vestigial 10th), the last bearing a pair of strong black caudal spines. The arrangement of the setae is that characteristic of the genus *Altica*, and does not present any specific characters. The only specific variation which the writer has noted in the pupal setae of the genus *Altica* is the number of setae present on the femora. Sometimes there are 3, and sometimes but 2. In *A. bimarginata* there are 3: a pair of pre-apical setae and one apical, on each femur.

Great variation prevails in the setae which may be present in any individual specimen. Any given seta may be wanting (though the writer has never found a pupa in which any of the head setae were absent), and certain extra setae are sometimes present on the thoracic segments. The greatest variation is to be found in the pygidial setae. Very rarely the caudal spines themselves may be wanting entirely. Where the setae are serially homologous, and the arrangement the same on both sides of the body, as on the abdomen, a seta missing on one segment is usually present on the others, and may be absent only on one side.

The setae occur only on the dorsal aspect of the body and serve to keep the insect from contact with the sides of the pupal cell, as it lies with the ventral aspect uppermost.

The average length of the pupa is 5 mm.; the average width is 2.5 mm.

When formed, the pupa is bright orange yellow, with the appendages a more translucent yellow; the setae are brown, and the caudal spines and the spiracles (which occur on the first 6 abdominal segments) black. Packard (1890) described the pupae as white, but this is without doubt a mistake. Lintner

(1887) corrected this statement, suggesting that Packard's description might have been made from an alcoholic specimen, or that just formed pupae might possibly be white. The context precludes the former explanation, and as has just been stated, the newly formed pupae, like the older ones, are yellow. Essig (1915) stated that the pupae are either white or yellow, but this statement is probably incorrect. The writer has spoken of this at length because *bimarginata* pupae may be distinguished from certain other *Altica* pupae which are white, by the color characters, which are very constant. As the pupae of *bimarginata* do become white in alcohol, this distinction is useful only in the case of living pupae.

Figure 27 shows the dorsal aspect of the pupa; figure 28, the ventral aspect; figure 21 A, the arrangement of the setae, dorsal aspect, (mesothorax, metathorax, abdominal segments 1 through 8); figure 21 B, the arrangement of the setae, ventral aspect; figure 21 C, the setae of the 8th abdominal segment and the pygidium; figure 21 D, the setae of the prothorax, dorsal aspect.

Color changes of the pupa. As has been stated, the pupa when formed is entirely bright orange yellow, except for the brown setae and the black caudal spines and the spiracles, which are also black. But as the pupa grows older, certain color changes appear, which are correlated with the internal metamorphosis, and furnish a good indication as to the age of the pupa. All other species of the Alticini and the Galerucini which the writer has studied show similar external evidences of the progress of the internal metamorphosis by the formation of pigment in the cuticula.

The first change is to be noticed in the eyes, which become light brown on the 4th or 5th day after the pupal molt. On the 7th day, as a rule, the eyes are dark brown, the wings light gray, and the tips of the mandibles red brown. On the 8th day, the eyes are black, the distal tarsal segments black, and the femorotibial joints black; the labrum, the tips of the mandibles, and the palpi are brown; and there are brown spots on the pronotum. On the last day of pupal life, in addition to these markings, the coxae and tibiae are black, and the head is brown between the eyes.

There is of course a considerable amount of individual variation as to the time required for the appearance of these

changes, even in pupae which have come from the same egg cluster, but the sequence of the changes and the pigmentations themselves take place very constantly.

The elytra do not become pigmented at all during the pupal period, although the true wings become dark gray or almost black; since the wings lie under the elytra, the latter appear as if they were colored gray, but if one lifts them up, it is clearly seen that they are uncolored.

Another point which should be noted is the fact that no pigment is deposited in the pupal cuticula. The imaginal cuticula begins to be formed on the 3rd or 4th day of pupal life, and all of the pigment is formed in this cuticula. The pigmented imaginal cuticula shows up very plainly inside of the sheaths of pupal cuticula which enclose them. The imaginal mouth-parts are not completely formed at the molt to the pupa, and the pupal sheaths are much larger than the organs developed within them.

THE ADULT.

Description.

"Oblong, subparallel, above blue or slightly bronzed, usually moderately shining, sometimes subopaque. *Antennae*[1] half as long as the body, piceous, joints 2-3-4 gradually increasing in length. *Head* feebly shining, frontal carina obtuse, tubercles usually well marked, a few punctures extending across the head above the tubercles and near the eyes. *Thorax* one-half wider than long, slightly narrower in front, sides feebly arcuate, the margin very narrow, disc moderately convex, the ante-basal transverse depression rather deep, slightly sinuous at the middle, reaching the sides and joining the marginal depression, surface distinctly alutaceous, sparsely punctulate, punctures more distinct near the apex and the front angles. *Elytra* distinctly wider at the base than the thorax, humeri distinct, umbone moderately prominent and with a slight depression within it, a prominent lateral plica begins at the umbone, extends parallel with the margin, curves toward the suture near the apex, surface alutaceous, the punctures fine and indistinct, not closely placed. *Body beneath* and *legs* blue black, shining, abdomen sparsely and indistinctly punctate. Length .20-.24 inches; 5-6 mm."

The above description is copied directly from Horn (1889).

The Maine forms are usually bright cobalt blue, but rarely they may be a greenish blue. The writer has never seen any bronzy or subopaque forms in the state. The lateral plica varies

[1]The italics are the writer's; there are no italicized words in Horn's description.

in prominence, but in all specimens which the writer has examined, it has been plainly in evidence.

Emergence of the adult. The pupa is as deeply pigmented as it will ever be about 12 hours before the emergence of the adult. The coloration has already been described on page 266.

About half an hour before the emergence, the mouth-parts are moved continually. The pupal cuticula first splits along the mid-dorsal line of the mesothorax; then this crack extends backward down the mid-dorsal line of the metathorax, and forward along that of the prothorax. This split is made by the scutellum, which is moved up and down until the cuticula is ruptured. Within 20 or 30 minutes after the crack has appeared, the head and mouth-parts, as well as the whole pronotum, have been freed from the pupal cuticula. The elytra and wings, which have increased to their full length, have been pushed nearly dorsad. The prothoracic legs project out on each side, strongly bent at the femoro-tibial joint; the mesothoracic legs extend straight down the body, as do also the metathoracic pair, which have been drawn from under the elytra. The antennae lie straight down the middle of the ventral aspect, slightly bent in at their tpis, but entirely free from the legs. The abdominal muscles contract and expand rhythmically.

After the mouth parts have been freed, the beetles usually rest about 5 minutes, but soon recommence the task of molting. The next step is to withdraw one of the prothoracic legs from its pupal sheath, the other following almost immediately. At this point the antennae usually are drawn out: the head is inclined ventrally as far as possible, and then is suddenly thrown backward dorsally as far as is possible, and thus the antennae are pulled out of their pupal cases. Kicking and pushing with the tibio-tarsal joints of the front legs, the beetle rapidly succeeds in drawing out the mesothoracic legs and then the metathoracic legs from their pupal sheaths. The movements of the abdomen have pushed the pupal cuticula farther and farther caudad on the dorsal aspect of the body, and on the wings and elytra, so that by this time they are two-thirds free from the cuticula. The wings and elytra lie entirely dorsad. The pupal skin is now pushed downward and backward off the tip of the abdomen; the tibio-tarsal joints of all of the legs are used in this process which requires only a short time for its accomplishment.

The pupa is formed with the ventral aspect uppermost, and the adult remains on its back for about 4 hours after it has emerged. The beetle is of course very soft, and remains in the pupal cell, until it is fully hardened and colored, which requires about 24 hours.

The coloration of the adult. The beetle which has just emerged is quite as yellow as was the pupa. The eyes, antennae, and mandibles (sometimes also the labrum) are black, the elytra are grayish orange, and the wings gray. The insect becomes colored gradually, but it is some 20 hours before the characteristic coloration is reached. The beetle is entirely blackish above within 5 hours, and the underparts do not begin to color up at all until after that time. The centers of coloration are the pronotum, the ventral aspect of the pygidium, the bases of the elytra, the bases of the coxae, and the femoro-tibial joints of the legs.

THE RANGE OF FOOD PLANTS.

In nature, the alder flea-beetle is confined almost entirely to the leaves of the alder, at least in Maine, and the only other plant on which the writer has taken them is the willow *(Salix rostrata* Richards.)

There is a biological race of this species which occurs on balsam poplar, in Veazie, Maine. Eggs, larvae, pupae, and adults are indistinguishable from the typical *bimarginata,* and the larvae and adults eat alder or willow as readily as they do balsam poplar. The forms taken on alder however (both larvae and adults) have been tested many times on the leaves of the balsam poplar, but the results have always been negative. This is not surprising, when individuals which had already eaten alder were concerned, for the glandular leaves of the balsam poplar have a very decided taste and smell, but just hatched larvae of the alder race which had never tasted any food were equally emphatic in their refusal to subsist on the balsam poplar. Both larvae and adults will feed freely on the leaves of willow; they ate the foliage of all species with which they were tested.

Nevertheless the writer feels very sure that these are only biological races of the same species, if they deserve even that distinction. The habits, size, appearance, and life-history of the variety on the balsam poplar are exactly the same as that described for the alder forms, save that the eggs are deposited

in clusters on the under side of the leaves. Specimens were referred to Mr. C. W. Leng of New York City, who kindly determined them as undoubtedly *Altica bimarginata* Say.

All of the data on pages 253-270 appertain to the alder race.

Gibson (1913 p. 6) recorded this species as feeding on alder, willow, and poplar. Essig (1915 p. 266) reported this insect from alder, willow, poplar, and cottonwood.

The following tables record a few food plant tests which were made with the larvae and adults of the 2 races. The tests 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.

Altica bimarginata. (Alder race.) Food-plants of adult.

(i) Eaten readily.
Willow, *Salix* sp. near *nigra* Marsh, *S. cordata* Muhl., *S. rostrata* Richards; alder, *Alnus incana* (L.) Moench.

(ii) Eaten slightly.
European gooseberry, *Ribes Grossularia* L.

(iii) Refused.
Balsam poplar, *Populus balsamifera* L.; gray birch, *Betula populifolia* Marsh; white elm, *Ulmus americana* L.; cultivated rose, *Rosa* sp.; wild red cherry, *Prunus pennsylvanica* L. f.

Altica bimarginata. (Poplar race.) Food-plants of adult.

(i) Eaten readily.
Willow, *Salix cordata* Muhl.; balsam poplar, *Populus balsamifera* L.; alder, *Alnus incana* (L.) Moench.

(ii) Eaten slightly.
White elm, *Ulmus americana* L.

(iii) Refused.
Gray birch, *Betula populifolia* Marsh; wild red cherry, *Prunus pennsylvanica* L. f.; red osier dogwood, *Cornus stolonifera* Michx.

Altica bimarginata. (Alder race.) Food-plants of larva.

(i) Eaten readily.
Willow, *Salix* sp. near *nigra* Marsh, *S. cordata* Muhl.; aspen pop- Richards; alder, *Alnus incana* (L.) Moench.

(ii) Refused.
Balsam poplar, *Populus balsamifera* L.; wild strawberry, *Fragaria virginiana* Duchesne; red osier dogwood, *Cornus stolonifera* Michx.

Altica bimarginata. (Poplar race.) Food-plants of larva.

(i) Eaten readily.

Willow, *Salix* sp. near *nigra* Marsh, *S. cordata* Muhl.; aspen poplar, *Populus tremuloides* L.; balsam poplar, *Populus balsamifera* L.; alder, *Alnus incana* (L.) Moench.

The form of the scientific names and the sequence of the plant families in the above tables follows the use of the last edition of Gray's Manual.

The writer has found the following references to additional host-plants in the literature:

Alder. *Alnus serrulata* Willd. [Now classed as *rugosa* (DuRoi) Spreng.]

Harris (1869); Lintner (1887); Packard (1890).

Knotweed and smartweed. Blatchley (1910).

ACTIVITIES OF THE ALDER FLEA-BEETLE.

FEEDING HABITS OF THE LARVA.

The larvae live exposed on the leaves of their food-plants, on either surface. In the case of the alder, when they first hatch they crawl to the petiole end of the leaf, where they feed for a few days protected under the slightly revolute margin. At first the larvae eat only the lower epidermis and the green tissue, leaving the upper epidermis; but before this instar is over, they eat this epidermis also, leaving only a skeleton of the larger veins. This perfect and beautiful skeletonization, which has also been remarked upon by Harris (1869), Lintner (1887), and Packard (1890) is characteristic of all of the larval feeding, with the exceptions here noted; it is illustrated in figure 29. The nearly full grown larva eats holes through the leaves, as does the adult. The skeletonization is not as perfect on the leaves of the balsam poplar or the willow, as it is in the case of the larva. A balsam poplar leaf skeletonized by the larvae of *Altica bimarginata* is shown in figure 31.

THE FEEDING HABITS OF THE ADULT.

The adult beetles feed very freely on the leaves of the alder, eating little holes through them. This method of feeding, which is as characteristic as that of the larvae, is illustrated in figure 30. The adults feed both in the fall and in the spring. Willow and balsam poplar are attacked in the same way, and in no case do the adults ever skeletonize the leaves.

COPULATION.

The male and female remain in copulation several hours. The writer has never observed them to pair more than once, but it is probable that they do, since this is quite characteristic of related species.

NUMBER OF EGGS DEPOSITED BY A SINGLE FEMALE.

The writer has very little data as to the number of eggs which one female may deposit. None of the females which he has isolated after pairing deposited more than 35 eggs. But related species may deposit as high as 500 eggs per female, and doubtless 35 is far too low even to approximate the number of eggs which one female *bimarginata* can deposit. They usually begin to oviposit within a few days after pairing.

NATURAL ENEMIES.

FUNGOUS ENEMIES.

Both in the laboratory and in the field, larvae, prepupae, pupae, and adults are very susceptible to the attacks of *Sporotrichum globuliferum* Speng, if the conditions are right for infection. The writer does not doubt that this fungus played an important part in checking the outbreak of the alder flea-beetle, since it was abundant both in 1914 and 1915. While probably the fungus was not the only agent in the extermination of this species, nevertheless the extreme abundance of these insects offered ideal conditions for fungus to work, and doubtless great numbers of *Altica bimarginata* were destroyed in this way. Dr. Roland Thaxter of Harvard University kindly determined the species of fungus for the writer.

The pupae are quite subject to a wilt-disease, probably bacterial in its nature, but the writer has made no attempt to isolate the causative organism.

INSECT PARASITES.

An interesting parasite was bred from the adult beetles in the summer of 1915, a dipterous insect of the family Tachinidae, which was determined by Mr. C. W. Johnson of the Boston

Museum of Natural History as *Hyalomyodes triangularis* Loew. It was described under the generic name of *Hyalomyia* by Loew (1863, p. 85), and described again as a new species by Townsend (1893, p. 429), as *Hyalomyodes weedi.* The identity of the types was established by Coquillet (1897, p. 70), but he recognized *Hyalomyodes* as a distinct genus from *Hyalomyia,* and therefore the correct name stands as *Hyalomyodes triangularis* Loew.

The larvae are internal parasites of the adult beetles. The writer has no data as to the length of larval life, nor the manner of oviposition, but it seems probable that the eggs are deposited on the adult beetles in the spring or summer, after they have come out from hibernation. When the larva is full grown, it issues from the beetle, forcing its way out through the dorsal side of the abdomen, between the last two abdominal segments. The larva is white, with irregular brown splotches. In a few hours a brown puparium is formed, and the adult fly emerges about 2 weeks later.

1 puparium formed July 9, 1915; adult emerged July 21.....12 days.
1 puparium formed July 21, 1915; adult emerged Aug. 9.....19 days.
2 puparia formed July 26, 1915; adults emerged Aug. 9.....14 days.

The writer has not found any reference to the life-history of this species in the literature. *Celatoria spinosa* Coquillet, a related species which the writer has bred from the adults of 2 species of *Altica,* has been recorded by Coquillet (1890, p. 235) as bred from the adults of *Diabrotica soror* LeC.

CONTROL.

The writer has had no occasion to work on the control of these insects, but there is no reason to suppose that the measures employed in combating other flea-beetles would not serve to keep the alder flea-beetle in check, wherever their application was practicable. A thorough spraying with arsenate of lead at the rate of 3 pounds (paste form) 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, if necessary, would doubtless control this species.

THE SYNONYMY OF THE GENUS *ALTICA* GEOFFROY.

Altica Geoffroy 1762. Hist. nat. des. ins. t. 1, p. 244.
Haltica Illiger 1802. (Emend.) Mag. f. Insektenk. Bd. 1:138.
**Haltica* Hoffman 1803. (Emend.) Ent. Hefte.
**Graptodera* Chevrolat 1834. Cat. Dejean. ed. 2.

The systematic position of the flea-beetles was a matter of great dispute for about 50 years after Geoffroy had proposed the genus *Altica* to include them. A summary of the usages of the various writers from the 10th edition of Linnaeus' "Systema naturae" in 1758, which has been adopted as the arbitrary starting point for zoological nomenclature, to the final establishment of *"Haltica"* as a definite genus by Illiger in 1807, is given in the 2 tables published below. A more complete account of this history may be found in Kutschera (1859), Allard (1860), and Chapius (1875).

Authors who retained *Altica* previous to 1807.

*1762 Geoffroy p. 244; 1764 Geoffroy p. 244; 1775 De Geer p. 290; 1775 Fabricius p. 112; *1785 Fourcroy; 1789 Olivier p. 128; 1790 Olivier p. 100; 1796 Latreille p. 63; 1802 Illiger p. 138 *(Haltica)*; *1803 Hoffman; 1804 Latreille p. 323; 1807 Latreille p. 63; 1807 Illiger p. 81 *(Haltica)*.

Authors not retaining *Altica* previous to 1807.[2]

1758 Linnaeus p. 373 *Chrysomela* (Saltatoriae femoribus posticis crassisimis); 1763 Scopoli p. 69 *Chrysomela* (Saltatoriae); 1776 Fabricius p. 32 *Chrysomela* (Altica similis Chrysomelae saltatoriae Linn. certe huius generis); 1781 Fabricius p. 131 *Chrysomela* (Alticae saltatoriae femoribus posticis incrassatis); 1787 Fabricius p. 75 *Chrysomela* (Alticae saltatoriae femoribus posticis incrassatis); 1788 Linnaeus p. 1691 *Chrysomela* (Saltatoriae femoribus posterioribus incrassatis: Alticae); 1792 Fabricius t. 1, pt. 2, p. 24 *Galeruca* (Saltatoriae); 1801 Fabricius t. 1, p. 417 *Colaspis* (Saltatoriae), t. 1 p. 445 *Chrysomela* (Saltatoriae), t. 1 p. 463 *Crioceris* (Saltatoriae), t. 1 p. 477 Lema (Saltatoriae), t. 1 p. 491 *Galleruca*[3] (Saltatoriae femoribus posticis incrassastis); t. 1 p. 502 *Cyphon* (Saltatorii); t. 2 p. 57 *Cryptocephalus* (Femoribus saltatoriis).

Altica was proposed by Geoffroy in 1762 as a distinct genus to include the jumping chrysomelids which had been included by Linnaeus (1758) in the genus *Chrysomela*. The original definition of *Altica* was "Antennae ubique aequales, femur a postica crassa subglobosa" (p. 244), and as first constituted the genus included 19 species. In modern usage, as one would expect, the genus *Altica* is defined within much narrower limits,

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*The writer has not had access to this paper.

[2]The flea beetles are grouped at the end of the respective genera in which they are placed with the designation "saltatoriae" or some similar expression, as is indicated in the parentheses.

[3]The older authors spelled this word sometimes with one "l" and sometimes with 2. The genus was constituted by Geoffroy (1762) as *Galeruca* (p. 251), which is therefore the correct form. In this section of the paper the writer has indicated the spelling as it is to be found in the various papers quoted.

and the original genus has been split up into many smaller ones, so that *Altica* as we regard it today includes only a small portion of the species agreeing with Geoffroy's original description, which quite closely approximates our present conception of the tribe Alticini.

Geoffroy's (1762) discussion of the alticines is very interesting, and a translation, as literal as possible, follows: "To jump actively in the air with the agility of fleas is one of the peculiarities of the insects of this genus, a character which has given them the Latin name of *Altica,* or in French sauteurs, in place of the name Mordelles under which they have been described by some recent writers. We have reserved this latter name for some insects which constitute a different genus from this, although the two have been confused.

"To accomplish this active and considerable jump, nature has made the hind legs of the altise larger and stronger than the others. Especially the femora of these legs are remarkable. In almost all of these insects they are disproportionately large and often almost spherical, a character which makes them walk badly and slowly; but these great femora also enclose sufficiently strong muscles to execute such a violent movement as that which these animals make in leaping. We have drawn the character of the genus from the large femora and from the form of the atnennae which are quite long and of the same diameter throughout. The altises are all quite small. They are found in great quantities on potherbs, especially in the spring. They riddle and consume them. I have also found on these same plants numbers of small larvae, which may well be those of these altises, a thing which I do not dare affirm as I have not followed their metamorphoses."

There are 3 points which should be noted in conection with the paragraphs just quoted. First, the date which is usually assigned for the erection of the genus *Altica* is 1764; however, this is an error. The original date of publication of the Histoire d'insects by Geoffroy was in 1762, and the 1764 edition was a reprint. (The writer has had access only to the latter edition, and the page references given in this paper all refer to that printing, but as all of the page references to the 1762 edition agree with the pages as here given, it is probable that the pagination of the 2 is identical; such also is the inference one would draw from Hagen's Bibliotheca Entomologica.)

In the second place, Geoffroy proposed *Altica* to take the place of *Mordella* Linnaeus (p. 244). But Geoffroy was mistaken in stating that Linnaeus placed the flea-beetles in the genus *Mordella.* In the 1758 edition of the Systema naturae which has been constituted the standard from which binomial nomenclature dates, the flea-beetles were put in the genus *Chrysomela*

with the designation "Saltatoriae femoribus posticis crassissimis" (p. 373). Each species under this heading is described as "Mordella etc." and it is possibly this fact that accounts for Geoffroy's statement, but more probably it is because in the 1756 edition the flea-beetles are evidently included under *Mordella,* which is characterized as "Antennae filiformes, ultimo globoso. Pedes saepe saltatorii". But in 1758 and all of the later editions *Mordella* is used by Linnaeus for Coleoptera very distinct from the flea-beetles.

Finally, Geoffroy was also mistaken in saying that *Altica* was derived from the Latin. It is really derived from a Greek word, ἅλτικος, a leaper. As in Greek "h" is not a letter but is represented only by an asper, this omission of the "h" was a not unnatural error.

Illiger (1802) pointed out the proper derivation and corrected the speling. In his list of insect genera, we find: "Halticaae f Flohkäfer. ἅλτικος, zum Springen geschikkt. Nicht Altica." (p. 138). But this emendation cannot stand, for by Article 19 of the International Code: "The original orthography of a name is to be preserved unless an error of transcription, a lapsus calami, or a typographical error is evident" we must return to the first spelling, *Altica.* Hoffman (1803) also emended the spelling to *Haltica,* apparently independently (Chapius 1875, p. 16: the writer has not had access to Hoffman's paper). In this connection it is interesting to note the opinion of Allard (1860) who wrote long before the Code was drawn up: "It seems to me that the orthography of the word should be determined by priority, and since Geoffroy in 1762 and Fourcroy in 1785 wrote it with an 'A', with Latreille we must respect their right of invention and omit the 'H' " (p. 41).

It is unfortunate that it is necessary to make any change in the name of a genus so important, so well-known, and so firmly established as *"Haltica",* but the change is such a slight one that there should but little confusion result. It is obvious that all of the larger groups of which *Altica* is the type genus must be changed in a corresponding fashion, Halticini to Alticini, Halticae to Alticae etc.

The English and German authors as a whole adopted the emended spelling as soon as it was proposed. The French however clung to the old spelling for many years. *"Haltica"* is the

spelling universally recognized today; the last systematic paper in which the writer has found the old spelling is Allard (1860). The word is probably spelled with an "A" in Allard (1867), a publication to which the writer has not had access.

Chevrolat (1834) proposed the genus *Graptodera* as a substitute for *Altica* Geoffroy, omitting this genus entirely. (The writer has not had access to this paper: authority for statement Chapius 1875, p. 60.) This usage was followed by Allard and several writers. But Chapius (1875) pointed out the convenience of the term "Halticides" and the consequent necessity of preserving a genus *"Haltica"*. Kutshcera (1859), Fairmaire (1856) and Redtenbacher (1849) all retained *"Haltica"*. Since Chapius' work, it is fair to state that *Graptodera* Chevrol. has been reduced to the synonymy, and that *"Haltica"* has been recognized as a valid genus. The use of Illiger (1802) has been universally followed in the spelling, but this practice is inadmissible, and we must return to Geoffroy's original orthography, *Altica*.

The writer is not in a position to discuss the proper systematic position of the genus *Altica*, nor the proper rank to which its group should be assigned, but a brief summary of the development of the Alticini as a tribe (or according to some writers as a family) may not be without interest. A full discusion may be found in Kutschera (1859) and Chapius (1875).

The first attempt to divide the chrysomelids into groups seems to have been made by DeGeer (1775), who divided them into 4 families, *Altica* being the sole representative of the 4th family (p. 289). Latreille (1796) grouped various chrysomelid genera together as his 24th family (p. 63). Later (1804) he called this family the Chrysomelinae (t. 11, p. 323) and placed the genus *Altica* in it (t. 12, p. 5). In his next publication (1807) he recognized the same classification (p. 42 and p. 63). In 1810, he divided this family into the Criocerides (p. 232) and the Chrysomelinae (p. 235), retaining *Altica* under the latter (p. 235). This same plan was followed in 1817[1], but in 1825[1] he changed these names to Eupodes and Cycliques respectively. In 1830[1] he subdivided the Cycliques into 3 groups, Cassidaires, Chrysomelines, and Gallerucites, the last being further sub-

[1]The writer has not had access to this publication; authority for statement Kutschera (1859), p. 10–11.

divided into the Gallerucites isopodes with *Galleruca* as the type, and the Gallerucites anisopodes with *Altica* as the type.

Chapius (1875) recognized the Galerucides as a tribe, which he divided into 2 subtribes, the Galerucides proper and the Halticides. The latter he subdivided into 19 groups. Le Conte and Horn (1883) followed this use, recognizing the Galerucini as a tribe of the Crysomelidae, and dividing it into the subtribes Galerucini and Halticini. Horn (1889) has published the only monograph of the American Halticini (properly to be called Alticini). He found 14 of Chapius' 19 groups in America, and subdivided 3 of them into 2 groups each, so that he listed 17 groups of American Alticini. One of these groups which he subdivided was the "Halticae" of Chapius, which became the Disonychae and "Halticae" (represented in this country by the single genus *Altica)* of Horn.

Some recent authors have constituted the Alticidae as a separate family, but it seems best to the writer at least for the present either to regard the Alticini as a tribe under the family Chrysomelidae, or to follow the use of Horn and regard it as a subtribe of the tribe Galerucini.

The following characterization of the group Alticae and the genus *Altica* is copied directly from Horn's monograph (1889):

Alticae. "Antennae 11-jointed. Thorax regularly arcuate at the base, with a distinct ante-basal line variable in distinctness, not limited at the extremeties by a longitudinal plica. Posterior tibiae with, at most, a very slight sulcus on the posterior edge near the apex. Anterior coxal cavities open behind. Claw joint of posterior tarsi slender, claws appendiculate."

Altica. "Head short, usually deeply inserted, front regularly declivious, the interocular carina never prominent, the tubercles usually feebly masked. Anntenae half as long as the body, joints 2-3-4 gradually longer, except in *rufa.* Labrum small. Maxillary papli short, rather stout, the terminal joint short and conical. Thorax usually one-half wider than long and broadest at base, and with a more or less distinct ante-basal impressed line, base arcuate, lateral margin more or less thickened at the front angles. Elytra usually a little wider at the base than the thorax, the punctation of surface confused. Prosternum rather narrow between the coxae, the coxal cavities open behind, angulate externally. Legs moderately long, tibiae of posterior legs not or feebly sulcate, terminated by a small spur. Tarsi moderate in length, claws with a broad dilatation at the base."

Allard, Eraste.

1860. Essai monographique sur les galerucites anisopodes (Latr.) ou description des altises d'Europe. Ann. Soc. ent. Fr. 1860. ser. 3, t. 8: 39–144, 3[illegible]–418, 539–578, and 785–834.

[1]1867. Monographie des alticides. L'Abeille. 1866–67. t. 3:169. (Ref. Chapius 1875 p. 16).

Blatchley, Willis Stanley.

[2]1910. An illustrated catalog of the Coleoptera or beetles known to occur in Indiana (p. 1201).

Briton, Wilton Everett.

[2]1911. Vacation notes in the Adirondacks. Jour Ec. Ent. v. 4:544.

Bruner, Lawrence.

[2]1893. Insect enemies of ornamental and shade trees. Ann. Rpt. Neb. Hort. Soc. 1893, p. 166–235 (*alni*, p 205–206, fig. 46).

Chapius, F.

1875. Histoire naturelles des insectes. Genera des Coleopteres. t. 11.

Chevrolat, Pierre Francois Marie Auguste, Comte.

[1]1834. *In* Dejean, Catalogue des Coleopteres, ed. 2. (Ref. Agassiz, Nomenclator zoölogicus. Chapius 1875, p. 61 and Kutschera 1859, p. 11, give this date as 1837).

Coquillett, Daniel William.

1890. The dipterous parasite of *Diabrotica soror*. Insect Life v. 2:233–236.

1897. Revision of the Tachinidae of America north of Mexico. U. S. Bur. Ent. Tech. Bul. 7. (p. 70).

DeGeer, Charles.

1775. Memoir pour servir d'l'histoire des insectes, t. 5.

Essig, E. O.

[2]1915. Injurious and beneficial insects of California. p. 264–266.

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[1]Writer has not had access to this paper: reference unverified.

[2]This paper deals directly with *Altica bimarginata* Say.

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1781. Species insectorum.
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1792. Entomologia systematica.....
1801. Systema eleutheratorum.

Fairmaire, Leon.

[1]1856. Genera des Coleopteres d'Europe. (Ref. Chapius 1875 p. 60).

Felt, Ephraim Porter.

[2]1905. Insects affecting park and woodland trees. (v. 2, p. 573).

Foudras, Antoine Casimir Marguerite Eugene.

[1]1859. Les alticides. Ann. soc. Linn. Lyon. 1859. ser. 2, t. 6: 157–384.

Fourcroy, A.

[1]1785. Entomologia parisiensis.....

Geoffroy, Etienne Louis.

[1]1762. Histoire abregee des insectes.....
1764. Histoire abregee des insectes....., ed. 2.

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[2]1869. The entomological corespondence of Thaddeus William Harris. Edited by Samuel Hubbard Scudder. Occ. papers Bos. Soc. Nat. Hist. I *(alni,* p. 267–268).

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[1]1803. Entomologische Hefte.

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[2]1889. A synopsis of the Halticini of Boreal America. Trans. Am. Ent. Soc. 1889. v. 16:163–320.

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Latreille, Pierre Andre.

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1804. Histoire naturelle..... des crustaces et des insectes. t. 11.

1807. Genera crustaceorum et insectorum.

1810. Considerations generales sur l'ordre naturel des animaux.....

[1]1817. Le regne animal. (Ref. Kutschera 1859, p. 10).

[1]1825. Familes naturelles. (Ref. Kutschera 1859, p. 10).

[1]1830. Le regne animal. ed 2. (Ref. Kutschera 1859, p. 11).

LeConte, John Lawrence.

[2]1857. Report of the Exploration and Surveys..... for a Railroad from the Mississippi River to the Pacific Ocean. v. 12. Report on the insects collected, p. 1–72, pl. 1–2. (*prasina*, p. 24, p. 67; *plicipennis*, p. 24.)

[2]1859. The Coleoptera of Kansas and Eastern New Mexico. (*ambiens*, p. 25; *subplicata*, p. 25).

[2]1860. Notes on Coleoptera..... Proc. Acad. Nat. Sci. Phila. v. 12:315–321. (p. 317).

LeConte, John Lawrence, and Horn, George Henry.

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1756. Systema naturae..... ed. 9.
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Lintner, Joseph Albert.

[2]1888. Fourth report on the injurious and other insects of the State of New York. p. 1–237. (p. 96–101).

Loew, Hermann.

1863. Diptera Americae Septentrionalis indigena. Centuria quarta. Berliner ent. Zeits. Bd. 7:275–326. (No. 85, p. 319)

Lugger, Otto.

[2]1899. Beetles.....injurious to plants. Minn. Agr. Exp. Sta. Bul. 66. (p. 241).

Mannerheim, Carl Gustav von.

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Olivier, Antoine Guillaume.

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Redtenbacher, Ludwig.

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[2]1824. Descriptions of coleopterous insects..... Journ. Acad. Nat. Sci. Phila. v. 4: .....– . (p. 85).

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Sturm, Jacob.

[1,2]1843. Catalog der Käfersammlung von J. Sturm. *(carinata,* p. 282).

Townsend, Charles Henry Tyler.

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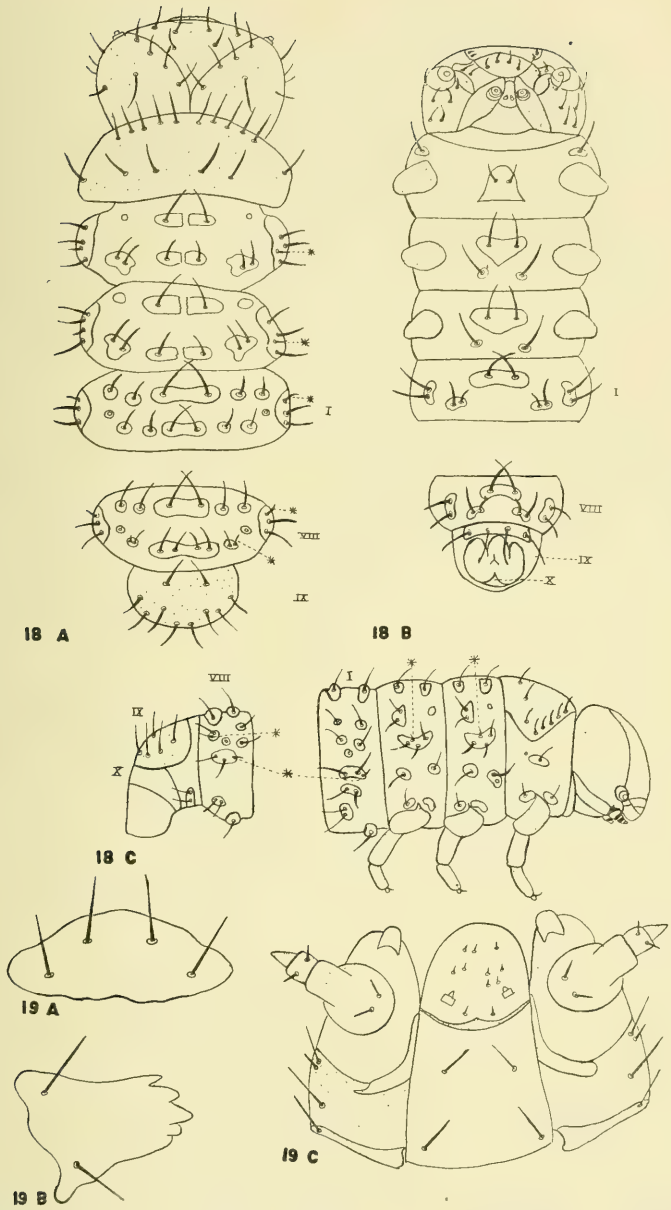
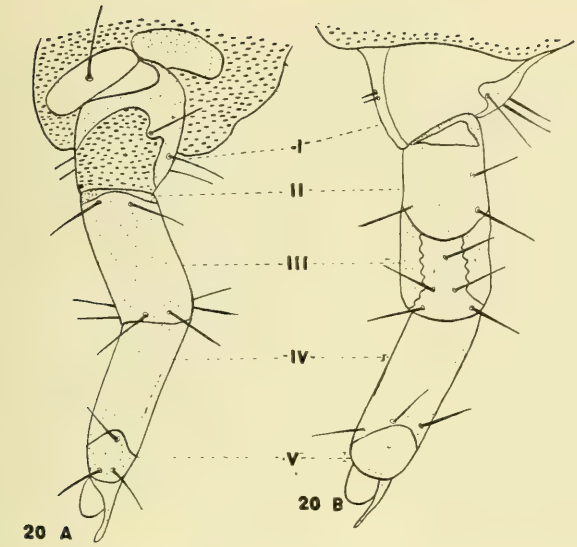
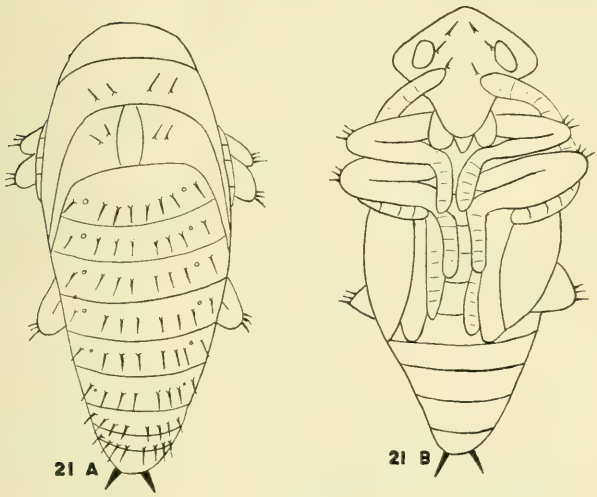
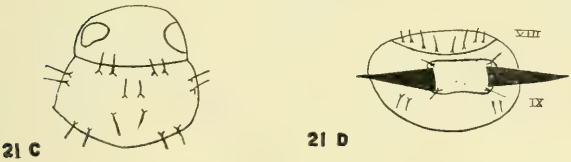


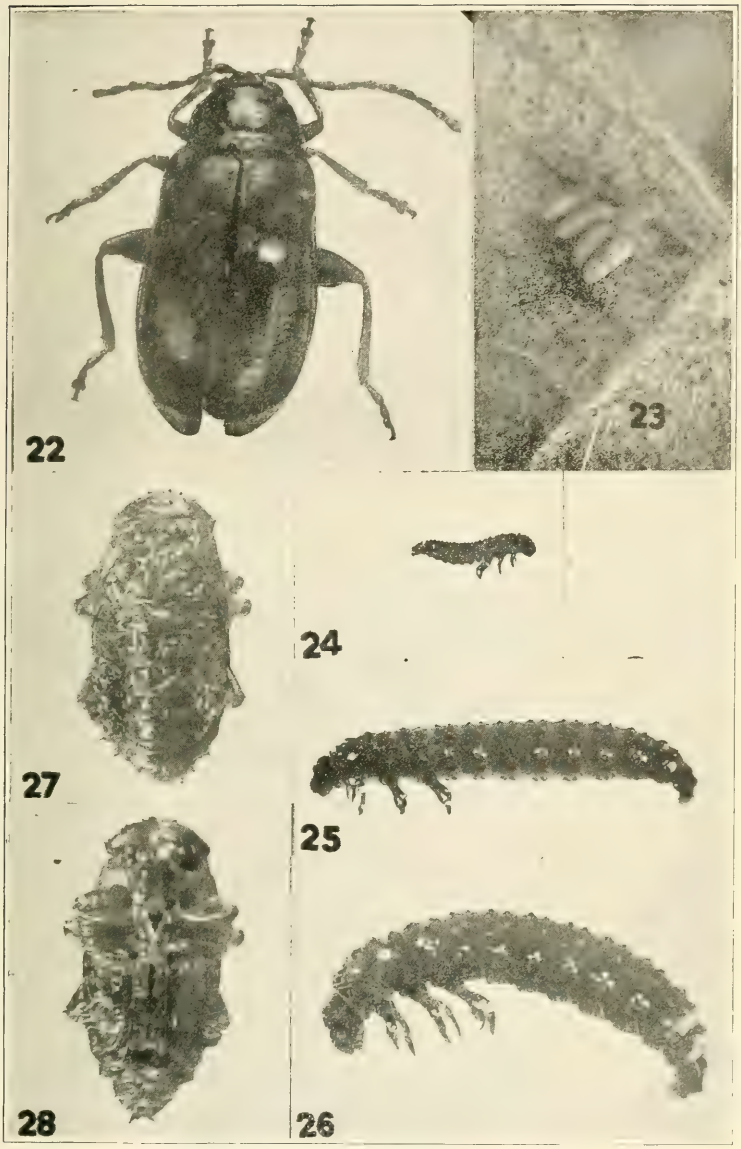
Altica bimarginata, larva. Fig. 18A: dorsal aspect, showing setae; fig. 18B: ventral aspect, showing setae; fig. 18C: lateral aspect, showing setae; fig. 19A: labrum; fig. 19B: mandible; fig. 19C: maxillae and labrum. For explanation see pages 258-260. Setae marked with an asterisk (*) are never found in first and second instar larvae and may be wanting in the third instar.



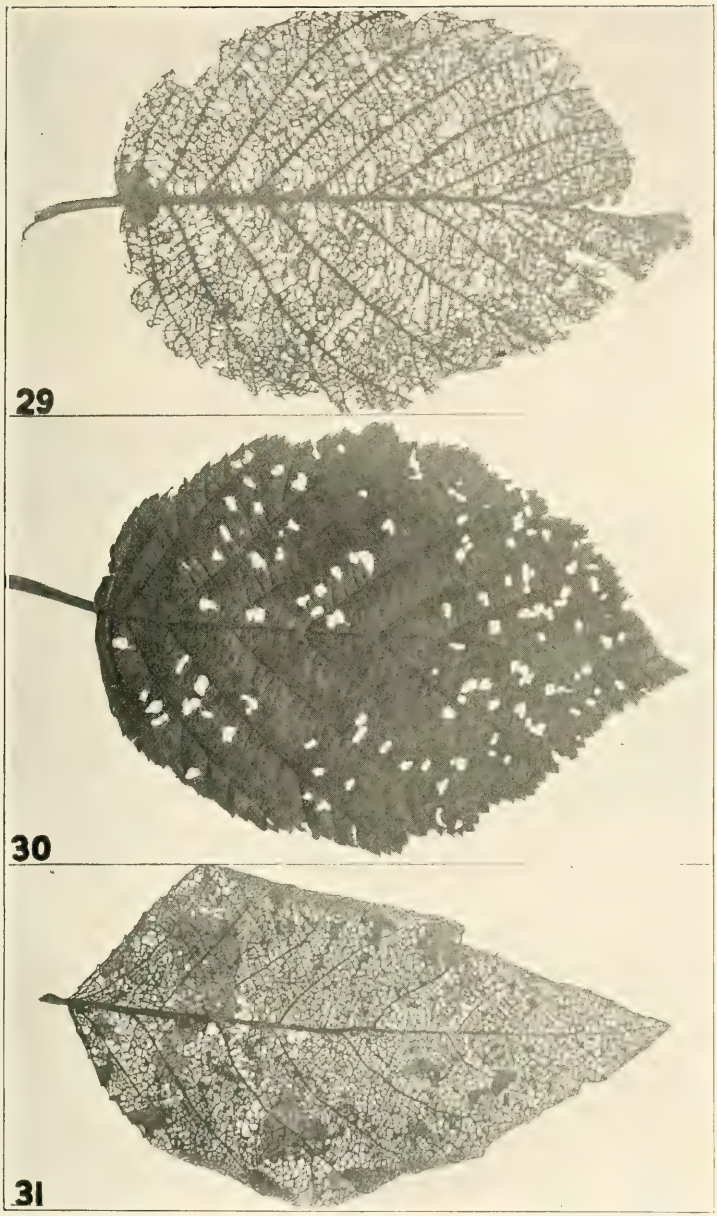




Altica bimarginata. Fig 20A: larval leg, ectal aspect; fig. 20B: ental aspect; fig. 21A: dorsal aspect of pupa, showing setae; fig. 21B: ventral aspect of pupa showing setae; fig. 21C: prothorax of pupa showing setae; fig. 21D: pygidium of pupa showing setae. For explanation see pages 260 and 265-267.



Altica bimarginata. Fig. 22: adult; fig. 23: eggs; fig. 24: 1st instar larva; fig. 25: 2nd instar larva; fig. 26: 3rd instar larva; fig. 27: pupa, dorsal aspect; fig. 28: pupa, ventral aspect.



Altica bimarginata. Fig. 29: work of larva on alder; fig. 30: work of adult on alder; fig. 31: work of larva on balsam poplar.

BULLETIN 266

THE CHEMICAL COMPOSITION OF GREEN SPROUTED OATS.

J. M. BARTLETT.

Green sprouted oats have been widely exploited in recent years as a succulent food for poultry. Indeed, there are some so-styled "Poultry systems" on the market which consist of little else than the use of this food. The Maine Station has been using sprouted oats in its poultry studies for a number of years. The method of sprouting devised by the Station was published in a bulletin that is now out of print. But it is reprinted in detail in "Poultry Management at the Maine Station." The essential points are outlined below.

The poultry investigations of this Station, for the most part bear only incidentally on food studies and the average of published analyses are sufficient for this purpose. In the earlier work the analyses of unsprouted oats were used in computing the rations, but as the amount of sprouted oats in the ration used at the Station were considerably increased it became desirable to know more concerning the composition of sprouted as compared with unsprouted oats. For this reason the studies here reported were undertaken.

THE PREPARATION OF SPROUTED OATS.

The first experiments with this material at the Maine Agricultural Experiment Station were not satisfactory. It was found difficult to get the oats to make a sufficiently quick growth. Experience here has indicated that in order to make a satisfactory green food the oats must be grown very quickly. In order to get quick growth it is necessary to have three things:—warmth, plenty of moisture, and sunlight.

A tight closet provided at the bottom with steam or hot water heating pipes, glass doors open to the south in a sunny room, and suitable trays for the thoroughly moistened grain furnish these three essentials. At the Station the trays are 2½ feet square and 2 inches deep inside. The closet can be of a capacity suited to the size of the poultry plant. The closet at the Station holds 12 trays in 3 tiers with 15 inches in height between the trays. The trays are made of wood and have holes bored in them to allow surplus water to drain off.

The only difficulty with which one has to contend is the matter of mold. There is always a tendency for the oats to mold in the sprouting process. The only way in which it has been found possible to control this mold is by thoroughly cleaning the trays after each time when they are used. After a tray has been emptied it is thoroughly scrubbed with a 50 per cent solution of commercial formaldehyde (that is, equal parts of commercial formaldehyde and water." Enough formaldehyde is used to soak the tray well. With this precaution, and if the oats are further made to grow rapidly, the mold does not give any trouble whatever.

The actual method of sprouting the oats is as follows: Clean and sound oats are soaked in water over night in a pail. The next morning the trays are filled to the depth of about 2 inches, and put into the sprouting closet. At the beginning freshly filled trays are placed near the top of the closet so as to get the maximum amount of heat, and in that way get the sprouts started at once. During the first few days, until the sprouts have become from a half to three-quarters of an inch long, the oats are thoroughly stirred and raked over 2 or 3 times during the day. This stirring insures an even distribution of moisture throughout the mass of oats in the tray. After the sprouts become sufficiently long so that the oats form a matted mass it is not desirable to stir them, or to disturb them in any way.

The sprouting oats need plenty of water and should be wet 3 times a day. This is readily done with an ordinary greenhouse sprinkling can, with little expenditure of time or labor. As the oats grow the trays are moved to different positions in the closet. The taller the green material gets, the nearer the trays are moved towards the floor, because the growing grain

then needs less heat. This procedure leaves the desirable places in the closet for the grain just beginning to sprout where high temperature is needed.

The oats are fed when they are from 4 to 6 inches in height. They are fed at the rate of a piece of the matted oats and attached green stalks about 6 to 8 inches square for each 100 birds per day.

THE COMPOSITION OF SPROUTED OATS.

The analyses of the sprouted oats were made at different stages of growth and in such a way that it was possible to compare the nutritive value of the sprouted with the unsprouted oats. Two experiments were carried out. In experiment 1 the oats were sprouted in the closet described above. In experiment 2 the oats were sprouted in glass dishes to avoid any possible loss from drainage.

EXPERIMENT I.

Four lots of 3000 grams of oats each were soaked over night, and put in trays in the sprouting closet. At the end of 48 hours, tray No. 1 was taken out, the oats weighed, thoroughly mixed and a sample taken and dried for analyses. The sprouts at this time were from ¼ to 1 inch long. After 2 days more tray No. 2 was taken out and treated the same as No. 1; the sprouts were from 2 to 3 inches long and roots had begun to form. At the end of 2 more days tray No. 3 was removed, weighed, and sampled the same as No. 1 and No. 2. At this time the tops were 2 to 3 inches high and the whole mass of oats was matted together with roots. The fourth tray was allowed to stand 2 days longer when the whole tray was covered with a dense growth of tops, many blades being 6 inches high. These plants had made more growth than is usually allowed. A section from this tray was weighed separately and the tops cut close to the roots and analyzed alone. The results of the analyses of all the trays are given in the following tables.

This Table Shows the Composition of the Oats Used, and Sprouted Oats at Different Stages of Growth.

Oats and Sprouted Oats	Water	Ash	Crude Protein	Albuminoid Nitrogen x 6.25	Crude Fiber	Nitrogen Free Extract	Fat	Starch by Acid Method	Sugar
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Oats used	10.35	2.85	9.88	8.25	8.97	41.14	5.03	52.88	1.74
Tray 1–2 days	55.60	1.33	5.11	4.13	4.84	30.75	2.38	26.33	1.55
Tray 2–4 days	67.31	0.96	3.69	3.16	3.73	22.55	1.76	16.69	1.72
Tray 3–6 days	76.55	0.74	2.83	2.21	2.93	15.58	1.36	9.93	2.59
Tray 4–8 days	78.71	0.73	2.75	2.13	3.24	13.32	1.25	6.75	3.43
Tops from tray 4	90.85	0.46	2.27	1.43	1.66	4.98	0.57	1.20	1.80

This Table Shows the Composition of the Oats, and the Sprouted Oats on Water Free Basis.

	Ash	Crude Protein	Albuminoid Nitrogen x 6.25	Crude Fiber	Nitrogen Free Extract	Fat	Starch by Acid Method	Sugar
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Oats	3.18	11.03	9.24	10.03	70.15	5.61	58.98	1.94
Tray 1	3.00	11.51	9.30	10.89	69.23	5.37	59.30	3.48
Tray 2	2.94	11.27	9.66	11.41	68.99	5.39	51.06	5.26
Tray 3	3.15	12.07	9.42	12.51	66.48	5.79	42.35	11.06
Tray 4	3.41	12.89	9.99	15.24	62.59	5.87	31.72	16.09
Tops from tray 4	4.99	24.76	15.57	18.18	45.89	6.18	13.08	19.64

This Table Shows the Amount of Nutrients in the Oats and Sprouted Oats at Different Stages of Growth.

	Dry Matter	Ash	Crude Protein	Albuminoid Protein	Crude Fiber	Carbo-hydrate	Fat	Starch	Sugar
	grams	grams	grams	grams	grams	grams	grams	grams	grams
Oats	2689.5	85.5	296.7	248.5	269.1	190.1	150.9	1587.0	52.1
Tray 1 2 days	2419.3	72.6	263.5	225.3	263.8	1676.0	130.0	1436.0	84.2
Tray 2 4 days	2500.	73.6	282.0	241.6	285.6	1726.0	135.0	1278.0	131.6
Tray 3 6 days	2350.6	74.1	284.0	221.7	294.3	1563.5	136.1	996.0	259.0
Tray 4 8 days	2239.5	76.4	288.7	223.8	341.2	1402.0	131.5	710.2	360.4
Tops of Tray 4	129.20	6.5	29.8	18.6	21.8	54.9	7.4	15.7	23.4

EXPERIMENT NO. 2.

A second experiment was undertaken in glass dishes as it was thought that possibly some leaching might take place in the wooden trays which were provided with drainage, it being impossible in practice not to add an excess of water and be sure that enough had been added to wet all the oats. Four covered glass crystalizing dishes were used for the purpose. Two hundred grams of oats were put in each dish and treated as nearly as possible the same as those sprouted in the trays but only enough water was added to keep the oats moist. At the laboratory temperatures the sprouting did not go on as rapidly as it did in the sprouting closet and about 3 days were allowed between each sprouting. In the fourth sprouting the tops were about 3 to 4 inches high, about the size that they are ordinarily fed. The results are given in the following tables.

This Table Shows the Composition of Oats and Sprouted Oats Sprouted in Glass Dishes, Calculated to Water Free Basis.

	Ash	Protein		Crude Fiber	Carbo-hydrate	Fat	Starch Acid Method	Sugar
	per cent	per cent		per cent	per cent	per cent	per cent	per cent
Oats	3.90	11.67	8.73	69.43	6.27	57.0	45.7	3.19
First sprouting, 3 days	3.27	12.52	8.04	69.83	6.34	54.8	43.7	3.66
Second sprouting, 6 days	3.50	11.95	11.12	67.03	6.40	43.5	41.1	7.64
Third sprouting, 8 days	3.67	12.86	10.90	66.30	6.27	42.2	34.5	7.95
Fourth sprouting, 11 days	3.80	13.66	12.33	64.58	5.63	31.9	24.4	13.1

This Table Shows the Amount of Dry Matter and Nutrients in the Oats and Sprouted Oats at Different Stages of Growth in Glass Dishes.

	Dry Matter	Ash	Protein	Fiber	Nitrogen Free Extract	Fat	Starch Acid Strength	Sugar
	grams	grams	grams	grams	grams	grams	grams	grams
Oats	180.0	7.02	21.00	15.7	125.3	11.28	102.6	5.72
First sprouting	166.9	5.45	20.9	13.4	116.6	10.58	91.7	6.11
Second sprouting	170.0	5.98	20.3	18.9	114.0	10.88	73.96	12.99
Third sprouting	154.2	5.65	19.83	16.81	102.2	9.66	65.1	12.26
Fourth sprouting	151.9	5.69	19.75	18.48	97.45	8.44	47.85	19.62

An inspection of the figures in the tables shows a loss of material in all the different stages of growth. There is a larger loss of dry material in tray No. 1 where only very little growth has been made than in tray No. 2 where considerable more growth had been made and some roots formed. In the wooden trays to which a liberal amount of water was applied it was thought that the loss might be due to leaching but the same thing occurred in the glass dishes where no leaching occurred and the loss could not be accounted for in that way.

Trays No. 3 and 4 represent about the usual sizes that oats are grown to feed out, consequently the average analyses of these two trays would probably be nearer the true composition of sprouted oats as usually used in practise than any one of the trays alone. The average analyses of these two trays shows a loss of dry matter of 14.5 per cent, crude protein 3.5 per cent, protein calculated from albuminoid nitrogen 9.6 per cent, nitrogen free extract (starch, sugar, etc.) 27.2 per cent and fat 12.8 per cent. The greatest loss was in starch but that was partly made up by the increase in sugar.

SUMMARY.

Sprouted oats at the proper stage to feed will carry about 77 per cent of water, 2.8 per cent protein, 3 per cent crude fiber, 1.3 per cent fat and 16 per cent nitrogen free extract.

There is an actual loss of dry matter in sprouting oats and the only advantage of the process is to produce a succulent green food at times when grass or other green foods are not available.

FISH WASTES FOR FEEDING ANIMALS

J. M. BARTLETT

The increasing demand for animal foods together with the high price and scarcity of beef scraps (which has been the chief supply in the past) has forced dealers and consumers of these materials to look to other sources for a supply. Fish waste or fish of any kind has been known always to be highly relished by meat eating animals and to produce excellent results in growth or egg production. The great objection to its use in large quantities has been the tendency to give the flesh or eggs a fishy flavor which is known to be very pronounced in water fowl that live largely on fish. Late investigations have shown that the fishy flavor is due largely to fish oil and when that is quite completely removed as it is now in some fish meals that have appeared on the market the material can be used in much larger quantities without imparting a disagreeable flavor to the product. In Europe waste fish products have been used for feeding animals for several years. Spier of Scotland reports no bad influence on milk when reasonable quantities of dried fish are fed to dairy cows, and in Germany, the better grades of dried fish waste have been used for feeding hogs, cattle and poultry for many years. Experiments conducted at the Experiment Station in Harlishausen, indicate that fish meal forms a desirable supplementary feeding stuff for farm animals especially for pigs. It was found that if fed in too large quantities or contained too high percentages of oil it would produce a fishy taste to the meat product, but meal containing only 2 percent to 4 percent of oil could be safely fed. The phosphate of lime found in the meal is deemed a valuable ajunct in feeding animals. The fish waste should not contain more than 3 percent of salt. It is recommended to feed as high as 2 pounds to 1000 lb. cows and one fourth to one half pound to pigs, depending on their size.

Large quantities of fish wastes are produced along the Maine Coast every year and these, in the main, have been sold to fertilizer companies in the raw condition. Much of this

material if it could be properly handled would be valuable food for animals and a very good substitute for beef scrap. Below are given several analyses of waste materials from sardine factories, which have been recently received from parties interested in their value as food and fertilizer.

Table Showing the Composition of Fish Wastes from Sardine Factories as they were Received.

		Water	Nitrogen	Acid Total Phos.	Protein N x 6.25	Fat	Ash*
579	So-called mush or chum as it comes from packers tables	70.88	2.54	1.69	15.88	7.99	5.91
580	Rendered material from Sardine factory	10.46	8.19	5.75	51.19	20.91	17.36
581	Chum from sardine factory, dried and ground	12.84	7.46	6.76	46.63	19.69	19.36
582	Herring pomace from sardine factory. Steamed and pressed	48.02	4.60	2.37	28.75	9.09	12.52
583	Pomace from head and trimmings of alewives	44.92	4.50	4.31	28.13	8.44	15.67

*Chiefly phosphate of lime.

Table Showing the Nutrients in the Fish Wastes from Sardine Factories when Air Dry.

		Water	Ash	Protein N x 6.25	Fat
579	So-called mush or chum as it comes from packers tables	12.02	17.84	43.93	24.15
580	Rendered material from Sardine factory	10.46	17.36	51.19	20.91
581	Chum from sardine factory, dried and ground	12.84	19.36	46.63	19.36
582	Herring pomace from sardine factory. Steamed and pressed	10.00	21.60	50.02	14.70
583	Pomace from head and trimmings of alewives	10.00	25.50	46.80	13.83

The above samples show a great variation in composition (in the first table) due, largely, to the variation in water content. When reduced to an air dry condition carrying approximately ten percent of water the variation in composition is not very great. The water content of a meal should not be much above 10 percent to have good keeping qualities. These samples show a large food value, but the oil content is too high to be safe to fed except in small quantities.

BULLETIN 267

THE APHID OF CHOKE CHERRY AND GRAIN.[1]

Aphis pseudoavenae sp. n.

EDITH M. PATCH.

Late in June, 1917, a group of choke cherries on the campus of the University of Maine were found to be heavily infested with a species of aphid which I had not previously taken, although specimens of the same thing were brought me from Fort Kent, Maine, July 6, 1916 where they were found by Professor C. L. Metcalf while collecting syrphids.

Mounted specimens of this aphid would be most likely to be determined as *Aphis avenae* (i. e. of American authors) because of the constriction before the flange of the cornicle, the arrangement of the sensoria of the antennae, and the rather long, pointed stigma and the noticeably short second branch of M in the wing.

However, the fresh colonies crowded close along the stem and ventral leaf would suggest at once the *Aphis rumicis* group on acount of the conspicuous areas of wax powder, and could not be mistaken for *avenae* in life.

DESCRIPTION FROM LIFE.

SPRING CHOKE CHERRY GENERATIONS.

Apterous viviparous female: A rather old individual had body dark olive green irregularly mottled with still darker. Areas of powder especially noticeable in lateral rows of spots on abdomen, one on each side of segments just dorsad of prominent lateral crease, and over the tip of the abdomen caudad cornicles. These white areas are conspicuous on undisturbed colony but the powder is soon shaken off from collected material and then the aphids show only a general rather slight pulverul-

[1]Papers from the Maine Agricultural Experiment Station: Entomology No. 95.

ency. There is a deep purplish area (internal) at the base of each cornicle. Tibiae and base of antennae pale, cauda and cornicles black. Cornicles with constriction before flange with perhaps a suggestion of constriction at middle. Beak short, scarcely reaching second coxae.

Alate viviparous female: Head and thoracic lobes glistening black, general body color dark olive green. Breastplate, anal plate, cauda and cornicles black. Cornicles constricted before flange and tendency toward a very slight midconstriction. There are three large, heavy, black spots along lateral line of abdomen cephalad the cornicles, and an irregular black patch at base of cornicle, caudad. The second branch of M is typically near margin of the wing, though there is considerable variation in the length of this branch. The shape and length of stigma is variable but it is always pointed and rather elongate. The relative length of the antennal segments and the number of sensoria are also unstable factors. The drawings show what is a good average. Sensoria are always present on III (25 more or less), and IV (10 more or less) and usually on V (a few). The beak reaches about half way between first and second coxae.

Spring nymph developing to alate female: The newly dropped or newly molted nymph is yellowish or pale brown, with rusty area (internal) at base of cornicle. The nymph soon colors to dark olive green.

INSTAR	ANTENNA	BEAK
1st.	4-segmented	just caudad 3rd coxae
2nd.	5-segmented	reaches 3rd coxae
3rd.	6-segmented	2nd coxae or beyond
4th. (pupae)	6-segmented	not reaching 2nd coxae.

In the pupal instar this nymph is dark olive green, with five lateral powder spots on each side of abdomen cephalad cornicles and a solid powder area caudad the cornicles. Powder spots are present on base of head and on prothorax. There is a dark rusty area at base of cornicle due to internal substance showing through the body wall. Cauda is pale at base with black tip, and the cornicles are black.

GRAIN GENERATIONS.

Apterous viviparous female. Unlike their choke cherry progenitors, the summer colonies do not share pulverulency in any instar. In general body color they are soft dark green, dull amber greenish, to very pale greenish; always unmarked by any darker green streaks and always with strong rusty space at base of cornicles and often connecting them, a color being due to internal structure showing through the body wall.

Alate viviparous female. The laboratory bred specimens had olive green abdomens with black lateral spots, a black patch at caudal base of cornicle and some black median dashes caudad the cornicles.

SUMMER FOOD PLANTS.

Migration tests were made by placing the winged June forms on various grasses. The progency of the migrants accepted the following: Timothy, Kentucky bluegrass, sheep fesque, meadow fesque, red top, barley and oats. The test was continued through one generation only, except with the oats which was used during the summer for the material under observation.

LIFE CYCLE.

No data are yet available for the stem female as the first choke cherry collection was made June 25. At this time both apterous and alate viviparous females were present, the latter being recently developed as was evidenced by the abundance of individuals in the pupal instar.

The migrants were already taking wing on June 25th and the process continued for a week or so longer.

No collections were taken in the field in the summer here but in the laboratory material continued to live on oats until about the first of September, the colony dying out at that time partly from unknown causes.

DISCUSSION OF NAME.

Whatever the ultimate fate of the name proposed for this species may be, there seems to be no safely established American

aphid to which to refer it. It is not the *avenae* of American authors which has well defined characteristic dark green longitudinal streaks entirely absent in *pseudoavenae*. It is not the *avenae* of Theobald (Canadian Entomologist, 1916 p. 235). It is not the *padi* described and figured by Koch and Buckton. Is it the *padi* of Van der Goot (1915 p. 241)? Possibly, "in part", though it is certainly not in accord with his collection from *Mespilus* and *Pirus malus*.

No such aphid has previously been recorded on its spring host in this country as it is none of the species listed from choke cherry.

That it has been taken on grain and confused with the apple grain aphid, the so called *"avenae"* of American authors seems not improbable as these two species are so much alike in structural characters that they would be distinguished with difficulty from mounted material. In life, however, they are readily separable especially in the spring generations with a simple hand lens, the characteristic dark green longitudinal lines of our so called *"avenae"* being entirely absent from all generations of *pseudoavenae* and the powder areas of the spring generations of *pseudoavenae* being particularly noticeable. Both species have a rusty internal area near the bases of the cornicles.

To designate this aphid as a new species seems the only way to preserve its life cycle from confusion at present.

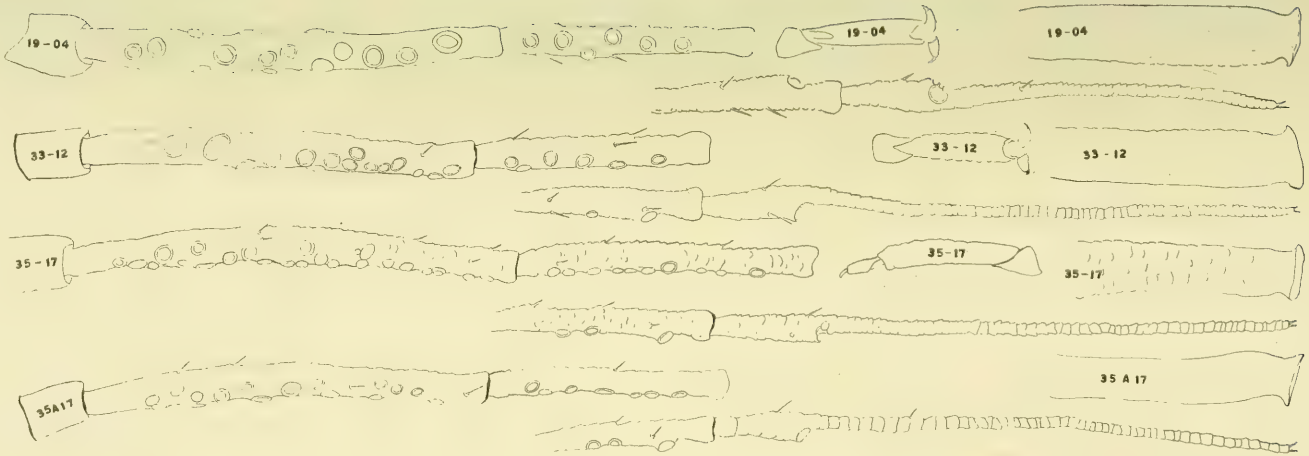


FIG. 32. THREE GRAIN APHIDS OF MAINE.

19–04. Antennal segments II to VI, tarsus, and cornicle of the spring migrant of an apple-grain aphid. Note relative length of cornicle and antennal segment VI.
33–12. Antennal segments II to VI, tarsus, and cornicle of the spring migrant of a hawthorn-grain aphid.
35–17. Antennal segments II to VI, tarsus, and cornicle of the spring migrant of a choke cherry-grain aphid. Note length of antennal segment IV, and the length of tarsus in relation to cornicle. 35A 17. Antenna and cornicle of an alate summer female of the foregoing on grain.

Too much emphasis should not be placed on the relative number of sensoria on segments III, IV and V as these are somewhat variable in all three species. The sensoria of the choke cherry-grain aphid, however, are consistently smaller than those of the other two species. All drawings are made to the same scale.

BULLETIN 268

ABSTRACTS OF PAPERS PUBLISHED BY THE STATION IN 1917 BUT NOT INCLUDED IN THE BULLETINS.

A complete list of all the publications issued by and from the Station in 1917 is given on pages x to xii 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.

THE EXPERIMENTAL MODIFICATION OF GERM CELLS.

I. General Plan of Experiments with Ethyl Alcohol and Certain Related Substances*

This paper is the first of a series of studies having to do with attempts, in the first place, to modify hereditary factors or determinants in a definite and specific way, and in the second place, to observe and analyze the hereditary behavior following such modification. The results here reported followed attempts to modify the germ cells by treating the individual domestic fowl with one or another of three poisons, viz., ethyl alcohol, methyl alcohol and ether.

The males used were Black Hamburgs. The females were pure bred Barred Plymouth Rocks. Both strains used have been so long pedigree bred, and used in such a variety of Mendelian experiments, that they may be regarded as reagent strains, whose genetic behavior may be predicted with practically complete certainly. Analyses of the inbreeding in their parents indicate that the amount of intensity of this inbreeding is low.

*This is an abstract from a paper by Raymond Pearl, having the same title and published in the Journal of Experimental Zoology, Vol. 22, No. 1, pp. 125-164.

This foundation stock is shown to be a random sample of the general population from which it came.

F_1 offspring from these parents were treated with the above poisons. The advantages in the use of these crossbred were, first, a heterozygous condition of many factors enabling a test of the effects of the poisons on usual conditions of Mendelian dominance, second, a possible increase in vigor due to heterosis. Full brothers and sisters of the treated birds were used to control the experiments.

The poisons were administered daily by the inhalation method in practically as large doses as could be tolerated when given in this way. Large tanks containing 7 cubic feet of air with capacity for 4 to 5 birds and small tanks with 4 cubic feet were used. Cotton was placed in an inhalation compartment soaked with the reagent. The air is then saturated with an atomizer and the birds introduced into the chamber. By this method a treatment in saturated air for one hour daily is insured. No accurate measure of the amount of inhaled alcohol is available. An estimate of the amount may, however, be made from the amount consumed in one inhalation. These amounts are, for the large tank, 45 cc. and for the small, 30 cc. or an amount per bird corresponding to that of a steady but moderate drinker.

It is reasonable to suppose that the effect, if any, of the alcoholization of the parents upon the progeny will depend in some degree, at least, upon the period of time during which the parents have been subject to treatment with alcohol prior to the birth of the offspring. The measure of this pre-birth treatment may be designated as the "total germ dosage index" and defined as the total number of days during which the two gametes making the offspring zygote have been exposed to alcoholic influence while sojourning in the body of the treated individual. Express graphically.

TOTAL GERM DOSAGE INDEX IN DAYS $= (M_h - A♂) + (M_h - A♀)$, where

M = Mean date of hatching of progeny.
A♂ = Date when treatment of ♂ parent began.
A♀ = Date when treatment of ♀ parent began.

The treatment of the F_1 generation ranges from 130 to 354 days with a mean of 210.35 days, or approximately 7 months in these experiments.

THE EXPERIMENTAL MODIFICATION OF THE GERM CELLS.

II. THE EFFECT UPON THE DOMESTIC FOWL OF THE DAILY INHALATION OF ETHYL ALCOHOL AND CERTAIN RELATED SUBSTANCES.*

This paper, the second of the series, deals with the effect of alcohol and related substances on the treated individuals. Summarily stated the results of this study are:

1. The mortality among the treated birds was much smaller than among their untreated control sisters. After 15 months of treatment the difference was 41 per cent in favor of the treated birds.

2. The body weight changes in the treated birds were as follows: immediately following the starting of treatment, which was in the autumn, there was an increase in mean body weight, probably in no way due to the treatment. Following this initial rise, which reached its peak in January or February, there was a sharp and prolonged fall in mean body weight which reached its lowest point in May or June. Beginning in June or July there was a steady increase in mean body weight continuing without break until the end of the period covered in this report (February 1, 1916). At the date mentioned the treated birds were on the average 9.9 per cent heavier than their untreated sisters.

3. Neither the total amount nor the distribution of egg production were significantly different in the treated birds from what they were in the controls. Both treated and control birds laid normally and well. Taking the whole untreated flock, the mean production per bird in the 15 months was 184.74 eggs, while the mean production for the treated birds was 183.97. Generalizing the results we may say that the treated birds are slightly superior to the untreated birds.

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*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the Journal of Experimental Zoology, Vol. 22, No. 1, pp. 165-186.

THE EXPERIMENTAL MODIFICATION OF GERM CELLS.

III. THE EFFECT OF PARENTAL ALCOHOLISM AND CERTAIN OTHER DRUG INTOXICANTS UPON THE PROGENY.*

This paper deals with the influence on the offspring of alcohol and like poisons administered to the parents. That this is one of the most fundamental problems of breeding admits of no doubt. The method by which this general problem is attacked in the present investigation is that of exposing systematically the germ cells of the bird to the fumes of ethyl alcohol, methyl alcohol and ether and analyzing the results on the offspring. The specific conclusions coming out of this investigation are:

1. The fertility of the eggs where one or both individuals are treated is reduced in direct proportion to the dosage of the poison.

2. The parental mortality (percentage of dead embryoes) was materially smaller where one or both parents were treated than the controls. The same conclusion holds true for post natal mortality.

3. The sex ratio of the progeny was not materially effected by treatment of the parents.

4. There was no significant difference in hatching weight of the offspring of treated males and the offspring of normal untreated control males when both were mated to sound untreated females. Both the male and female offspring of matings in which both parents were treated showed a higher mean hatching weight than the offspring of either completely normal control matings, or of matings in which the father only was treated. The adult offspring of alcholyzed parents (one or both) were heavier than the controls.

5. In the case of the male chickens there was no substantial difference in the rate of growth in the three lots until after an age of about 100 days was passed. From that point on the male offspring of treated ♂♂ X untreated and treated ♀♀ grew at a more rapid rate than the controls. The difference in mean

*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the Journal of Experimental Zoology, Vol. 22, No. 2, pp. 241-310.

body weight for a given age became increasingly large as the age advanced. In the case of the female chickens there was no substantial difference in the rate of growth in the three lots until after an age of 150 days was passed. During the next 25 days the controls grew faster than the chicks from treated parents. At and after 200 days of age, however, the offspring of treated parents (one and both) showed a higher mean body weight than the controls. At all ages in the case of the male chicks, and in all ages but two (12.5 and 19.5 days) in the case of the female chicks, the mean body weight of the offspring having both parents alcoholic was higher than that of the offspring having one parent only, the father, alcoholic.

6. The proportion of abnormal chicks produced from treated parents was no greater than that produced from untreated parents.

7. The normal Mendelian inheritance was in no way affected by the treatment of the parents, so far as concerns any of the numerous characters observed and tested. This statement applies only to phenomena of dominance, recessiveness and sex linkage. Other Mendelian phenomena have not as yet been tested in these experiments.

8. There was no evidence from these experiments that the treatment of individual fowls, whether male or female, with either ethyl alcohol, methyl alcohol, or ether, had any deleterious effect upon those germ cells which formed zygotes. The treatment rendered many germ cells incapable of forming zygotes at all, but those which did form zygotes had plainly not been injured in any way. Further no specific germinal changes have been induced by the treatment, at least so far as concerns those germ cells which produced zygotes.

It is suggested that these results, as well as the results of earlier workers, may be most satisfactorily accounted for on the hypothesis that alcohol and similar substance act as selective agents upon the germ cells of treated animals. The essential points in such an hypothesis may be put in the following way.

a. Assume that the relative vigor, or resisting power of germ cells varies or grades continuously from a low degree to a high degree and further assume that the absolute vigor of the whole population of germ cells, measured by the mean let us say, is different for different species.

b. In the intensity of dosage employed in inhalation experiments alcohol does not destroy or functionally inactivate all germ cells. The proportionate number of the whole population of germ cells which will be inactivated by such dosage may fairly be supposed to depend upon the mean absolute vigor or resisting power characteristic of the particular species or strain used. In a species with germ cells of absolutely low mean vigor proportionately more will be functionally inactivated than in a species of high absolute mean vigor of germ cells.

c. Besides the germ cells which are wholly inactivated by the deleterious agent, and which we may designate as class (a), we may fairly assume that there is a possibility of two other classes existing, viz., (b) germ cells which, while not completely inactivated, are so injured by the agent as to produce zygotes which are measurably defective in some degree, and (c) germ cells which are not measurably affected by the agent at all in the dosage employed, and produce zygotes which are not discernibly otherwise than perfectly normal.

d. It appears entirely fair to assume that germ cells of the (a) class are of relatively the lowest mean vigor or resisting power, class (b) next, and class (c) the highest. The proportionate number of the two sorts of zygotes corresponding to classes (b) and (c) of germ cells which would be expected to appear in any experiments made to test the point would clearly be a function of the mutual relationship or proportionality between two variables, the dosage of the deleterious agent on the one hand, and the mean absolute resisting power of the germ cells characteristic of the strain or species of animal used in the experiments on the other hand.

e. If the dosage of the agent be relatively high in proportion to the mean absolute resisting power it would be expected that all the germ cells would fall into classes (a) and (b), producing no zygotes at all or zygotes in some degree defective. This about represents the condition, so far as can be judged from the data given, with Stockard's alcoholized guinea pigs and Weller's lead-poisoned guinea pigs. The dosage is sufficiently high in proportion to the absolute germinal resisting power that all or practically all of the offspring are defective in greater or less degree and in reference to some one or more characters. Stockard's F_2 and F_3 results indicate that

though the untreated F_1 animals from alcoholists may appear normal, they really are somewhat defective.

f. If, on the other hand, the dosage, though absolutely the same, be relatively lower in proportion to the mean absolute resisting power of the germ cells it would be expected that all three germ cell classes (a), (b) and (c) would be represented. The zygotes actually formed would be chiefly produced by (c) germ cells, and to a much smaller extent by (b) cells. Under these circumstances it would necessarily follow that a random sample of the zygotes produced after the action of the deleterious agent would, on the average, be superior in respect to such qualities as growth, etc., which may be supposed to depend in part at least upon germinal vigor, to a random sample of zygotes formed before the action of the agent, because the germ cells of class (c) are a selected superior portion of the total gametic population.

g. Essentially that proportionality between effective dosage of the deleterious agent and absolute resisting power of the germ cells outlined in the preceding paragraph (f) is believed to have obtained in the present experiments with fowls, Nice's experiments with mice, and nature's experiments with the workingmen's population studied statistically by Elderton and Pearson.

THE PROBABLE ERROR OF A DIFFERENCE AND THE SELECTION PROBLEM.*

This paper deals with the results of Ackert in selection of Paramecium. Due to his arithmatically wrong calculation of the probable error of a difference Ackert deductions based on this are wrong. Corrected his data is contradictory and when compared with the other selection work on Paramecium neither confirms nor refutes the previous results.

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*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the Genetics, Vol. 2, pp. 78-81.

ON THE DIFFERENTIAL EFFECT OF CERTAIN CALCIUM SALTS UPON THE RATE OF GROWTH OF THE TWO SEXES OF THE DOMESTIC FOWL.*

Calcium Lactate and Calcium lacto-phosphate given to chicks in doses of 0.1 gram to 0.3 grams daily are shown to increase the body weight and reproductive ability of the females but in no way to effect the males. An inhibitory substance, corpus lutium, also inhibits this increase as the presence of the calcium salts.

A NOTE ON FITTING OF PARABOLAS.†

Formula for the fitting of parabolas by the method of Moments assuming origin at the mid-point have already been given by Pearson. A need has, however, been felt by many investigators for formulas and tables for fitting of parabolas taking origin one unit below the first ordinate. This paper supplies such a need.

THE PROBABLE ERROR OF A MENDELIAN CLASS FREQUENCY.‡

In view of the defect in the calculation of the probable errors of small subclasses in mendelian work, the writer has suggested a new method of estimating the significance of these constants by calculating the median and quartile classes. Tested on material where the hypergeometrical is known, this method gives good results.

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*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in Science, N. S., Vol. XLIV No. 1141, pp. 687-688.

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†This paper is an abstract from a paper by John Rice Miner, having the same title and published in The Proceedings of the National Academy of Sciences, Vol. 3, pp. 91-95.

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‡This paper is an abstract from a paper by Raymond Pearl, having the same title and pubilshed in the American Naturalist, Vol. LI. No. 603, pp. 144-156.

THE SELECTION PROBLEM.*

This paper deals with the general problem, "Does selection (in the sense of long continued selection) cause gradual changes in the given plasm in the direction of selection." The evidence when studied is found to prove just the opposite, that these supposed careful selections are in reality chance selection of favorable mutations.

STUDIES ON THE PHYSIOLOGY OF REPRODUCTION IN THE DOMESTIC FOWL.

XVII. THE INFLUENCE OF AGE UPON REPRODUCTION ABILITY, WITH A DESCRIPTION OF A NEW REPRODUCTIVE INDEX.†

The belief is widespread among poultry breeders that two year-old birds or older should be used for breeding purposes. The alleged reasons for this are superior vigor of the offspring or more numerous progeny per mating, etc. This paper takes up the points for the 1114 mating in the nine years' experience of the writer. A mathematical measure of the reproductive ability or fertility is introduced for this treatment. This New Reproductive Index for Poultry is

$$RI = \frac{\text{Number of chickens alive at the end of the 3rd week after hatching} \times 100}{\text{Total number of days from the day when this mating began to the day when the last egg from this mating began its incubation.}}$$

Treated in this way the following facts are brought out:

For the strain of Barred Rocks used, and under the conditions of environment and management which obtained during the experiments, the reproductive index has a mean value of about 12 per cent.

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*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the American Naturalist, Vol. LI, No. 602, pp. 65-91.

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†This paper is an abstract from a paper by Raymond Pearl, having the same title and published in Genetics, Vol. 2, pp. 417-432.

Net fertility, as measured by the reproductive index, is a rather highly variable character, agreeing in this respect with other purely physiological characters.

Reproductive ability, as measured by the index, dimishes with advancing age of the birds mated, having its maximum when each of the birds mated is from 10 to 14 months of age.

The decline in reproductive ability with advancing age is at a more rapid rate in the case of the males than in the case of the females.

STUDIES ON OAT BREEDING V.

THE F_1 AND F_2 GENERATIONS OF A CROSS BETWEEN A NAKED AND A HULLED OAT.*

This paper is an account of the results obtained from a cross between representatives of two subspecies *Avena sativa patula* var. Victor and *Avena sativa nuda* var. *inermis*. The contrasting characters involved in this cross are: firm flowering glumes, biflorous spikelets, black color of the glumes, strong awns, a long but sparse pubescence at the sides of the base of the lower grain—vs. loose membranous flowering glumes, multiflorous spikelets, white or light yellow glume color, and almost total absence of awns and the absence of pubescence.

The F_1 generation is distinctly intermediate in most characters. In regard to the glumes, both naked and firmly hulled grain as well as intermediate forms are found on the same panicle and even in the same spikelet.

The F_2 generation segregates into a large number of intermediate forms. In addition to the two parental hull types, four intermediate classes were distinguished. These intermediate forms contain all gradations from the plants with perfectly hulled grain to the perfectly naked forms.

The inheritance of the hull characters presents a simple Mendelian relation giving 1 hulled, 2 intermediate, 1 naked. Likewise, in respect to grain color, there are 3 plants with black grain to 1 plant with white grain, the genes for these two characters, segregating independently of each other.

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*This is an abstract from a paper by Jacob Zinn and Frank M. Surface, having the same title and published in the Journal of Agricultural Research Vol X, pp. 293-312.

Multiflorous spikelets occur only in connection with naked grain. Plants with completely hulled grain bear only biflorous spikelets.

The inheritance of the pubescence at the base of the lower grain presents some difficulties, since this character can not manifest itself on plants with naked grains. In the group of plants having hulled and intermediately hulled grains the pubescence behaves as a bifactorial character, giving 15 pubescent plants to 1 without pubescence. Neither of these genes are linked with the color genes.

The long and short pubescence at the base of the grain behaves as a monohybrid character and segregates independently of the other genes considered.

An interesting feature of this cross is the presence of pubescence at the base of the upper or second grain. No cultivated oat varieties possess this character. In this cross these forms occur only on spikelets where the lower grain is naked or seminaked, indicating that this condition may be due to physiological disturbances caused by the presence of the naked lower grain.

In regard to the inheritance of the awn character, the hulled and intermediately hulled types of grain appear to present a simple 3 to 1 ratio between plants with medium strong to strong awns and those plants with weak awns.

STUDIES ON INBREEDING. VII.

SOME FURTHER CONSIDERATION REGARDING THE MEASUREMENT AND NUMERICAL EXPRESSION OF DEGREES OF KINSHIP.*

This paper has as its object the defining in simple manner the basic concepts of inbreeding. On the basis of these definitions a new and more accurate method of measuring and expressing numerically the degree of kinship between any two individuals, whatsoever, whose pedigrees are known, is possible. This new constant, the partial inbreeding index, is defined as the part of the total inbreeding exhibited in the pedigree of any individual which is due to relationship between the sire and the dam of that individual.

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*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in The American Naturalist, Vol. LI, No. 609, pp. 545-549.

SEX STUDIES. IX.

INTERSTITIAL CELLS IN THE REPRODUCTIVE ORGANS OF THE CHICKEN.*

True, secreting, interstitial cells appear to be always present in the ovary. These cells are strictly homologous, and indeed cytologically identical in the fowl and in the cow. Furthermore these cells are cytologically identical in the male, when they are present, and in the female.

In the fowl true interstitial cells are sometimes present in the testis at the time of hatching. We have found no trace of them in the testes of a large series of adult males.

In general, the facts as to the occurrence and distribution of interstitial cells are such in the fowl as to make it very difficult to suppose that these cells have any casual influence upon secondary sexual characters.

STUDIES ON INBREEDING. VIII.

A SINGLE NUMERICAL MEASURE OF THE TOTAL AMOUNT OF INBREEDING.†

The need has been felt for a single numerical measure of inbreeding to supplement or replace the inbreeding curves. Such a constant has been found, which, it is believed, uniquely and rigorously meets the requirements. This new constant is defined by

$$\frac{Z_{Tn}}{100} = \frac{\sum \frac{z_n}{z_1}}{F_{Tn}}$$

*This paper is an abstract from a paper by Alice M. Boring and Raymond Pearl, having the same title and published in the Anatomical Record, Vol. 13, No. 5, pp. 253-268.

†This paper is an abstract from a paper by Raymond Pearl, having the same title and published in The American Naturalist, Vol. LI, No. 610, pp. 636-639.

where Σ denotes summation of all values between the inclusive limits indicated, and F_{Tn} is a constant having the value set forth in Table 1. F_{Tn} is of course the total area of the maximum brother X sister curve up to and including the n+1-th generation. Studied by this unique measure the American Jersey Cattle are shown to be about 28 to 30 per cent as closely inbred as the maximum possible inbreeding which could occur.

THE SEX RATIO IN THE DOMESTIC FOWL.*

The material dealt with is the sex ratio found in over 22,000 chicks representing the matings of eight years' work by the writer. Data is presented to show that the normal sex ratio found in chickens indicate an excess of females. This excess of females is not a sporadic, but rather a regular phenomon in the stock and conditions. The ratio in individual families is shown to be approximately symmetrical about the mean with high contact at both ends. These fitted curves make possible some definite conclusions, thus out of every 1000 families of twenty birds one is expected containing twenty or more pullets.

This difference in males to females is not due to prenatal mortality at least after the 10 days since of the dead embryoes opened 927 were males and 994 females. The conclusion is justified that prenatal mortality is not differential in respect to sex, and that in consequence the observed sex ratio at birth is substantially the same as the initial zygotic sex ratio.

AN INFESTATION OF POTATOES BY A MIDGE.†

On October 25, 1913, potatoes were received from Roxie, Maine, with the statement that they represented the condition of an infested acre. The trails contained numerous dipterous larvae so different from any pest known to the writer that it

*This paper is an abstract from a paper by Raymond Pearl, having the same title and published in the Proceedings of the American Philosophical Society, Vol. XVI, No. 5, 416-436.

†This is an abstract of a paper with the same title, by Edith M. Patch, published in the Journal of Economic Entomology, Vol. 10, No. 5, 1917.

was at first suspected that they had worked into mines made by something else and that their presence was accidental. That such was not the case was testified by the larvae themselves when a cut tuber was placed under the microscope. The exposed miners were busily tunneling down into healthy tissue. As they worked they moved the ventral flap under the head up against the mouthparts. Some of the trails lay under the skin near the surface of the potato and were apparent as soon as the tuber was washed. Others extended for some distance into the vegetable.

The larvae were three-sixteenths of an inch in length. They were abundant in the trails, where frequently as many as fifteen or twenty could be found together in the wider places, though the narrow mines seemed to be the work of single individuals.

A specific determination was not possible on the data presented, but Dr. O. A. Johannsen kindly examined the larvae and pronounced them "probably *Camptocladius* sp."

No similar occurrence has come to the attention of the writer since this record for 1913 and it is hoped that the attack was due to some peculiar local condition which may not again prove favorable to this midge in its career as a serious pest of potatoes.

EASTERN APHIDS, NEW OR LITTLE KNOWN, PART I.*

The present paper resulted from the examination of the collection of Connecticut aphids lent by Dr. W. E. Britton. Several undescribed species were found, some of which were well known in certain collections without having made their way into literature. A few of these are briefly described by the writer of Part I, and the others are presented by Mr. Baker in Part II as he was already at work on the groups those species represent, and kindly undertook their examination.

Most of the species are described with reference to material from Connecticut, though a few not yet reported from that state are included.

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*This is an abstract of a paper with the same title, by Edith M. Patch, published in Journal of Economic Entomology, Vol. 10, pp. 416-420.

The species treated were

APHIS VIBURNIPHILA n. sp.
APHIS RUMEXICOLENS n. sp.
APHIS SALICETI Kaltenbach
APHIS DAVISI, new name
PROCIPHILUS APPROXIMATUS n. sp.
PROCIPHILUS XYLOSTEI de Geer
LACHNUS ROSAE Cholodkovsky

STUDIES UPON THE BLACKLEG DISEASE OF THE POTATO, WITH SPECIAL REFERENCE TO THE RELATIONSHIP OF THE CAUSAL ORGANISMS.*

This paper may be roughly divided into two parts. The first part gives a brief historical review of the subject, describes the character and appearance of the disease, its geographical distribution and economic aspects, sources of infection, means of distribution, and control measures. The second part, is concerned with an investigation of the causal organisms, and contains the results secured from a comparative study extending over a series of years.

While the fact that the potato is subject to maladies like that under consideration was noted at a comparatively early date in the history of bacterial diseases of plants it was not until about 1897 that blackleg was definitely connected with a bacterial parasite. Since 1902 a number of different investigators in Europe and one in America have isolated, described and named as separate species, bacterial parasites associated with and found capable of causing the type of potato disease known as blackleg.

Blackleg is a disease of both the stem and tuber. The attacked stems are characterized by an inky-black discoloration starting from the base, at the junction with the seed piece. Usually the blackening extends only to the surface or at the most only a few inches above the surface of the soil. Under favorable weather conditions it may follow up the stem for several inches, or even out on the larger branches destroying

*This is an abstract of a paper by W. J. Morse, having the same title and published in the Journal of Agricultural Research, Vol. VIII, No. 3, pp. 79-126. January 15, 1917.

the stem with great rapidity. The attacked plants usually present a characteristic appearance in the field. If the progress of the disease is slow they are more or less unthrifty and undersized, and have a more compact, upward growing habit than normal, turning first lighter green then yellow and finally dying. If the progress of the disease is rapid the plant may fall over suddenly without much previous signs of disease.

A soft rot of the tubers is also produced. Infection takes place in the hill by means of the disease following along the stolons from the stem to the base of the tuber.

Blackleg has been observed in Germany, France, Belgium, Holland, England, Ireland, Canada and the United States. It was first reported in the United States in 1906 and in Maine in 1907. Evidence is given to show that it was introduced into and widely disseminated in the United States by means of infected seed potatoes.

Most writers on the subject have emphasized the economic importance of the disease. While blackleg is by no means unimportant, judgments based on observations made in Maine would indicate that its destructiveness has been overestimated. This more particularly applies to the losses occasioned by tuber decay caused by the blackleg organism, which have undoubtedly been confused with those primarily due to other causes.

At the same time the evidence is conclusive that in Maine the disease does not live over winter in the soil and that infected seed tubers are the sole source of infection and means of distribution of blackleg.

Successful methods of control have been worked out, which depend upon the elimination of all diseased or imperfect seed tubers and then disinfecting the remainder with corrosive sublimate or formaldehyde.

The aim of the bacteriological investigation was to secure cultures of all named pathogenic organisms previously described in Europe and America as the cause of blackleg and, in comparison with like cultures obtained from diseased plants in Maine, subject them to the same tests, at the same time, under identical conditions. This work resulted in the conclusion that *Bacillus atrosepticus* van Hall, *Bacillus solanisaprus* Harrison and *Bacillus melanogenes* Pethybridge and Murphy were identical with each other and with the organisms obtained from diseased plants

from different parts of Maine. For various reasons it was felt that the name *B. atrosepticus* should be adopted for the group. Two different cultures were obtained from Germany as *Bacillus phytophthorus* Appel but neither of these proved pathogenic. In cultural characters they did not agree with each other nor with Appel's original description of this organism.

A FORM OF POTATO DISEASE PRODUCED BY RHIZOCTONIA.*

What appeared to be an undescribed type of potato tuber disease was observed a few years ago in southern Maine for the first time. While authors have described many troubles more or less in association with Rhizoctonia, as far as the writer was able to ascertain, outside of Maine, no other reference had been made in the literature to this type of injury which the writer chooses to call "dry core" of the potato tuber.

Two phases of the disease are noted. First a stage which on superficial examination might be mistaken for common scab. Second, a stage showing a canal formation which might be confused with the injury caused by the wire worm.

In the first phase the fungus enters at the lenticels and works its way down into the tuber without much external disturbance. The definite boundary and dark brown color of the area suggests a form of scab. The interior mass of hyphae, broken-down cells and starch grains all remain in position, forming a dry core.

The second phase in this type of injury is found in the older stage where the infected area reaches a greater diameter than 3 mm. Owing to a drying out and shrinkage of tissues, a pit or canal is formed in the center of the affected area. This may present an appearance somewhat similar to wire worm injury.

The diseased areas are approximately circular in outline and at the surface vary in size from that of a lenticel to 6 or 7 mm. in diameter. They usually extend into the flesh of the tuber to a depth equal to or somewhat greater than the diameter.

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*This is an abstract of a paper with the same title, by G. B. Ramsey, published in the Journal of Agricultural Research, Vol. IX, No. 12, June 18, 1917, pp. 421-426 with 4 plates.

The dry core thus formed is usually proportioned and shaped quite like a thimble. Surrounding the mature core there is a very definite line of demarcation separating the diseased tissue from the healthy. In many cases, by inserting the point of a knife, one may lift out these cores bodily.

Rhizoctonia mycelium is found in abundance in all stages of dry core formation. Pure cultures have repeatedly been obtained from the inner parts of the diseased areas. Evidence shows that the host cells die and loose their contents, and the walls suberize and are more or less broken down several cells in advance of the fungal filaments. This might lead one to suspect that part of the action is due to a toxin that is secreted by the fungus.

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 gauge; self-recording anemometer; vane; and barometers. The observations at Orono now form an almost unbroken record of forty-nine years.

METEOROLOGICAL SUMMARY FOR 1917.

Observations Made at the University of Maine.

1917.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Averages.	Totals.
Highest temperature	48	45	65	63	72	84	91	90	81	68	58	41	-------	-------
Lowest temperature	–10	–20	9	14	27	42	49	47	29	26	–1	–29	-------	-------
Mean temperature	20.2	17.3	30.2	41.6	48	61.5	70.0	68.9	53.0	46.4	33.4	15.6	42.17	-------
Mean temperature in 49 years	16.57	12.5	30.0	40.2	51.5	60.8	65.9	66.1	59.8	50.8	38.1	24.2	42.75	-------
Total precipitation in inches	4.11	3.67	3.22	2.39	3.18	7.49	4.05	4.09	1.08	5.89	1.65	3.24	-------	44.06
Mean precipitation in 49 years	2.52	3.49	4.05	2.95	3.57	3.50	3.43	2.33	3.41	3.83	3.47	3.55	-------	-------
Number of days with precipitation of .01 or more	10	9	10	9	11	16	11	13	5	15	5	6	-------	120
Snowfall in inches	24	31.5	13.0	12.0	3.0	-------	-------	-------	-------	3.0	2.75	28	-------	117.25
Mean snowfall in 49 years	21.53	21.51	15.13	5.91	.23	-------	-------	-------	-------	.74	7.02	16.6	-------	-------
Number of clear days	15	17	20	16	12	16	24	21	24	17	17	17	-------	216
Number of fair days	7	2	6	6	13	5	4	4	2	6	6	5	-------	66
Number of cloudy days	9	9	5	8	6	9	3	6	4	8	7	9	-------	83
Total movement of wind in miles	5213	3664	5066	4537	5319	3629	3449	3438	2789	5120	4183	4507	4285	51414

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, 1917, 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.

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1917.

DISBURSEMENTS.

RECEIPTS.	Hatch fund.	Adams fund.	Animal husbandry investigations.
Salaries	5919.07	11364.40	4827.12
Labor	3043.85	44.65	27.00
Publications	156.30	--------	--------
Postage and Stationery	759.69	116.24	46.25
Freight and Express	156.53	118.51	2.63
Heat, light and power	630.20	108.53	--------
Chemical and laboratory supplies	1.65	26.43	--------
Seeds, plants and sundry supplies	573.83	260.02	10.70
Fertilizers	191.10	--------	--------
Feeding stuffs	1946.45	1496.77	--------
Library	250.22	--------	--------
Tools, machinery and appliances	268.92	21.55	--------
Furniture and fixtures	80.29	142.81	--------
Scientific apparatus and specimens	74.42	136.30	--------
Live stock	--------	2.60	--------
Traveling expenses	515.57	440.65	26.30
Contingent expenses	40.00	180.00	--------
Buildings	391.91	540.54	--------
Total	15000.00	15000.00	4940.00

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1917 —Concluded.

DISBURSEMENTS.

RECEIPTS.	Aroostook farm.	General account.	Inspection analysis.
Salaries	2470.69	3156.06	11139.08
Labor	4469.85	1733.80	--------
Publications	--------	--------	--------
Postage and Stationery	41.87	28.70	273.40
Freight and Express	60.30	57.78	163.21
Heat, light and power	85.41	89.08	432.87
Chemical and laboratory supplies	--------	6.14	544.38
Seeds, plants and sundry supplies	759.18	934.33	35.94
Fertilizers	753.92	11.93	--------
Feeding stuffs	544.09	145.94	--------
Library	--------	--------	--------
Tools, implements and machinery	339.00	14.77	--------
Furniture and fixtures	53.00	37.79	34.67
Scientific apparatus	--------	4.64	12.83
Live stock	986.00	1073.00	--------
Traveling expenses	121.86	330.88	101.06
Contingent expenses	126.57	301.33	17.70
Buildings	230.50	45.34	--------
Total	11042.24	7971.51	12735.14

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APPENDIX

Official Inspections

81 to 85

CONTENTS

January, 1917.

(Sent to printer Dec. 27, 1916)

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director.

ANALYSTS.

James M. Bartlett
Royden L. Hammond
John H. Perry
Herman H. Hanson
Elmer R. Tobey

Official Inspections

81

COMMERCIAL AGRICULTURAL SEEDS, 1916.

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 Seed Inspection 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 chief requirements of the law follow. The full text of the law will be sent on request to the Commissioner of Agriculture, Augusta.

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, design or device which is false or misleading in any particular, or if it does not carry the statements named in 2.

Explanation of Tables.

The tables on pages 3 to 26 are self explanatory. The table on pages 27 and 28 is explained on page 28.

A list of weed seeds found in seeds examined in 1916.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908.

	Common Name.	Scientific Name.
1.	American pennyroyal	Hedeoma pulegioides (L.) Pers.
2.	American wild mint	Mentha canadensis (L.) Briquet.
3.	Ax-seed	Coronilla varia (L.)
4.	Barnyard grass	Echinochloa crusgalli (L.) Beauv.
5.	Black medick	Medicago lupulina L.
6.	Bladder campion	Silene latifolia (Mill.) B. & R.
7.	Bladder ketmia	Hibiscus trionum L.
8.	Bird's foot trefoil	Lotus corniculatus L.
9.	Blue field madder	Sherardia arvensis L.
10.	Blue vervain	Verbena hastata L.
11.	Bracted plantain	Plantago aristata Michx.
12.	Bull thistle	Cirsium lanceolatum (L.) Hill.
13.	Buttercup	Ranunculus acris L.
14.	Canada thistle	Cirsium arvense (L.) Scop.
15.	Catnip	Nepeta cataria L.
16.	Chess	Bromus secalinus L.
17.	Chicory	Cichorium intybus L.
18.	Clarkia	Clarkia sp.
19.	Clover dodder	Cuscuta epithymum Murr.
20.	Common chickweed	Stellaria media (L.) Cyrill.
21.	Common nightshade	Solanum nigrum L.
22.	Common speedwell	Veronica officinalis L.
23.	Common St. John's wort	Hypericum perforatum L.
24.	Corn camomile	Anthemis arvensis L.
25.	Corn cockle	Agrostemma githago L.
26.	Crabgrass	Digitaria sanguinalis (L.) Scop.
27.	Crane's bill	Geranium maculatum L.
28.	Dock	Rumex sp.
29.	Ergot	*Claviceps purpurea (Fr.) Tul.
30.	Evening primrose	Oenothera biennis L.
31.	False flax	Camelina microcarpa Andrz.
32.	False redtop	Poa triflora Gilib.
33.	Field dodder	Cuscuta arvensis Beyrich.
34.	Field scorpion grass	Myosotis arvensis (L.) Hill.
35.	Five finger	Potentilla monspeliensis L.
36.	Fowl meadow grass	Glyceria nervata (Willd.) Trin.
37.	Goosefoot	Chenopodium album L.
38.	Green foxtail	Setaria viridis (L.) Beauv.
39.	Hard fescue	Festuca ovina L.
40.	Hairy stickseed	Lappula echinata Gilib.
41.	Heal-all	Prunella vulgaris L.
42.	Hedge mustard	Sisymbrium officinale (L.) Scop.
43.	Indian mallow	Abutilon theophrasti Medic.
44.	Knot-grass	Polygonum aviculare L.
45.	Lady's thumb	Polygonum persicaria L.
46.	Mayweed	Anthemis cotula L.
47.	Meadow fescue	Festuca elatior L.
48.	Mint	Mentha sp.
49.	Moth mullein	Verbascum blattaria L.
50.	Mouse-ear chickweed	Cerastium vulgatum L.
51.	Mustard	Brassica nigra (L.) Koch.
52.	Night-flowering catchfly	Silene noctiflora L.

* Sclerotia of the fungus.

A list of weed seeds found in seeds examined in 1916—Concluded.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908—CONCLUDED.

	Common Name.	Scientific Name.
53.	Old witch grass	Panicum capillare L.
54.	Ovoid spike rush	Eleocharis ovata (Roth) R. & S.
55.	Ox-eye daisy	Chrysanthemum leucanthemum L.
56.	Pale persicaria	Polygonum lapathifolium L.
57.	Pennsylvania persicaria	Polygonum pennsylvanicum L.
58.	Peppergrass (Field)	Lepidium campestre (L) R. Br.
59.	Peppergrass (Wild)	Lepidium virginicum L.
60.	Perennial sweet vernal grass	Anthoxanthum odoratum L.
61.	Pigweed	Amaranthus retroflexus L.
62.	Pimpermel	Anagallis arvensis L.
63.	Plantain	Plantago major L.
64.	Poison hemlock	Conium maculatum L.
65.	Purslane	Portulaca oleracea L.
66.	Quack grass	Agropyron repens (L.) Beauv.
67.	Ragweed	Ambrosia artemisiifolia L.
68.	Ribgrass	Plantago lanceolata L.
69.	Rugel's plantain	Plantago rugelii Done.
70.	Russian thistle	Salsola Kali tenuifolia (L.) G. F. W. Mey.
71.	Sand rocket	Diplotaxis muralis (L.) D. C.
72.	Sedge	Carex unidentified.
73.	Sheep sorrel	Rumex acetosella L.
74.	Shepherd's purse	Capsella Bursa-pastoris (L.) Medic.
75.	Slender crabgrass	Digitaria filiformis (L.) Koeler.
76.	Small flowered crane's bill	Geranium pusillum Burm.
77.	Sow thistle	Sonchus oleraceus L.
78.	Spiny sida	Sida spinosa L.
79.	Sprouting crabgrass	Panicum dichotomiflorum Michx.
80.	Spurge	Euphorbia preslii Guss.
81.	Spurry	Spergula arvensis L.
82.	Suckling clover	Trifolium dubium Sibth.
83.	Sunflower	Helianthus annuus (L.)
84.	Toothed spurge	Euphorbia dentata Michx.
85.	Tumble-weed	Amaranthus graecizans L.
86.	Virginia three-seeded mercury	Acalypha virginica L.
87.	Vetch	Vicia sativa L.
88.	White hoarhound	Marrubium vulgare L.
89.	White vervain	Verbena urticaefolia L.
90.	Whorled mallow	Malva verticillata L.
91.	Wild buckwheat	Polygonum convolvulus L.
92.	Wild carrot	Daucus carota L.
93.	Wild madder	Galium mollugo L.
94.	Wild rose	Rosa pratincola Greene.
95.	Willow herb	Epilobium adenocaulon Haussk.
96.	Winged pigweed	Cycloloma atriplicifolium (Screng.) Coult.
97.	Wormseed mustard	Erysimum cheiranthoides L.
98.	Yarrow	Achillea millefolium L.
99.	Yellow alyssum	Alyssum alyssoides L.
100.	Yellow daisy	Rudbeckia hirta L.
101.	Yellow foxtail	Setaria glauca (L.) Beauv.
102.	Yellow rocket	Barbarea vulgaris R. Br.
103.	Yellow-wood sorrel	Oxalis corniculata L.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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.			
8184	Belfast. H. L. Whitten. Alfalfa	99.0	92.1	38, 70, 68, 61, 21, 6, 17.
8479	Clinton. Gerald Bros. Alfalfa clover	98.0	99.9	
	ALSIKE CLOVER.			
8331	Anson. A. B. Willis. Alsike	98.0	94.8	73, 82, 60, 68.
8430	Auburn. Oscar Holway Co. Blue Jay Alsyke	98.5	99.0	37.
8242	Bangor. R. B. Dunning Co. Ace Alsike	97.0	95.1	73, 52, 37, 63, 5, 46, 14, 82, 38, 61, 60.
8289	Biddeford. Andrews & Horigan. Alsike	95.0	93.7	73, 82, 52, 46, 68, 60, 28, 99, 5, 53, 38, 37, 30.
†7999	Bingham. H. B. Whipple. Alsyke	99.0	98.2	73, 52, 50, 58.
8341	Bingham. S. J. Whitney. Alsike	91.0	92.6	73, 46, 20, 68, 42, 52, 37,5.
8085	Blaine. N. E. Dorrity. Alsike	98.0	94.4	73, 5, 46, 68, 37, 52, 38.
8231	Brewer. A. C. Moore. Queen Alsike	88.0	86.5	73, 63, 42, 46, 35, 5, 75, 68, 58, 52, 37.
8468	Brooks. Brooks Farmers' Union. Alsyke	97.0	97.5	52.
8465	Brooks. C. F. Spaulding. Alsyke	95.0	93.7	73, 52, 14, 28, 37.
8366	Brownville Jct. G. W. Small. Alsyke	97.0	95.8	52, 73, 63, 28, 69, 58, 37, 5, 14, 74.
8156	Bucksport. E. B. Gardner. Alsike	94.0	93.7	73, 82, 52, 46, 58, 28, 37.
8158	Bucksport. H. L. Marks. Alsike	94.0	93.9	73, 82, 52, 5, 68, 28, 61, 14, 72, 63, 38.
8311	Buxton. Soule Bros. Ace Alsike	93.0	92.3	73, 5, 52, 37, 68, 82, 46.
8176	Camden. J. C. Curtis. Alsike	96.0	97.7	5.
8067	Caribou. J. H. Glenn. Pine Tree Alsike	97.0	96.8	28, 59, 52.
8071	Caribou. Shaw & Mitton. Ace Alsike	95.0	97.2	52, 37.
8072	Caribou. Shaw & Mitton. Pine Tree Alsike	97.0	96.0	52, 37, 14, 61, 28, 73, 35, 10, 15, 30.
8154	Castine. Parker and Wescott. Alsike	96.0	95.3	73, 82, 5, 52, 50, 38, 68,28.
8263	Charleston. W. L. Farmer. Ace Alsike	94.0	94.2	73, 82, 52, 68, 37.

*The numbers refer to weeds named in the table on pages 3 and 4. E. g. 1 is for American pennyroyal, 2 is American wild mint, etc.

† Sample taken under directions with guaranty and sent by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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.			
8475	Clinton. W. M. Keene. Ace Alsyke	95.0	93.5	73, 52, 69, 14, 37, 63, 72, 34.
8196	Danforth. H. H. Putnam. Ace Alsike	95.0	93.6	73, 52, 82, 5, 68, 46, 14, 61, 60, 37, 63, 31, 28.
8218	Dennysville. H. H. Allen. Alsike	91.0	95.1	73, 68, 82, 60, 46.
8209	Eastport. E. S. Martin. Alsike	93.0	92.0	5, 52, 73.
8286	Ellsworth. Whitcomb, Haynes & Whitney. Alsike	94.0	97.0	42, 73, 37.
8391	Farmington. W. W. Small. Alsike	95.0	98.1	35, 5, 37, 73.
8059	Fort Fairfield. S. Nightingale & Son. Globe Alaska Alsike	97.0	94.1	73, 82, 52, 37, 5, 68, 46, 14, 53, 28.
8088	Fort Kent. P. A. Roy. Ace Alsike	95.0	93.8	73, 82, 52, 68, 28, 15, 21, 53, 38, 102, 69, 5, 37.
8097	Foxcroft. Central Maine Cooperative Store. Alsike	98.0	92.8	73, 37, 52, 28.
†8002	Gardiner. Gray-Hildreth Co. Alsike	98.0	98.1	5, 73, 52, 31, 38, 50, 14.
8452	Gray. Sweetser & Cole. Alsike	96.0	93.4	73, 82, 52, 46, 37, 60, 5, 68, 102, 75, 63, 31.
‡8347	Greenville. Folsom, Prentiss Co. Alsike clover	–	93.2	73, 82, 68, 37.
8349	Greenville. D. T. Sanders & Son. Alsike	94.0	93.0	73, 37, 28, 35, 63.
8355	Guilford. John Scales & Sons. Alsike	95.0	93.8	73, 82, 52, 68, 37, 28, 60, 46, 53, 69, 45, 31, 30, 103, 75, 5.
‡8312	Halloweil. F. S. Wingate. Alsike clover.	–	97.0	5, 73.
8288	Hampden. C. L. & R. G. Barrows. Alsike	96.4	96.2	52, 73, 82, 63, 74, 68, 50, 60, 28, 5, 46, 41.
8255	Hampden. E. H. Rowell. Alsike	99.0	99.7	
8283	Hancock. Pamola Grange Store. Alsike	94.0	94.5	73, 82, 52, 60, 37, 68, 20.
8257	Hermon. L. I. Leathers. Alsike	96.4	96.6	73, 52, 5, 74, 82, 63.
8052	Houlton. E. M. Smith. Alsike	97.0	96.1	73, 37, 30, 69, 63, 35, 15, 28, 10, 58.

* The numbers refer to weeds named in the table on pages 3 and 4. E. g. 1 is for American pennyroyal, 2 is American wild mint, etc.

† Sample taken under directions with guaranty and sent in by dealer.

‡ Seed placed in table under name of what it proved to be. Information with sample gave it another name. Probably inspector's error.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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.			
†7962	Houlton. John Watson & Co. Globe Alsyke 86633C	99.0	98.2	37, 52, 35.
†7983	Globe Alsyke 86655	99.0	97.9	52, 37, 42, 38, 14, 5.
†7985	Globe Alsyke	99.0	98.2	37, 52, 73, 31, 28.
†7990	Globe Alsyke	99.0	98.3	37, 52, 28, 73.
†8012	Globe Alsyke 86606B	98.0	98.2	52, 37, 61, 46, 73, 42.
†8013	Ace Alsyke 86667D	94.0	94.0	73, 52, 82, 37, 28, 5, 46, 68, 54.
†8015	Ace Alsyke 86667 C	94.0	93.4	73, 52, 82, 5, 28, 37, 46, 27, 61, 53, 41, 65, 68, 42, 40.
†8034	Globe Alsyke 86695	98.0	97.2	37, 52, 73, 28, 42.
†8035	Ace Alsyke 86685	93.0	92.2	73, 5, 52, 37, 63, 14, 46, 28, 82, 58, 31, 102, 68, 44.
8049	Ace Alsyke	97.0	81.7	73, 37, 52, 49, 28, 30, 63.
8050	Globe Alsyke	98.0	97.2	37, 52, 5, 73, 28.
8091	Island Falls. Island Falls Grange Store. Globe Alsike	98.0	97.8	73, 52.
8294	Kennebunk. E. L. Littlefield & Co. Alsike	95.0	96.4	73, 82, 52, 28.
8146	Kingman. J. T. Baldwin. Ace Alsike	95.0	94.1	73, 82, 52, 68, 37, 5, 46, 38, 28.
†7924	Lewiston. Haskell Implement & Seed Company. Prime Alsyke	91.19	90.0	73, 42, 82, 37, 69, 68, 63, 59, 5, 74, 28, 31, 35, 72, 52, 36, 93.
8426	Lewiston. Haskell Implement & Seed Company. Kizer Clover (Alsike)	91.0	91.2	73, 35, 82, 42, 68, 46, 63, 72, 37, 52.
8327	Madison. N. A. Weston. Prime Alsike	91.0	91.2	73, 52, 37, 68, 28, 82.
8413	Mexico. J. M. Doyen Co. Alsyke	98.0	95.9	52, 73, 28, 63, 35, 5, 14, 10.
8354	Monson. H. E. Gilbert. Alsike	98.0	94.3	73, 82, 52, 5, 28, 68, 37, 69, 46.
8336	North Anson. Porter & Marston. Ace Alsike	95.0	95.2	73, 82, 52, 69, 60.
8483	Oakland. H. W. Greeley Co. Alsyke	91.0	92.7	73, 52, 46, 37, 28, 69.
8484	Oakland. H. W. Greeley Co. Alsyke	96.0	97.3	5, 52, 73.
8486	Oakland. D. M. Marshall. Alsyke	98.0	98.9	73, 59.
8240	Old Town. Old Town Supply Co. Alsike	99.6	99.7	37.
8238	Old Town. Sawyer, Rand & Co. Pan American Alsike	97.0	98.5	73, 5.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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.			
8161	Orland. A. R. Buck. Alsike	88.4	84.8	73, 68, 37, 42, 58, 14, 46, 74, 31, 63, 28, 38, 5, 15.
8106	Pittsfield. Eastern Grain Co. Bell Alsike	96.0	96.8	5, 52, 73, 82, 31, 50.
8113	Pittsfield. Eastern Grain Co. Pan American Alsyke	97.0	97.2	73.
8107	Pittsfield. E. W. Wallace. Pan American Alsyke	97.0	97.8	52, 73, 50.
‡8169	Portland. Kendall & Whitney. Alsike clover	–	95.6	73, 52, 28, 14.
8201	Princeton. C. A. Rolfe. Alsike	98.0	97.2	37, 73, 52, 46, 28, 63.
8489	Ripley. L. R. Ramsdell. Ace Alsyke	95.1	82.8	73, 42, 46, 52, 37, 58, 68, 60, 69, 28, 82, 41, 30, 75, 54, 53, 38, 34.
8168	Rockland. Wright Seed Co. Alsike	95.0	95.2	52, 28, 63, 58, 73, 37.
8365	Sangerville. A. C. Dow. Alsyke	99.2	98.8	86, 37, 73, 5.
8189	Searsport. Searsport Grain Co. Ace Alsike	95.0	94.8	73, 52, 37, 46, 82, 5, 38, 28, 59.
8320	Skowhegan. Farmers' Union. Alsyke	99.2	99.2	5, 37, 52.
†7933	Skowhegan. D. A. & W. E. Porter. Pan American Alsike B—L 10933	97.0	96.9	73, 5.
8119	Skowhegan. Stewart & Smiley. Globe Alsyke	99.5	96.6	73, 37, 52, 82, 35, 42, 31, 58, 46, 74, 50, 49.
8221	South Brewer. F. H. Brastow & Sons. Alsike	95.7	97.5	5, 63, 52.
8451	South Paris. L. L. Russell. Alsike	98.0	89.6	73, 82, 46, 52, 68, 5, 60, 38, 53, 69, 63, 9, 14, 35, 72, 42.
8398	Strong. Daggett & Will. Alsike	97.0	92.7	73, 52, 37, 14, 69, 5, 28, 74, 68.
8075	Van Buren. A. E. Hammond. Ace Alsike	94.0	94.2	73, 82, 52, 28, 37.
8346	Waterville. Central Maine Farmers Exchange. Alsike	98.0	97.5	5.
8381	Wilton. W. F. Sawyer. Alsyke	91.0	91.9	73, 42, 35, 82, 46, 63, 28, 29, 37, 5, 74.
8379	Wilton. B. F. Stanley. Alsyke	91.0	90.7	73, 82, 46, 63, 31, 68, 37, 53.

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‡ Seed placed in table under name of what it proved to be. Information with sample gave it another name. Probably inspector's error.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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—Concluded.			
8480	Winslow. D. B. Mason. Alsyke	97.0	96.2	82, 73, 5, 60, 28, 52, 69.
†8045	Westfield. Don C. Sylvester. Alsyke	98.0	96.7	73, 52, 82, 68, 46, 74, 63, 35, 42, 5, 37.
8140	West Jonesport. Cummings & Norton. Alsike	98.0	97.7	5.
8125	West Pembroke. E. H. Fisher & Son. Alsike	95.0	98.0	42, 37.
	BARLEY.			
†8006	Gardiner. Gray-Hildreth Co. Two-Rowed Barley	98.0	98.35	91, 45, 25, 101, 81.
8345	Waterville. Central Maine Farmers Exchange. Barley	99.5	98.5	91.
	BUCKWHEAT.			
†8007	Gardiner. Gray-Hildreth Co. Buckwheat	98.0	99.04	67.
	CRIMSON CLOVER.			
‡8086	Blaine. N. E. Dorrity. Crimson clover	–	98.3	5, 28, 9, 51, 52, 76.
8425	Lewiston. Haskell Implement & Seed Co. Clover Crimson	98.0	98.9	5, 6, 28, 51.
†8044	Westfield. Don C. Sylvester. Crimson clover	99.0	98.5	5, 27, 9, 51, 28.
	GERMAN MILLET.			
‡8402	Strong. C. V. Starbird Estate. Millet, German	97.0	97.9	38, 79.
‡8396	West Farmington. E. H. Lowell. Millet, German	98.0	99.0	38, 61.
8424	West Peru. Arnold Brothers. German Millet	98.0	99.0	38.
	HUNGARIAN.			
8325	Anson. G. W. Booth. Hungarian	98.0	98.7	45, 38.
8330	Anson. A. B. Willis. Hungarian	98.0	99.3	56, 30, 38, 53.
8436	Auburn. Wilson & Co. Hungarian	97.0	96.6	101, 38, 53, 4, 67, 37, 75, 85, 26.
8222	Bangor. F. H. Brastow & Son. Hungarian	98.0	98.0	101, 38, 51, 37, 67, 26, 45.
8183	Belfast. H. L. Whitten. Hungarian	98.0	98.3	45, 37, 38, 60.
8467	Brooks. C. F. Spaulding. Hungarian	98.0	99.1	38, 45.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity.		*Kinds of Noxious Weed Seeds.
		Guaranty.	Found.	
8470	Burnham. Chute & Mitchell. Hungarian	97.0	98.6	101, 38, 37.
8269	Cherryfield. A. M. Mathews. Hungarian	96.0	97.7	38, 101, 37, 75, 53, 4.
8478	Clinton. Gerald Bros. Hungarian	97.0	98.0	38, 53, 56, 67.
8416	Dixfield. O. O. Gould. Hungarian	98.0	98.4	45, 56.
8264	East Corinth. J. K. Farrar. Hungarian	98.0	97.0	56, 4, 38, 75, 101, 37, 45, 53, 79, 86, 70, 26.
8307	East Lebanon. F. L. Pierce. Hungarian	99.0	99.4	38, 56.
8393	Farmington. F. L. Butler. Hungarian	97.0	94.9	53, 38, 45, 67, 56, 85, 44, 101, 4, 37, 30, 75, 63.
†8004	Gardiner. Gray-Hildreth Co. Hungarian	97.0	95.3	38, 75, 101, 45, 56, 53, 37, 4, 67, 48, 86.
8267	Kenduskeag. A. M. Foss & Son. Hungarian	98.0	99.1	56, 61.
8199	Milltown. S. S. Pineo. Hungarian	96.0	96.6	56, 45, 37, 38, 44, 30, 67, 26, 10, 101.
8338	North Anson. Porter & Marston. Hungarian	96.0	98.1	38, 101, 56, 53, 86.
8111	Pittsfield. T. E. Getchell. Hungarian	97.0	94.2	53, 56, 45, 79, 38, 67, 85, 44, 4, 101, 37, 96, 63,30.
8315	Shawmut. L. S. Bray. Hungarian	98.0	98.8	45, 38, 56.
8319	Skowhegan. Farmers Union. Hungarian	98.8	98.6	63, 38, 37, 43, 45.
†7936	Skowhegan. D. A. & W. E. Porter. Fancy Hungarian B–2, 10963	97.0	98.5	38, 101, 45, 4, 79.
8115	Skowhegan. Stewart & Smiley. Hungarian	97.0	99.2	38, 53.
8370	South Sebec. A. J. Chase & Son. Millet	97.0	99.7	
8399	Strong. Daggett & Will. Hungarian	98.0	98.2	56, 45, 85, 53, 38, 26.
8400	Strong. C. V. Starbird Estate. Hungarian	98.0	98.4	56, 45, 70, 26, 75.
8164	Thomaston. E. L. Dillingham. Hungarian	98.0	99.1	44, 45, 56.
8344	Waterville. Central Maine Farmers Exchange. Hungarian	97.0	98.2	101, 53, 75, 45, 79, 38.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, arranged alphabetically by towns and dealers—Continued.

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	JAPANESE MILLET.			
8324	Anson. George W. Booth. Japanese Millet	98.0	99.0	38.
8429	Auburn. Oscar Holway Co. Japanese Millet	98.0	98.9	101.
8180	Belfast. H. H. Hoover. Japanese Millet	96.0	98.0	67.
8462	Brooks. A. E. Chase Co. Japanese Millet	96.0	96.5	101, 44, 67, 38, 45.
8471	Burnham. L. E. Gerald. Japanese Millet	96.0	98.2	67, 101.
8152	Castine. A. W. Clark. Japanese Millet	98.0	98.6	101, 38, 70.
8477	Clinton. Gerald Bros. Japanese Millet	98.0	98.5	101.
8314	Fairfield. Fairfield Grain Co. Japanese Millet	93.0	94.2	101, 67, 57.
†8003	Gardiner. Gray-Hildreth Co. Japanese Millet	97.0	96.7	67, 38, 48, 45, 101, 7, 89, 44, 46.
†7966	Lewiston. Haskell Implement & Seed Company. Prime Japanese Millet	96.0	97.3	101, 67, 45, 81.
8214	Lincoln. Lincoln Produce Co. Japanese Millet	98.0	98.0	101, 67, 45.
8375	Livermore Falls. George Chandler. Japanese Millet	87.5	89.6	101, 38, 45, 57, 67, 51.
8352	Monson. W. H. Eldredge. Japanese Millet	97.0	98.5	101, 38.
8384	North Jay. S. H. Niles. Japanese Millet	98.0	98.4	101, 67, 96, 57.
8094	Patten. I. B. Gardner & Son. Jap Millet	98.0	98.4	101, 83.
8136	Pembroke. Hobart-Pattangall. Pine Tree Jap Millet	88.0	92.5	101, 67.
8421	Peru. Kidder Bros. Millet	96.0	97.0	67, 101, 57, 45.
8446	Rangeley. James S. Moore. Jap Millet	96.0	97.6	67, 101, 57, 45, 44.
†7935	Skowhegan. D. A. & W. E. Porter. Fancy Japanese Millet B–2 10963	97.0	96.2	67, 38, 101, 48, 45, 46, 37, 69, 44, 68, 55, 30, 14, 50
8454	Upper Gloucester. A. W. Sharp. Jap Millet	93.0	96.5	101, 67.
8423	West Peru. Arnold Brothers. Jap Millet	96.0	97.7	101, 67, 45.
	KENTUCKY BLUE GRASS.			
†7943	Portland. Allen, Sterling & Lothrop Kentucky Blue Grass	–	89.1	
8299	York Beach. J. B. Paul. Kentucky Blue Grass	77.0	75.6	72, 50, 74, 65, 59, 68.

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	MAMMOTH CLOVER.			
8070	Caribou. Shaw & Mitton. Mammoth Globe Clover	99.0	98.9	68, 24, 67.
8060	Fort Fairfield. S. Nightingale & Son. Globe Mammoth Red Clover	99.0	99.0	37, 73.
8096	Foxcroft. E. W. Judkins. Peavine Clover	98.0	98.1	73, 38, 92.
†7964	Houlton. John Watson & Co. Globe Mammoth Clover M 60	99.0	99.3	73, 38, 48.
†7982	Houlton. John Watson & Co. Ace Mammoth Clover M 103	98.0	98.1	37, 73, 38, 30.
†8014	Globe Mammoth Clover 1767	99.0	98.6	73, 37, 52, 38, 30.
†8033	American Mammoth Globe Clover 71080	99.0	99.5	48.
8419	Peru. Kidder Bros. Pea Vine Clover	98.0	97.7	73, 28, 37, 11.
8408	Rangeley. Oakes & Badger. Pea Vine Clover	98.0	97.8	73, 51, 68, 28, 45, 5, 3, 69. 30.
8362	Sangerville. Sanders Bros. Co. Mammoth Clover	98.0	99.6	89.
	OATS.			
8229	Bangor. C. M. Conant & Co. Silver Maine Oats	99.5	98.16	25, 91.
8244	Bangor. R. B. Dunning Co. Copeland Pearl Oats	99.0	100.0	
	ORCHARD GRASS.			
8251	Bangor. E. B. Thompson. Orchard Grass	–	95.8	32.
†7944	Portland. Allen, Sterling & Lothrop. Orchard Grass	–	90.1	73, 72.
	RED CLOVER.			
‡8360	Abbot. Buxton, Philbrick Co. Red Clover	98.0	98.5	68, 92, 41, 89, 75.
8383	Anson. G. W. Booth. Clover	98.0	98.3	38, 5.
†7899	Auburn. Oscar Holway Co. "Paste" R. Clover	97.8	97.9	68, 28, 92, 41, 8, 73, 44, 5.
†7903	Auburn. Oscar Holway Co. Red Clover, "Ajac"	99.27	99.4	92, 37, 6, 68.
†7921	Red Clover, "Ajac"	99.0	99.1	68, 5, 28, 92, 6.
8428	N. Y. Clover. Oscar Holway Co.	98.0	98.2	68, 38.
8227	Bangor. C. M. Conant Co. French Red Clover	97.0	96.5	68, 92, 89, 41, 28, 17.
8243	Bangor. R. B. Dunning Co. Clover	98.0	99.0	68, 44, 69.
8248	Bangor. Herbert Dunning. Red Clover	98.0	96.8	68, 38, 92, 41.
8246	Bangor. Eastern Grain Co. Pan American Red Clover	98.0	98.0	68.

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	RED CLOVER—Continued.			
8061	Bangor. Knowles, Dow & Co. Globe Brand D Clover	99.0	99.1	37.
8224	Bangor. Knowles & Dow. Eureka Red Clover	99.5	99.5	28, 38.
8225	Bangor. Knowles & Dow. Pan American Red Clover	97.5	97.6	68, 6, 41, 62.
8253	Bangor. J. Milliken. Red Clover	98.0	99.2	38, 28, 8.
8250	Bangor. E. B. Thompson. Red Clover	98.0	99.5	
9179	Belfast. H. H. Hoover. Red Clover	98.0	98.4	38, 69.
8178	Belfast. Swan, Whitten, Bickford. Red Clover	98.0	99.4	28.
8303	Berwick. H. E. Tibbetts. Red Clover	97.0	99.0	68.
†7997	Bingham. H. B. Whipple. Red Clover	99.5	98.3	38, 73, 37, 68, 4, 45.
8340	Bingham. S. J. Whitney. Red Clover	98.0	99.0	38, 41, 8.
‡8056	Blaine. N. E. Dorrity. Red Clover	–	97.8	28, 38, 68, 51, 69, 8.
8464	Brooks. A. E. Chase Co. Red Clover	98.0	98.5	28, 68, 41, 69.
8466	Brooks. C. F. Spaulding. Ace Clover	98.0	98.6	73, 8, 37, 68, 5.
8368	Brownville Jct. G. W. Small. Red Clover	99.20	98.4	68, 46.
8160	Bucksport. Fannie Ginn. Red Clover	97.0	99.5	38, 28.
8473	Burnham. L. E. Gerald. Clover	96.5	96.5	38, 69, 4, 37, 52.
8068	Caribou. Briggs Hardware Co. Globe Red Clover	99.0	98.1	5, 92, 69, 45.
8069	Ace Red Clover	98.0	98.0	5, 92, 68.
8153	Castine, Parker & Wescott. Red Clover	98.0	97.8	38, 68, 69, 37, 45, 52, 46, 67, 79, 101, 86, 53, 75.
8149	Castine. W. J. Patterson. Ace Red Clover	98.0	99.0	68, 73, 38.
8261	Charleston. J. F. Dority. Ace Red Clover	98.0	98.5	68, 5, 41, 73, 75, 92.
8143	Cherryfield. A. L. Stewart & Son. Red Clover	98.0	98.1	38, 45, 101.
8137	Columbia Falls. R. M. Allen. Red Clover	97.0	99.4	
†7957	Corinna. Eastern Grain Co. Pan American Red Clover	98.0	97.4	68, 5, 41, 17, 27, 92.
†7961	Pan American Clover Seed	98.0	97.9	68, 5, 92, 28, 41, 69, 17.
8194	Danforth. C. W. Littlefield. Red Clover	98.0	98.6	92, 68, 73.

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	RED CLOVER—Continued.			
8216	Dennysville. A. L. R. Gardner. Ace Red Clover	98.0	97.7	69, 41, 37, 38, 68, 5, 92.
8101	Dexter. Dexter Grange Store. Red Clover	99.0	99.3	68, 92.
8103	Dexter. S. M. Small. Clover	99.0	99.6	
8415	Dixfield. O. O. Gould. Red Clover	98.0	98.0	68, 38, 9, 92.
8133	East Machias. H. R. White. Red Clover	98.0	98.4	38, 45, 101, 28.
8207	Eastport. G. W. Capen Corp. Red Clover	97.9	98.0	92, 68.
8285	Ellsworth. A. H. Joy. Red Clover	99.0	98.8	68.
8313	Fairfield Grain Co. Red Clover	98.0	99.3	28.
8392	Farmington. F. L. Butler. Red Clover	98.0	99.4	38, 92.
8390	Farmington. W. W. Small. Red Clover	98.0	98.0	68, 28, 8, 92, 4, 38.
8077	Fort Kent. J. H. Andibert. Ace Clover	98.0	98.0	8, 92, 75, 69.
8079	Fort Kent. Fort Kent Milling Co. Ace Clover	99.0	98.9	68.
8089	Fort Kent. O. H. Michaud. Oriole Red Clover	99.5	98.5	68, 8, 5, 37, 28, 41, 6, 35.
8081	Fort Kent. G. H. Page. Ace Clover	98.0	97.2	68, 28, 92, 38, 37, 11, 52, 4, 88, 44, 5, 45.
8082	Fort Kent. P. A. Roy. Ace Red Clover	98.0	98.0	68, 75, 41, 8, 92, 28, 101.
8277	Franklin. W. B. Blaisdell Co. Ace Red Clover	98.0	98.1	45, 38, 101, 8.
†8001	Gardiner. Gray-Hildreth Co. Red Clover	98.0	97.6	68, 28, 92.
8254	Hampden. E. H. Rowell. Red Clover	99.5	99.5	38.
8282	Hancock. P. E. Walker. Red Clover	93.0	94.7	38, 68, 69, 80, 85, 45, 53, 75, 28.
8274	Harrington. O. S. Plummer. Queen Red Clover	95.0	97.5	68, 37, 38, 85.
8259	Hermon. Thurston & Hunt. Red Clover	99.0	99.5	28, 8.
8053	Houlton. E. M. Smith. Globe Red Clover	99.0	99.0	27.
†7965	Houlton. John Watson & Co. Globe Medium Clover 70831	99.0	99.2	28, 5.
†7979	Globe Medium Clover 70866	99.0	98.7	38, 28, 37.
†7980	Ace Medium Clover C 70857	98.0	98.1	69, 68, 38, 92, 28, 75, 37, 89, 8, 45, 27, 86, 5.
†7981	Ace Medium Clover 70858	98.0	98.6	69, 86, 38, 75, 28, 101, 68, 26.

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	RED CLOVER—Continued.			
†8009	Globe Medium Clover 76954	99.0	98.9	73, 92, 68, 17, 6, 8, 19, 38.
†8032	Houlton. John Watson & Co. Medium Red Clover 71115	99.0	98.3	38, 68, 8.
8048	Houlton. John Watson Co. Ace Red Clover	98.0	98.3	5, 68, 28, 38, 75, 86, 93, 67, 37, 63.
8084	Island Falls. Island Falls Grange Store. Globe Clover	99.0	99.9	
8139	Jonesport. B. B. Mansfield. Red Clover	98.0	97.1	68, 38, 92, 41, 28, 8, 45, 101, 5, 6, 93, 73.
8293	Kennebunk. George Cousens. Red Clover	98.0	99.0	38.
8292	Kennebunk. Curtis & Roberts. Red Clover	98.0	96.8	28, 68, 37, 38, 92, 45, 84, 33, 101, 11, 53, 52, 14.
8147	Kingman. W. H. Martin. Queen Red Clover	98.0	87.7	69, 75, 38, 28, 37, 53, 68, 59, 86, 67, 73, 79, 35, 4, 45, 61, 5, 46, 80, 11, 92, 44, 30, 63, 47, 101.
8439	Lewiston. E. P. Ham. Veri-best Clover	93.0	97.5	37, 86, 38, 69.
8434	Lewiston. J. L. Hayes & Co. Pan American Clover	93.0	97.7	73, 68, 38.
8374	Livermore Falls. George Chandler. Red Clover	90.0	97.5	68, 38, 41, 5, 8, 33, 92, 37, 52.
8131	Machias. A. B. Ingles. Red Clover	98.0	98.2	37, 62, 68, 75, 5, 92, 38.
8333	Madison. Stanley, Harlow & Hight Co. Pan-American Clover	98.0	96.2	68, 92, 5, 38.
8328	Madison. N. A. Weston. Prime Clover	96.0	96.0	28, 73, 101, 68, 75, 52, 69, 4, 38.
8055	Mars Hill. York & Fenderson. Globe Red Clover	99.0	99.0	73, 92, 68.
8414	Mexico. J. M. Doyen Co. Red Clover	88.0	97.4	38, 28, 68, 41, 73, 92.
8198	Milltown. S. S. Pineo. Red Clover	98.0	98.7	8, 68.
8105	Newport. Hanson & Pingree. Ace Red Clover	97.5	97.5	36, 68, 37, 5.
8104	Newport. Judkins & Gilman Co. Imperator Clover	97.0	97.8	92, 68, 5, 51, 64, 69, 77.
8335	North Anson. Porter & Marston. Choice Clover	98.0	98.5	68.8.
8304	North Berwick. Boyle Bros. Red Clover	94.0	99.3	38.45.
8306	North Berwick. D. W. Bragdon. Red Clover	99.5	99.5	68.
8442	North Jay. North Jay Grange Store. Red Clover	99.0	97.6	68, 41, 38, 28, 33, 8.

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	RED CLOVER—Continued.			
8385	North Jay. H. E. Purrington. Red Clover	96.0	95.7	38, 28, 92, 51, 75.
8236	Old Town. C. E. Grant. Globe Red Clover	99.0	99.7	38.
8127	Pembroke. C. Laughlin. Red Clover	98.0	98.8	8, 5.
8122	Perry. Gove & Son. Red Clover	98.0	98.0	38, 14, 45, 75, 68, 101, 51.
8444	Phillips. Haley & Russell. Red Clover	98.0	98.0	38, 68, 8, 28.
8405	Phillips. C. H. McKenzie Trading Co. Red Clover	99.0	98.3	68, 38, 41, 8, 5.
8403	Phillips. E. R. Toothacher. Red Clover	98.0	99.3	68.
8066	Presque Isle. Aroostook Co-operative Company. Globe Red Clover	99.0	97.3	68, 28, 5, 10, 38, 73, 72, 52, 63, 9, 45.
8064	Presque Isle. E. W. Fernald. Clover	98.0	97.8	68, 28, 38.
8203	Princeton. R. M. Allen. Ace Red Clover	98.0	98.0	68, 38, 8, 45, 41, 67.
8205	Princeton. I. M. Furbish. Pan American Red Clover	97.0	97.2	68, 92, 6, 5, 77.
8455	Ripley. L. R. Ramsdell. Red Clover	88.5	91.3	69, 75, 37, 73, 59, 53, 61, 28, 45, 38, 14, 67, 68, 63, 9.
‡8170	Rockland. G. H. Hart. Red Clover	–	98.4	73.
8166	Rockland. Littlehale & Co. Red Clover	98.0	98.1	68, 5, 28.
8174	Rockport. S. E. & H. L. Shepherd. Red Clover	85.0	99.2	38, 4.
8412	Rumford. A. S. Burgess. Red Clover	98.0	97.6	68, 5, 73, 37, 92, 41, 72, 69, 52, 28, 9.
8410	Rumford. James S. Morse. Clover	99.0	99.0	73, 8, 68, 92.
8364	Sangerville. A. C. Dow. Red Clover	99.0	98.7	38.
8190	Searsport. Searsport Grain Co. Ace Red Clover	98.0	97.1	68, 73, 38, 69, 53, 28, 11, 101, 37, 46, 5, 61, 33.
8188	Searsport. F. E. Whitcomb. Queen Red Clover	95.0	89.4	69, 75, 28, 37, 53, 38, 68, 59, 11, 46, 73, 26, 62, 61, 10, 42, 30, 12, 51, 63, 1, 80.
†7934	Skowhegan. D. A. & W. E. Porter. Pan American Clover B–2 10933	98.0	98.3	68, 92, 41, 28, 5, 17, 47.
†7991	Skowhegan. D. A. & W. E. Porter.			

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	RED CLOVER—Concluded.			
	Ace Brand Clover C 583	97.5	96.7	68, 38, 28, 75, 101, 53, 11 69, 78, 73, 86, 45.
8317	Skowhegan. D. A. & W. E. Porter. Pine Tree Clover	99.0	99.0	5, 92.
8120	Skowhegan. Stewart & Smiley. Red Clover	98.0	98.0	68.
8300	South Berwick. F. M. Hersom. Red Clover	97.0	97.9	68, 92, 5, 44.
8371	South Sebec. A. J. Chase & Son. Blue Jay Clover	99.25	99.3	101.
8310	Springvale. Sam D. Hanson. Red Clover	90.0	90.3	38, 62, 28, 45, 37, 79, 73, 4, 11, 101.
8192	Stockton. Goodhue & Co. Red Clover	99.0	99.4	
8459	Thorndike. Farwell Bros. Red Clover	98.0	97.7	68, 8, 41, 28.
8461	Thorndike. Peter Harmon & Son. Red Clover	98.0	99.0	68, 38.
8074	Van Buren. A. R. Hammond. Ace Clover	98.0	98.0	68, 38, 8, 3, 92, 28, 5, 45.
8073	Van Buren, W. F. Paradis Ace Red Clover	98.0	98.2	68, 41, 38.
8117	Waterville. G. A. Kennison & Co. Red Clover	–	98.7	92, 41, 68, 17, 28, 6, 9, 38.
8343	Waterville. Vigue Harness & Carriage Company. Fancy Clover	96.0	98.7	38, 3.
†8047	Westfield. Don C. Sylvester. Clover Medium or Red	99.0	97.2	68, 38, 5, 41, 8, 9.
8378	Wilton. B. F. Stanley. Ace Clover	98.0	97.8	68, 8.
8481	Winslow. D. B. Mason. Red Clover	98.0	98.2	69, 68, 38.
8449	Wiscasset. Wiscasset Grain Co. Red Clover	98.0	99.0	38.
	REDTOP.			
†7922	Auburn. Oscar Holway Co. Red Top "Archer"	90.0	92.2	98, 72, 48, 53, 63, 50.
8228	Bangor. C. M. Conant & Co. Climax Red Top	93.3	93.4	98, 72, 29.
8182	Belfast. B. D. Field. Red Top	90.0	91.2	98, 29, 53, 48.
8186	Belfast. C. F. Smith. Red Top	90.0	90.2	98, 63, 72, 48, 50.
8290	Biddeford. Joel Bean & Sons. Red Top	90.0	92.2	98, 72, 29, 35.
†8000	Bingham. H. B. Whipple. Red Top	90.0	93.6	98, 29, 73, 50, 72.
8372	Brownville. O. P. Gerry. Red Top	90.0	91.8	98, 72, 2.

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	REDTOP—Continued.			
8367	Brownville Jct. G. W. Small. Red Top	93.33	93.6	98, 72, 48.
8150	Castine. W. J. Patterson. Red Top	90.0	91.2	98, 50, 53, 29.
8476	Clinton. W. M. Keene. Redtop	90.0	91.8	98, 35, 69, 72, 48, 50.
8141	Columbia Falls. B. B. Tibbetts. Redtop	90.0	94.4	29, 98, 72.
†7959	Corinna. Eastern Grain Co. Redtop	90.0	91.0	98, 29, 72, 48, 35.
8417	Dixfield. O. O. Gould. Redtop	–	89.4	98, 72, 35, 48, 50.
8265	East Corinth. J. K. Farrar. Redtop	90.0	91.8	98, 35, 72, 29.
8284	Ellsworth. C. W. Grindal. Redtop	90.0	91.6	98, 35, 73, 29, 72, 48, 58.
8095	Foxcroft. Central Maine Co-operative Store. Redtop	90.0	94.8	98, 10, 72.
8099	Foxcroft. A. W. Gilman & Co. Fancy Redtop	90.0	91.6	98, 35, 72, 63, 29.
†8005	Gardiner. Gray-Hildreth Co. Redtop	91.9	89.5	98, 63, 50, 29, 65.
8359	Guilford. H. Douglass & Co. Redtop	95.0	93.6	29, 98, 72, 49, 59, 35, 50. 42.
8356	Guilford. John Scales & Sons. Redtop	90.0	92.2	98, 72, 35, 53.
8437	Lewiston. E. P. Ham. Redtop	90.0	93.4	98, 72, 53, 73.
8427	Lewiston. Haskell Implement & Seed Company. Redtop	97.2	97.6	98, 72, 50.
8377	Livermore Falls. H. A. Morrison. Redtop	90.0	91.0	98, 50, 72, 69, 39.
8130	Machias. L. W. Longfellow. Redtop	85.0	86.2	35, 98, 29, 72, 48, 100, 58, 65.
8334	Madison. Stanley, Harlow & Hight Co. Redtop	90.0	91.2	98, 29, 35, 50, 48, 53, 72, 65.
8233	Milford. E. W. Stuart. Redtop	85.0	81.6	98, 35, 63, 73, 72, 59, 29, 68, 50.
8271	Millbridge. J. C. & G. R. Strout. Redtop	91.0	87.9	98, 29, 69, 35, 72, 68, 48, 50, 53, 101.
8272	Millbridge. E. W. Wallace. Redtop	90.0	91.2	98, 72, 50, 29.
8383	North Jay. S. H. Niles. Redtop	90.0	89.8	98, 72, 35, 63.
8388	North Jay. North Jay Grange Store. Redtop	90.0	90.8	98, 50, 35, 53, 8.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916; 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.			
8386	North Jay. H. E. Purrington. Redtop	90.0	91.2	98, 72, 50, 63, 53.
8487	Oakland. D. M. Marshall & Co. Redtop	90.0	91.4	98, 72, 48, 39.
8297	Ogunquit. C. L. Maxwell. Redtop	86.0	85.4	98, 50, 29, 48, 72.
8234	Old Town. Lore Alford. Redtop	91.0	91.4	98, 50, 29, 48.
8420	Peru. Kidder Bros. Redtop	90.0	90.8	98, 35, 72, 50, 29, 71.
8406	Phillips. C. H. McKenzie Trading Co. Redtop	90.0	91.8	98, 35, 72, 48, 50, 29.
8404	Phillips. E. R. Toothacker. Redtop	92.0	93.8	98, 29, 72, 48, 53.
8109	Pittsfield. E. W. Wallace. Pan American Redtop	90.0	89.0	98, 35, 29, 72, 46, 50, 53.
8411	Rumford. A. S. Burgess. Redtop	90.0	92.0	98, 72.
8291	Saco. Saco Grain & Milling Co. Redtop	91.0	92.4	29, 98, 72, 89.
8321	Skowhegan. Farmers Union. Redtop	90.0	92.4	98, 72, 29, 50, 35, 69, 48.
†7937	Skowhegan. D. A. & W. E. Porter. Pan American Redtop B–2 10933	90.0	90.4	98, 72, 48.
8318	Skowhegan. D. A. & W. E. Porter. Redtop	90.0	91.6	98, 29, 50, 35, 72, 48, 69.
8457	Thorndike. Farwell Bros. Redtop	90.0	90.8	98, 72, 50.
8460	Thorndike. Peter Harmon & Sons. Redtop	90.0	89.4	98, 35, 72, 50, 29, 58, 69, 48, 53.
8118	Waterville. G. A. Kennison & Co. Redtop	–	92.0	98, 72, 73, 29, 48.
8342	Waterville. G. A. Kennison & Co. Redtop	90.0	92.4	98, 72, 29.
8395	West Farmington. E. H. Lowell. Redtop	90.0	90.4	98, 72, 50, 29, 53, 48.
8380	Wilton. W. F. Sawyer. Redtop	90.0	90.6	98, 53, 35, 50, 72, 2, 29.
8298	York Beach. A. M. Chase. Redtop	92.0	90.2	98, 35, 29, 72, 50, 63, 100 48.
	SIBERIAN MILLET.			
8432	Auburn. J. E. Tibbetts Co. Siberian Millet	98.0	99.0	38.
8450	Warren. A. & P. D. Starrett. Siberian Millet	98.0	99.1	38, 37.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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.			
‡8361	Abbot. Buxton Philbrick Co. Timothy	99.5	99.5	
8322	Anson. George W. Booth. Bison Timothy	97.8	98.2	35, 69, 59.
8329	Anson. A. B. Willis. Timothy	98.0	97.7	69, 35, 30, 98, 73, 26, 53, 37, 97.
8373	Auburn. Oscar Holway Co. Pine Tree Timothy	99.5	99.5	58, 35.
8431	Auburn. J. E. Tibbetts Co. Pine Tree Timothy	99.5	99.3	30, 73, 37, 58.
8435	Auburn. Wilson & Co. Pine Tree Timothy	99.5	99.6	35.
8226	Bangor. C. M. Conant & Co. Climax Timothy	99.6	99.7	72.
8247	Bangor. H. Dunning. Timothy	99.0	99.0	30.
8241	Bangor. R. B. Dunning Co. Bison Timothy	97.0	97.5	69, 37, 35.
8245	Bangor. Eastern Grain Co. Timothy	99.5	99.6	30.
8223	Bangor. Knowles & Dow. Pan American Timothy	99.5	99.7	30.
8252	Bangor. J. Milliken. Timothy	99.0	99.3	69, 30.
8121	Bangor. Charles Murry. "Grains of Gold" Timothy	97.7	99.6	
8249	Bangor. E. B. Thompson. Timothy	99.5	99.5	100, 30.
8181	Belfast. B. D. Field. Timothy	99.5	99.7	73.
8185	Belfast. C. F. Smith. Timothy	98.0	98.0	35, 58, 30, 69, 29, 98, 100.
8177	Belfast. Swan, Whitten, Bickford. Bison Timothy	97.7	98.3	69, 29, 10, 37, 35.
8301	Berwick. Jason Tibbetts. Timothy	93.0	98.0	69, 35, 30, 100, 5, 85.
8302	Berwick. J. E. Tibbetts. Timothy	99.5	99.5	30.
†7998	Bingham. H. B. Whipple. Timothy	99.5	98.9	35, 73, 58, 46, 45, 37.
8339	Bingham. S. J. Whitney. Bison Timothy	98.0	98.1	69, 35, 73, 2, 68, 17.
8087	Blaine. N. E. Dorrity. Timothy	99.5	99.5	68, 28.
8447	Boothbay Harbor. B. E. Hume. Timothy	98.0	98.3	69, 35, 58, 46.
8230	Brewer. A. C. Moore. Bison Timothy	97.9	98.3	35, 30, 100, 38, 37.
8463	Brooks. A. E. Chase Co. Timothy	99.5	99.7	
8469	Brooks. Brooks Farmers Union. Timothy	99.0	99.0	69, 30, 29, 35.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, arranged alphabetically by towns and dealers.—Continued.

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	TIMOTHY—Continued.			
8155	Bucksport. E. B. Gardner. Bison Timothy	97.0	98.5	38, 35, 29.
‡8159	Bucksport. Fannie Ginn. Timothy	99.5	99.5	69.
8157	Bucksport. H. L. Marks. Pine Tree Timothy	99.5	99.6	
8472	Burnham. L. E. Gerald. Timothy	97.7	97.4	35, 30, 69, 73, 28, 29, 31.
8175	Camden. J. C. Curtis. Timothy	98.0	98.3	58, 10, 35, 37, 69, 93.
8151	Castine. A. W. Clark. Timothy	98.0	90.8	69, 35, 98, 59, 58, 29, 72, 10, 102, 30, 68.
8260	Charleston. J. F. Dority. Bison Timothy	97.7	98.4	69, 35, 37, 100, 10.
8262	Charleston. W. L. Farmer. Pine Tree Timothy	99.6	99.6	30.
8268	Cherryfield. Davis & Webb. Pine Tree Timothy	99.5	98.6	35, 58, 69, 30, 10, 49, 2, 72, 29.
8142	Cherryfield. J. Monohon. Timothy	98.0	98.0	73, 30, 35, 59, 69, 48.
8474	Clinton. W. M. Keene. Timothy	99.5	99.6	101.
8134	Columbia Falls. Charles F. Wilson. Pine Tree Timothy	99.5	99.5	73.
†7956	Corinna. Eastern Grain Co. Pan American Timothy	99.5	99.5	53, 73, 59, 26, 68, 55.
8197	Danforth. Danforth Grain Co. Bison Timothy	98.0	98.0	35, 69, 30, 28, 37, 100.
8193	Danforth. C. W. Littlefield. Bison Timothy	97.8	98.1	35, 69, 2, 73, 72.
8195	Danforth. H. H. Putnam. Bison Timothy	97.8	98.2	35, 30.
8217	Dennysville. H. H. Allen. Pine Tree Timothy	99.5	99.7	73.
8215	Dennysville. A. L. R. Gardner. Bison Timothy	97.7	97.9	35, 30, 100.
8219	Dennysville. I. H. Kelly. Bison Timothy	97.7	98.7	30, 35, 95, 46, 59, 37.
8213	Dennysville. J. H. Kilby. Pine Tree Timothy	99.5	99.7	
8100	Dexter. Dexter Grange Store. Timothy	99.0	99.2	69, 35.
8102	Dexter. S. M. Small. Timothy	99.0	99.1	35.
8098	Dover. V. L. Warren. Pine Tree Timothy	99.5	99.5	37, 35.
8278	East Franklin. T. M. Fernald. Timothy	99.6	99.5	37, 69.

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	TIMOTHY—Continued.			
8308	East Lebanon. Ernest Chamberlain. Timothy	98.0	98.4	69, 35, 30.
8206	Eastport. G. W. Capen Corp. Timothy	99.0	99.4	35, 49.
8210	Eastport. Hume & Son. Timothy	99.0	99.3	69, 73, 65.
8208	Eastport. E. S. Martin & Son. Oriole Timothy	99.0	99.5	102, 58, 35.
†8027	Fairfield Center. H. L. Hold & Co. Timothy 2061	99.75	99.4	35, 29, 69, 65.
8443	Farmington. W. W. Small Co. Timothy	97.0	98.1	95, 35, 37, 46, 69, 100.
8057	Fort Fairfield. Ames & Hacker. "Globe Timothy"	99.75	99.7	64, 73.
8058	Fort Fairfield. Ames & Hacker. "Pine Tree Timothy"	99.5	99.6	37.
8062	Fort Fairfield. Knowles & Dow Co. Pan American Timothy	99.5	99.5	37, 30.
8078	Fort Kent. J. M. Duprey. Pine Tree Timothy	99.5	99.5	37.
8080	Fort Kent. I. H. Michaud. Oriole Timothy	99.5	99.2	69, 2, 35, 30, 48, 10, 100, 93, 97, 49, 37, 73, 65.
8090	Fort Kent. G. H. Page. Pine Tree Timothy	99.5	99.5	30, 64.
8083	Fort Kent. L. S. Ramsey. Pine Tree Timothy	99.5	99.5	59, 69, 30, 73.
8275	Franklin. L. C. Bragdon. Pine Tree Timothy	99.6	99.7	69.
8276	Franklin. F. P. Gott. Pine Tree Timothy	99.5	99.7	73.
‡8348	Greenville. Folsom-Prentiss Co. Timothy	–	99.5	73.
8440	Greenville. D. T. Sanders & Son. Pine Tree Timothy	99.5	99.6	53, 52.
8441	Greenville. D. T. Sanders & Son. Timothy Pine Tree	99.5	99.7	37, 30.
‡8358	Guilford. H. Douglass & Co. Timothy	–	99.3	10, 37, 69.
8357	Guilford. John Scales & Sons. Bison Timothy	97.8	98.0	35, 69, 75, 30, 2.
8281	Hancock. C. B. Young & Son. Timothy	99.5	99.6	
8273	Harrington. E. W. Coffin. Pine Tree Timothy	99.5	99.6	30, 73, 59.
8258	Hermon. Thurston Hunt. Timothy	97.0	98.2	69, 100, 37, 73, 30, 29.
8256	Hermon. L. I. Leathers. Timothy	99.0	98.8	35, 30, 46, 48, 10.
†7963	Houlton. John Watson & Co. Pine Tree Timothy 68705	99.5	99.5	37, 52, 68, 30, 46, 73, 35.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, arranged alphabetically by towns and dealers.—Continued.

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	TIMOTHY—Continued.			
†7984	Pine Tree Timothy 68729	99.5	99.5	69, 37, 35.
†8010	B. H. Globe Timothy 68163	99.8	99.8	73, 30, 98, 41.
†8011	Pine Tree Timothy 68780	99.5	99.5	73, 59, 35.
†8030	Bright Hull Globe Timothy 68480	99.75	99.8	37, 74, 64, 98, 28, 95.
†8031	Pine Tree Timothy 68874	99.5	99.5	30, 35, 58, 73, 97, 48.
8138	Jonesport. B. B. Mansfield. Timothy	99.6	99.7	69.
8266	Kenduskeag. A. M. Foss. Pine Tree Timothy	99.6	99.8	30.
8295	Kennebunk. G. W. Larrabee. Timothy	98.0	98.3	35, 95, 69, 46, 30.
8145	Kingman. G. T. Baldwin. Pine Tree Timothy	99.5	99.6	73.
8148	Kingman. W. H. Martin. Bison Timothy	97.9	98.2	69, 30, 35, 29, 10).
8438	Lewiston. E. P. Ham. Bell Timothy	99.5	99.5	59, 73.
8433	Lewiston. J. L. Hayes & Co. Pan American Timothy	99.5	99.5	73.
8144	Lincoln. Lincoln Produce Co. Timothy	99.5	99.1	30, 2, 10, 93, 35, 69, 49.
8376	Livermore Falls. H. A. Morrison. Pine Tree Timothy	98.0	99.2	10, 69, 30, 73.
8211	Lubec. Samuel L. Staples. Timothy	99.0	99.7	
8212	Lubec. S. B. Stuart & Son. Timothy	99.0	99.0	29.
8129	Machias. C. W. Longfellow. Timothy	99.0	98.9	69, 35, 75, 100.
8132	Machias. Machias Lumber Co. Pine Tree Timothy	99.5	99.3	73, 37, 35.
8332	Madison. Stanley, Harlow & Hight Co. Pan American Timothy	99.5	99.6	30.
8326	Madison. N. A. Weston. Bison Timothy	98.0	98.4	37, 69, 35, 95.
8051	Mars Hill. E. M. Smith. Pine Tree Timothy	99.5	99.5	30.
8054	Mars Hill. York & Fenderson. Pine Tree Timothy	99.5	99.6	73, 35.
8232	Milford. E. W. Stuart. Timothy	97.7	97.5	35, 73, 100, 37, 30, 58, 69.
8270	Millbridge. F. W. Sawyer. Timothy	99.5	99.6	58.
8351	Monson. W. H. Eldridge. Bison Timothy	98.0	98.8	35, 69, 30, 59, 37, 53, 72, 100.
8350	Monson. H. E. Gilbert. Timothy	99.5	99.6	30, 37, 35.
8287	Newburg. C. A. Staples & Son. Timothy	99.0	99.2	69, 30, 35, 10, 48.
8453	New Gloucester. C. R. Atwood. Timothy	98.0	98.7	35, 69, 38, 6, 58.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, arranged alphabetically by towns and dealers—Continued.

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	TIMOTHY—Continued.			
8114	ewport. Hanson & Pingree. Bison Timothy	98.0	97.7	69, 35.
8337	North Anson. Porter & Marston. Bison Timothy	98.0	98.0	35, 69, 30, 29.
8305	North Berwick. Johnson Bros. Timothy	98.0	98.7	35, 73, 30, 38, 69.
8382	North Jay. S. H. Niles. Timothy	98.0	98.3	35, 69, 98.
‡8389	North Jay. North Jay Grange Store. Timothy	98.0	98.0	35, 69, 73, 58, 30, 72.
8387	North Jay. H. E. Purrington. Timothy	98.0	98.5	73, 69, 55, 30, 72.
8279	North Sullivan. Crabtree & Havey. Timothy	99.5	99.6	61.
8280	North Sullivan. Harvey Robertson. Timothy	97.7	98.3	35, 69, 58.
8482	Oakland. H. W. Greeley Co. Timothy	99.0	99.2	10, 30, 69, 35, 37.
8485	Oakland. D. M. Marshall & Co. Timothy	98.0	99.0	73, 35, 53, 10, 30, 69.
8235	Old Town. C. E. Grant. Pine Tree Timothy	99.0	99.5	
8239	Old Town. Old Town Supply Co. Pine Tree Timothy	99.5	99.5	69.
8237	Old Town. Sawyer, Rand & Co. Pan American Timothy	99.5	99.6	73, 53, 72.
8162	Orland. A. R. Buck. Timothy	98.0	98.1	35, 69, 29, 10.
8093	Patten. I. B. Gardner & Son. Pine Tree Timothy	99.5	99.5	37, 35.
8126	Pembroke. C. Laughlin. Pine Tree Timothy	99.5	99.5	
8135	Pembroke. Hobart Pattangall. Pine Tree Timothy	99.5	99.6	69.
8128	Pembroke. E. H. Sprague & Son. Square Deal Timothy	99.0	99.0	30, 53, 37, 69.
8123	Perry. J. F. Gove & Sons. Timothy	98.0	97.7	59, 69, 35, 72, 53.
8418	Peru. Kidder Bros. Timothy	99.5	99.6	100, 73, 30.
8445	Phillips. Haley & Russell. Timothy	99.5	99.6	72.
8108	Pittsfield. E. W. Wallace. Pan American Timothy	99.5	98.7	30, 69, 2.
8112	Pittsfield. Whitten & Emerson. Pine Tree Timothy	99.5	99.2	10, 30, 35, 37, 73, 72, 46, 58, 52, 69.
8065	Presque Isle. Aroostook Co-operative Company. Pine Tree Timothy	99.5	99.6	73, 95.
8202	Princeton. W. M. Allen. Pine Tree Timothy	98.0	98.8	69, 30, 58, 98.
8204	Princeton. I. M. Furbish			

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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.			
	Herald Timothy	98.0	98.6	73, 58, 30.
8200	Princeton. C. A. Rolfe. Timothy	97.7	99.6	35.
8407	Rangeley. Oakes & Badger. Timothy	99.5	99.5	
8456	Ripley. L. R. Ramsdell. Timothy	98.0	98.7	35, 69, 100, 68.
8165	Rockland. Littlehale Grain Co. Pan American Timothy	99.5	99.4	30, 35.
8167	Rockland. Wright Seed Co. Bison Timothy	98.0	98.5	35, 69, 61, 30, 73.
8171	Rockport. Rockport Ice Co. Timothy	98.0	98.7	35, 58, 69, 73, 100.
8173	Rockport. S. L. & H. L. Shepherd. Timothy	98.0	98.6	69, 29, 100, 35.
8409	Rumford. James S. Morse. Timothy	99.0	99.2	10, 37.
8363	Sangerville. A. C. Dow. Timothy	99.5	99.8	30.
8187	Searsport. F. E. Whitcomb. Pine Tree Timothy	99.5	99.6	
8350	Shirley. F. A. Virgie. Timothy	99.5	99.6	37.
†7932	Skowhegan. D. A. & W. E. Porter. Pan American Timothy B–2 10933	99.5	99.5	73, 68, 36.
8316	Skowhegan. D. A. & W. E. Porter. Pine Tree Timothy	99.5	99.7	35.
8220	South Brewer. F. H. Brastow & Son. Pine Tree Timothy	99.5	99.6	58, 46.
8369	South Sebec. A. J. Chase & Son. Pine Tree Timothy	99.5	99.5	
8309	Springvale. Ross & Bradford. Timothy	98.0	98.9	35, 53, 59, 100, 72.
8191	Stockton. Goodhue Co. Square Deal Timothy	99.0	99.0	69, 35, 42, 73, 29, 75, 100, 68, 18.
8401	Strong. C. V. Starbird Estate. Timothy	98.0	98.6	35, 95.
8397	Strong. Daggett & Will. Timothy	98.0	97.8	35, 30, 48, 98, 69.
8163	Thomaston. E. L. Dillingham. Timothy	98.0	98.2	35, 59, 37, 72, 73, 61, 69.
8458	Thorndike. Farwell Bros. Timothy	97.7	97.7	69, 53, 35, 73, 68, 29.
8490	Thorndike. Peter Harmon & Son. Timothy	99.5	99.6	69, 30.
8076	Van Buren. A. E. Hammond. Pine Tree Timothy	99.5	99.7	
8116	Waterville. G. A. Kennison & Co. Timothy	–	98.8	69, 35, 30, 59, 68, 65, 46, 73, 72.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1916, 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.
	TIMOTHY—Concluded.			
8296	Wells. F. E. Rankin. Timothy	98.0	98.5	37, 69, 35, 29, 61.
8394	West Farmington. E. H. Lowell. Timothy	98.0	98.0	73, 69, 30, 35, 58, 29, 49, 50.
†8046	Westfield. Don C. Sylvester. Timothy	99.5	99.5	69, 30, 59.
8124	West Pembroke. E. H. Fisher & Son. Square Deal Timothy	92.0	98.6	69, 37, 35, 49.
8422	West Peru. Arnold Bros. Timothy	98.0	98.3	35, 69, 30.
8448	Wiscasset. Wiscasset Grain Co. Timothy	99.5	99.4	30.
†8092	Yarmouth. W. G. Sweetser. Timothy	99.8	99.7	69, 95, 68.
	WHITE CLOVER.			
8110	Pittsfield. T. E. Getchell. White Clover	95.0	94.6	73, 5, 20, 76, 31, 41, 22, 50, 63.
8172	Rockport. Rockport Ice Co. White Clover	95.0	96.6	73, 24, 50, 5, 20, 23, 68.

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† Sample taken under directions with guaranty and sent in by dealer.

Explanation of Table on Pages 27 and 28.

The object of this table is to show the weed seeds that are common to different kinds of grass and clover seeds. For instance the first kind of seed named in the table is Red Clover. It will be noted from the first line of the table that 142 samples of Red Clover were examined. Following down the column will show the kinds of weed seeds that were found in these samples of Red Clover. It will be noted that Black medick, Birds foot trefoil, Dock, Goosefoot, Head-all, Rugel's plantain, and Sheep sorrell are quite commonly found in Red Clover; that a third of the samples contained Wild carrot; half of the samples had Green foxtail; and two-thirds of the samples contained Ribgrass. In like manner it will be found that five finger is a very common weed seed in Timothy. There were 55 samples of Red Top examined and the table will show that Yarrow was present in 55 samples. That is all of the Red Top examined contained more or less of Yarrow as a weed seed.

Table showing results of examination of samples of seed in 1916.

Names of Weeds.	Kind of Seed and Number of Samples.											
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millet.	Hungarian.	Oats.	White clover.	Alfalfa.	Kentucky bluegrass.	Crimson clover.
Number of samples examined	142	118	14	185	55	21	30	11	3	2	3	3
American pennyroyal	1	–	–	–	–	–	–	–	–	–	–	–
American wild mint	–	–	–	10	2	–	–	–	–	–	–	–
Ax-seed	2	–	1	–	–	–	–	–	–	–	–	–
Barnyard grass	9	–	–	–	–	–	7	1	–	–	–	–
Black medick	44	67	1	1	–	–	–	–	3	–	–	3
Bladder campion	9	1	–	1	–	–	–	1	–	–	–	1
Bladder ketmia	–	–	–	–	–	–	1	–	–	–	–	–
Bird's foot trefoil	34	–	–	–	–	–	–	–	–	–	–	–
Blue field madder	10	1	–	–	–	–	–	–	–	–	–	2
Blue vervain	2	3	–	24	1	–	1	–	–	–	–	–
Bracted Plantain	7	–	1	–	–	–	–	–	–	–	–	–
Bull thistle	1	–	–	–	–	–	–	–	–	–	–	–
Buttercup	1	–	–	–	–	–	–	–	–	–	–	–
Canada thistle	4	19	–	1	–	1	–	–	–	–	–	–
Catnip	–	6	–	–	–	–	–	–	–	–	–	–
Chess	–	–	–	–	–	–	–	1	–	–	–	–
Chicory	7	–	–	1	–	–	–	–	–	1	–	–
Clarkia	–	–	–	1	–	–	–	–	–	–	–	–
Clover dodder	2	–	–	–	–	–	–	–	–	–	–	–
Common chickweed	–	2	–	–	–	–	–	–	2	–	–	–
Common nightshade	–	1	–	–	–	–	–	–	–	1	–	–
Common speedwell	–	1	–	–	–	–	–	–	1	–	1	–
Common St. Joan's wort	–	–	–	–	–	–	–	–	1	–	–	–
Corn camomile	–	–	–	–	–	–	–	–	1	–	–	–
Corn cockle	–	–	–	–	–	–	–	3	–	–	–	–
Crabgrass	2	–	–	2	–	–	6	–	–	–	–	–
Crane's bill	3	1	–	–	–	–	–	–	–	–	–	1
Dock	55	51	6	7	–	–	–	3	–	–	–	3
Ergot	–	1	–	27	37	–	–	–	–	–	–	–
Evening primrose	2	6	3	83	–	1	4	–	–	–	–	–
False flax	–	16	–	1	–	–	–	1	1	–	–	–
*False redtop	–	–	–	–	–	–	–	–	–	–	–	–
Field dodder	4	–	–	–	–	–	–	–	–	–	–	–
Field scorpion grass	–	2	–	–	–	–	–	–	–	–	–	–
Five finger	2	14	–	100	23	–	–	–	1	–	–	–
Fowl meadow grass	–	2	–	2	–	–	–	–	–	–	–	–
Goosefoot	24	71	6	43	–	2	12	1	–	–	–	–
Green foxtail	77	13	–	5	–	7	25	6	–	1	–	–
Hard rescue	–	–	–	–	2	–	–	–	–	–	–	–
Hairy stickseed	–	1	–	–	–	–	–	–	–	–	–	–
Heal-all	33	4	–	1	–	–	–	–	1	–	–	–
Hedge mustard	1	20	–	5	1	–	–	–	–	–	–	–
Indian mallow	–	–	–	–	–	–	2	–	–	–	–	–
Knot-grass	6	1	–	–	–	4	4	2	–	–	–	–
Lady's thumb	22	1	1	1	–	9	17	5	–	–	–	–
Mayweed	5	35	–	14	1	2	–	–	–	–	–	–
Meadow fescue	2	–	–	–	–	–	–	–	–	–	–	–
Mint	–	1	2	12	26	2	1	–	–	–	–	–
Moth mullein	–	2	–	8	1	–	–	–	–	–	–	–
Mouse-ear chickweed	–	9	–	1	33	1	–	–	3	–	2	–
Mustard	6	–	1	–	–	1	1	3	–	–	–	3
Night-flowering catchfly	12	82	1	5	–	–	–	2	1	–	–	1
Old-witch grass	8	8	–	11	14	–	12	–	–	–	–	–

* Found in orchard grass.

Table showing results of examination of samples of seed in 1916—Concluded.

Names of Weeds.	Kind of Seed and Number of Samples.											
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millet.	Hungarian.	Oats.	White clover.	Alfalfa.	Kentucky bluegrass.	Crimson clover.
Ovoid spike rush	–	2	–	–	–	–	–	–	–	–	–	–
Ox-eye daisy	–	–	–	2	–	1	–	–	–	–	–	–
Pale persicaria	–	–	–	–	–	–	15	–	–	–	–	–
Pennsylvania persicaria	–	–	–	–	–	5	–	2	–	–	–	–
Peppergrass (field)	–	11	–	28	3	–	–	–	1	–	–	–
Peppergrass (wild)	3	5	–	17	2	–	–	–	–	–	1	–
Perennial sweet vernal grass	–	14	–	–	–	–	1	–	–	–	–	–
Pigweed	4	7	–	4	–	–	4	2	–	1	–	–
Pimpernel	4	–	–	–	–	–	–	–	–	–	–	–
Plantain	7	28	–	1	11	–	1	–	2	–	–	–
Poison hemlock	1	–	–	4	–	–	–	–	–	–	–	–
Purslane	–	1	–	4	3	–	–	–	–	–	2	–
Quack grass	–	–	–	–	–	–	–	4	–	–	–	–
Ragweed	5	–	1	–	–	15	7	–	–	–	–	–
Ribgrass	100	36	3	16	2	1	–	–	1	1	1	–
Rugel's plantain	25	16	1	96	6	1	1	–	1	–	–	–
Russian thistle	1	–	–	–	–	1	2	–	–	1	–	–
Sand rocket	–	–	–	–	1	–	–	–	–	–	–	–
Sedge	2	7	–	18	48	–	–	–	–	–	2	–
Sheep sorrel	24	81	9	52	6	–	–	–	3	–	–	–
Shepherd's purse	–	12	–	1	–	–	–	–	–	–	2	–
Slender crabgrass	19	4	–	3	–	–	8	–	–	–	–	–
Small flowered crane's bill	–	–	–	–	–	–	–	–	1	–	–	1
Sow thistle	3	–	–	–	–	–	–	–	–	–	–	–
Spiny sida	1	–	–	–	–	–	–	–	–	–	–	–
Sprouting crabgrass	3	–	–	–	–	–	6	–	–	–	–	–
Spurge	4	–	–	–	–	–	1	–	–	–	–	–
Spurry	–	–	–	–	–	1	–	–	–	–	–	–
Suckling clover	–	40	–	1	–	–	–	–	–	–	–	–
Sunflower	–	–	–	–	–	1	–	1	–	–	–	–
Toothed spurge	1	–	–	–	–	–	–	–	–	–	–	–
Tumble-weed	1	–	–	2	–	–	5	–	–	–	–	–
Virginia three-seeded mercury	9	5	–	–	–	–	3	–	–	–	–	–
Vetch	–	–	–	–	–	–	–	1	–	–	–	–
White hoarhound	1	–	–	–	–	–	–	–	–	–	–	–
White vervain	4	–	1	2	1	1	–	–	–	–	–	–
Whorled mallow	1	–	–	–	–	–	–	–	–	–	–	–
Wild buckwheat	–	–	–	–	–	–	–	7	–	–	–	–
Wild carrot	51	–	1	–	–	–	–	–	–	–	–	–
Wild madder	2	1	–	3	–	–	–	–	–	–	–	–
Wild rose	–	–	–	–	–	–	–	1	–	–	–	–
Willow herb	–	–	–	10	–	–	–	–	–	–	–	–
Winged pigweed	–	–	–	–	–	1	1	–	–	–	–	–
Wormseed mustard	–	1	–	5	–	–	–	–	–	–	–	–
Yarrow	–	–	–	9	55	–	–	–	–	–	–	–
Yellow alyssum	–	1	–	–	–	–	–	–	–	–	–	–
Yellow daisy	–	–	–	32	2	–	–	–	–	–	–	–
Yellow foxtail	16	–	–	1	1	19	13	2	–	–	–	–
Yellow rocket	–	5	–	3	–	–	–	–	–	–	–	–
Yellow-wood sorrel	–	1	–	–	–	–	–	–	–	–	–	–

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MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

Official Inspections

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MISCELLANEOUS DRUG PREPARATIONS.

CHAS. D. WOODS.

The Commissioner of Agriculture is the executive of the law regulating the sale of drugs 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.

SPIRIT OF NITROUS ETHER.

Table showing results of analyses of samples of spirit of nitrous ether (sweet spirit of nitre) purchased in the fall and winter of 1914-15 and in the fall of 1915. Properly prepared spirit of nitrous ether will carry 92 per cent alcohol and not less than 4 per cent ethyl nitrite. The samples are arranged alphabetically by towns.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Examination As Regards Ethyl Nitrite
16006	Curtis & Tupper, Bangor. "Sweet Spirit of Nitre. Alcohol 92 per cent."	Eighty-two per cent of standard strength. Adulterated.
16578	Curtis & Tupper, Bangor. "Sweet Spirit of Nitre. Alcohol 92 per cent"	Eighty-seven per cent of standard strength. Adulterated.
13950	Frank Karam, Bangor. "Stickney & Poor's Best Sweet Spirits Nitre. Stickney & Poor Spice Co., Boston, Mass. 91 per cent alcohol."	Slightly below standard strength.
13951	Frank Karam, Bangor. "Dill's Sweet Spirits of Nitre. Alcohol 92 per cent. Prepared by The Dill Medicine Co., Norristown, Pa."	Forty-three per cent of standard strength. Adulterated.
15992	Priest's Pharmacy, Bangor. "Sweet Spirit of Nitre. Alcohol 92 per cent."	Fifty-eight per cent of standard strength. Adulterated.
15994	Riker-Jaynes Co., Bangor. "Spirits Nitrous Ether. Alcohol 92 per cent."	Eighty-seven per cent of standard strength. Adulterated.
15699	L. D. Snow Est., Brunswick. "Dr. Dill's Sweet Spirits Nitre. 92 per cent alcohol. Prepared by The Dill Medicine Co., Norristown, Pa."	Two bottles. One bottle seventy-three per cent of standard strength; other bottle eighty-three per cent of standard strength. Adulterated.
15870	G. H. Cates, East Vassalboro. "Spirit Nitrous Ether. Alcohol 94 per cent. Mfg. April 8, 1915, John W. Perkins Co., Portland. Not to be dispensed after 12 weeks."	Seventy-one per cent of standard strength. Adulterated.
15875	P. E. Frost, Monmouth. "Pure U. S. P. Nitre. Derivation of alcohol 93 per cent (Date Dec. 29, 1914). Mfg. by Frank E. Harris, Binghampton, N. Y.	Slightly below standard strength.
15869	W. A, Marriner, North Vassalboro. "Three Crow Brand Spirit Nitrous Ether. Contains not over 92 per cent alcohol. The Atlantic Spice Co., Rockland, Me."	Eighty-four per cent of standard strength. Adulterated.
16018	Samuel J. Foster, Oakland. "Sweet Spirits of Nitre. Alcohol 92 per cent."	Eighty per cent of standard strength. Adulterated.
13358	F. W. Demerritt, Ocean Park, Old Orchard. "Brewster's Pure U. S. P. Sweet Spirit Nitre. Alcohol 92 per cent."	Slightly below standard strength.
13359	F. W. Demerritt, Ocean Park, Old Orchard. "Foss' Pure Spirit Nitrous Ether or Sweet Spirit Nitre. Contains 92 per cent alcohol. Prepared by Schlotterbeck & Foss Co., Portland, Me. The contents of this bottle should not be sold or used after October 18, 1913."	Above standard strength.
15998	E. T. Fifield & Co., South Brewer. "Sweet Spirits Nitre. Alcohol 92 per cent."	Eighty-one per cent of standard strength. Adulterated.

SPIRIT OF NITROUS ETHER—Concluded.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Examination As Regards Ethyl Nitrite
16136	W. G. Preble, South Gardiner. "Pure U. S. P. Sweet Spirits Nitre. Alcohol 93 per cent. Mfg. by Frank E. Harris Co., Binghampton, N. Y. April 27, 1914."	In accord with standard.
16025	Wm. C. Hawker, Waterville. "Sweet Spirit of Nitre. Alcohol 92 per cent."	Eighty-four per cent of standard strength. Adulterated.
14533	W. C. Perry, Winnegance. "Sweet Spirits Nitre. Contains alcohol 92 per cent. D. T. Dougherty, Bath, Me."	Slightly below standard strength.

SPIRIT OF PEPPERMINT.

Table showing the results of analyses of samples of spirit of peppermint (improperly called essence of peppermint by many Maine druggists), purchased in the spring and fall of 1916. Properly prepared spirit of peppermint will carry 85.5 per cent of alcohol and 10 per cent of oil of peppermint. Small deficiencies in alcohol are not reported. Samples are arranged alphabetically by towns.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Analysis.
16532	Percy L. Lord, Calais. "Essence of Peppermint. Alcohol 85 per cent."	Practically up to standard.
16531	McAlliston Drug Store, Calais. "Essence Peppermint. Alcohol 85.5%."	Half standard strength. Adulterated.
16692	W. D. Spaulding, Hallowell. "Essence Peppermint. Alcohol 75 per cent."	Sixty-four per cent standard strength. Adulterated.
16652	Mabee's Drug Store, Lubec. "Essence Pepermint. Alcohol 85-5 per cent."	Up to standard.
17356	Frank J. Gallagher, Portland. "Spirits Peppermint. Alcohol 85.5 per cent."	Eighty-four per cent standard strength. Adulterated.
17335	J. H. Hamel, Portland. "Essence Peppermint. Alcohol 85.5 per cent."	Up to standard.
17331	John D. Keefe, Portland. "Spirits Peppermint. Alcohol 85.5 per cent."	Up to standard.
17329	Lafayette Hotel Pharmacy, Portland. "Spirits Peppermint. Each ounce contains 85.5 per cent alcohol."	Up to standard.
17358	E. J. Bradbury, Saco. "Essence of Peppermint."	Eighty-six per cent standard strength. Adulterated. Percentage of alcohol not stated, as required by law.
16535	Chas. E. MacIninch, Woodland. "Essence Peppermint. Alcohol 86 per cent."	Seventy-two per cent standard strength. Adulterated.

TINCTURE OF IODINE.

Table showing the results of analyses of samples of tincture of iodine purchased in the fall and winter of 1915-16 and in the summer of 1916. Properly prepared tincture of iodine should carry not less than 6.5 grams nor more than 7.5 grams of iodine per 100 c. c., and not less than 4.5 grams nor more than 5.5 grams of potassium iodide per 100 c. c. Samples are arranged alphabetically by towns.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Examination As Regards Iodine
16008	Central Pharmacy Co., Bangor. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
15987	Essex Pharmacy, Bangor. "Tincture Iodine. Alcohol 94.9 per cent."	Materially below standard strength Adulterated.
15993	Frawley's Pharmacy, Bangor. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16001	Merrill Drug Co., Brewer. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16921	Davis-Dow Co., Bridgton. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16039	A. R. Pilley, Brooks. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16734	E. E. Boynton, Camden. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16731	C. A. Richards, Damariscotta. "Tincture Iodine. Alcohol 94.9 per cent."	Below standard strength. Adulterated.
16016	Fred H. Neal, Fairfield. "Tincture Iodine. Alcohol 94.9 per cent."	Below standard strength. Contains ethyl and methyl alcohol and some benzine. Adulterated.
16011	Wm. Buck & Co., Foxcroft. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16687	Burke's Pharmacy, Gardiner. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16691	W. D. Spaulding, Hallowell. "Tincture Iodine."	In accord with standard. Percentage of alcohol not stated on label, as required by law.
16373	Quality Drug Store, Lewiston. "Tincture Iodine. Alcohol 94.4 per cent."	Below standard strength. Adulterated.
16405	Ham's Drug Store, Livermore Falls. "Tincture Iodine. Alcohol 94.9 per cent."	Practically in accord with standard.
16002	Alexander Fraser, Old Town. "Tincture Iodine. Alcohol 94.4 per cent."	Practically in accord with standard.
16021	Sampson & Avore, Skowhegan. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16012	Harry H. Dunbar, Waterville. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.
16156	Raymond & Marr, Westbrook. "Tincture Iodine. Alcohol 94.9 per cent."	Practically in accord with standard.
16695	C. P. Hannaford & Son, Winthrop. "Tincture Iodine. Alcohol 94.9 per cent."	Below standard strength. Adulterated.
16730	E. H. Pushor, Wiscasset. "Tincture Iodine. Alcohol 94.9 per cent."	In accord with standard.

SPIRIT OF CAMPHOR.

Table showing the results of analyses of samples of spirit of camphor purchased in the fall of 1915 and the spring of 1916. Properly prepared spirit of camphor will carry 86 per cent alcohol and 10 per cent gum camphor. The samples are arranged alphabetically by towns.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Examination As Regards Camphor.
16382	Bumpus & Getchell, Auburn. "Spirits Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16380	O. W. Jones, Auburn. "Spirits Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16381	O. W. Jones, Auburn. "Spirits Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16379	Claude E. Packard, Auburn. "Spirits Camphor. Alcohol 86 per cent."	In accord with standard.
16378	Perryville Drug Store, Auburn. "Spirits Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16099	P. J. Begin, Augusta. "Spirits Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16097	B. Earle Bithers, Augusta. "Spirits Camphor. Contains 86 per cent alcohol."	Somewhat above standard strength.
16096	Bowditch-Webster Co., Augusta. "Spirit of Camphor. Contains alcohol 86 per cent."	In accord with standard.
16098	J. Coughlin, Augusta. "Spirits Camphor. Contains 86 per cent alcohol."	Somewhat above standard strength.
16101	B. E. Getchell, Augusta. "Spirits Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16095	H. E. Goodrich, Augusta. "Spirits Camphor. Contains 86 per cent alcohol."	Slightly above standard strength.
16094	Frank R. Partridge, Augusta. "Liquid Camphor. Contains about 60% alcohol."	Seventy-two per cent of standard strength. Adulterated.
16093	Willis R. Partridge, Augusta. "Spirits Camphor. Contains 86 per cent alcohol."	Slightly below standard strength.
16100	Arthur Tetreault, Augusta. "Spirit Camphor. Alcohol 86 per cent."	In accord with standard.
15996	Buckley Drug Co., Bangor. "Spirits Camphor. Alcohol 86 per cent."	In accord with standard.
16465	Fred A. Gonya, Bar Harbor. "Spirits Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16463	Charles A. Keucher, Bar Harbor. "Spirits of Camphor."	Slightly above standard strength. Percentage of alcohol not stated on label, as required by law.
16464	West End Drug Co., Bar Harbor. "Spirits Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16035	Wm. O. Poor & Son, Belfast. "Spirits of Camphor. Alcohol 90 per cent."	Somewhat above standard strength.
16733	Chandler's Pharmacy, Camden. "Spirits of Camphor. Alcohol 86 per cent."	Slightly above standard strength.

CAMPHOR—Continued.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Examination As Regards Camphor.
13523	George H. Parker, Cornish. "Spirit of Camphor. Contains 86 per cent alcohol."	Somewhat above standard strength.
16732	F. L. Smithwick, Damariscotta. "Spirits Camphor. Alcohol 93 per cent."	Somewhat above standard strength.
16656	Kingsley's Drug Store, East Machias. "Spirit of Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16539	Byron N. Andrews, Eastport. "Spirits of Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16536	William E. Capen, Eastport. "Spirits Camphor. Alcohol 86 per cent."	In accord with standard.
16538	Havey & Wilson, Eastport. "Spirit of Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16540	J. P. Hutchison, Eastport. "Spirits Camphor. 94 per cent alcohol."	Somewhat above standard strength.
16537	E. S. McGregor, Eastport. "Spirit of Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16461	E. G. Moore, Ellsworth. "Spirits Camphor. Alcohol 86 per cent."	Eighty per cent of standard strength Adulterated.
16462	Parcher's Pharmacy, Ellsworth. "Spirit of Camphor. Contains alcohol 86 per cent."	Slightly above standard strength.
16017	Holman & Nelson, Fairfield. "Spirits Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16408	Frank E. Drake, Farmington. "Spirit of Camphor. Alcohol 86 per cent."	Sixty-six per cent of standard strength. Adulterated.
16410	Hardy's Pharmacy, Farmington. "Spirit of Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16409	Marr's Drug Store, Farmington. "Spirit of Camphor. Contains alcohol 86 per cent."	Slightly below standard strength.
16009	Elmer E. Cole, Foxcroft. "Spirits of Camphor. Alcohol about 86 per cent."	Slightly above standard strength.
16685	Beane's Drug Store, Gardiner. "Spirits Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16689	Fred H. Call, Gardiner. "Spirit of Camphor. Alcohol 86 per cent."	Eighty-three per cent of standard strength. Adulterated.
16686	Jackson's Drug Store, Gardiner. "Spirit of Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16688	Ward, The Druggist, Gardiner. "Spirits Camphor."	In accord with standard. Percentage of alcohol not stated on label, as required by law.
16693	City Drug Store, Hallowell. "Spirits Camphor. Contains 86 per cent alcohol."	Slightly above standard strength.
16690	W. D. Spaulding, Hallowell. "Spirit Camphor. Alcohol 86 per cent."	In accord with standard.
16659	Geo. C. Harmon, Jonesport. "Spirit Camphor. Alcohol 86 per cent."	Slightly above standard strength.

CAMPHOR—Continued.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Examination As Regards Camphor.
16657	Frank T. Stewart, Jonesport. "Spirit Camphor. Alcohol not less than 90 per cent."	Slightly below standard strength.
16363	H. R. Alden, Lewiston. "Spirits Camphor. Contains 86 per cent alcohol."	Somewhat above standard strength.
16365	Babcock's Drug Store, Lewiston. "Spirits Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16375	Arthur Boucher, Lewiston. "Spirits Camphor. 86 per cent alcohol."	Seventy per cent of standard strength. Adulterated.
16362	R. W. Clark, Lewiston. "Spirit Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16374	Arthur Dussault, Lewiston. "Spirits of Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16387	Globe Drug Store, Lewiston. "Spirit of Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16368	Harvard Pharmacy, Lewiston. "Spirit of Camphor. Alcohol 86 per cent."	In accord with standard.
16364	Louis K. Liggetts, Lewiston, "Spirit Camphor (Assayed). Alcohol 86 per cent."	Slightly above standard strength.
16369	Martel's Pharmacy, Lewiston. Spirits Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16367	Chas. W. Newell, Lewiston. "Spirit of Camphor. Alcohol 86 per cent."	Eighty per cent of standard strength. Adulterated.
16385	People's Pharmacy, Lewiston. "Spirits Camphor. 93 per cent alcohol."	Slightly below standard strength.
16371	Ernest Petrell, Lewiston. "Spirit of Camphor. Alcohol 86 per cent."	Forty-eight per cent of standard strength. Adulterated.
16384	Pharmacie Franco-Americaine, Lewiston. "Spirits Camphor. 93 per cent alcohol."	Slightly above standard strength.
16370	Pharmacie Nationale, Lewiston. "Spirit of Camphor. 86 per cent alcohol."	Slightly below standard strength.
16372	Warren E. Riker, Lewiston. "Spirit of Camphor. Alcohol 45 per cent."	Slightly below standard strength.
16361	Smith's Drug Store, Lewiston. "Spirit of Camphor. Alcohol 85 per cent."	Slightly below standard strength.
16383	W. H. Teague, Lewiston. "Spirit of Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16366	Wakefield Bros., Lewiston. "Spirits Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16407	S. S. Locklin, Livermore Falls. "Spirit of Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16406	E. P. Smart, Livermore Falls. "Spirit of Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16653	D. A. Gillis & Co., Lubec. "Spirit of Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16655	Crane's Pharmacy, Machias. "Spirit of Camphor. Alcohol 86 per cent."	Slightly above standard strength.

CAMPHOR—Concluded.

Station number	Name and Address of Dealer and Maker and Brand.	Results of Examination As Regards Camphor.
16654	D. A. Curtis & Co., Machias. "Spirit of Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16533	Percy L. Lord, Milltown. "Spirit of Camphor. Alcohol 90 per cent."	Slightly below standard strength.
16377	Ralph F. Burnham, New Auburn. "Spirit of Camphor. Alcohol 86 per cent."	Slightly below standard strength.
16376	Joseph Phoenix, New Auburn. "Spirits Camphor. Alcohol 86 per cent."	In accord with standard.
17330	Frank Gallagher, Portland. "Spirits Camphor. Contains 86 per cent alcohol."	In accord with standard.
17334	J. H. Hamel, Portland. "Spirit of Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
17332	John D. Keefe, Portland. "Spirits Camphor. 86 per cent alcohol."	Slightly above standard strength.
16684	Booker's Pharmacy, Randolph. "Spirits Camphor. Contains 86 per cent alcohol."	In accord with standard.
17359	E. J. Bradbury, Saco. "Spirits of Camphor."	Ninety per cent of standard. Alcohol not stated, as required by law.
15997	T. G. Seymour, South Brewer. "Spirits Camphor. Alcohol 86 per cent."	In accord with standard.
16022	Wm. G. Lord, Skowhegan. "Spirit of Camphor. Alcohol 86 per cent."	Slightly above standard strength.
16015	W. R. Jones, Waterville. "Spirit of Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16024	Larkin Drug Co., Waterville. "Spirits of Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16658	A. F. Knapp, West Jonesport. "Spirits Camphor. Alcohol 90 per cent."	In accord with standard.
16479	H. R. Dascombe Co., Wilton. "Spirits Camphor."	Percentage of alcohol not stated on label, as required by law.
16694	Jackson's Drug Store, Winthrop. "Spirits Camphor. Alcohol 86 per cent."	Somewhat above standard strength.
16729	G. W. Keirstead, Wiscasset. "Spirit of Camphor. Alcohol 86 per cent."	In accord with standard.

July, 1917.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

ANALYSTS.

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Official Inspections

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MAINE PACKED BLUEBERRIES, CORN AND SARDINES.

CHAS. D. WOODS.

The Commissioner of Agriculture is the executive of the law regulating the sale of foods 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.

CANNED BLUEBERRIES

Twelve samples of canned blueberries from 7 different packers in Washington County, Maine were examined. The claimed weight of contents ranged from 18 to 20 ounces and all cans examined were full weight. No report that water is added in packing was made but the high water content of all samples except the last indicates that water was added quite freely in the case of the other packers. Fresh berries carry about 82 per cent of water. With the exception noted all the cans examined carried 6 to 8 per cent more water than fresh berries do.

Table showing the results of analyses of samples of Maine packed canned blueberries collected by the inspector in the packing season of 1916. The samples are arranged alphabetically by the names of packers.

Station number	Name and Address of Packer and Brand.	Results of Examination
17319–17320.	"Pigeon Brand Blueberries. Packed by E.M. Frye & Co., Harrington, Me. Contents 1 lb. 2 ozs." Samples collected at factory Aug. 21, 1916.	Net weight in accord with claim. Cans full and corroded. Appearance not very attractive. Some sticks and leaves. Water 89.7 per cent.
17321–17322.	"Hall Brand Fancy Blueberries. Packed and guaranteed by Hall Packing Co., Columbia Falls, Me. Net weight 1 lb. 4 ozs." Written in on can: "Packed by Pleasant River Canning Co." Samples collected at factory Aug. 21, 1916.	Net weight in accord with claim. Cans corroded. One can, appearance good; one can, appearance fine, berries large. Water 89 per cent.
17328.	"Our Brand of Blueberries. Packed by Hinkley, Stevens & Co., West Jonesport, Me. Net weight 20 ozs." Sample collected at factory Aug. 21, 1916.	Net weight in accord with claim. Can badly corroded. Appearance not very good. Many unripe berries, sticks, and leaves. Water 88.8 per cent.
17327.	"Packed by H. S. Kane, Brooklin & Addison, Me. Contents 1 lb. 3 ozs. Pleasant River Brand Maine Blueberries." Sample collected at factory Aug. 21, 1916.	Net weight in accord with claim. Can badly corroded. Appearance fair. Some sticks and leaves. Water 89 per cent.
17323–17324.	"Packed by A. & R. Loggie Co., Ltd., of Loggieville, N. B., Canada. Eagle Brand Blueberries. Packed at Columbia Falls, Me. Contents 1 lb. 3 ozs." Samples collected at factory Aug. 21, 1916.	Net weight in accord with claim. Cans badly corroded. Appearance poor. Many small, unripe, and shriveled berries, and sticks. Water 88.4 per cent.
17317–17318.	"Stewart's Brand Blueberries. Net weight 1 lb. 3 ozs. A. L. Stewart & Sons, Cherryfield, Me." Samples collected at factory Aug. 21, 1916.	Net weight in accord with claim. Both cans full; one not corroded, one somewhat corroded. Appearance good. An occasional leaf, stick, green or shriveled berry. Water 88.8 per cent.
17325–17326.	"Wyman's Brand Blueberries. Packed and guaranteed by Jasper Wyman & Son, Milbridge, Me. Contents 1 lb. 3 ozs." Samples collected at factory August 21, 1916.	Net weight in accord with claim. One can little corroded; one can badly corroded. Appearance good. Water 82.3 per cent.

CANNED CORN

About 60 samples of corn from 30 factories were examined in the laboratory. These goods were all taken at the factory at time of packing and were unlabeled. Information was given as to whether or not starch was added at time of packing. Water and sugar are used in packing. Starch is or is not added as the superintendent deems necessary to make the goods put out uniform in appearance. Only sufficient water to give proper fluidity to the pack is used. As corn starch is used and as all corn carries sugar, laboratory examination will not determine whether or not either of these materials were added to the corn. As the water content of green corn varies greatly with the maturity of the corn, laboratory examination will not disclose the amount of added water. Salt is usually added to make the product palatable. It was not tested for.

WEIGHT OF CAN CONTENTS

As caned corn has quite a high nutritive value the amount of corn contained in a can is of considerable importance. Twenty ounce cans are used and with one exception the can contents over weighed the weight claimed. The contents ran from 19.5 ounces to 21.5 ounces and averaged about 20.75 ounces. The net weights are shown in the table that follows.

Table showing net weight of can contents in the case of Maine packed sweet corn. The weights are given in ounces and are arranged from the lowest to the highest weights.

19.41	20.47	20.68	20.86	21.02	21.34
20.05	20.51	20.68	20.88	21.03	21.35
20.14	20.51	20.74	20.89	21.07	21.37
20.15	20.52	20.74	20.91	21.07	21.42
20.26	20.54	20.75	20.91	21.07	21.44
20.40	20.56	20.75	20.95	21.16	21.51
20.40	20.56	20.77	20.97	21.18	
20.42	20.61	20.77	20.97	21.20	
20.47	20.61	20.82	20.97	21.21	
20.47	20.67	20.82	21.00	21.32	

TOTAL DRY MATTER IN SAMPLES CANNED CORN EXAMINED

When the inspectors obtained the samples they asked relative to the addition of starch. In rather more than half of the samples the packers stated that starch had been added. It is claimed that starch is only added to make a uniform looking pack and that it is added to immature rather than mature corn. The percentages of dry matter found in the samples are given in the two tables that follow. In the first table no starch was claimed and in the second it was stated that starch was added. In both tables the samples are arranged in accordance with the amount of dry matter beginning with that containing the least.

Table showing the per cent of dry matter in samples of canned corn packed without the addition of starch in canning.

18.26	20.91	22.60	23.10	23.62	25.14
18.61	22.33	22.84	23.15	23.79	25.38
20.19	22.43	22.87	23.26	24.22	26.35
20.22	22.50	22.89	23.49	24.99	

Table showing the per cent of dry matter in samples of canned corn to which starch was added in the process of canning.

19.33	19.94	21.34	22.16	23.13	23.98
19.64	20.28	21.84	22.36	23.15	24.14
19.66	20.67	22.00	22.51	23.20	24.48
19.69	20.74	22.01	22.62	23.41	24.87
19.77	21.09	22.09	22.78	23.61	
19.89	21.17	22.13	22.84	23.72	

CORN ON THE COB CANNED

Two samples from the same factory of corn that was packed on the cob were examined. The net weight of the cans was about 37 ounces. The free liquid found in the cans was the water added in canning. It contained small amounts of the more soluble portions of the corn dissolved out in processing. The liq-

uid amounted to about 15½ ounces. The cobs weighed about 9 ounces, so that there were about 14 ounces of corn in each can. The dry matter in the corn was, however, much higher than in corn canned after being cut from the cob and was about 30 per cent against 20 to 25 per cent dry matter in the samples of ordinary canned corn here reported.

Water in Cannned Corn

Corn like all other green vegetable foods carries in its natural state quite high percentages of water. Since water in a food material serves, so far as is known, in nutrition no better purpose than any other water, its presence always means a lowered nutritive value product. Sweet corn in the early dough stage, which is the desirable condition for table use, will carry a little more than 70 per cent of water. Hence such corn will have a little less than 30 per cent of dry matter which is the nutritive part of corn. Partly to improve the appearance of the finished goods and partly to add bulk and weight water is added to canned corn in the process of canning. To add water to make the goods more liquid and to add starch to make the goods have greater consistency would seem to be in the nature of adulteration. It is probable that canned corn need never carry less than 25 per cent of dry matter. With quite immature corn—and too immature corn should not be packed—this percentage of dry matter can be maintained without the addition of starch. From the appearance of the opened goods in the laboratory there is no indication that starch was added with good judgment or in most cases was needed at all.

Since starch, sugar and water are all natural constituents of corn their addition cannot be surely detected in the laboratory. Investigations are being made and probably before many years standards will be established for canned corn. But when they are they will probably be based upon what is found to be common practice by packers and like other standards will be so low that considerable manipulation—perhaps as great as is now practiced—will come withen the limits. In the meantime possibly some packer will come forward with a more solid product than the general run of factories are now putting out and bid for patronage on the high food value of his output. It may be that when

standards are established that the amount in ounces of added water, sugar and starch will be required to be stated on the label.

In this connection it is well to remember that Maine corn is higher in solids and hence has a higher nutritive value than the run of packed corn the country over. In an examination of canned corn purchased in the open market it was found in North Dakota that over a third of the samples contained less than 20 per cent of dry matter. In the samples here reported only two fell below 19 per cent in dry matter and the average was about 22 per cent.

CANNED SARDINES.

There is no food product of higher nutritive value put up in Maine than the small herring that are packed in oil, mustard sauce or tomato sauce under the name of sardines. The fish used are a different species from those packed in the Mediterranean. But they both belong to the herring family and the fish occuring along the Maine coast are as fine in quality and of as high nutritive value as the true sardine. Maine sardines are, for the most part, packed in cotton seed oil or in mustard sauce. The oil packed fish are usually in "quarter sizes", with the net contents a little less than four ounces. The mustards are mostly packed in "three quarter sizes". Undoubtedly originally this was intended to be a 12 ounce package but usage has somewhat reduced (as in the case of nearly all tin packed goods) the size of the package . The net weight of the contents of a "three quarters" sized tin is a little less than 11 ounces. At the prices at which these goods are sold there is no better low priced animal food obtainable the country over. As pointed out on pages 51 and 52, while there is still room for improvement, a great advance in the quality and appearance of the finished product, and in the sanitary surroundings of the factories has been made in the past 5 years.

The results of the examination of nearly 200 samples are given in the table that follows.

CANNED SARDINES

Table showing the results of analyses of Maine packed sardines collected by the inspectors in 1916. The samples are arranged alphabetically by the names of the packers.

The samples are grouped by the nature of the material in which they are packed and under each group by the names of the packers.

Station number	Name and Address of Packer and Brand.	Results of Examination
	IN COTTONSEED OIL.	
17174–17178.	"Arrow Brand American Sardines in cottonseed oil. 3¼ ozs. Packed by E. W. Brown Co., So. Portland, Me." Samples purchased at factory Oct. 24, 1916.	Net weight 3.7 to 4.1 ozs. Six to 8 fish in can in cottonseed oil. Fish hard, firm, good flavor; no feed. Four cans not corroded; one slightly corroded.
17159–17163.	"Clyde American Sardines in cottonseed oil. Packed at So. Portland, Me., by E. W. Brown Co. Contents 3¼ avoir. ozs." Samples purchased at factory Oct. 24, 1916.	Net weight 3.8 to 4.5 ozs. From 8 to 16 fish in can in cottonseed oil. Fish hard, firm, good flavor; 3 of the cans no feed, two cans no red feed but a few of the fish contained digested feed in small amounts. Two cans not corroded, 3 cans very slightly coroded.
17235–17239.	"Casco Brand American Sardines in cottonseed oil. Brown-Willard Co., Portland, Me. Weight 3¼ ozs." Samples purchased from Cut Price Market, 405 Lisbon St., Lewiston, Oct. 25, 1916.	Net weight from 3.6 to 4.2 ozs. Seventeen to 22 fish in can. Fish hard, firm, good flavor, but with less salt than sardines usually have. No feed. Cans slightly corroded.
17403–17407.	"Banquet Brand American Sardines in cottonseed oil." Samples taken from packer's bench where goods were being packed at factory of L. D. Clark & Son, Eastport, Me., Nov. 11, 1916.	Net weight 3.8 to 4.3 ozs. Six to 10 small fish in can in cottonseed oil. Fish somewhat broken, with mussy appearance. Flavor good. Some fish in each can contained red feed. Cans slightly corroded.
17413–17417.	"Clark Brand American Sardines in cottonseed oil. Packed at Eastport, Me., by L. D. Clark & Son. Weight 3¼ ozs." Samples collected at factory Nov. 11, 1916.	Net weight 3.4 to 4.1 ozs. Five to 10 fish in can in cottonseed oil. In 3 cans fish hard, firm; in 2 cans fish slightly soft; good flavor. One can, no feed; 4 cans each had few fish containing red feed. Cans very slightly corroded.
17224–17228.	"Holmes Company (H C O Brand) American Sardines in cottonseed oil. Packed at Robbinston, Me. Average net weight 3⅜ ozs." Sample purchased from E. Janelle & Co., 396 Lisbon St., Lewiston, Oct. 25, 1916.	Net weight 3.8 to 4.1 ozs. Seven to 18 fish in can in cottonseed oil. In 2 cans fish hard, firm and good flavor, with small amount of red feed; 3 cans slightly soft, flavor flat, some red feed. All cans corroded, some badly.
17308–17312.	"American Sardines in Cottonseed Oil. Laurens & Cie. 3¼ ozs. Packed by Lawrence Canning Co., Rockland, Me." Samples collected from factory of Lawrence Canning Co. at Stockton Springs Sept. 22, 1917.	Net weight 3.9 to 4.2 ozs. Five or 6 fish in can in cottonseed oil. Fish hard, firm, good flavor; no feed. Cans corroded.
17090.	"Campfire Brand American Sardines in Cottonseed oil. Packed by Lawrence Canning Co., Rockland, Me. 3¼ ozs." Sample collected from John Pelkey, 35 Winter St., Rockland, Oct. 24, 1916.	Net weight 3.6 ozs. Can about two-thirds full. Fish hard, firm, good flavor; no feed. Can somewhat corroded.

CANNED SARDINES—Continued.

Station number	Name and Address of Packer and Brand.	Results of Examination
17095.	"E-M-L Brand American Sardines. Packed by Lawrence Canning Co., Rockland, Me. Weight 3¼ ozs." Sample collected from John Pelkey, Oct. 24, 1916.	Net weight 3.5 ozs. Six fish in can. Fish hard, firm, good flavor; no feed. Can slightly corroded.
17091.	Sardines in tin box without label. Lawrence Canning Co., Rockland. Sample collected from John Pelkey, 35 Winter St., Rockland, Oct. 24, 1916.	Net weight 4 ozs. Can well filled. Fish hard, firm, good flavor; no feed. Can somewhat corroded.
17300–17304.	"Togo Brand American Sardines in cottonseed oil. 3¼ avoir. ozs. Lubec Sardine Co., Belfast, Me." Samples collected at factory Sept. 22, 1916, taken at random in packing room.	Net weight 4.2 to 4.6 ozs. Five to 7 fish in can in cottonseed oil. One can fish hard, 4 cans fish slightly soft, flat flavor. Four cans no feed, one can small amount white feed. Four cans not corroded, one can slightly corroded.
17184–17188.	"Cape Elizabeth Brand American Sardines in cottonseed oil. 3¼ ozs. Packed by Portland Products Co., So. Portland, Me." Samples purchased from factory Oct. 25, 1916.	Net weight 3.5 to 4.2 ozs. Eight to 12 fish in can in cottonseed oil. Fish hard, firm, good flavor; no feed. Cans not corroded.
17199–17203.	"Yarmouth Maine Brand American Sardines in cottonseed oil. 3½ ozs. Packed by Royal River Packing Co., Yarmouth, Me." Samples purchased at factory Oct. 26, 1916.	Net weight 3.8 to 4.8 ozs. One can 13 fish in cottonseed oil; other 4 cans from 18 to 21 fish in tomato sauce. Hard, firm, good flavor; no feed. One can not corroded; 4 cans slightly corroded.
17368–17372.	"American Sardines in Cottonseed Oil." Seacoast Canning Co., Eastport, Me. Factory No. 4. Samples were taken from factory from five different cases before being cartoned, Nov. 10, 1916.	Net weight averaged about 4 ozs. Three of these cans over-ran, 2 under-ran. Eleven to 16 small fish in can in cottonseed oil. Flesh hard, firm and good flavor. Three cans without feed; slight amount of red feed; in few fish in 2 cans. Cans were slightly corroded.
17240–17244.	"Big Smoke American Smoked Sardines in cottonseed oil. Contents 3¼ ozs. Seacoast Canning Co., Eastport, Me." Samples purchased from Cut Price Market, 405 Lisbon St., Lewiston, Oct. 25, 1916.	Net weight from 3.5 to 4.4 ozs. Four to 7 fish in can in cottonseed oil. Fish hard, firm and good flavor; 2 cans without feed, 3 cans with small amount of feed in some of the fish. Cans slightly corroded.
17398–17402.	"Conquerer American Sardines in Cottonseed Oil. Weight 3¼ ozs." Seacoast Canning Co., Eastport, Me. Samples taken at factory Nov. 10, 1916.	Net weight from 3 to 4.4 ozs. Eight to 11 fish in can, in cottonseed oil. Fish hard, firm and good flavor; 3 fish in one and one fish in each of 2 other cans contained small amount of red feed, otherwise no feed. Cans slightly corroded.
17373–17377.	"Continental American Sardines in Cottonseed Oil." Seacoast Canning Co., Eastport, Me. "Weight 3¼ ozs." Each sample represents a case. Taken at factory Nov. 10, 1916.	Net weight ranges from 2.9 to 4 ozs. This low weight can was the only one below claimed net weight. Eight to 11 fish in can. Four cans had fish hard, firm and good flavor; one can, fish slightly soft with flat flavor. No feed. Cans slightly corroded.
17393–17397.	"Dixie Brand American Sardines in cottonseed oil. Weight 3¼ ozs." Seacoast Canning Co., Eastport, Me. Samples taken at factory Nov. 10, 1916.	Net weight from 3 to 3.7 ozs. Eight to 20 fish in can in cottonseed oil. Fish hard, firm and good flavor; small amount of red feed in one can. Cans slightly corroded.

CANNED SARDINES—Continued.

Station number	Name and Address of Packer and Brand.	Results of Examination
17378–17382.	"Red Horse American Sardines. Packed in cottonseed oil. Contents 3¾ avoir. ozs." Seacoast Canning Co., Eastport, Me. Each sample from separate boxes, taken at factory Nov. 10, 1916.	Net weight ranges from 3.5 to 4.3 ozs. Five fish in each can. Fish hard and firm and good flavor; no feed. Cans slightly corroded.
17229–17233.	"American Sardines. Extra Quality. Fried. Packed in cottonseed oil for W. H. Shurtleff Co., Portland, Me. Net weight 5 to 6 ozs." Sample purchased from E. Janelle & Co., 396 Lisbon St., Lewiston, Oct. 25, 1916. In stock since 1912.	Net weight 5 to 6.4 ozs. Sixteen to 19 fish in can in cottonseed oil. Fish hard, firm, good flavor; no feed. Cans slightly corroded.
17306–17307.	American sardines packed by Stockton Springs Canning Co., Stockton Springs, Me. Samples taken at random before goods were cartoned, at factory, Sept. 22, 1916.	Net weight 4 and 4.2 ozs. Four fish in one can, five fish in other can, in cottonseed oil. Fish hard, firm, good flavor; no red feed, a little white feed in one can. Cans slightly corroded.
17234.	"Luncheon Brand American Sardines in cottonseed oil. Weight 3¼ ozs. The Stockton Springs Canning Co., Stockton Springs, Me." Five samples examined as A, B, C, D, and E. Purchased from E. Janelle & Co., 396 Lisbon St., Lewiston, Oct. 25, 1916.	Net weight from 2.8 to 4.1 ozs. This low weight only one below claimed weight. Four or 5 fish in can in cottonseed oil. Fish in one can hard, firm; in 3 other cans some of the fish were hard and firm and others were slightly soft; flavor good but not very salt. Fish in one can soft, flat flavor and bitter taste; evidently old fish; not fit for food. No feed. Cans slightly corroded.
17305.	"Luncheon Brand American Sardines in cottonseed oil. 3¼ ozs. Packed by Stockton Springs Canning Co., Stockton Springs, Me." Sample collected at factory Sept. 22, 1916.	Net weight 3.8 ozs. Nineteen fish in cottonseed oil. Fish hard, firm, good flavor, smoked; no feed. Can not corroded.
	IN OLIVE OIL.	
17142.	"Portland Brand American Sardines. Weight 3¼ ozs. In pure olive oil. Packed by Brawn-Willard Co., Portland, Me." Five samples examined as A, B, C, D, and E. Collected at factory Oct. 30, 1916.	Net weight from 4 to 4.2 ozs. Eight to 10 fish in olive oil. Fish hard, firm, good flavor; one can, no feed; 4 cans, small amount of feed. Some of the cans slightly corroded.
17219–17223.	"Viola Brand Sardines in pure olive oil. Contents 3¼ ozs. Distributed by Deep Sea Sardine Co., New Orleans, La." Samples collected at factory of E. W. Brown Co., So. Portland, where goods are packed, Oct. 27, 1916.	Net weight 3.9 to 4.3 ozs. Eight to 10 fish in can in olive oil. Fish hard, firm, good flavor; no feed. Cans slightly corroded.
17113–17117.	"Clover Brand American Sardines packed in pure olive oil. Contents 3¼ ozs. Lawrence Canning Co., Rockland, Me. Samples collected at factory Oct. 24, 1916.	Net weight 3.5 to 4.1 ozs. Ten to 20 fish in can in olive oil. In 4 cans fish hard, firm, good flavor; in one can fish rather soft with flat flavor; no feed. Cans not corroded.
17179–17183.	"Fancy American Sardines in Pure Olive Oil. Contents 3¼ ozs. Packed by Portland Products Co., So. Portland, Me." Samples purchased at factory Oct. 25, 1916.	Net weight 3.5 to 4.2 ozs. Eight fish in can in olive oil. Fish hard, firm, good flavor; no feed. Cans slightly corroded.

CANNED SARDINES—Continued.

Station number	Name and Address of Packer and Brand.	Results of Examination
17214–17218.	"Mytinice Brand Norwegian Style Unsmoked Sardines in Pure Olive Oil. Packed at Yarmouth, Me., 3½ ozs. for Figved Importing Co., Chicago, Ill." Samples collected at factory of Royal River Packing Co., Yarmouth, Oct. 26, 1916.	Net weight 3.4 to 3.9 ozs. Six to 21 fish in can in olive oil. Fish in 4 cans hard, firm, good flavor; fish in one can hard, firm, but flavor flat. Slight amount red feed in one fish in one can; others no feed. Cans corroded.
17204–17208.	"Norwegian Style Smoked Sardines in pure olive oil. Prince Peer Brand. Packed at Yarmouth, Me., for Figved Importing Co., Chicago, Ill. Contents 3½ ozs." Samples collected at factory of Royal River Packing Co., Yarmouth, Oct. 26, 1916.	Net weight 3.5 to 4.4 ozs. Six to 19 fish in can in olive oil. Fish hard, firm, good flavor; no feed. Cans slightly corroded.
	IN MUSTARD SAUCE.	
17164–17168.	"American Tomah Brand Sardines. Packed in mustard sauce. E. W. Brown Co., So. Portland. 11 ozs." Samples purchased at factory Oct. 24, 1916.	Net weight 10.2 to 11.1 ozs. Four to 9 fish in can in mustard sauce, also many pieces. Although the fish were fairly hard they appeared to fall to pieces readily. Appeared mussy. Two cans good flavor, 3 cans flavor flat. Three cans no feed; two cans had few fish containing digestible material which appeared to be red feed. Cans not corroded.
17169–17173.	"Arrow Brand Sardines in Mustard Sauce. Average net weight 11 ozs. Packed by E. W. Brown Co., So. Portland, Me." Samples purchased at factory Oct. 24, 1916.	Net weight 10.4 to 11.2 ozs. Three to 15 fish and several pieces in can in mustard sauce. One can fish hard, firm, good flavor; 2 cans fish fairly soft with flat flavor; one can fish slightly soft with flat flavor; one can fish soft with flat flavor. Few fish in two cans contained dark colored feed similar to mud; from one to 3 fish in other cans contained red feed. Cans not corroded.
17149–17153.	"Clyde American Sardines packed in mustard sauce. Weight 10 ozs. Packed at So. Portland, Me., by E. W. Brown Co." Samples purchased at factory Oct. 24, 1916.	Net weight 9.7 to 11.4 ozs. Six to 8 fish in can in mustard sauce; in one can six unbroken fish and several pieces. Fish hard, firm, good flavor; no feed. Cans not corroded.
17154–17158.	"Clyde American Sardines in mustard sauce. Packed at So. Portland, Me., by E. W. Brown Co. Weight 3¾ ozs." Samples purchased at factory Oct. 24, 1916.	Net weight 3.8 to 4.5 ozs. Five or 6 fish in can in mustard sauce. Fish hard, firm, good flavor; two fish in one can contained white feed, others had no feed. Cans not corroded.
17408–17412.	"Banquet Brand American Sardines in Mustard Sauce. L. D. Clark & Son, Eastport, Me. Samples taken from separate boxes at factory Nov. 11, 1916.	Net weight 11.1 to 12.0 ozs. Four fish in can in mustard sauce. Fish hard, firm, flavor flat. Few fish in 4 cans contained red feed; one can no feed. Cans not corroded.
17118–17122.	"E-M-L Brand Sardines in Mustard Sauce. Packed by Lawrence Canning Co., Rockland, Me. 11 ozs." Samples collected from factory Oct. 24, 1916.	Net weight 10.6 to 11.8 ozs. Five to 8 fish in can in mustard sauce. Fish hard, firm, good flavor; no feed. Cans not corroded.
17092–17094.	"Laurens & Cie American Sardines in Mustard Sauce. Packed by Lawrence Canning Co., Rockland, Me. Weight 10 ozs." Samples collected from John Pelkey, 35 Winter St., Rockland, Oct. 24, 1916.	Net weight 9.7 to 11.9 ozs. Eight to 11 fish in can in mustard sauce. Fish hard, firm, good flavor; no feed. Cans not corroded.

CANNED SARDINES—Continued.

Station number	Name and Address of Packer and Brand.	Results of Examination
17363–17367.	"American Sardines in Mustard Sauce." Seacoast Canning Co., Eastport, Me. Factory No. 4. Samples were taken from shipping room before being cartoned, Nov. 10, 1916.	Net weight in excess of 12 ozs. Cans contained from 3 to 5 fish. With the exception of one fish no feed present. Part of the fish were hard and firm; others were slightly soft. Flavor of all was good. Cans were not corroded.
17388–17392.	"American Sardines in Mustard Sauce." Plain tins. Seacoast Canning Co., Eastport, Me. Samples taken from 5 different cases at factory Nov. 10, 1916.	Net weight from 3.4 to 4.1 ozs. Seven to 12 fish in each can in mustard sauce. Fish hard, firm, good flavor; no feed. Cans not corroded.

IN TOMATO SAUCE.

17143.	Sardines in tomato sauce. Plain cans. Conners & Thompson, Freeport, Me. Five samples examined as A, B, C, D, and E. Collected at factory Nov. 3, 1916.	Net weight 3.8 to 4.1 ozs. Four or 5 fish in each can in tomato sauce. Fish hard, firm, good flavor; no feed. Cans slightly corroded.
17123–17127.	American Sardines in Tomato Sauce. Lawrence Canning Co., Rockland, Maine. Samples taken from stock in shipping room at factory before being labeled, Oct. 24, 1916.	Net weight 2.9 to 4.1 ozs. Four fish in can in tomato sauce. Fish hard, firm, good flavor; no feed. Three cans not corroded, 2 cans slightly corroded.
17209–17213.	"Rob Roy Dainty American Sardines in Tomatoes. Net weight 3½ ozs. Packed for J. M. McNien & Co., New York." Samples collected at factory of Royal River Packing Co., Yarmouth, Oct. 26, 1916.	Net weight 4.1 to 4.4 ozs. Six to 8 fish in can in tomatoes. Fish hard, firm, good flavor; no feed. Cans slightly corroded.
17189–17193.	"Piper Brand Fresh Herring in Tomato Sauce. 7 ounces. Packed by Portland Products Co., Portland, Me." Purchased from factory Oct. 25, 1916.	Net weight 7.1 to 8.7 ozs. Four to 6 fish in can in tomato sauce. Fish hard, fine flavor; no feed, except small amount of white feed. Cans slightly corroded.
17194–17198.	"Piper Brand Fresh Herring in Tomato Sauce. Net contents one lb. Packed by Portland Products Co., Portland, Me." Samples purchased at factory Oct. 25, 1916.	Net weight 12.7 to 15.6 ozs. Five to 9 fish in can in tomato sauce. Fish hard, firm, good flavor; no red feed but a little white feed. Cans not corroded.
17383–17387.	"American Sardines in Tomato Sauce. One-fourth size." Seacoast Canning Co., Eastport, Me. Samples taken from different cases at factory Nov. 10, 1916.	Net weight from 2.7 to 4 ozs. Eight to 15 fish in can, in tomato sauce. The light weight can was only half full. Fish hard, firm, good flavor; no feed. Cans not corroded.

STATMENT BY THE EXECUTIVE OF THE LAW.

A. M. G. SOULE, CHIEF BUREAU OF INSPECTIONS.

A special endeavor was made during the season of 1916 to make a more complete inspection of food factories and collection of products than ever before, with particular reference to the three principal canning industries of the State of Maine: Corn factories, blueberry factories and sardine factories.

The following tabulations will show the unique importance of the sardine industry in Maine as compared with the rest of the United States; they also compare the blueberry pack in Maine with that of the rest of the country and define the position the state occupies in the clam and corn canning industries:

Total number of cases of sardines packed in the United States in 1914	5,012,199
Total number of cases of sardines packed in the State of Maine in 1914	4,634,424
Total number of cases of blueberries packed in the United States in 1914	151,636
Total number of cases of blueberries packed in the State of Maine in 1914	116,001
Total number of cases of clams packed in the United States in 1914	185,186
Total number of cases of clams packed in the State of Maine in 1914	94,813
Total number of cases of clam chowder packed in the United States in 1914	102,838
Total number of cases of clam chowder packed in the State of Maine in 1914	86,771

While not leading in the production and packing of corn, it is unnecessary to state that the quality of the Maine product makes up for the inability to show championship figures for production; we are, however, nearly at the top of the list, with a pack of 1,101,333 cases.

CORN CANNING FACTORIES

In fortunate cooperation with an inspector from the United States Department of Agriculture, detailed by the Chief of the Bureau of Chemistry to accompany a deputy of the State Department, a rather complete inspection of the corn factories was made. The cooperation of the deputy sealer of weights and measures was also obtained and in this way rather complete information was gained as to general sanitary conditions and the raw product used, and the scales and measures employed by the packers were tested.

Our deputy gave careful attention to the methods employed in packing, noting the source of the water supply, the health and cleanliness of the employees, etc. Some of the factories did not have proper washing and drinking facilities, nor were soap and towels supplied; other establishments, however, had sanitary notices posted, and where their use was not in evidence it was recommended. The use of corn-starch was investigated; samples from practically all of the factories were obtained and have been examined at the laboratory. Thus far, the results have been most pleasing and indicate that wherever corn starch has been added the fact has been stated upon the label. We are glad to make the general assertion that the average corn packer in the State of Maine is attempting to put upon the market an excellent product—worthy of the enviable reputation which Maine packed corn bears.

BLUEBERRY FACTORIES

In two counties in the state—Washington and Hancock—the caning of blueberries has become an important industrial operation and, realizing its importance, we have devoted some time during the past season to the inspection of this industry. From about the 20th of July until the 20th of September, when the season for canning blueberries is at its height, an inspector was assigned to this particular work; he visited sixteen factories, advising with the packers and calling to their attention the rules and regulations of this Bureau providing that factories shall be kept clean and free from dust and cobwebs; the floors kept clean; the utensils used in the process of canning cared for

in a sanitary manner; the toilets kept in a cleanly condition, and soap and a supply of clean towels always accesible. It was also a regulation that particular care should be taken with the berries before canning, in order that all foreign substances might be removed—and upon the enforcement of this regulation rested the greater responsibility. The inspector detailed for this work devoted his whole time to the blueberry industry, and was thus able to give a part of every day to some one of the packers for a few hours, at least. The result of this inspection work has been most encouraging.

A tour of inspection was also made by other inspectors during the height of the season, when practically all the blueberry canning factories in operation were visited. At this time it was especially noted that the canners were entirely willing to accept the recommendations made by the inspector, and avowed their intentions to comply with the regulations with the idea of the betterment of their product. In many cases it was found additional help had been put on for the express purpose of picking the berries cleaner than they have ever done before, and this will go a long way toward the general improvement of their product. This seems to be the only way of insuring clean berries, as no system of winnowing has yet been devised that will produce berries absolutely clean from sticks, leaves and other foreign sustances, in preparation for canning. During the busy season—particularly on the old burns—that is, barrens where it will be necessary to burn the following season—the fruit is gathered by raking. The implement used for this purpose is very similar to a cranberry rake, resembling a dust-pan, with the bottom composed of stiff, parallel wire rods. The berries may be gathered much more quickly and cheaply by this means, but by the use of the rake the fruit is considerably mixed with leaves, sticks, chokeberries, bunchberries, and other foreign substances. Before being crated for transportation to the factory, they are passed through a fanning mill and then, again, at the factory are submitted to another winnowing, but this is not all that is necessary to insure a clean, attractive product; an individual picking is necessary and, to this end, the regulations requiring particular care with this specific branch of the work have been recommended.

The possibilities of the industry are wonderful, and the figures previously given will show the unique qualifications of the inductry to Maine as compared with any other section of the United States. Growing, as they do, on land that is practically unfit for any other purpose, they furnish employment to the inhabitants and are a source of revenue for the whole community.

The method of preparation for canning is practically the same in all factories. It consists in cooking the berries in a large steam cooker, with or without the addition of water, filling the cans with the hot berries, sealing immediately and transferring to a colling process by submerging the cans in cold water. Except in one or two instances, there has been practically no atempt made to place on the market any other product than the unsweetened fruit. This, it is believed, is to be regretted for, by using syrup of sugar, and making a careful selection of the raw material, a greater demand would certainly be created for this product and much larger profits realized.

Sardine Factories

This industry, which means a great deal to the State of Maine, has come in for its share of attention in the inspection work of the past season.

We have fortunately secured the cooperation of the United States Department for our investigations, and have also welcomed the inauguration of rather an elaborate system of inspection by the National Canners' Association, financed by the packers themselves, which—on the whole—has been productive of wonderful results.

Early in the season an informal conference was held with the director of the National Canners' Association, and rules and regulations satisfactory to the Association and this department were agreed upon. We feel sure that the results have been pleasing to all concerned.

A special investigation, during the early spring months, was made in regard to the habits and methods of the fishermen in securing the fish furnished the factories. This work was carried on in compliance with the regulations promulgated by the Canners' Association, to the effect that fish shall not be packed

which have been seined and not confined in keeping pounds or allowed to remain in the seine for a sufficient time to rid themselves of the "red feed." The quality of the fish, in some instances, was ascertained by the inspectors intercepting the boats upon their arrival at the factories.

No attempt was made to make any recommendations for expensive equipment at the sardine factories, or suggest ideas too fastidious for fulfilment but—aside from the proper selection of fish—our recommendations have been for convenient and cleanly toilets and dressing rooms, with a supply of soap and clean towels always available. We have strongly urged the discontinuance of the common drinking cup, although in some cases this advice has not been heeded.

At the beginning of the packing season, and also when the work of packing was well advanced, samples consisting of from five to ten units to a sample, and covering practically the whole variety of the product of the factories, were obtained; these samples have been examined at the laboratory and the results have shown a cleanly and attractive product.

It is with considerable pleasure that the statement is made that the cooperation of the state and federal departments, the excellent inspection which has begun with the National Canners' Association, together with the apparent willingness of the packers themselves, have gone a long way toward producing a product which can be placed on a parity with the Norwegian or French brands of sardines, and overcoming the prejudice which has existed against the Maine product.

October, 1917

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

ANALYSTS.

James M. Bartlett
Royden L. Hammond
Harold R. King
Herman H. Hanson
Elmer R. Tobey

Official Inspections

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COMMERCIAL FEEDING STUFFS, 1916-7.

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 IN 1916-17.

REGISTRATION AND RESULTS OF INSPECTION.

The following pages contain the report of the analyses of commercial feeding stuffs made since the publication of Official Inspections 79.

There are reported in all about 700 samples, including all received up to July 1, 1917. 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.

DESCRIPTION OF TABLES.

In the left hand column of the tables will be found listed the name of each brand of feeding stuff registered in Maine in 1916 or 1917, the name of the manufacturer, the list of ingredients, and the guaranteed analysis as given on the certificate of registration filed with the Commissioner of Agriculture. Unregistered brands of which samples have been examined are also included in the list. The feeds are grouped into classes and in those classes the names of the manufacturer are arranged alphabetically. In the right hand column the results of the examination of the samples of each brand are discussed. 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 constituents 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 to 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 registrations of feeding stuffs and results of examination of samples.

Brand, Maker and Guaranties.	Results of Examination.
COTTON SEED MEALS.	
Owl Brand Cotton Seed Meal. F. W. Brode & Co., Memphis, Tenn. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 41 per cent protein. Registered in 1916. Not registered in 1917.	One official sample. In accord with guaranty in all respects. One dealer's sample. 1½ per cent below guaranty in protein. Not examined for fiber and fat.
Dove Brand Cotton Seed Meal. F. W. Brode & Co., Memphis, Tenn. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. (1916 certificate gives 10 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	Nine official samples. Three were in accord with guaranty in protein; one was very slightly below; one was slightly below; one was three-fourth per cent below; two were 1½ per cent below; one was 4½ per cent below. The six samples low in protein were examined for fiber and fat. All were in accord with guaranty in fat. Three were in accord with the 1917 guaranty in fiber; two were slightly above; and the one most deficient in protein was 5 per cent high in fiber. Twenty-three dealers' samples. Ten were in accord with guaranty in protein; six were slightly below; one was between one-half and one per cent below; five were between one and two per cent below; and one was 4 per cent below. Not examined for fiber and fat.
Jay Brand Cotton Seed Feed. F. W. Brode & Co., Memphis, Tenn. Composed of cottonseed meal and cottonseed hulls. Contains not more than 14 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Not registered in 1916. Registered in 1917.	Two official samples. One was in accord with guaranty in protein; the other was two per cent below. The one low in protein was examined for fiber and fat and found in accord with guaranty.
Cowslip Cotton Seed Meal. Brown & Murphy, Birmingham, Ala. No certificate filed. Claims on package: Contains not more than 10 per cent crude fiber, and not less than 6.5 per cent fat and 41 per cent protein. Unregistered .	One dealer's sample. Eight-tenths per cent below guaranty in protein. Not examined for fiber and fat.
Cotton Seed Meal. Brown & Murphy, Birmingham, Ala. No certificate filed. Claims on package: Contains not more than 12 per cent crude fiber, and not less than 7.5 per cent fat and 38.62 per cent protein. Unregistered.	One official sample. In accord with guaranty in protein and fat. Not examined for fiber.
"Buckeye" Prime Cottonseed Meal. Buckeye Cotton Oil Co., Cincinnati, O. Manufactured from cotton seed only. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
"Buckeye" Good Cottonseed Meal. Buckeye Cotton Oil Co., Cincinnati, O. Manufactured from cottonseed only. Contains not more than 14 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Single Hump Camel Brand. C. L. Campbell & Co., Little Rock, Ark. Cotton seed meal with such portion of the fiber or hull and oil as may be left in the ordinary course of manufacture. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.5 per cent protein. Registered in 1916. Not registered in 1917.	Two official samples collected in 1916. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat.
Missouri Brand Cottonseed Meal. Caruthersville Cotton Oil Co., Caruthersville, Mo. No certificate filed. Claims on package: Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. Unregistered.	Four official samples. One in accord with guaranty in all respects; one slightly below in protein, in accord in fat, not examined for fiber; two were over two per cent below in protein; the lower was examined for fiber and fat and found in accord with guaranty. One dealers' sample. In accord with guaranty in protein. Not examined for fiber and fat.
Goodluck Brand Cottonseed Meal. S. P. Davis, Little Rock, Ark. Decorticated cotton seed. Contains not more than 9 per cent crude fiber, and not less than 6 per cent fat and 41 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Veribest Brand Cottonseed Meal. S. P. Davis, Little Rock, Ark. Decorticated cotton seed. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 38½ per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; over one per cent high in fiber.
Beauty Brand Cottonseed Meal and Cracked Screened Cake. S. P. Davis, Little Rock, Ark. No certificate filed. Claims on certificate: Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 36 per cent protein. Unregistered.	One dealer's sample. In accord with guaranty in protein. Not examined for fiber and fat.
Illinois Brand Cotton Seed Meal. East St. Louis Cotton Oil Co., National Stock Yards, Ill. Ground cottonseed. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 41 per cent protein. (1916 certificate gives 10 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. One dealer's sample. Over one per cent below guaranty in protein; not examined for fiber and fat.
East St. Louis Brand Cottonseed Meal. East St. Louis Cotton Oil Co., National Stock Yards, Ill. Ground cottonseed. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.5 per cent protein. Registered in 1916 and 1917.	Five official samples. One in accord with guaranty in all respects; one slightly below in protein, in accord in fiber and fat; two about one per cent below in protein, not examined for fiber and fat; one four per cent below in protein and eight-tenths per cent high in fiber, in accord in fat. Seven dealers' samples. Five in accord with guaranty in protein; two slightly below; not examined for fiber and fat.
St. Clair Brand Cottonseed Meal. East St. Louis Cotton Oil Co., National Stock Yards, Ill. Ground cottonseed. Contains not more than 16 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Registered in 1916 and 1917.	Five official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat. Three dealers' samples. All in accord with guaranty in protein; not examined for fiber and fat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Milko Brand Cotton Seed Meal. H. F. H. Eberts, Little Rock, Ark. No certificate filed. Claims on package: Contains not more than 12 per cent crude fiber, and not less than 5.5 per cent fat and 38.55 per cent protein. Registered in 1916. Not registered in 1917.	Two official samples. One in accord with guaranty in protein; not examined for fiber and fat. The other, one-half per cent below guaranty in protein; in accord in fiber and fat.
Bossy Cotton Seed Meal. H. F. H. Eberts, Little Rock, Ark. No certificate filed. Claims on package: Contains not more than 15 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects.
Big League Cotton Seed Meal. Eldred Mill Co., Jackson, Mich. Made from decorticated cottonseed. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Bull Brand Cotton Seed Meal. Humphreys-Godwin Co., Memphis, Tenn. Made from pressed cotton seed. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 41 per cent protein. Registered in 1916. Not registered in 1917.	One official sample, collected in 1916. In accord with guaranty in all respects.
Dixie Brand Cottonseed Meal. Humphreys-Godwin Co., Memphis, Tenn. Made from pressed cottonseed. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. One dealer's sample. One and one-half per cent below guaranty in protein; not examined for fiber and fat.
Forfat Brand Cottonseed Meal. Humphreys-Godwin Co., Memphis, Tenn. Made from pressed cottonseed. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.55 per cent protein. Registered in 1916 and 1917.	Four official samples. One in accord with guaranty in protein; one one per cent below; one two per cent below; and one over three per cent below. The two samples lowest in protein were examined for fiber and fat. Both were in accord in fat; one was in accord in fiber, the other over one per cent high. Nine dealers' samples. Four in accord with guaranty in protein; one was slightly below; four from one-half to 1½ per cent below. The lowest sample was examined for fiber and fat and found in accord in fiber but slightly below in fat.
Danish Brand Cottonseed Meal. Humphreys-Godwin Co., Memphis, Tenn. Made from pressed cottonseed. Contains not more than 15 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Registered in 1916 and 1917.	Six official samples. Four in accord with guaranty in protein; the two examined, in accord in fiber and fat. One very slightly below and one one per cent below in protein; not examined for fiber and fat. Twelve dealers' samples. Three in accord with guaranty in protein; one slightly below; two one per cent below; four about 1½ per cent below; two over two per cent below. Not examined for fiber and fat.
Canary Brand Cotton Seed Meal. Lanier Bros., Nashville, Tenn. No certificate filed. Claims on package: Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 41 per cent protein. Unregistered.	One dealer's sample. Three per cent below guaranty in protein. Not examined for fiber and fat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Jersey Brand Cottonseed Meal. Lanier Bros., Nashville, Tenn. Decorticated cottonseed only. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. Registered in 1916 and 1917.	Three official samples. In accord with guaranty in protein and fat; one to two per cent high in fiber. Six dealers' samples. Four practically in accord with guaranty in protein; one slightly below and one two per cent below. Not examined for fiber and fat.
Kineda Prime Cottonseed Meal. J. M. Macdonald, Cincinnati, O. Cottonseed product. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.6 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
Avon Cottonseed Meal. J. M. Macdonald, Cincinnati, O. Cottonseed product. Contains not more than 14 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Not registered in 1916. Registered in 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. One dealer's sample. In accord with guaranty in protein. Not examined for fiber and fat.
Eagle Brand Cotton Seed Meal. C. L. Montgomery & Co., Memphis, Tenn. Fully decorticated cotton seed. Contains not more than 14 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Registered in 1916. Not registered in 1917.	One official sample. Slightly below guaranty in protein; two per cent high in fiber; in accord with guaranty in fat.
Star Brand Cotton Seed Meal. C. L. Montgomery & Co., Memphis, Tenn. No certificate filed. Claims on package: Contains not more than 14 per cent crude fiber, and not less than 6 per cent fa and 36 per cent protein. Unregistered.	One official sample. Two per cent below protein guaranty; in accord with fiber and fat guaranties.
Butterfly Brand Cottonseed Meal. W. C. Nothern, Little Rock, Ark. Made from decorticated cottonseed. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. (1916 certificate gives 10 per cent as maximum guaranty of crude fiber and 39 per cent as minimum guaranty of protein). Registered in 1916 and 1917.	Three official samples. All were examined for protein; two for fiber and fat. All were found in accord with guaranty.
Choice Cotton Seed Meal. Phoenix Cotton Oil Co., Dyersburg, Tenn. No certificate filed. Claims on package: Contains not more than 10 per cent crude fiber, and not less than 7 per cent fat and 38 per cent protein. Unregistered.	One dealer's sample. Practically up to guaranty in protein. Not examined for fiber and fat.
Winner Prime Cotton Seed Meal. Ralston Purina Co., Inc., St. Louis, Mo. No certificate filed. Claims on package: Contains not more than 7.5 per cent crude fiber, and not less than 6 per cent fat and 38.5 per cent protein. Unregistered.	One official sample. Protein and fat above guaranty; crude fiber overruns maximum guaranty about 1 per cent.
"Pilgrim" Cotton Seed Meal. J. E. Soper Co., Boston, Mass. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 38½ per cent protein. Registered in 1916 and 1917.	Two official samples. One was in accord with guaranty in protein; not examined for fiber and fat. The other was 1½ per cent low in protein and over 2 per cent too high in fiber. One dealer's sample. Slightly low in protein.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
"Puritan" Cotton Seed Meal. J. E. Soper Co., Boston, Mass. On 1916 certificate: Contains not more than 16 per cent crude fiber, and not less than 5½ per cent fat and 36 per cent protein. On 1917 certificate: Contains not more than 15 per cent crude fiber, and not less than 5 per cent fat and 36 per cent protein. Registered in 1916 and 1917.	One official sample. One half per cent low in protein; in accord with guaranty in fiber and fat.
American Red Tag Cotton Seed Meal. Union Seed & Fertilizer Co., New York, N. Y. Contains not more than 11.5 per cent crude fiber, and not less than 6 per cent fat and 38.62 per cent protein. (1916 certificate gives 6.5 and 38.55 per cent as minimum fat and protein guaranties respectively). Registered in 1916 and 1917.	Six official samples. Four were in accord with guaranty in protein; one was examined for fiber and found in accord with guaranty; no other examinations for fiber and fat were made on these samples. One sample was slightly below in protein and another nearly 1 per cent below; both of these were in accord with guaranty in fiber and fat. Six dealers' samples. Three were in accord with guaranty in protein. The others were five-tenths, seven-tenths, and 1.8 per cent below respectively. Not examined for fiber and fat.
Security Brand Cotton Seed Meal. Union Seed & Fertilizer Co., New York, N. Y. Contains not more than 14 per cent crude fiber, and not less than 5.5 per cent fat and 36 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Surety Brand Cotton Seed Meal. Union Seed & Fertilizer Co., New York. Contains not more than 14 per cent crude fiber, and not less than 5.5 per cent fat and 36 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.

COTTON SEED FEEDS.

Jay Brand Cotton Seed Feed. F. W. Brode and Co., Memphis, Tenn.	Carries 36 per cent protein and is listed under Cotton Seed Meals.
Fox Brand Cotton Seed Feed. F. W. Brode & Co., Memphis, Tenn. Composed of cottonseed meal and cottonseed hull bran. Contains not more than 22 per cent crude fiber, and not less than 5 per cent fat and 20 per cent protein. Not registered in 1916. Registered in 1917.	One dealer's sample. Seven-tenths per cent below guaranty in protein; not examined for fiber and fat.
"Buco" Cottonseed Feed. Buckeye Cotton Oil Co., Cincinnati, O. Composed of cottonseed meal and cottonseed hulls. On 1916 certificate: Contains not more than 23 per cent crude fiber, and not less than 4 per cent fat and 20 per cent protein. On 1917 certificate: Contains not more than 27 per cent crude fiber, and not less than 3½ per cent fat and 20 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Minter Brand Cottonseed Feed. Humphreys-Godwin Co., Memphis, Tenn. Made from cottonseed meal and delinted cottonseed hulls. Contains not more than 16 per cent crude fiber, and not less than 4 per cent fat and 32 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
77 Cottonseed Feed. Humphreys-Godwin Co., Memphis, Tenn. Made from cottonseed meal and delinted cottonseed hulls. Contains not more than 28 per cent crude fiber, and not less than 4 per cent fat and 20 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in protein and fiber and practically in accord in fat.
Clifton Cottonseed Feed. J. M. Macdonald, Cincinnati, O. Cottonseed meal and cottonseed hulls. Contains not more than 23 per cent crude fiber, and not less than 3¾ per cent fat and 20 per cent protein. Not registered in 1916. Registered in 1917.	One dealer's sample. In accord with guaranty in protein; not examined for fiber and fat.
"Cyclone" Cotton Seed Feed. Memphis Cotton Hull & Fiber Co., Ltd., Memphis, Tenn. Composed of cottonseed meal and ground cottonseed hulls. Contains not more than 23 per cent crude fiber, and not less than 3 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Columbia Cotton Seed Feed. Union Seed & Fertilizer Co., New York, N. Y. Cottonseed meal and cottonseed hulls. Contains not more than 25 per cent crude fiber, and not less than 3 per cent fat and 20.56 per cent protein. Registered in 1916 and 1917.	One official sample. One and one-fourth per cent below in protein; in accord with guaranty in fiber and fat. One dealer's sample. In accord with guaranty in protein; not examined for fiber and fat.

LINSEED MEALS.

Brand, Maker and Guaranties.	Results of Examination.
"Hypro" Pure Old Process Linseed Meal. American Linseed Co., New York. Flaxseed. Contains not more than 8 per cent crude fiber, and not less than 5 per cent fat and 34 per cent protein. Registered in 1916 and 1917.	One official sample. Practically in accord with guaranty in protein; in accord in fiber and fat.
Old Process Oil Meal. American Linseed Co., New York. Flaxseed. Contains not more than 8 per cent crude fiber, and not less than 5 per cent fat and 34 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Amco Old Process Linseed Meal. American Milling Co., Peoria, Ill. Flax seed product. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 30 per cent protein. Registered in 1916. Not registered in 1917.	Four official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Old Process Ground Oil Cake. Archer-Daniels Linseed Co., Buffalo, N. Y., and Minneapolis Minn. By-product from the manufacture of linseed oil. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 33 per cent protein. (1916 certificate gives 32 per cent as minimum protein guaranty). Registered in 1916 and 1917.	Six official samples. The one guaranteed 32 per cent protein was in accord with guaranty in all respects. Of the five guaranteed 33 per cent protein, two were in accord and one practically in accord with guaranty in protein; one was one-half per cent and the other one per cent below. The three examined were in accord in fiber and fat. One dealer's sample. One per cent below guaranty (33 per cent) in protein; in accord in fat; not examined for fiber.
Pure Old Process Linseed Oil Meal. Spencer Kellogg & Sons, Inc., Buffalo, N. Y. and Minneapolis, Minn. Ground linseed oil cake. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 33 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat.
Old Process Oil Meal. (Registered in 1916 as Major Brand Old Process Oil Meal). Toledo Seed & Oil Co., Toledo, O. Flaxseed. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 30 per cent protein. Registered in 1916. Not registered in 1917.	Two official samples. In accord with guaranty in all respects.
Bonnie Old Process Oil Meal. Traders & Producers Supply Co., Buffalo, N. Y. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 34 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects.

STARCH FACTORY BY-PRODUCTS.

Atlas Corn Oil Meal. Atlas Feed & Milling Co., Peoria, Ill. Made from corn. Contains not more than 9 per cent crude fiber, and not less than 7 per cent fat and 18 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Cream of Corn Gluten Feed. American Maize Products Co., New York. Corn gluten feed. Contains not more than 8½ per cent crude fiber, and not less than 1½ per cent fat and 24 per cent protein. Registered in 1916 and 1917.	Two official samples. Both over one per cent below guaranty in protein and over ½ per cent high in fiber; in accord with guaranty in fat.
Clinton Corn Gluten Feed. Clinton Sugar Refining Co., Clinton, Iowa. Corn gluten feed. Contains not more than 8 per cent crude fiber, and not less than 3 per cent fat and 23 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Diamond Corn Gluten Meal. Corn Products Refining Co., New York. Corn gluten meal. Contains not more than 4 per cent crude fiber, and not less than 1 per cent fat and 40 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat.
Buffalo Corn Gluten Feed. Corn Products Refining Co., New York. Corn gluten feed. Contains not more than 8.5 per cent crude fiber, and not less than 1 per cent fat and 23 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein. The two examined, in accord in fiber and fat. Two dealers' samples. Both in accord with guaranty in protein; not examined for fiber and fat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Crescent Corn Gluten Feed. Corn Products Refining Co., New York. Corn gluten feed. Contains not more than 8.5 per cent crude fiber, and not less than 1 per cent fat and 23 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
Globe Corn Gluten Feed. Corn Products Refining Co., New York. Corn gluten feed. Contains not more than 8.5 per cent crude fiber, and not less than 1 per cent fat and 23 per cent protein.	One official sample. In accord with guaranty in all respects.
Argo Corn Oil Cake Meal. Corn Products Refining Co., New York. Corn oil cake meal. Contains not more than 13 per cent crude fiber, and not less than 7 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Douglas Corn Gluten Feed. Douglas Co., Cedar Rapids, Iowa. Corn gluten feed. Contains not more than 8 per cent crude fiber, and not less than 1 per cent fat and 23 per cent protein. Registered in 1916 and 1917.	Five official samples. All in accord with guaranty in protein. The two examined, in accord in fat; one in accord in fiber, the other, nearly one per cent high.
KKK Corn Gluten Feed. J. C. Hubinger Bros. Co., Keokuk, Iowa. Corn starch by-product with corn solubles. Contains not more than 7.5 per cent crude fiber, and not less than 2.4 per cent fat and 23 per cent protein. Registered in 1916 and 1917.	One official sample. Slightly below guaranty in protein; in accord in fiber and fat.
Jenks Corn Gluten Feed. Huron Milling Co., Harbor Beach, Mich. Corn starch by-product with corn bran. Contains not more than 8 per cent crude fiber, and not less than 3 per cent fat and 22 per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat.
Staley's Corn Gluten Feed. A. E. Staley Mfg. Co., Decatur, Ill. Composed of corn bran, corn gluten concentrated steep water, germ oil meal. Contains not more than 12 per cent crude fiber, and not less than 2½ per cent fat and 23 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

BREWERS' GRAINS AND DISTILLERS' GRAINS.

Atlas Distillers' Grains. Atlas Feed & Milling Co., Peoria, Ill. Composed of corn, oats, barley, rye. Contains not more than 14 per cent crude fiber, and not less than 8 per cent fat and 30 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber but nearly one per cent below in fat. No weed seeds found, except a few hulls of wild buckwheat in one sample.
Ajax Flakes. Manufactured by Chapin & Co., Hammond, Ind., for Ajax Milling & Feed Co., New York. Corn distillers' grains. Contains not more than 14 per cent crude fiber, and not less than 10 per cent fat and 30 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Continental Gluten Feed. Continental Cereal Co., Peoria, Ill. A distillery by-product manufactured from corn, oats, rye and barley. Contains not more than 10 per cent crude fiber, and not less than 10 per cent fat and 29 per cent protein. Registered in 1916 and 1917.	One official sample. Eight-tenths per cent below guaranty in protein; slightly high in fiber; in accord with guaranty in fat. No weed seeds found. Two dealers' samples. One in accord and the other practically in accord with guaranty in protein. Not examined for fiber and fat.
Eagle Three D Grains. (Registered in 1916 as Corn Three D Grains). Dewey Bros. Co., Blanchester, O. Distillers dried grains principally from corn. On 1916 certificate: Contains not more than 13 per cent crude fiber, and not less than 9 per cent fat and 26 per cent protein. On 1917 certificate: Contains not more than 13 per cent crude fiber, and not less than 10 per cent fat and 30 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Bull Brand Dried Brewers Grains. Farmers Feed Co., N. Y. City and Buffalo, N. Y. Composed of corn, rice, grits and malt. Contains not more than 15.2 per cent crude fiber, and not less than 6.3 per cent fat and 27.2 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Columbia Corn Distillers Grains. Grain Products Sales Co., Buffalo, N. Y. No certificate filed. Claims on package: Contains not more than 11 per cent crude fiber, and not less than 12 per cent fat and 30 per cent protein. Unregistered.	Four official samples. Two practically in accord with guaranty in protein; one two per cent and one three per cent below. The three examined, in accord with guaranty in fiber and fat. No weed seeds found, except a few hulls of wild buckwheat in one sample.
Hector Distillers Dried Grains. The Hottelet Co., Milwaukee, Wis. Distillers dried grains are the dried residue from cereals obtained in the manufacture of alcohol and distilled liquors, corn predominating. Contains not more than 14 per cent crude fiber, and not less than 10 per cent fat and 30 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the two examined, in accord in fiber and fat. No weed seeds found, except a few hulls of wild buckwheat in one sample.
Columbia Corn Distillers Grains. Industrial Distilling Co., Waterloo, N. Y. Mostly corn grains, small per cent rye and barley. Contains not more than 14 per cent crude fiber, and not less than 10 per cent fat and 30 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
"Golders Kalb" Brewers Dried Grains. K. & E. Neumond, Inc., St. Louis, Mo. Composed of malted barley, rice and corn grits. Contains not more than 13 per cent crude fiber, and not less than 6 per cent fat and 24 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Alco Flakes. Chas. F. Riordon, Boston, Mass. No certificate filed. Claims on package: Contains not more than 14 per cent crude fiber, and not less than 10 per cent fat and 30 per cent protein. Unregistered.	One official sample. Protein 3¼ per cent below guaranty. Fiber and fat as claimed. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Big Three Feed. Stanley, Harlow, Hamlin, Inc., Charlestown, Mass. Composed of corn distillers grains, barley malt grains and rye distillers grains. Contains not more than 16 per cent crude fiber, and not less than 10 per cent fat and 25 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat.
Fourex (XXXX) Corn Distillers Dried Grains. Ubiko Milling Co., Cincinnati, O. Contains not more than 13 per cent crude fiber, and not less than 12 per cent fat and 31 per cent protein. Registered in 1916 and 1917.	Five official samples. Only one was in accord with guaranty in protein, the others being from 2 to 6½ per cent below. The three examined for fiber and fat were found in accord with guaranty in fiber and two were in accord in fat; the other was over one per cent below. No weed seeds were found. One dealer's sample. Nearly 5 per cent below guaranty in protein; not examined for fiber and fat.
DRIED BEET PULP.	
Dried Beet Pulp. The Hottelet Co., Milwaukee, Wis. No certificate filed. Claims on package: Contains not more than 20 per cent crude fiber, and not less than 0.5 per cent fat and 8 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects.
Dried Beet Pulp. Larrowe Milling Co., Detroit, Mich. Residue of sugar beets dried after extraction of sugar. Contains not more than 20 per cent crude fiber, and not less than ½ of 1 per cent fat and 8 per cent protein. Registered in 1916 and 1917.	Two official samples. In accord with guaranty in all respects except that one was slightly high in fiber.
Dried Beet Pulp. Chas. Pope, Riverdale, Ill. Composed only of residue of sugar beets dried after extraction of sugar. Contains not more than 20 per cent crude fiber, and not less than ½ per cent fat and 8 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
BRAN, MIDDLINGS, MIXED FEED, RED DOG FLOUR. (Wheat and Rye)	
Acme Feed. Acme-Evans Co., Indianapolis, Ind. Composed of wheat bran, wheat middlings, and not exceeding mill run of ground cleaned wheat screenings. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. (1916 certificate gives 16.5 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
Standard Wheat Middlings with ground screenings not exceeding mill run. Atlas Flour Mills, Milwaukee, Wis. No certificate filed. Claims on package: Contains not more than 10.5 per cent crude fiber, and not less than 3.5 per cent fat and 13.5 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Trojan Bran. The Allen & Wheeler Co., Troy, O. Pure offal from wheat. Contains not more than 9.5 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein . Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some hulls of corn cockle.
Trojan Middlings. The Allen & Wheeler Co., Troy, O. Pure offal from wheat, screenings not exceeding mill run. Contains not more than 6 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Trojan Mixed Feed. The Allen & Wheeler Co., Troy, O. Pure offal from wheat, screenings not exceeding mill run. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some hulls of corn cockle.
Bran. Ansted & Burk Co., Springfield, O. Composed of wheat bran with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 11½ per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 12½ per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	Two official samples. In accord with 1917 guaranty (which they carried) in all respects. Both contained a few hulls of corn cockle, etc.
Middlings. Ansted & Burk Co., Springfield, O. Composed of wheat middlings with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 7½ per cent crude fiber, and not less than 4 per cent fat and 14½ per cent protein. On 1917 certificate: Contains not more than 5½ per cent crude fiber, and not less than 5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranties (which it carried) in protein and fat; one per cent high in fiber. Contained a few hulls of wild buckwheat.
Mixed Feed. Ansted & Burk Co., Springfield, O. Composed of wheat bran and middlings mixed with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 11½ per cent crude fiber, and not less than 3½ per cent fat and 14½ per cent protein. On 1917 certificate: Contains not more than 8½ per cent crude fiber, and not less than 4½ per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranties (which it carried) in all respects. Contained a few hulls of corn cockle and wild buckwheat.
Standard Middlings with Screenings. Atkinson Milling Co., Minneapolis, Minn. Composed of wheat and wheat screenings, not exceeding mill run. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 14 per cent protein. Not registered in 1916. Registered in 1917.	Two official samples. In accord with guaranty in all respects. Both contained a few weed seeds including night-flowering catchfly, etc.
Bran Flakes, Barber Milling Co., Minneapolis, Minn. Pure wheat. On 1916 certificate: Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. On 1917 certificate: Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Star Middlings. Barber Miling Co., Minneapolis, Minn. Pure wheat. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
White Middlings. Barber Milling Co., Minneapolis, Minn. Pure wheat. Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 17 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Fancy Low Grade. Barber Milling Co., Minneapolis, Minn. Pure wheat. Contains not more than 4 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. (1916 certificate gives 5 per cent fat and 18 per cent protein as minimum guaranties). Registered in 1916 and 1917.	No dealers' or official samples received.
White Satin Mixed Feed. Barber Milling Co., Minneapolis, Minn. Pure wheat. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
"Winona" Coarse Wheat Bran. Bay State Milling Co., Winona, Minn. Pure wheat product. On 1916 certificate: Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. On 191 certificate: Contains not more than 12 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
"Winona" Wheat Middlings & Wheat Screenings. Bay State Milling Co. ,Winona, Minn. Pure wheat product and less than 8 per cent ground screenings from wheat. Contains not more than 8 per cent crude fiber, and not less than 5 per cent fat and 16 per cent protein. (1916 certificate gives 15 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
"Winona" Fancy White Flour Middlings. Bay State Milling Co., Winona, Minn. Pure wheat product. On 1916 certificate: Contains not more than 2.5 per cent crude fiber, and not less than 5 per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 2.5 per cent crude fiber, and not less than 4.5 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Reddog Flour. Bay State Milling Co.,Winona, Minn. Pure wheat product. On 1916 certificate: Contains not more than 2 per cent crude fiber, and not less than 5 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 2 per cent crude fiber, and not less than 4.5 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	Two official samples, both unlawful in that they carried different guaranties from those filed in the certificate. Both were in accord with the package guaranty in protein but three-fourths and one per cent respectively below the registered guaranty. The one examined was in accord with guaranty in fiber but one per cent below the registered guaranty and 1½ per cent below the package guaranty in fat. Not examined for weed seeds.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
"Winona" Fancy Mixed Wheat Feed & Whea Screenings. Bay State Milling Co., Winona, Minn. Composed of mill run of wheat bean, middlings and reddog flour, and less than 6 per cent ground screenings from wheat. On 1916 certificate: Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 8 per cent crude fiber, and not less than 4.5 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Middlings. Christian Breisch & Co., Lansing, Mich. Contains not more than 4.13 per cent crude fiber, and not less than 14.96 per cent protein. Ash 4.21 per cent, ether extract 5.25 per cent, nitrogen-free extract 61.23 per cent. Registered in 1916 and 1917.	No dealers' or official samples received.
Mixed Feed, Ground Screenings not to exceed mill run. Christian Breisch & Co., Lansing, Mich. Contains not more than 7.06 per cent crude fiber, and not less than 14.61 per cent protein. Ash 12.07 per cent, ether extract 3.63 per cent, protein 57.19 per cent. Registered in 1916 and 1917.	Two official samples, one unlawful in that it carried different guaranties from those filed in the certificate. Both were three-fourths per cent below the registered guaranty in protein; one was slightly high and the other 1½ per cent high in fiber; both were in accord with guaranty in fat. One contained a few seeds and one a few hulls of various weeds.
Flour Middlings. Buffalo Cereal Co., Buffalo, N.Y. With not to exceed mill run ground screenings. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Commander Bran with ground screenings not exceeding mill run. Commander Mill Co., Minneapolis, Minn. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed.
Wheat Bran with ground screenings. Commercial Milling Co., Detroit, Mich. Wheat bran with ground screenings not exceeding mill run Contains not more than 12 per cent crude fiber, and not less than 3.5 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Standard Wheat Middlings. Commercial Milling Co., Detroit, Mich. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 10 per cent crude fiber, and not less than 4.5 per cent fat and 13.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Wheat Fine Middlings. Commercial Milling Co., Detroit, Mich. Wheat middlings with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 6 per cent crude fiber, and not less than 7 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 8.5 per cent crude fibe and not less than 5 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wheat Mixed Feed. Commercial Milling Co., Detroit, Mich. Wheat feed with ground screenings not exceeding mill run. Contains not more than 11 per cent crude fiber, and not less than 4.5 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat.
Henkel's Fine White Feed. Commercial Milling Co., Detroit, Mich. Wheat and rye middlings with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 6 per cent crude fiber, and not less than 7 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1916 guaranty (which it carried) in all respects. Not examined for weed seeds.
Wheat Bran. Wm. A. Coombs Milling Co., Coldwater, Mich. Wheat bran with ground screenings not exceeding mill run. Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. Nearly one per cent below guaranty in protein; one-half per cent high in fiber; in accord with guaranty in fat. Contained a few hulls of corn cockle and wild buckwheat.
Wheat Middlings. Wm. A. Coombs Milling Co., Coldwater, Mich. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Wheat Mixed Feed. Wm. A. Coombs Milling Co., Coldwater, Michigan. Wheat mixed feed with ground screenings not exceeding mill run. Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Dudley Wheat Bran with ground screenings not exceeding mill run. Chas. M. Cox Co., Boston, Mass. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 15.5 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. One per cent below guaranty in protein; nearly 3 per cent high in fiber; in accord with guaranty in fat. Contained a few seeds of pigweed and mustard.
Monogram Fancy Bran. Chas. M. Cox Co., Boston, Mass. Wheat bran. (On 1916 certificate: Wheat bran, ground screenings not exceeding mill run). Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. Over two per cent high in fiber; in accord with guaranty in protein and fat. Contained a few hulls of wild buckwheat.
Wirthmore Middlings. Chas. M. Cox Co., Boston, Mass. Composed of wheat middlings and reddog flour with less than mill run of screenings. Contains not more than 7 per cent crude fiber, and not less than 4 per cent fat and 14½ per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Wirthmore Wheat Feed. Chas. M. Cox Co., Boston, Mass. Composed of wheat bran, reddog flour, less than mill run of screenings. Contains not more than 7 per cent crude fiber, and not less than 4½ per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. Nearly one per cent high in fiber; in accord with guaranty in protein and fat. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wheat Standard Middlings with Ground Screenings not Exceeding Mill Run. William G. Crocker, Minneapolis, Minn., and Buffalo, N. Y. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle and wild buckwheat.
Duluth Imperial Bran. Duluth-Superior Milling Co., Duluth, Minn. Wheat bran and not exceeding mill run ground screenings. Contains not more than 11.9 per cent crude fiber, and not less than 3.75 per cent fat and 14.5 per cent protein. (1916 certificate gives 12.25 per cent as maximum crude fiber guaranty. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed.
S Standard Middlings. Duluth-Superior Milling Co., Duluth, Minn. Wheat middlings and not exceeding mill run ground screenings. On 1916 certificate: Contains not more than 7.75 per cent crude fiber, and not less than 4.75 per cent fat and 16.5 per cent protein. On 1917 certificate: Contains not more than 8.1 per cent crude fiber, and not less than 4.7 per cent fat and 16.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1916 guaranty (which it carried) in all respects. Not examined for weed seeds.
Flour Middlings. Duluth-Superior Milling Co., Duluth, Minn. Contains not more than 7 per cent crude fiber, and not less than 5 per cent fat and 16.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Dog Flour. Duluth-Superior Milling Co., Duluth, Minn. On 1916 certificate: Contains not more than 3 per cent crude fiber, and not less than 4.25 per cent fat and 16.75 per cent protein. On 1917 certificate: Contains not more than 3.1 per cent crude fiber, and not less than 4.25 per cent fat and 16.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1916 guaranty (which it carried) in all respects. Not examined for weed seeds.
Boston Mixed Feed. Duluth-Superior Milling Co., Duluth, Minn. Composed of bran, middlings, red dog flour and not exceeding mill run ground screenings. On 1916 certificate: Contains not more than 9.75 per cent crude fiber, and not less than 4.25 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 9.75 per cent crude fiber, and not less than 4.5 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	Three official samples. In accord with 1917 guaranty (which they carried) in all respects. Varied from no weed seeds to a few seeds of mustard.
Wheat Bran with ground screenings not exceeding mill run. Duluth Universal Milling Co. No certificate filed. Claims on package: Contains not more than 12.3 per cent crude fiber, and not less than 4.6 per cent fat and 14.6 per cent protein. Unregistered.	One official sample. One per cent below protein guaranty; in accord with fiber and fat guaranty. Contained many hulls of wild buckwheat and some of corn cockle.
Bran. Eldred Mill Co., Jackson, Mich. Wheat offal without ground screenings. Contains not more than 9.24 per cent crude fiber, and not less than 4.97 per cent fat and 16.19 per cent protein. Registered in 1916 and 1917.	One official sample. Over one per cent below guaranty in protein; in accord with guaranty in fiber and fat. Contained some hulls of corn cockle.
Middlings. Eldred Mill Co., Jackson, Mich. Wheat offal without ground screenings. Contains not more than 6.74 per cent crude fiber, and not less than 6.2 per cent fat and 16.93 per cent protein. Registered in 1916 and 1917.	One official sample. Unlawful in that guaranties on package differed from those filed in certificate. Over one per cent below registered guaranty in protein and over 1½ per cent below in fat; in accord with guaranty in fiber. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Elmore Flour Middlings. Elmore Milling Co., Oneonta, N. Y. Low grade wheat flour—wheat middlings. Contains not more than 5 per cent crude fiber, and not less than 4.25 per cent fat and 16.5 per cent protein. Registered in 1916 and 1917.	One official sample. Over 2½ per cent high in fiber; in accord with guaranty in protein and fat. Contained a few hulls of wild buckwheat.
Elmore Snow Middlings. Elmore Milling Co., Oneonta, N. Y. Low grade wheat flour—wheat middlings. Contains not more than 4.5 per cent crude fiber, and not less than 4.25 per cent fat and 17 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pure Mill Feed. Eldred Mill Co., Jackson, Mich. Straight offal run of a flour mill and contains no ground screenings or receiving separator dust. Contains not more than 9.62 per cent crude fiber, and not less than 4.37 per cent fat and 14.57 per cent protein. Registered in 1916 and 1917.	Two official samples. One unlawful in that guaranties on package differed from those filed in certificate. Both in accord with registered guaranty in protein; the one examined, in accord in fiber and fat. Both contained a few hulls of corn cockle.
E-A-CO Wheat Bran. Everett, Aughenbaugh & Co., Waseca, Minn. Wheat bran and ground screenings not to exceed mill run. On 1916 certificate: Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 14 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
E-A-CO Wheat Middlings. Everett, Aughenbaugh & Co., Waseca, Minn. Standard and flour middlings and ground screenings not to exceed mill run. On 1916 certificate: Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 15 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
E-A-CO Wheat Middlings. Everett, Aughenbaugh & Co., Waseca, Minn. Standard and flour middlings and ground screenings not to exceed mill run. On 1916 certificate: Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 15 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
E-A-CO Mixed Feed. Everett, Aughenbaugh & Co., Waseca, Minn. Wheat bran and middlings and ground screenings not to exceed mill run. On 1916 certificate: Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. On 1917 certificate: Contains not more than 15 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Dairy Maid Winter Wheat Bran with Ground Screenings Not Exceeding Mill Run. Federal Milling Co., Lockport, N. Y. Winter wheat offal with ground screenings not exceeding mill run. Contains not more than 14 per cent crude fiber, and not less than 2 per cent fat and 13 per cent protein. (1916 certificate gives 2.5 per cent as minimum fat guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of chess, lady's thumb, and mustard.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Lucky Spring Wheat Bran with Ground Screenings Not Exceeding Mill Run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 14 per cent crude fiber, and not less than 2.5 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of mustard, pigweed and various other weeds.
Dairy Maid Winter Wheat Middlings with Ground Screenings Not Exceeding Mill Run. Federal Milling Co., Lockport, N. Y. Winter wheat offal with ground screenings not exceeding mill run. Contains not more than 8.5 per cent crude fiber, and not less than 2.25 per cent fat and 13.5 per cent protein. (1916 certificate gives 3.5 per cent as minimum fat guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of night-flowering catch-fly and pigweed.
Lucky Spring Wheat Flour Middlings with Ground Screenings Not Exceeding Mill Run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 10 per cent crude fiber, and not less than 3.5 per cent fat and 14 per cent protein. (1916 certificate gives 8.5 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed.
Sphinx Fancy Spring Wheat Flour Middlings with Ground Screenings Not Exceeding Mill Run. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 8 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. (1916 certificate gives 3.5 per cent as minimum fat guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Kennel Club Flour. Federal Milling Co., Lockport, N. Y. Second clear wheat flour. Contains not more than 1 per cent crude fiber, and not less than 2 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Dairy Maid Winter Wheat Mixed Feed, with Ground Screenings not Exceeding Mill Run. Federal Milling Co., Lockport, N. Y. Winter wheat offal with ground screenings not exceeding mill run. Contains not more than 11 per cent crude fiber, and not less than 2.25 per cent fat and 13.5 per cent protein. (1916 certificate gives 3 per cent as minimum fat guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of chess, quack grass, and corn cockle.
Lucky Spring Wheat Mixed Feed with Ground Screenings Not Exceeding Mill Run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 11 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of wild buckwheat, mustard, pigweed, and green foxtail.
Sphinx Fancy Spring Wheat Mixed Feed with Ground Screenings Not Exceeding Mill Run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 11 per cent crude fiber, and not less than 3 per cent fat and 13.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Bran. Goshen Milling Co., Goshen, Ind. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle.
Wheat Middlings. Goshen Milling Co., Goshen, Ind. Contains not more than 7 per cent crude fiber, and not less than 3.2 per cent fat and 13.5 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Improved Grafton Wheat Feed. (Registered in 1916 as Grafton Wheat Feed). Grafton Roller Mill Co., Grafton, N. Dak. Wheat products. On 1916 certificate: Contains not more than 9.3 per cent crude fiber, and not less than 4.5 per cent fat and 15.4 per cent protein. On 1917 certificate: Contains not more than 8.4 per cent crude fiber, and not less than 2.7 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	Two official samples. Both practically in accord with 1916 guaranty (which they carried) in protein; the one examined, in accord in fiber and fat. One contained a few seeds of mustard; both a few hulls of corn cockle.
Groton Milling Co. Bran, Groton, So. Dakota. Jaquith, Parker, Smith & Co., Boston, Mass. Wheat bran mill run. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. One-half per cent below guaranty in protein in accord with guaranty in fiber and fat. Contained some seeds of various weeds including yellow foxtail and wild buckwheat.
Wheat Bran with screenings not exceeding mill run. Gwinn Milling Co., Columbus, O. Contains not more than 10 per cent crude fiber. and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. Nearly one per cent below guaranty in protein; in accord with guaranty in fiber and fat. Contained a few hulls of corn cockle and wild buckwheat.
Wheat Middlings with screenings not exceeding mill run. Gwinn Milling Co., Columbus, O Contains not more than 7.5 per cent crude fiber. and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle and wild buckwheat.
Dairy Feed with screenings not exceeding mill run. Gwinn Milling Co., Columbus, O. Bran and middlings with screenings not exceeding mill run. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some hulls of corn cockle.
Acme Mixed Feed. Jonathan Hale & Sons, Ionia. Mich. Mill run bran and middlings mixed and ground screenings not exceeding mill run. Contains not more than 7.9 per cent crude fiber. and not less than 3.45 per cent fat and 13.65 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of chess and mustard.
Choice Wheat Bran with Trace of Screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. On 1916 certificate: Contains not more than 11.5 per cent crude fiber, and not less than 4.25 per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 12.5 per cent crude fiber, and not less than 3 per cent fat and 13.75 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1916 guaranty (which it carried) in all respects. Contained some hulls of corn cockle and wild buckwheat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Standard Middlings with Mill Run Screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. On 1916 certificate: Contains not more than 8.5 per cent crude fiber, and not less than 6 per cent fat and 16.5 per cent protein. On 1917 certificate: Contains not more than 9.25 per cent crude fiber, and not less than 4.75 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Fancy White Middlings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. On 1916 certificate: Contains not more than 5.5 per cent crude fiber, and not less than 5 per cent fat and 16.75 per cent protein. On 1917 certificate: Contains not more than 5.85 per cent crude fiber, and not less than 4.75 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Dog. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. On 1916 certificate: Contains not more than 5 per cent crude fiber, and not less than 4.5 per cent fat and 16.75 per cent protein. On 1917 certificate: Contains not more than 5.5 per cent crude fiber, and not less than 4 per cent fat and 16.25 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1916 guaranty (which it carried) in all respects. Not examined for weed seeds.
Mixed Feed with Mill Run Screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. On 1916 certificate: Contains not more than 9.25 per cent crude fiber, and not less than 5.25 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 11.5 per cent crude fiber, and not less than 3.75 per cent fat and 14.75 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Wheat Bran (with screenings not exceeding mill run). Highland Milling Co., Highland, Ill. Contains not more than 10 per cent crude fiber, and not less than 3.55 per cent fat and 14.3 per cent protein. Registered in 1916 and 1917.	One official sample. One per cent high in fiber; in accord with guaranty in protein and fat. Not examined for weed seeds.
White Wheat Middlings. Highland Milling Co., Highland, Ill. Offal from the wheat milling operation, ground up and which is not put into bran, also called "shorts" at times among the trade. Contains not more than 6 per cent crude fiber, and not less than 4 per cent fat and 15.75 protein. (1916 certificate gives 15 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
Wheat Bran and Middlings run together, with screenings not exceeding mill run (known in the trade as Mixed Feed). Highland Milling Co., Highland, Ill. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle.
Jersey Cow Feed. Houlton Mills & Light Co., Houlton, Me. Composed of corn, wheat bran, buckwheat, cottonseed meal and wheat screenings. Contains not more than 16 per cent crude fiber, and not less than 5 per cent fat and 17 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Flaky Bran with screenings. Hubbard Milling Co. No certificate filed. Claims on package: Contains not more than 12.5 per cent crude fiber, and not less than 3 per cent fat and 13 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects. Contained a few seeds of wild buckwheat and lady's thumb.
Jenks White Middlings. Huron Milling Co., Harbor Beach, Mich. Wheat middlings. On 1916 certificate: Contains not more than 3½ per cent crude fiber, and not less than 2½ per cent fat and 13 per cent protein. On 1917 certificate: Contains not more than 2½ per cent crude fiber, and not less than 3½ per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Jenks Mixed Feed. Huron Milling Co., Harbor Beach, Mich. Wheat bran with ground screenings not to exceed mill run. On 1916 certificate: Contains not more than 5.85 per cent crude fiber, and not less than 4 per cent fat and 15.5 per cent protein. On 1917 certificate: Contains not more than 11.5 per cent crude fiber, and not less than 3.5 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	Two official samples, both unlawful in that guaranties on package did not agree with those filed in certificate. Both were practically in accord with 1917 guaranties. Both contained a few seeds of corn cockle and one contained some seeds of chess.
Blue Tag Mixed Feed. F. W. Kelley Co., St. Johnsbury, Vt. A mixture of wheat bran and red dog and may contain not more than mill run of ground screenings. Contains not more than 7½ per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. One per cent high in fiber; in accord with guaranty in fat and practically in accord in protein. Not examined for weed seeds.
Anchor Bran with Ground Wheat Screenings not Exceeding Mill Run. Kemper Mill & Elevator Co., Kansas City, Mo. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; slightly high in fiber. No weed seeds found.
Anchor Pure Bran. Kemper Mill & Elevator Co., Kansas City, Mo. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with guaranty in protein; the one examined, in accord in fat and slightlly high in fiber. No weed seeds found in any sample.
Diamond K Bran with Ground Wheat Screenings not Exceeding Mill Run. Kemper Mill & Elevator Co., Kansas City, Mo. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of chess and corn cockle.
Crescent Mixed Feed with Ground Screenings Not Exceeding Mill Run. Kemper Mill & Elevator Co., Kansas City, Mo. Composed of bran, middlings and ground wheat screenings. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of pigweed and other weeds.
Pyramid Mixed Feed. Kimball Bros. Co., Bath, Me. Contains not more than 8.47 per cent crude fiber, and not less than 3.58 per cent ether extract and 13.56 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Both contained a few hulls of corn cockle.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Badger Fancy Middlings. Chas. A. Krause Milling Co., Milwaukee, Wis. Made from Maizo reddog flour and wheat middlings with ground screenings not exceeding mill run. Contains not more than 7 per cent crude fiber, and not less than 4½ per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Badger Fancy Mixed Feed. Chas. A. Krause Milling Co., Milwaukee, Wis. Made from Maizo reddog flour and wheat bran with ground screenings not exceeding mill run. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 12½ per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
"Snowflake" Bran. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Pure wheat product. Contains not more than 9.5 per cent crude fiber, and not less than 3.8 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
"Snowflake" Middlings. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Pure wheat product. Contains not more than 6 per cent crude fiber, and not less than 5.1 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fat but one per cent high in fiber. No weed seeds found.
"Snowflake" Mixed Feed. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. On 1916 certificate: Wheat bran and middlings with ground screenings not exceeding mill run. On 1917 certificate: Pure wheat bran and middlings—contains no screenings. Contains not more than 8 per cent crude fiber, and not less than 4.3 per cent fat and 15.2 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fat but three-fourths per cent high in fiber. Both contained a few hulls of wild buckwheat and corn cockle.
Perfection Roller Mills Winter Wheat Bran. John C. Liken & Co., Sebewaing, Mich. On 1916 certificate: Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. On 1917 certificate: Contains not more than 12 per cent crude fiber, and not less than 3.5 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Perfection Roller Mills Winter Wheat Middlings. John C. Liken & Co., Sebewaing, Mich. Contains not more than 8 per cent crude fiber, and not less than 4.5 per cent fat and 13.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Elmco Bran. Listman Mill Co., La Crosse, Wis. Pure wheat. On 1916 certificate: Contains not more than 11.37 per cent crude fiber, and not less than 3.63 per cent fat and 15.51 per cent protein. On 1917 certificate: Contains not more than 12.27 per cent crude fiber, and not less than 3.31 per cent fat and 14.87 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein and fat; the one examined, in accord in fiber. Both contained a few hulls of corn cockle.
Elmco Standard Middlings. Listman Mill Co., La Crosse, Wis. Pure wheat with screenings. Contains not more than 9.59 per cent crude fiber, and not less than 5.11 per cent fat and 17.7 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Elmco Reddog. Listman Mill Co., La Crosse. Wis. Pure wheat. On 1916 certificate: Contains not more than .93 per cent crude fiber. and not less than 3.57 per cent fat and 15.91 per cent protein. On 1917 certificate: Contains not more than 1.9 per cent crude fiber, and not less than 4.02 per cent fat and 16.70 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Waseo Bran. Lyon & Greenleaf Co., Wauseon O. Wheat bran. Contains not more than 9.5 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Waseo Middlings. Lyon & Greenleaf Co., Wauseon, O. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 6 per cent crude fiber, and not less than 4 per cent fat and 17 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Waseo Mixed Feed. Lyon & Greenleaf Co., Wauseon, O. Wheat bran and middlings with ground screenings not exceeding mill run. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Wheat Bran and ground screenings not exceeding mill run. Maney Milling Co., Omaha, Nebr. No certificate filed. Claims on package: Contains not more than 10.5 per cent crude fiber, and not less than 4.25 per cent fat and 14 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat.
Triangle Fancy Bran. Mansfield Milling Co., Inc., Mansfield, O. Wheat bran and screenings not exceeding mill run. Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of various weeds, including chess, pigweed, etc.
Triangle Midlings. Mansfield Milling Co., Inc., Mansfield, O. Wheat middlings and screenings not exceeding mill run. Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed and mustard.
Triangle Mill Run. Mansfield Milling Co., Mansfield, O. Wheat mill run and screenings not exceeding mill run. Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat.
Brooks Fancy Mixed Feed. A. H. McLeod Milling Co., St. Johnsbury, Vt. Composed of reddog and bran. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of penny cress.
Wheat Bran with Screenings not Exceeding Mill Run. National Feed Co., St. Louis, Mo. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Not registered in 1916. Registered in 1917.	Two official samples. In accord with guaranty in all respects. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Seal of Minnesota Bran. New Prague Flouring Mill Co., New Prague, Minn. Wheat bran with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 10.5 per cent crude fiber, and not less than 4.5 per cent fat and 13.1 per cent protein. On 1917 certificate: Contains not more than 11.25 per cent crude fiber, and not less than 3 per cent fat and 13.3 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; one was examined for fiber and fat and found in accord with guaranty. Both contained hulls of wild buckwheat and corn cockle; one contained a few seeds of green foxtail.
Seal of Minnesota Standard Middlings. New Prague Flouring Mill Co., New Prague, Minn. On 1916 certificate: Contains not more than 6 per cent crude fiber, and not less than 6 per cent fat and 13.5 per cent protein. On 1917 certificate: Contains not more than 7 per cent crude fiber, and not less than 5.25 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
N. M. Co.'s Wheat Bran and Screenings. Noblesville Milling Co., Noblesville, Ind. Wheat bran and screenings not exceeding mill run. Contains not more than 8 per cent crude fiber, and not less than 3.7 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; two, examined for fiber and fat, were found in accord with guaranty. The only one examined for weed seeds contained a few hulls of corn cockle and wild buckwheat.
N. M. Co.'s Middlings. Noblesville Milling Co., Noblesvile, Ind. Wheat middlings and ground screenings not exceeding mill run. Contains not more than 7 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
N. M. Co.'s Mixed Feed. Noblesville Milling Co., Noblesville, Ind. Composed of wheat bran, middlings, and ground wheat screenings not exceeding mill run. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	Five official samples. Two were in accord with guaranty in protein; the other three were from one-tenth to six-tenths per cent below. All were in accord with guaranty in fat; all examined were in accord in fiber. All contained a few hulls of corn cockle; one contained a few seeds of chess.
Pure Wheat Bran. Northwestern Consolidated Milling Co., Minneapolis, Minn. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	One official sample. Seven-tenths per cent below guaranty in protein; in accord in fiber and fat Contained some hulls of corn cockle.
Wheat Standard Middlings with Ground Screenings not Exceeding Mill Run. Northwestern Consolidated Milling Co., Minneapolis, Minn. Contains not more than 11 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Not examined for weed seeds.
Wheat Flour Middlings with Ground Screenings not Exceeding Mill Run. Northwestern Consolidated Milling Co., Minneapolis Minn. Contains not more than 6 per cent crude fiber, and not less than 4.5 per cent fat and 15.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wheat Mixed Feed composed of wheat bran, flour middlings and ground screenings not exceeding mill run. Northwestern Consolidated Milling Co., Minneapolis, Minn. Contains not more than 10 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Planet Feed. Northwestern Consolidated Milling Co., Minneapolis, Minn. Wheat bran and reddog flour. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
XXX Comet. Northwestern Consolidated Milling Co., Minneapolis, Minn. Reddog flour. Contains not more than 3 per cent crude fiber, and not less than 4 per cent fat and 16.5 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fat but six-tenths per cent high in fiber. Not examined for weed seeds.
Pillsbury's Wheat Bran with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Both contained some hulls of wild buckwheat and corn cockle; one contained a few seeds of pigweed.
Pillsbury's Durum Wheat Bran with ground screenings not exceeding mill run. Contains not more than 14 per cent crude fiber, and not less than 4 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pillsbury's Wheat "A" Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Composed of wheat shorts, reddog and ground screenings. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Pillsbury's Wheat Standard "B" Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Pillsbury's Durum Wheat Standard "B" Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 12.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of green foxtail and a few hulls of wild buckwheat and mustard.
Pillsbury's Rye Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Contains not more than 9 per cent crude fiber, and not less than 3.5 per cent fat and 15 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Pillsbury's Fancy Wheat Mixed Feed with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Composed of wheat bran, reddog and ground screenings. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat and corn cockle.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Pillsbury's XX Daisy. Pillsbury Flour Mills Co., Minneapolis, Minn. Low-grade wheat flour. Contains not more than 4 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Not examined for weed seeds.
Champion Mixed Feed with ground screenings not exceeding mill run. Portland Milling Co., Portland, Mich. Contains not more than 8.47 per cent crude fiber, and not less than 3.58 per cent fat and 13.56 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. One contained a few seeds of chess; the other, some of chess and a few of corn cockle.
Winter Wheat Bran (with screenings not to exceed mill run). Quaker City Flour Mills Co., Philadelphia, Pa. Contains not more than 10½ per cent crude fiber and not less than 3 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some hulls of corn cockle.
Winter Wheat Middlings (with screenings not to exceed mill run). Quaker City Flour Mills Co., Philadelphia, Pa. Contains not more than 5½ per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Bell Cow Bran. Quaker Oats Co., Chicago, Ill. Wheat bran with ground screenings not to exceed mill run. Contains not more than 7.6 per cent crude fiber, and not less than 5.5 per cent fat and 15.3 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Buckeye Feed. Quaker Oats Co., Chicago, Ill. Wheat mixed feed with ground screenings not exceeding mill run, and rye shorts. Contains not more than 8.5 per cent crude fiber, and not less than 4.5 per cent fat and 15.5 per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with guaranty in protein; the two examined, in accord in fat but nearly one per cent high in fiber. All contained some seeds of various weeds, including mustard, pigweed, etc.
Royal Bran. Royal Milling Co., Great Falls, Mont. Wheat bran with screenings not to exceed mill run. Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat and corn cockle.
Royal Mixed Feed. Royal Milling Co., Great Falls, Mont. Bran and standard middlings with screenings not to exceed mill run. Contains not more than 8 per cent crude fiber, and not less than 3.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Both contained a few hulls of wild buckwheat; one contained in addition a few seeds of mustard, wild buckwheat and apetalous peppergrass.
Bran. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Standard Middlings. Russell-Miller Milling Co., Minneapolis, Minn. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Flour Middlings. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Occident Wheat Feed. Russel-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 10 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the two examined, in accord in fiber and fat. Contained a few hulls of corn cockle and wild buckwheat. One dealers' sample. In accord with guaranty in protein; not examined for fiber and fat.
Red Dog Flour. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 6 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. (1916 certificate gives 16 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
Snowball Wheat White Middlings with mill run screenings. Shane Bros. & Wilson Co., Minneapolis, Minn. Contains not more than 7 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat.
"Gold Mine" Feed. Sheffield-King Milling Co., Minneapolis, Minn. Composed of bran shorts, low grade flour, wheat product and pulverized screenings. On 1916 certificate: Contains not more than 8.98 per cent crude fiber, and not less than 4.9 per cent fat and 15.9 per cent protein. On 1917 certificate: Contains not more than9.9 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranty in all respects. Contained a few seeds of pigweed and mustard and some hulls of corn cockle.
Pure Mill Run Bran. Southwestern Milling Co., Inc., Kansas City, Mo. The mill run of pure wheat bran and brown shorts. Contains not more than 9.2 per cent crude fiber, and not less than 4.3 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pure Wheat Bran. Southwestern Milling Co., Inc., Kansas City, Mo. Contains not more than 10.2 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples reccived.
Pure Wheat Brown Shorts. Southwestern Milling Co., Inc., Kansas City, Mo. Contains not more than 8 per cent crude fiber, and not less than 4.2 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pure Gray Shorts. Southwestern Milling Co., Inc., Kansas City, Mo. The mill run of pure wheat brown shorts and pure fancy white middlings. Contains not more than 6.7 per cent crude fiber, and not less than 3.8 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pure Fancy White Middlings. Southwestern Milling Co., Inc., Kansas City, Mo. Contains not more than 4.2 per cent crude fiber, and not less than 2.5 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Pure Mixed Feed. Southwestern Milling Co., Inc., Kansas City, Mo. The mill run of pure wheat bran, brown shorts and fancy white middlings. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Try Me Mixed Feed. Sparks Milling Co., Alton, Ill. Composed of pure wheat bran, middlings, and ground screenings not exceeding mill run. Contains not more than 9 per cent crude fiber, and not less than 3.5 per cent fat and 16 per cent protein. (1916 certificate gives 8 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranty in all respects. Contained a few seeds of pigweed.
Star & Crescent Bran with ground screenings not exceeding mill run. Star & Crescent Milling Co., Chicago, Ill. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Standard Middlings. Bernhard Stern & Sons, Milwaukee, Wis. Wheat middlings with ground screenings, not exceeding mill run. Contains not more than 11 per cent crude fiber, and not less than 4.5 per cent fat and 12.5 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Stock's Bran. F. W. Stock & Sons, Hillsdale, Michigan. Bran made from wheat with mill-run screenings. Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of chess and a few hulls of corn cockle.
Stock's Middlings. F. W. Stock & Sons, Hillsdale, Mich. Contains not more than 6 per cent crude fiber, and not less than 4 per cent fat and 16½ per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; slightly high in fiber. No weed seeds found.
"Monarch" Wheat Feed. (Registered in 1916 as Monarch Mixed Feed). F. W. Stock & Sons, Hillsdale, Mich. Composed of wheat bran, middlings and mill-run screenings. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. Three-quarters of one per cent below guaranty in protein; in accord with guaranty in fiber and fat. Contained a few seeds of mustard, pigweed and dock and some hulls of corn cockle and wild buckwheat.
"Superior" Mixed Feed. F. W. Stock & Sons, Hillsdale, Mich. Composed of wheat bran, middlings, low grade flour and mill run screenings. Contains not more than 7 per cent crude fiber, and not less than 4½ per cent fat and 16 per cent protein. Registered in 1916 and 1917.	Two official samples. One in accord with guaranty in protein; the other, over one per cent below. Both in accord with guaranty in fat and very slightly high in fiber. Both contained a few seeds of mustard and night-flowering catchfly and a few hulls of corn cockle.
Spring Wheat Bran and Wheat Screenings. David Stott Flour Mills, Inc., Detroit, Mich. Wheat bran with ground clean wheat screenings. On 1916 certificate: Contains not more than 10½ per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein On 1917 certificate: Contains not more than 11½ per cent crude fiber, and not less than 4 per cent fat and 13½ per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with 1917 guaranty in protein and the one examined, in accord in fiber and fat. The one examined for weed seeds contained a few seeds of mustard, chess and wild buckwheat and some hulls of wild buckwheat and corn cockle.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Stott's Pure Winter Wheat Bran. David Stott Flour Mills, Inc., Detroit, Mich. On 1916 certificate: Contains not more than 10½ per cent crude fiber, and not less than 4½ per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 9½ per cent crude fiber, and not less than 3½ per cent fat and 13 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with 1917 guaranty in protein but one bore the 1916 guaranty and fell below it by over half a per cent. Both in accord with guaranties in fat and fiber. Both contained hulls of corn cockle; one contained a few seeds of wild buckwheat.
Climax Middlings. David Stott Flour Mills, Inc., Detroit, Mich. White and brown wheat middlings. On 1916 certificate: Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 16 per cent protein. On 1917 certificate: Contains not more than 6 per cent crude fiber, and not less than 4½ per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranty in all respects. Contained a few hulls of wild buckwheat.
Stott's Fine White Middlings. David Stott Flour Mills, Inc., Detroit, Mich. On 1916 certificate: Contains not more than 6 per cent crude fiber, and not less than 4½ per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 5½ per cent crude fiber, and not less than 4 per cent fat and 14½ per cent protein. Registered in 1916 and 1917.	One official sample. Nearly four-tenths per cent below guaranty in protein; (in accord with 1917 guaranty); in accord with guaranty in fiber and fat. Not examined for weed seeds.
Pennant Middlings. David Stott Flour Mills, Inc., Detroit, Mich. Brown wheat middlings with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 8 per cent crude fiber, and not less than 5 per cent fat and 15½ per cent protein. On 1917 certificate: Contains not more than 7 per cent crude fiber, and not less than 4½ per cent fat and 15 per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with 1917 guaranty in protein; the one examined, in accord in fiber and fat. Three contained a few hulls of wild buckwheat and the fourth contained a few seeds of ribgrass, pigweed and night-flowering catchfly.
Stott's Heavy Pure Mixed Wheat Feed. David Stott Flour Mills, Inc., Detroit, Mich. Composed of wheat flour, bran and middlings. On 1916 certificate: Contains not more than 8 per cent crude fiber, and not less than 4½ per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Stott's Honest Mixed Feed. David Stott Flour Mills, Inc., Detroit, Mich. Wheat bran and middlings with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 8 per cent crude fiber, and not less than 4½ per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 8½ per cent crude fiber, and not less than 4 per cent fat and 14½ per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with guaranty in protein. The two examined, in accord in fiber and fat. All contained a few seeds of some of the following:—mustard, chess, night-flowering catchfly, charlook or wild buckwheat.
Stag Flour. David Stott Flour Mills, Inc., Detroit, Mich. Low grade wheat flour. On 1916 certificate: Contains not more than 2 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 1½ per cent crude fiber, and not less than 2 per cent fat and 12.8 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Angelus Wheat Bran with ground screenings not exceeding mill run. Thompson Milling Co., Lockport, N. Y. Contains not more than 14 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Angelus Wheat Middlings with ground screenings not exceeding mill run. Thompson Milling Co., Lockport, N. Y. Contains not more than 14 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Omar Mixed Feed. Tioga Mill & Elevator Co., Waverly, N. Y. Composed of wheat bran and wheat middlings (may contain ground screenings not exceeding mill run). Contains not more than 10 per cent crude fiber, and not less than 3.8 per cent fat and 14.8 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Wheat Bran with ground screenings not exceeding mill run. Geo. Urban Milling Co., Buffalo, N. Y. Contains not more than 12.5 per cent crude fiber, and not less than 3.5 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. One contained many, the other a few, seeds of various weeds, including pigweed, wild buckwheat, etc.
Wheat Middlings with ground screenings not exceeding mill run. Geo. Urban Milling Co., Buffalo, N. Y. Contains not more than 9.5 per cent crude fiber, and not less than 4.5 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed.
Wheat Mixed Feed with ground screenings not exceeding mill run. George Urban Milling Co., Buffalo, N. Y. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Farmers' Favorite Wheat Bran with mill run of screenings. Valley City Milling Co., Grand Rapids, Mich. On 1916 certificate: Contains not more than 11.2 per cent crude fiber, and not less than 5 per cent fat and 13.8 per cent protein. On 1917 certificate: Contains not more than 11.05 per cent crude fiber, and not less than 4.38 per cent fat and 12.51 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle and wild buckwheat.
Farmers' Favorite Wheat Middlings with mill run of screenings. Valley City Milling Co., Grand Rapids, Mich. On 1916 certificate: Contains not more than 7.1 per cent crude fiber, and not less than 5.26 per cent fat and 14.4 per cent protein. On 1917 certificate: Contains not more than 7.5 per cent crude fiber, and not less than 5.25 per cent fat and 12.75 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Farmers' Favorite Wheat Cowfeed with mill run of screenings. Valley City Milling Co., Grand Rapids, Mich. Composed of wheat bran and wheat middlings and mill run of screenings. On 1916 certificate: Contains not more than 7.10 per cent crude fiber, and not less than 4.73 per cent fat and 15.6 per cent protein. On 1917 certificate: Contains not more than 10 07 per cent crude fiber, and not less than 5 per cent fat and 12.71 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with 1917 guaranty in all respects. One which carried the 1916 guaranty fell below that guaranty in protein and overran in fiber. Both contained a few hulls and one a few seeds of corn cockle.
Victor Spring Wheat Bran with ground screenings not exceeding mill run. Victor Milling Co., Victor, N. Y. Contains not more than 15 per cent crude fiber, and not less than 4 per cent fat and 14.6 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of green foxtail, mustard and wild buckwheat and many hulls of wild buckwheat.
Victor Spring Wheat Middlings with ground screenings not exceeding mill run. Victor Milling Co., Victor, N. Y. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 17.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of lady's thumb, mustard and green foxtail and a few hulls of wild buckwheat.
Victor Spring Wheat Mixed Feed with ground screenings not exceeding mill run. Victor Milling Co., Victor, N. Y. Composed of spring wheat, low grade flour and screenings. Contains not more than 10 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Voigt's Crescent Bran containing mill run of screenings. Voigt Milling Co., Grand Rapids, Mich. On 1916 certificate: Contains not more than 10 per cent crude fiber, and not less than 3.5 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	Two official samples. In accord with 1917 guaranty in all respects. Contained a few seeds of chess and corn cockle and hulls of corn cockle and wild buckwheat.
Voigt's Crescent Middlings. Voigt Milling Co., Grand Rapids, Mich. On 1916 certificate: Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. On 1917 certificate: Contains not more than 10 per cent crude fiber, and not less than 3.5 per cent fat and 14.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranty in all respects. Not examined for weed seeds.
Voigt's Cowfeed containing mill run of screenings. Voigt Milling Co., Grand Rapids, Mich. Composed of Voigt's middlings and bran and mill run of screenings. Contains not more than 10 per cent crude fiber, and not less than 3.5 per cent fat and 14.5 per cent protein. (1916 certificate gives 15 per cent as minimum protein guaranty). Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranty in all respects. Contained a few seeds of chess, wild buckwheat, corn cockle and dock.
Wheat Bran with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn., and Buffalo, N. Y. Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 13 per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with guaranty in protein; the two examined, in accord in fiber and fat. Two contained a few seeds and all a few to many hulls of various weeds including wild buckwheat, corn cockle, pigweed, etc.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wheat Standard Middlings with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn., and Buffalo, N. Y. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat. All contained a few to some seeds of various weeds, including mustard, pigweed, etc.
Wheat Flour Middlings with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn., and Buffalo, N. Y. Composed of wheat standard middlings, red dog flour and ground screenings not exceeding mill run. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Wheat Mixed Feed with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn., and Buffalo, N. Y. Composed of wheat bran, wheat flour middlings and ground screenings not exceeding mill run. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. One, examined for weed seeds, contained a few seeds of green foxtail and mustard and a few hulls of corn cockle and lady's thumb.
Red Dog Flour (Adrian). Washburn-Crosby Co., Minneapolis, Minn., and Buffalo, N. Y. Contains not more than 4 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Not examined for weed seeds.
Second Clear Flour (Arlington). Washburn-Crosby Co., Minneapolis, Minn., and Buffalo, N. Y. Contains not more than 4 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Spring Wheat Bran with ground screenings not exceeding mill run. Western Canada Flour Mills Co. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 14½ per cent protein. Registered in 1916 by Chas. M. Cox Co., Boston, Mass. Not registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle and wild buckwheat.
Blackhawk Bran. Western Flour Mill Co., Davenport, Iowa. (Registered by New Prague Flouring Mill Co., New Prague, Minn). Wheat bran with ground screenings not exceeding mill run. On 1916 certificate: Contains not more than 10.5 per cent crude fiber, and not less than 4.5 per cent fat and 13.1 per cent protein. On 1917 certificate: Contains not more than 11.25 per cent crude fibre, and not less than 3 per cent fat and 13.3 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Kent Mixed Feed. Williams Bros. Co., Kent, O. Composed of pure winter wheat, no ground screenings. On 1916 certificate: Contains not more than 15 per cent crude fiber, and not less than 2 per cent fat and 12 per cent protein. On 1917 certificate: Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranty in all respects. Contained a few hulls of corn cockle.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Nokomos Durum Wheat Bran. Yerxa, Andrews & Thurston, Inc., Minneapolis, Minn. Contains not more than 13 per cent crude fiber, and not less than 5.5 per cent fat and 12 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of mustard, wild buckwheat and hairy stickweed and some hulls of wild buckwheat and corn cockle.
Nokomos Durum Wheat Middlings. Yerxa, Andrews & Thurston, Inc., Minneapolis, Minn. Contains not more than 10.5 per cent crude fiber, and not less than 5.5 per cent fat and 14.5 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
ADULTERATED WHEAT FEEDS.	
Blue Grass Valley Feed. A. Waller & Co., Inc., Henderson, Ky. Composed of winter wheat bran, ground corn and cob. Contains not more than 17 per cent crude fiber, and not less than 2 per cent fat and 10 per cent protein. (1916 certificate gives 9 per cent as minimum protein guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat but nearly 2 per cent above the high fiber guaranty it carried. Contained a few seeds of chess and corn cockle and many hulls of corn cockle.
CORN AND OATS GROUND TOGETHER. Including two feeds with barley also.	
Corn and Oats, ½ and ½. Buffalo Cereal Co., Buffalo, N. Y. Contains not more than 4 per cent crude fiber, and not less than 4 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Corn & Oat Chop. Carll Bros., Waterboro, Me. Contains not more than 5 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of wild buckwheat.
Corn & Oat Feed. E. A. Clark & Co., Portland, Maine. Ground corn and oats. Contains not more than 7 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Ground Corn and Oats. Eastern Grain Co., Bangor, Me. Contains not more than 5 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. Over one-half per cent below guaranty in both protein and fat; in accord with guaranty in fiber. No weed seeds found.
Pure Corn & Oats. Elmore Milling Co., Oneonta, N. Y. Ground oats—corn meal. Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; slightly high in fiber. No weed seeds found.
Farmers Union C & O Feed. Farmers Union Grain & Supply Co., Waterville, Me. Composed of corn and oats. Contains not more than 7 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of mustard.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
G—M Ground Feed. Gray Milling Co., East Gray, Maine. Composed of corn, oats and barley. Contains not more than 7 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fiber; six-tenths per cent below guaranty in fat. Contained a few seeds of various weeds.
Excelsior Horse Feed. Hales & Edwards Co., Chicago, Ill. Composed of rolled oats, sifted cracked corn and rolled barley. Contains not more than 8 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Corn & Oat Chop. J. B. Ham Co., Lewiston, Me. Corn and oats. Contains not more than 5 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. Practically in accord with guaranty in protein; in accord in fiber and fat. No weed seeds found.
Corn and Oats Ground. Houlton Grange Store, Houlton, Maine. No certificate filed. No guaranty on package.	Unlawful.
Corn and Oats (Registered in 1916 as Corn and Oat Feed). Houlton Mills & Light Co., Houlton, Me. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Corn & Oat Chop. Merrill & Mayo Co., Waterville, Me. Corn and oats. Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 10 per cent protein. Registered in 1916. Not registered in 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. No weed seeds found in the sample examined.
Puritas Corn & Oat Feed. Portland Milling Co., Portland, Mich. Corn and oats, ground. Contains not more than 6.38 per cent crude fiber, and not less than 4.23 per cent fat and 10.41 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Overall Corn ½ and ½ Oats. Park & Pollard Co., Boston, Mass. Ground: corn and oats. Contains not more than 8 per cent crude fiber, and not less than 1½ per cent fat and 10 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of wild buckwheat and dock.
Corn & Oat Feed. Tioga Mill & Elevator Co., Waverly, N. Y. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 9.25 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Chop Feed. A. A. Wilson, Springvale, Me. Corn and oats. Contains not more than 6 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Corn & Oats. Yeaton's Mills, South Berwick, Me. Corn and oats ground together, and nothing else. Contains not more than 5.5 per cent crude fiber, and not less than 5 per cent fat and 10.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
FEEDS UTIILIZING CORN AND OAT BY-PRODUCTS.	
Acme Stock Feed Acme-Evans Company, Indianapolis, Ind. No certificate filed. Claims on package:—fiber not over 4 per cent; fat not less than 4 per cent; protein not less than (claims on one lot 9 per cent; on the other 10 per cent).	Two official samples. Both below guaranty in protein, one of them over two per cent below; both below guaranty in fat; both high in fiber, one of them three per cent and the other six. No weed seeds found.
Ohio Farm Feed. Ansted & Burk Co., Springfield, O. One-half wheat middlings, one-third corn bran and corn meal, balance wheat bran and ground and cleaned wheat screenings not to exceed mill run. Contains not more than 8½ per cent crude fiber, and not less than 4½ per cent fat and 11½ per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Portage Stock Feed. Akron Feed & Milling Co., Akron, O. Made from either white or yellow shelled corn, barley, oat shorts, oat hulls, oat middlings, and ½ of one per cent of salt. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 8½ per cent protein. (1916 certificate gives 8 per cent as minimum protein guaranty). Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the one examined, in accord in fat but over three per cent high in fiber. No weed seeds found, except a few hulls of wild buckwheat in one sample.
Bufceco Chop Feed. Buffalo Cereal Co., Buffalo. N. Y. Composed of ground corn, oats and barley, hominy feed, oat shorts, oat hulls. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 8 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Bufceco Dairy Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, hominy feed, corn gluten feed, oat shorts, oat middlings, oat hulls, ½ of 1 per cent salt. Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; over two per cent high in fiber. Contained a few seeds of wild rose and a few hulls of wild buckwheat.
Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, oats and barley, wheat middlings, hominy feed, oat shorts, oat middlings, oat hulls, linseed meal, corn gluten feed. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	Two official samples. One was one-half per cent below and the other over one per cent below guaranty in protein; both were in accord with guaranty in fiber and fat. One contained a few seeds of various weeds, the other no weed seeds.
Bufceco Steam Cooked Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn and oats, hominy feed, oat shorts, oat middlings, oat hulls, and ½ of 1 per cent salt. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both practically in accord with guaranty in protein; the one examined, in accord in fat but eight-tenths per cent high in fiber. No weed seeds found.
Bufceco Stock Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, oats and barley, wheat middlings, corn gluten feed, hominy feed, oat shorts, oat middlings, oat hulls, and ½ of 1 per cent salt. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fat but over 1½ per cent high in fiber. Both contained a few seeds of pigweed and other weeds.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Henkel's Chop Feed. Commercial Milling Co., Detroit, Mich. Composed of corn meal, rye and oat middlings, oats and oat-hulls. Contains not more than 10 per cent crude fiber, and not less than 3.5 per cent fat and 8.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed, dock and ragweed.
Corno Stock Feed. The Corno Mills Co., St. Louis, Mo. Oat feed and hominy feed. Contains not more than 12.75 per cent crude fiber, and not less than 4.5 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with registered guaranty in all respects. (Fiber guaranty on package differed from that filed in certificate). Contained a few seeds of wild buckwheat.
Henkel's Coarse Feed Corn Meal. Commercial Milling Co., Detroit, Mich. Corn meal. On 1916 certificate: Contains not more than 3 per cent crude fiber, and not less than 3 per cent fat and 8.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass. A compound of ground barley, ground oats, hominy meal, ground corn, oat meal mill by-products (oat middlings, oat shorts, oat hulls), and ½ of 1 per cent salt. Part of the ingredients, having been cooked or steamed, are more easily assimilated than raw grains and have better keeping qualities. Contains not more than 9½ per cent crude fiber, and not less than 4 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Both contained a few seeds of mustard.
Crosby's Special Stock Food. E. Crosby & Co., Brattleboro, Vt. Composed of wheat middlings, corn meal, hominy feed, brewers' dried grains, oat meal mill by-product (oat shorts, oat hulls, oat middlings), 1 per cent table salt. Contains not more than 12.75 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat. No weed seeds found except a few hulls of wild buckwheat in one sample.
Elmore Stock Feed. Elmore Milling Co., Oneonta, N. Y. Composed of corn meal, hominy, dried brewers grains, wheat bran, oat meal mill by-products (oat hulls, oat middlings, oat shorts), salt. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Farmers Union Stock Feed. Farmers Union Grain & Supply Co., Waterville, Me. Composed of corn meal, hominy, dried brewers grains, wheat bran, oat meal mill by-products (oat hulls, oat middlings and oat shorts) and salt. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Both contained a few weed seeds—one mustard and the other wild buckwheat.
Grandin's Stock Food. D. H. Grandin Milling Co., Jamestown, N. Y. Composed of fine white hominy feed, oat meal mill by-products (oat middlings, oat hulls, oat shorts), and salt. On 1916 certificate: Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 8.5 per cent protein. On 1917 certificate: Contains not more than 14 per cent crude fiber, and not less than 5 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat. One contained no weed seeds, one a few hulls and one a few seeds.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Lucky Oat-Corn Feed. Federal Milling Co., Lockport, N. Y. Composed of crushed oats, cracked corn, corn feed meal and hominy feed. On 1916 certificate: Contains not more than 8 per cent crude fiber, and not less than 3 per cent fat and 8 per cent protein. On 1917 certificate: Contains not more than 12 per cent crude fiber, and not less than 2.5 per cent fat and 8 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pioneer Hog Feed (with Dried Buttermilk). Hales & Edwards Co., Chicago, Ill. Composed of wheat middlings, corn feed meal, linseed oil meal, ground and bolted wheat, barley and kaffir screenings, and dried buttermilk. Contains not more than 12 per cent crude fiber, and not less than 3 per cent milk fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pioneer Stock Feed. Hales & Edwards Co., Chicago, Ill. Composed of corn feed meal, oat middlings, oat shorts, oat hulls, wheat middlings, wheat bran, corn gluten feed and crushed oats. Contains not more than 9 per cent crude fiber, and not less than 2½ per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Haskell's Stock Feed. W. H. Haskell & Co., Toledo, O. Composed of ground corn, ground oats, hominy feed, oat hulls, oat shorts and salt. Contains not more than 9 per cent crude fiber, and not less than 6 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat. No weed seeds found.
Monmouth Corn & Oats Feed. E. M. Marks, Monmouth, Me. Composed of corn, oats and Canadian oat feed. Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 7 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; three per cent high in fiber. No weed seeds found.
Brooks Fancy Corn and Oats Stock Feed. A. H. McLeod Milling Co., St. Johnsbury, Vt. On 1916 certificate: Corn, oats and gluten feed. Contains not more than 8.5 per cent crude fiber, and not less than 3 per cent fat and 9 per cent protein. On 1917 certificate: Composed of ground corn, corn bran, ground oats. oat middlings, oat hulls and gluten feed. Contains not more than 9 per cent crude fiber, and not less than 3.25 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Daily Dividend Stock Feed. Merrill & Mayo Co., Waterville, Me. Composed of wheat middlings, corn meal, hominy feed, brewers' dried grains, oat meal mill by-product (oat shorts, oat hulls, oat middlings) and 1 per cent salt. Contains not more than 12.75 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein. The one examined, in accord in fiber and fat. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Boss Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, corn feed meal, by-product from manufacture of hominy and corn meal by degerminator process with partial extraction of oil, oatmeal mill by-product (oat middlings, oat hulls, oat shorts), ½ of 1 per cent salt. Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 8 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
White Diamond Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, cornfeed meal, by-product from the manufacture of hominy and cornmeal by degerminator process with partial extraction of oil, oatmeal mill by-product (oat middlings, oat hulls, oat shorts), ½ of 1 per cent salt. Contains not more than 9 per cent crude fiber, and not less than 3.25 per cent fat and 8 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Victor Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, corn feed meal, by-products from the manufacture of hominy and cornmeal by degerminator process with partial extraction of oil, oat meal mill by-product (oat middlings, oat hulls, oat shorts), ½ of 1 per cent salt. Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 8 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Sterling Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, corn feed meal, by-product from manufacture of hominy and cornmeal by degerminator process with partial extraction of oil, ground barley, wheat flour, wheat middlings (with ground screenings not exceeding mill run), cottonseed meal, oatmeal mill by-product (oat middlings, oat hulls, oat shorts), ½ of 1 per cent salt, ground puffed rice, ground puffed wheat. Contains not more than 10 per cent crude fiber, and not less than 3.25 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Derby Stock Feed. Tioga Mill & Elevator Co., Waverly, N. Y. Composed of corn offal, hominy feed, corn gluten feed, oat middlings, oat hulls. Contains not more than 13.25 per cent crude fiber, and not less than 4 per cent fat and 10.5 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Fidelity Stock Feed. Nowak Milling Corporation, Buffalo, N. Y. Composed of ground oats, corn feed meal, hominy feed, wheat middlings, clipped oat by-product, ground grain screenings, salt ¾ of 1 per cent, and oat middlings. Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 8 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Park & Pollard Stock Feed. Park & Pollard Co., Boston, Mass. Composed of ground: corn, hominy feed, oat hulls, oat middlings and oat shorts. Contains not more than 12 per cent crude fiber, and not less than 1½ per cent fat and 9 per cent protein. Registered in 1916 and 1917.	Two official samples. One in accord with guaranty in protein; the other six-tenths per cent below. Both in accord with guaranty in fiber and fat. The one examined for weed seeds contained a few seeds of wild buckwheat.
Iowa Stock Feed. Purity Oats Co., Davenport, Iowa. Composed of corn meal, wheat middlings, hominy feed, brewers dried grains, oat meal mill by-products (oat hulls, oat shorts, oat middlings) and 1 per cent table salt. Contains not more than 12.75 per cent crude fiber, and not less than 4 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. No weed seeds found.
Schumacher Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, corn feed meal, by-product from manufacture of hominy and corn meal by degerminator process with partial extraction of oil, ground barley, wheat flour, wheat middlings (with ground screenings not exceeding mill run), cottonseed meal, oatmeal mill by-product (oat hulls, oat shorts, oat middlings), ½ of 1 per cent salt, ground puffed rice, ground puffed wheat. Contains not more than 10 per cent crude fiber, and not less than 3.25 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the one examined, in accord in fat and slightly high in fiber. Some weed seeds found in all samples, including mustard, pigweed and wild buckwheat.
Syragold Stock Feed. Syracuse Milling Co., Syracuse, N. Y. Composed of ground corn, oats and barley, oat hulls, oat middlings, oat shorts, hominy feed, cottonseed meal, corn gluten feed and salt. Contains not more than 13 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One dealer's sample. Over one per cent below guaranty in protein; not examined for fiber and fat. Not examined for weed seeds. The sample submitted carried over 4 per cent of salt.
Oatfeed. Robin Hood Mills, Ltd., Moose Jaw, Sask., Can. Oat. Hulls (ground). Contains not more than 28 per cent crude fiber, and not less than 2.5 per cent fat and 5.25 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with its low guaranty. No weed seeds found. Hay from mixed grasses contains more protein and fat and no more fiber than this feed.
Stott's Winner Feed. David Stott Flour Mills, Inc., Detroit, Mich. Composed of corn meal, oats, screenings, oat hulls and salt. Contain not more than 8½ per cent crude fiber, and not less than 5 per cent fat and 9½ per cent protein. (1916 certificate gives 10½ per cent as minimum protein guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Domino Stock Feed. Nowak Milling Corporation, Buffalo, N. Y. Composed of hominy feed, low grade flour, oat middlings, oat hulls, corn feed meal, salt ¾ of 1 per cent. On 1916 certificate: Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. On 1917 certificate: Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	One official sample. Over one per cent below guaranty in protein and nearly 3 per cent high in fiber; in accord with guaranty in fat. Contained a few hulls of wild buckwheat. One dealer's sample. One-half per cent below guaranty in protein. Not examined for fiber and fat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
HOMINY FEEDS.	
Homco Hominy Feed. American Hominy Co., Indianapolis, Ind. Manufactured from white corn only. Contains not more than 7 per cent crude fiber, and not less than 6 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
Homcoline Feed. American Hominy Co., Indianapolis, Ind. Corn germ meal. Contains not more than 7 per cent crude fiber, and not less than 5 per cent fat and 17 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Hominy Feed. Baltimore Pearl Hominy Co. Baltimore, Md. Straight white corn. On 1916 certificate: Contains not more than 6 per cent crude fiber, and not less than 7 per cent fat and 14 per cent protein. On 1917 certificate: Contains not more than 6 per cent crude fiber, and not less than 6 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with 1917 guaranty (which it carried) in protein and fat and practically in accord in fiber. No weed seeds found.
Bufceco Hominy Feed. Buffalo Cereal Co., Buffalo, N. Y. Contains not more than 5 per cent crude fiber, and not less than 6 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat. Slightly high in fiber. No weed seeds found.
Hominy Feed. Cereal Mills Co. No certificate filed. Claims on package: Contains not more than 4 per cent crude fiber, and not less than 8.5 per cent fat and 11.25 per cent protein. Unregistered.	One official sample. In accord with guaranty in protein and fat. Over one per cent high in fiber. No weed seeds found.
Paragon Hominy Meal. Chas M. Cox Co., Boston, Mass. Ground white corn. Contains not more than 7 per cent crude fiber, and not less than 7½ per cent fat and 9½ per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fiber; slightly below guaranty in fat. Not examined for weed seeds.
Success Hominy Feed. Deutsch & Sickert Co., Milwaukee, Wis. Offal of corn grits and meal manufacture. Contains not more than 6 per cent crude fiber, and not less than 6 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Evans Hominy Feed. Evans Milling Co., Indianapolis, Ind. Corn. Contains not more than 7 per cent crude fiber, and not less than 7½ per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Badger Hominy Feed. Chas. A. Krause Milling Co., Milwaukee, Wis. Made from white corn. Contains not more than 5 per cent crude fiber, and not less than 6 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Not examined for weed seeds.
Mystic Hominy Feed. Mystic Milling Co., Sioux City, Iowa. Product of corn. Contains not more than 5 per cent crude fiber, and not less than 5.5 per cent fat and 11 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. One per cent below guaranty in protein and seven-tenths per cent below in fat; in accord with guaranty in fiber. No weed seeds found. One dealer's sample. One per cent below guaranty in protein. Not examined for fiber and fat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Hominy Feed. Patent Cereals Co., Geneva, N. Y. Made from corn. Contains not more than 5 per cent crude fiber, and not less than 6 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
"Blue Ribbon" Hominy Chop. J. E. Soper Co., Boston, Mass. By-product white corn. Contains not more than 5 per cent crude fiber, and not less than 6 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fiber; practically in accord in fat. No weed seeds found.
"Logan" Hominy Feed. Standard Cereal Co., Chillicothe, Ohio. Parts of grain of corn. Contains not more than 6 per cent crude fiber, and not less than 7 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fiber; 1½ per cent below in fat. No weed seeds found.
Acme Hominy Feed. Suffern-Hunt Mills, Decatur, Ill. Compounded from white corn, guaranteed pure and unadulterated. Contains not more than 7 per cent crude fiber, and not less than 7 per cent fat and 9½ per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Frumentum Hominy Feed. United States Frumentum Co., Detroit, Mich. Composed of hull, germ and particles of starchy part of the kernel of white corn. Contains not more than 7 per cent crude fiber, and not less than 7.3 per cent fat and 9.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

MOLASSES FEEDS. PROTEIN UNDER 15 PER CENT

Bufcolene Horse Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of crushed oats, cracked corn, corn feed meal, wheat bran and molasses. Contains not more than 7 per cent crude fiber, and not less than 3 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Iroquois Horse Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn and oats, crushed oats, alfalfa meal, oat middlings, oat shorts, oat hulls and molasses. Contains not more than 11 per cent crude fiber, and not less than 2 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Clover Leaf Mills Dairy Feed. Clover Leaf Milling Co., Buffalo, N. Y. Composed of cottonseed meal, corn distillers dried grains, mixed broken grains consisting of wheat, corn, barley, flax, speltz, ground grain screenings, cocoa shell meal, clipped oat by-product, molasses and one-half of 1 per cent salt. Contains not more than 15 per cent crude fiber, and not less than 3.5 per cent fat and 13.5 per cent protein. (1916 certificate gives 4 per cent as minimum fat guaranty). Registered in 1916 and 1917.	Two official samples. One in accord with guaranty in protein and fat; over one-half per cent high in fiber. The other over one per cent below guaranty in protein and over one per cent high in fiber; in accord with guaranty in fat. One contained many seeds of pigweed; the other, a few hulls of wild buckwheat.
Greeno Feed. Hales & Edwards Co., Chicago, Ill. Composed of alfalfa and molasses. Contains not more than 26 per cent crude fiber, and not less than .5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Harvest Horse Feed. Hales & Edwards Co., Chicago, Ill. Composed of alfalfa, molasses, cracked corn, oats and barley. Contains not more than 15 per cent crude fiber, and not less than 2 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
The H-C Company's De-Fi Feed. The H-O Co., Buffalo, N. Y. Composed of oat hulls, oat shorts, ground corn, hominy feed, wheat middlings, oat middlings, molasses, salt ½ of 1 per cent. Contains not more than 21 per cent crude fiber, and not less than 3 per cent fat and 8 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
The H-O Company's Algrane Horse Feed. The H-O Co., Buffalo, N. Y. Composed of oats, oat shorts, ground corn, oat hulls, wheat middlings, hominy feed, molasses, corn gluten feed, salt ½ of 1 per cent. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; over one per cent high in fiber. Contained a few hulls of wild buckwheat.
The H-O Company's Algrane Milk Feed. The H-O Co., Buffalo, N. Y. Composed of oat hulls, clipped oat by-products, wheat middlings, cottonseed meal, oat shorts, corn gluten feed, ground corn, ground oats, ground grain screenings, molasses, salt ½ of 1 per cent. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Both contained a few weed seeds, including wild buckwheat, etc.
The H-O Company's New England Stock Feed The H-O Co., Buffalo, N. Y. Composed of wheat middlings, ground corn, hominy feed, oat hulls, oat shorts, ground oats, molasses, salt ½ of 1 per cent. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fiber; over one-half per cent below guaranty in fat. Contained a few seeds of pigweed.
Domino Horse Feed with Alfalfa. Nowak Milling Corporation, Buffalo, N. Y. Composed of cracked corn, crushed oats, whole oats, ground alfalfa, molasses, and ¾ of 1 per cent salt. Contains not more than 12 per cent crude fiber, and not less than 2 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pure-Mo-Lene Horse Feed. Nowak Milling Co., Buffalo, N. Y. No certificate filed. Claims on package: Contains not more than 12 per cent crude fiber, and not less than 2 per cent fat and 9 per cent protein. Unregistered.	One official sample. In accord with guaranty in protein and fat. Over 1½ per cent high in fiber. Contained a few seeds of wild buckwheat.
Park & Pollard Horse Feed. Park & pollard Co., Boston, Mass. Composed of alfalfa, corn, oats, molasses and salt. Contains not more than 12 per cent crude fiber, and not less than 1½ per cent fat and 9 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Purina Feed with Molasses. Purina Mills Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of cracked corn, oats, ground alfalfa, molasses and 1 per cent salt. Contains not more than 13 per cent crude fiber, and not less than 1.7 per cent fat and 9.3 per cent protein. (1916 certificate gives 11.7 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Tom Boy Horse Feed. Purity Oats Co., Davenport, Iowa. Composed of cracked corn, whole oats, alfalfa meal, oat mill by-products (oat shorts, oat middlings), cottonseed meal and molasses. Contains not more than 18 per cent crude fiber, and not less than 2 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Green Cross Horse Feed with Molasses. Quaker Oats Co., Chicago, Ill. No certificate filed. Claims on package: Contains not more than 12 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Unregistered.	One official sample. Protein ½ per cent below guaranty. Fat and fiber in accord with guaranty. No weed seeds found.
Good Luck Dairy Feed. Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of cottonseed meal, brewers dried grains, clipped oat by-products, ground wheat screenings, molasses and 1 per cent salt. Contains not more than 13 per cent crude fiber, and not less than 3.5 per cent fat and 13.5 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. Nearly one per cent below guaranty in protein; in accord with guaranty in fiber and fat.
Purina O-Molene Feed. Purina Mills Branch Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of cracked corn, oats, ground alfalfa, molasses and 1 per cent salt. Contains not more than 8 per cent crude fiber, and not less than 3.2 per cent fat and 9.7 per cent protein. Registered in 1916 and 1917.	Two official samples. In accord with guaranty in all respects. One contained a few seeds of wild buckwheat; in the other, no weed seeds were found.
Colonel's Ration. Tioga Mill & Elevator Co., Waverly, N. Y. Composed of alfalfa meal, molasses, wheat middlings, corn feed meal, brewers grains, wheat bran, hominy feed, linseed meal, a small percentage of salt. Contains not more than 15 per cent crude fiber, and not less than 2.5 per cent fat and 12 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Tioga Dairy Feed "Blue Brand." Tioga Mill & Elevator Co., Waverly, N. Y. Composed of wheat middlings, corn distillers grains, wheat bran, molasses, corn feed meal, alfalfa meal, hominy feed, corn gluten meal, brewers grains, corn gluten feed, cottonseed meal, a small percentage of salt. Contains not more than 12 per cent crude fiber, and not less than 3.5 per cent fat and 14 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Xtra-vim Feed. Xtravim Molasses Feed Co., Boston, Mass. Pure cane sugar molasses and sphagnum moss. On 1916 certificate: Contains not more than 4.5 per cent crude fiber, and not less than .81 per cent fat and 4.61 per cent protein. On 1917 certificate: Contains not more than 5 per cent crude fiber, and not less than .6 per cent fat and 4.6 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; one per cent high in fiber.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
MOLASSES FEEDS. PROTEIN OVER 15 PER CENT	
Iroquois Dairy Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, corn gluten feed, cottonseed meal, ground grain screenings, molasses, and ½ of 1 per cent salt. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 17 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Lactola Dairy Feed. Chapin & Co., Hammond, Ind. Composed of choice cottonseed meal, corn distillers' Grains, clipped oat by-product, corn gluten feed, corn germ meal, brewers' grains, ivory nut meal, cane molasses, salt. Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 16.5 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. Practically in accord with guaranty in protein; in accord in fiber and fat. Not examined for weed seeds.
Gold Flake Dairy Feed. Hales & Edwards Co., Chicago, Ill. Composed of cottonseed meal, corn gluten feed, linseed oil meal, molasses, clipped oat by-product, ground and bolted wheat, barley and kaffir screenings, and salt. Contains not more than 15 per cent crude fiber, and not less than 3½ per cent fat and 16 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
International Special Dairy Feed. International Sugar Feed Co., Minneapolis, Minn. Composed of cottonseed meal, molasses, ground cleaned grain screenings, ground clipped oat by-product, and salt. Contains not more than 12 per cent crude fiber, and not less than 4.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein and fat; one and two per cent high in fiber respectively. Both contained many weed seeds including pigweed, etc.
Domino Cream-O-Lene Dairy Ration. Nowak Milling Corporation, Buffalo, N. Y. Composed of cottonseed meal, corn gluten feed, linseed oil meal, wheat middlings, corn distillers dried grains, corn feed meal, clipped oat by-product, malt sprouts, brewers dried grains, ground and bolted grain screenings, cocoanut oil meal, molasses, salt ¾ of 1 per cent. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Purina Cow Chow Feed. Purina Mills Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of cottonseed meal, gluten feed from corn, brewers dried grains, molasses, ground alfalfa, and 1 per cent salt. Contains not more than 13.5 per cent crude fiber, and not less than 4.5 per cent fat and 24 per cent protein. Registered in 1916 and 1917.	Four official samples. All in accord with guaranty in protein; the one examined, in accord in fat but nearly 2 per cent high in fiber. No weed seeds found in the three samples examined.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Blue Ribbon Dairy Feed. Quaker Oats Co., Chicago, Ill. Composed of hominy feed, corn feed meal, by-product from manufacture of hominy and corn meal by degerminator process with partial extraction of oil, wheat bran (with ground screenings not exceeding mill run), cottonseed meal, oatmeal mill by-product (oat middlings, oat hulls, oat shorts), molasses, new process linseed oil meal, ½ of 1 per cent salt, dried distillers grains. On 1916 certificate: Contains not more than 12 per cent crude fiber, and not less than 3.5 per cent fat and 25 per cent protein. On 1917 certificate: Contains not more than 14 per cent crude fiber, and not less than 5 per cent fat and 25 per cent protein. Registered in 1916 and 1917.	One official sample. Five per cent below guaranty in protein; over one per cent high in fiber; in accord with guaranty in fat. Contained a few hulls of wild buckwheat.
Quaker Dairy Feed with Molasses. Quaker Oats Co., Chicago, Ill. On 1916 certificate: Composed of molasses, malt sprouts, cottonseed meal, ground grain screenings, new process linseed oil meal, oat meal by-product (oat middlings, oat hulls, oat shorts), ½ of 1 per cent salt. Contains not more than 14.5 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. On 1917 certificate: Composed of molasses, cottonseed meal, ground grain screenings, oatmeal mill by-product (oat hulls, oat shorts, oat middlings), ½ of 1 per cent salt, dried distillers grains. Contains not more than 16 per cent crude fiber, and not less than 5.5 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained about 2 per cent of weed seeds, including pigweed, green foxtail, etc.
Tioga Dairy Feed "Red Brand". Tioga Mill & Elevator Co., Waverly, N. Y. Composed of cottonseed meal, corn distillers grains, molasses, wheat middlings, corn gluten feed, corn gluten meal, brewers grains, wheat bran, a small percentage of salt. Contains not more than 11 per cent crude fiber, and not less than 3.5 per cent fat and 23 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Tioga Dairy Feed "White Brand". Tioga Mill & Elevator Co., Waverly, N. Y. Composed of corn distillers grains, wheat middlings, molasses, cottonseed meal, corn feed meal, wheat bran, corn gluten feed, hominy feed, corn gluten meal, brewers grains, a small percentage of salt. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 17 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Hammond Dairy Feed. Western Grain Products Co., West Hammond, Ill. (P. O. Hammond, Ind.). Composed of cottonseed meal, corn distillers grains, malt sprouts, ground clipped oat by-product, ground grain screenings, cocoa shell meal, molasses and salt. Contains not more than 12 per cent crude fiber, and not less than 3.5 per cent fat and 16.5 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
MISCELLANEOUS COMPOUNDED FEEDS. PROTEIN OVER 18 PER CENT.	
Blatchford's Calf Meal. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of locust bean meal, unpressed flaxseed, wheat flour, blood flour, barley and malt sprout meal, ground beans and peas, rice polish, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, fenugreek, dried milk, anise and salt. Contains not more than 6¾ per cent crude fiber, and not less than 5 per cent fat and 24 per cent protein. Registered in 1916 and 1917.	Three official samples. Two in accord with guaranty in protein; one, over 1½ per cent below. The two examined, in accord with guaranty in fat; one in accord in fiber, the other over one per cent high. Not examined for weed seeds.
Blatchford's Pig Meal. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of old process oil meal, barley and malt sprout meal, oats, corn, locust bean, cottonseed and cocoa shell meals, blood flour, ground beans and peas, unpressed flaxseed, wheat flour, rice polish, anise and salt. Contains not more than 7 per cent crude fiber, and not less than 5 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; practically in accord in fiber. Not examined for weed seeds.
Bufceco Creamery Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, hominy feed, corn gluten feed, cottonseed meal, oat shorts, oat middlings, oat hulls, ½ of 1 per cent salt. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Unicorn Dairy Ration. Chapin & Co., Hammond, Ind. Composed of corn distillers grains, cottonseed meal, linseed meal, hominy meal, gluten feed, corn starch by-products with corn bran, barley feed, malt sprouts, brewers grains, pure wheat bran, and salt. Contains not more than 11 per cent crude fiber, and not less than 5.5 per cent fat and 26 per cent protein. Registered in 1916 and 1917.	Three official samples. All in accord with guaranty in protein; the one examined, in accord in fiber and fat. Contained a few to many seeds of various weeds, including wild buckwheat, charlock, etc.
Wirthmore Balanced Ration. Chas. M. Cox Co., Boston, Mass. Composed of choice cottonseed meal, linseed, gluten feed, fancy distillers grains, bran, choice malt sprouts, hominy or corn meal, and not over ¾ per cent dairy salt. On 1916 certificate: Contains not more than 8½ per cent crude fiber, and not less than 5 per cent fat and 25 per cent protein. On 1917 certificate: Contains not more than 9½ per cent crude fiber, and not less than 5.2 per cent fat and 25½ per cent protein. Registered in 1916 and 1917.	One official sample carrying 1917 guaranty. In accord with guaranty in protein and fat; one-half per cent high in fiber. Contained a few seeds of wild buckwheat.
Crosby's Ready Ration. E. Crosby & Co., Brattleboro, Vt. Composed of dried distillery grains, cottonseed meal, oil meal, malt sprouts, wheat bran, wheat middlings, hominy feed and ½ per cent salt. Contains not more than 9 per cent crude fiber, and not less than 7 per cent fat and 25 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fat but nearly two per cent high in fiber. Both contained a few seeds of wild buckwheat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Dewey's Ready Ration. Dewey Bros. Co., Blanchester, O. Composed of Eagle distillers dried grains, linseed oil meal, cottonseed meal, malt sprouts, wheat bran, wheat middlings, hominy feed and ½ per cent salt. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 25 per cent protein. Registered in 1916 and 1917.	Three official samples. Two in accord with guaranty in protein and one 1½ per cent below. The one low in protein was in accord with guaranty in fiber and fat. Two contained a few weed seeds and the other a few hulls.
Elmore Milk Grains. Elmore Milling Co., Oneonta, N. Y. Composed of corn distillers dried grains, 41 per cent cottonseed meal, old process linseed meal, corn gluten feed, hominy meal, choice wheat bran, barley malt sprouts, dried brewers grains, salt. Contains not more than 10 per cent crude fiber, and not less than 6 per cent fat and 25 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of wild buckwheat, mustard, charlock and various other weeds.
Farmers Union Ready Ration. Farmers Union Grain & Supply Co., Waterville, Me. Composed of corn distillers dried grains, cottonseed meal, linseed meal, gluten, hominy, wheat bran, barley, malt sprouts, brewers grains and salt. Contains not more than 9 per cent crude fiber, and not less than 6 per cent fat and 25 per cent protein. (1916 certificate gives 10 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, practically in accord in fat; one per cent high in fiber. Both contained a few seeds of wild buckwheat.
Grandin's Milk Maker. D. H. Grandin Milling Co., Jamestown, N. Y. Composed of linseed oil meal, cottonseed meal, corn gluten feed, corn distillers dried grains, brewers dried grains, hominy feed, malt sprouts, wheat bran, wheat middlings and a small quantity of salt. Contains not more than 13 per cent crude fiber, and not less than 4 per cent fat and 22.5 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
G-M Dairy Ration. Gray Milling Co., East Gray, Me. Composed of wheat bran, linseed oil meal, cottonseed meal, distillers grains, gluten feed and salt. Contains not more than 12 per cent crude fiber, and not less than 6 per cent fat and 25 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Red Horn Calf Meal. Hales & Edwards Co., Chicago, Ill. Composed of ground flaxseed, wheat flour, locust bean meal, recleaned cottonseed meal, blood flour, ground peas and beans, cocoa shell meal, barley meal, rice polish, linseed oil meal, cocoanut meal, dried milk, fenugreek, anise and salt. Contains not more than 7 per cent crude fiber, and not less than 5 per cent fat and 24 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Horn Dairy Feed. Hales & Edwards Co., Chicago, Ill. Composed of cottonseed meal, corn gluten feed, linseed oil meal, wheat bran, malt sprouts, corn feed meal and brewers dried grains. Contains not more than 15 per cent crude fiber, and not less than 4 per cent fat and 25 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of wild buckwheat, charlock, yellow foxtail and mustard.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Orono Dairy Feed. J. B. Ham Co., Lewiston, Me. Composed of wheat bran, hominy, gluten feed, linseed oil meal, cottonseed meal, distillers grains and salt. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 22 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Dry Feed. W. A. Jennison, Bangor, Me. Composed of hominy feed, gluten feed, meat scrap, linseed oil meal, wheat middlings. Contains not more than 9 per cent crude fiber, and not less than 5 per cent fat and 22 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Larro-Feed. Larrowe Milling Co., Detroit, Mich. Composed of cottonseed meal, corn gluten feed, dried distiller's grains (mainly from corn), dried beet pulp, standard wheat bran, standard wheat middlings, and ¾ of 1 per cent salt. Wheat bran and wheat middlings may contain ground screenings not exceeding mill run. Contains not more than 14 per cent crude fiber, and not less than 3 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	Three official samples. Two in accord with guaranty in protein, one six-tenths per cent below. The two examined, in accord in fiber and fat. One contained no weed seeds, the other two, a few hulls.
Merrill's Balanced Ration. Maine Farmers' Supply Co., Lisbon Falls, Me. Composed of cottonseed meal, gluten flour, Ajax Flakes, hominy meal, corn meal, mixed feed, bran and salt. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 22 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Domino Calf Meal. Nowak Milling Corporation, Buffalo, N. Y. Composed of carob beans, flaxseed, wheat flour, cottonseed meal, beans, lintils, fenugreek, anise, cocoa shell meal and salt. Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 25 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Stevens 44 Dairy Ration. Park & Pollard Co., Boston, Mass. Composed of oil meal, cottonseed meal, wheat bran with mill run of screenings, corn gluten feed, cocoanut oil meal, pea meal, corn distillers' grains, brewers' dried grains, ground barley, wheat middlings, hominy meal, corn germ meal, buckwheat middlings, corn meal, salt. Contains not more than 14 per cent crude fiber, and not less than 5 per cent fat and 24 per cent protein. Registered in 1916 and 1917.	Five official samples. In accord with guaranty in all respects. All contained a few weed seeds, chiefly wild buckwheat. Two dealers' samples. One in accord with guaranty in protein; one slightly below. Not examined for fiber and fat.
Schumacher Calf Meal. Quaker Oats Co., Chicago, Ill. Composed of oatmeal, wheat meal, ground flaxseed, milk albumen, ½ of 1 per cent bicarbonate of soda, cottonseed meal. Contains not more than 4 per cent crude fiber, and not less than 8 per cent fat and 18 per cent protein. (1916 certificate gives 3 per cent as maximum fiber guaranty). Registered in 1916 and 1917.	One official sample. Six-tenths per cent below registered guaranty in protein (and 1.6 below guaranty on package which did not agree with registered guaranty). Slightly high in fiber. In accord with guaranty in fat. Not examined for weed seeds.
Ryde's Cream Calf Meal. Ryde & Co., Chicago, Ill. Composed of ground flaxseed, wheat flour, bean meal, recleaned cottonseed meal, blood flour, bean and lentils, cocoa shell meal, fenugreek, anise and salt. Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 25 per cent protein. Registered in 1916 and 1917.	One official sample. Over 1½ per cent below guaranty in protein and slightly high in fiber. Practically in accord with guaranty in fat. Not examined for weed seeds.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Syragold Dairy Feed. Syracuse Milling Co., Syracuse, N. Y. Composed of ground corn, wheat bran with screenings, corn gluten feed, hominy feed, cottonseed meal and linseed meal. Contains not more than 7 per cent crude fiber, and not less than 5 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Towle's Balanced Ration. J. N. Towle & Co., Bangor, Me. Composed of wheat bran, old process linseed meal, corn meal, gluten feed and one per cent fine salt. (1916 certificate gives cottonseed meal as a constituent in place of gluten feed). Contains not more than 9.13 per cent crude fiber, and not less than 5.72 per cent fat and 22.13 per cent protein. Registered in 1916 and 1917.	Two official samples. One nearly 3 per cent below guaranty in protein; practically in accord in fiber and fat. Contained some seeds and many hulls of wild buckwheat. The other sample, in accord with guaranty in protein; not otherwise examined.
Towle's Pig Feed. J. N. Towle & Co., Bangor, Me. Composed of wheat bran, wheat middlings, hominy meal, corn meal and meat meal. (1916 certificate gives old process linseed meal as one of the ingredients in place of wheat middlings). Contains not more than 7.22 per cent crude fiber, and not less than 6.72 per cent fat and 18.63 per cent protein. Registered in 1916 and 1917.	Two official samples. One nearly 2 per cent below guaranty in protein and over 1½ per cent below in fat; slightly high in fiber. Contained a few seeds of wild buckwheat, green foxtail and night-flowering catchfly. The other sample, in accord with guaranty in protein; not otherwise examined.
Union Grains, Ubiko, Biles Ready Dairy Ration. Ubiko Milling Co., Cincinnati, O. Composed of fourex corn distillers dried grains, choice cottonseed meal, old process linseed meal, white wheat middlings, winter wheat bran, hominy meal, brewers dried grains, barley malt sprouts, and one-half per cent of fine table salt. Contains not more than 10 per cent crude fiber, and not less than 7 per cent fat and 24 per cent protein. (1916 certificate gives 9 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	Five official samples and one dealer's sample. One official sample was one per cent below guaranty in protein, slightly below in fat and very slightly high in fiber. The other four samples were all in accord with guaranty in protein and the one examined, in accord in fiber and fat. Of the four examined for weed seeds, one contained none, and the other three a few, chiefly wild buckwheat.
Crescent Dairy Feed. Wentworth Bros., Cornish, Me. Composed of corn meal, wheat bran, cottonseed meal, distillers grains, linseed oil meal and salt, and gluten meal. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 22 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein; slightly below in fat; over 2 per cent high in fiber. Not examined for weed seeds.
Creamery Cow Feed. Wiscasset Grain Co., Wiscasset, Me. Composed of corn, oat and barley products, cottonseed meal, linseed oil meal, gluten, bran, middlings, and salt. Contains not more than 9 per cent crude fiber, and not less than 5 per cent fat and 20 per cent protein. Not registered in 1916. Registered in 1917.	Two official samples. One was one per cent below guaranty in protein and one per cent high in fiber; in accord in fat. The other was in accord with guaranty in protein; not examined for fiber and fat. One contained a few hulls of wild buckwheat and corn cockle; in the other no weed seeds were found. One consumer's and one manufacturer's samples were both in accord with registered guaranty in protein; not examined for fiber and fat. (Some of the packages carried a higher protein guaranty than that registered and fell below it).

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
COMPOUNDED POULTRY FEEDS.	
Acme Scratch Feed. Acme-Evans Co., Indianapolis, Ind. No certificate filed. Claims on package: Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Humpty Dumpty Scratch Feed. Ansted & Burk Co., Springfield, O. Composed of wheat, corn, kaffir corn, milo maize, barley, rye, sunflower seed and wheat screenings, buckwheat. (Grit and charcoal included in the ingredients given in 1916 certificate). Contains not more than 4 per cent crude fiber, and not less than 3 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	One official sample. Over one per cent below guaranty in protein; in accord with guaranty in fiber and fat. Contained about 5 per cent weed seeds, mostly chess.
"B-G" Scratch Feed. Bath Grain Co., Bath, Me. Composed of cracked corn, milo maize, wheat, buckwheat, barley, oats, sunflower seed and charcoal. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No official samples received.
"B-G" Mash. Bath Grain Co., Bath, Me. Composed of corn meal, meat scraps, bran, linseed oil meal, cottonseed meal, hominy, alfalfa, white middlings, gluten and granulated charcoal. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	No official samples received.
Blatchford's "Fill the Basket" Egg Mash. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of locust bean meal, unpressed flaxseed, wheat flour, rice polish, blood flour, barley and malt sprout meal, ground beans and peas, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, fenugreek, dried milk, anise and salt, also alfalfa, bone, corn and oat meals, wheat bran, wheat middlings, meat scraps, fish, capsicum and powdered limestone. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 19 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Blatchford's Milk Mash. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of locust bean meal, unpressed flaxseed, wheat flour, barley and malt sprout meal, blood flour, ground beans and peas, rice polish, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, fenugreek, dried milk, anise and salt, also bone, corn and oat meals, wheat middlings, meat scraps, fish and powdered limestone. Contains not more than 7½ per cent crude fiber, and not less than 4 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Monarch Poultry Mash. F. H. Brastow & Son, South Brewer, Me. Composed of wheat bran, wheat middlings, gluten feed, beef scraps, alfalfa and corn meal. Contains not more than 7 per cent crude fiber, and not less than 5.5 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	One official sample. Over one per cent below guaranty in protein and over one per cent high in fiber; in accord with guaranty in fat. Contained a few hulls of corn cockle and wild buckwheat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Bufceco Chick Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, wheat, kaffir corn, peas, millet and oat groats. Contains not more than 2 per cent crude fiber, and not less than 2 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat and practically in accord in fiber. Contained many weeds seeds, including wild buckwheat, mustard, pigweed, etc.
Iroquois Chick Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, wheat, kaffir corn, peas and millet. Contains not more than 3 per cent crude fiber, and not less than 2 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Bufceco Intermediate Scratching Grains. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, wheat, kaffir corn, buckwheat, millet and peas. Contains not more than 4 per cent crude fiber, and not less than 2 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Bufceco Scratching Grains. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, oats, barley, buckwheat, kaffir corn, wheat, sunflower seed and peas. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Iroquois Scratching Grains. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, oats, barley, kaffir corn, buckwheat, wheat and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fiber and practically in accord in fat. Contained many seeds of various weeds, including mustard, corn cockle, etc.
Target Scratching Grains. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, oats, barley, wheat, kaffir corn and buckwheat. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Bufceco Laying Mash. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, oats, wheat and kaffir corn, wheat bran, wheat middlings, linseed meal, alfalfa meal, oat middlings, meat and bone scrap, ½ of 1 per cent salt. Contains not more than 6 per cent crude fiber, and not less than 5 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; over one per cent high in fiber. Not examined for weed seeds.
Bufceco Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, hominy feed, corn gluten feed, oat middlings and rolled oats. Contains not more than 6 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Iroquois Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, corn gluten feed and alfalfa meal. Contains not more than 12 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Bufceco Pigeon Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of cracked corn, wheat, peas and kaffir corn. Contains not more than 4 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Baby Chick Feed. (Registered in 1916 as Peerless Baby Chick Feed). E. A. Clark & Co., Portland, Me. Composed of cracked wheat, hulled oats, cracked kaffir, cracked corn and millet seed. Contains not more than 4 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	One official sample. Over one per cent below guaranty in protein; in accord with guaranty in fiber and fat. Contained very many seeds of various weeds including wild buckwheat, mustard, etc.
Peerless Intermediate Chick Feed. E. A. Clark & Co., Portland, Me. Composed of cracked corn, wheat, kaffir corn, hulled oats, barley, and millet seed. Contains not more than 4 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Peerless Scratch Feed. E. A. Clark & Co., Portland, Me. Composed of cracked corn, wheat, oats, buckwheat, barley, kaffir corn, and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of various weeds, including wild buckwheat, corn cockle, etc.
Peerless Growing Feed. E. A. Clark & Co., Portland, Me. Composed of ground oats, wheat bran, wheat meal, corn meal, bone meal, meat meal, granulated milk and powdered charcoal. Contains not more than 5 per cent crude fiber, and not less than 4 per cent fat and 14 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Peerless Poultry Mash. E. A. Clark & Co., Portland, Me. Composed of ground oats, fish meal, alfalfa meal, wheat bran, wheat meal, gluten, milk albumen, meat meal and powdered charcoal. Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few hulls of corn cockle and wild buckwheat.
Yankee Scratch Feed. O. L. Clark, Freeport, Me. Composed of cracked corn, cracked wheat, buckwheat, milo maize, oats, hemp, sunflower seed and barley. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 9 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Yankee Cereal Mash (with Fish). O. L. Clark, Freeport, Me. Composed of corn meal, bran, fish meal, corn flour, rolled oats, alfalfa, charcoal and peanut meal. Contains not more than 6.5 per cent crude fiber, and not less than 3 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of corn cockle and wild buckwheat.
Wirthmore Gritless Chick Feed. Chas. M. Cox Co., Boston, Mass. Composed of cracked milo maize, white corn, yellow corn, wheat, hulled oats, kaffir corn, peas and fish. Contains not more than 3½ per cent crude fiber, and not less than 3 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	One official sample. One-half per cent below guaranty in protein; in accord with guaranty in fiber and fat. Contained many seeds of various weeds, including mustard, wild buckwheat, etc.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wirthmore Gritless Intermediate Chick Feed. Chas. M. Cox Co., Boston, Mass. Composed of cracked white corn, cracked yellow corn, wheat, kaffir corn, milo maize, buckwheat and peas. Contains not more than 3½ per cent crude fiber, and not less than 3 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained many seeds of various weeds including wild buckwheat, mustard, pigweed, etc.
Wirthmore Scratch Feed. Chas. M. Cox Co., Boston, Mass. Composed of wheat, kaffir corn, sunflower seed, buckwheat, barley, oats, cracked corn and milo maize. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	One official sample. Slightly below guaranty in protein; in accord with guaranty in fiber and fat. Contained some seeds of various weeds, including wild buckwheat, corn cockle, etc.
Wirthmore Growing Feed with Scraps. Chas. M. Cox Co., Boston, Mass. Composed of beet pulp, wheat middlings, ground corn, wheat, barley, oats, milo maize, peas, salt and choice fine ground beef scraps. Contains not more than 4½ per cent crude fiber, and not less than 4½ per cent fat and 16 per cent protein. (1916 certificate gives 17 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
Wirthmore Fish & Scraps Poultry Mash. Chas. M. Cox Co., Boston, Mass. Composed of ground oats, ground barley, gluten feed, alfalfa meal, wheat bran, ground corn, choice fine ground beef scraps, fish meal, wheat middlings, and about ¾ of 1 per cent salt. Contains not more than 9½ per cent crude fiber, and not less than 3½ per cent fat and 18½ per cent protein. Registered in 1916 and 1917.	Three official samples, all unlawful in that they did not carry the same guaranty on the package as filed in the certificate. Two carrying lower guaranties than those in the certificate were in accord with their guaranty but below the certificate guaranty in protein. One carrying a higher guaranty than those in the certificate was in accord both with its guaranty and the certificate guaranty in protein. No weed seeds found except a few hulls in one sample.
Conkey's "Buttermilk" Starting Food (for chicks). The G. E. Conkey Co., Cleveland, O. Composed of gentian root, iron sulphate (copperas), mustard seed, wheat, corn, hulled oats, wheat middlings, bone and evaporated buttermilk. Contains not more than 4 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Globe Chick Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, kaffir corn, hulled oats, millet and grit. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of charlock, lady's thumb, dock, etc.
Globe Developing Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, kaffir corn, hulled oats, buckwheat, millet and grit. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of wild buckwheat, ragweed and pigweed.
Globe Scratch Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, barley, oats, kaffir corn, buckwheat, sunflower, linseed oil cake, grit. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of wild buckwheat, corn cockle and cow herb.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Globe Egg Mash. Albert Dickinson Co., Chicago, Ill. Composed of wheat bran, wheat middlings, alfalfa meal, corn bran, corn feed meal, linseed oil cake, meat scraps, salt ½ of 1 per cent. Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Queen Poultry Mash. Albert Dickinson Co., Chicago, Ill. Composed of alfalfa meal, corn feed meal, wheat middlings, ground corn bran, wheat bran, meat scraps, linseed oil cake, salt ½ of 1 per cent. Contains not more than 10 per cent crude fiber, and not less than 2.5 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	Two official samples. In accord with guaranty in all respects. No weed seeds found.
King Pigeon Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, buckwheat, kaffir corn, peas, millet, hemp and grit. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Elmore Chick Feed. Elmore Milling Co., Oneonta, New York. Composed of millet seed, cracked kaffir corn, cracked corn, cracked wheat and oat meal. Contains not more than 3.5 per cent crude fiber, and not less than 3.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Elmore Intermediate Chick Feed. Elmore Milling Co., Oneonta, N. Y. Composed of cracked corn, wheat, millet seed, buckwheat and kaffir corn. Contains not more than 3 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Elmore Scratch Feed. Elmore Milling Co., Oneonta, N. Y. Composed of wheat, cracked corn, barley, buckwheat, oats, kaffir corn and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 3.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
O-NE-ON-TA Scratch Feed. Elmore Milling Co., Oneonta, N. Y. Composed of wheat, cracked corn, barley, buckwheat, oats, kaffir corn and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 3.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Elmore Growing Mash. Elmore Milling Co., Oneonta, N. Y. Composed of rolled oats, corn gluten feed, old process oil meal, wheat middlings, wheat bran, bone meal and salt. Contains not more than 6 per cent crude fiber, and not less than 4 per cent fat and 17 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Elmore Egg Mash. Elmore Milling Co., Oneonta, N. Y. Composed of corn meal, rolled oats, ground barley, wheat flour middlings, hominy feed, wheat bran, meat and bone meal, corn gluten feed, alfalfa meal, old process oil meal and salt. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of mustard.
Farmers Union Scratch Feed. (Registered in 1916 as Farmers Union Scratch Grain). Farmers Union Grain & Supply Co., Waterville, Me. Composed of wheat, cracked corn, barley, oats, buckwheat, kaffir corn, and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 3.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fiber; slightly below in fat. Contained some seeds of various weeds, including wild buckwheat, mustard, etc.
Grandin's Scratch Feed. D. H. Grandin Milling Co., Jamestown, N. Y. Composed of wheat, cracked corn, kaffir corn, milo maize, barley, buckwheat and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
G-M Dry Mash. Gray Milling Co., East Gray, Me. Composed of wheat bran, middlings, corn meal, gluten ground oats, alfalfa meal, ground meat scraps. Contains not more than 9 per cent crude fiber, and not less than 5 per cent fat and 20 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Greene's "First Feed". Greene Chick Feed Co., Marblehead, Mass. Composed of white corn steam cooked, yellow corn germ meal, shredded codfish steam cooked, ground hulled oats steam cooked, dried buttermilk steam cooked, entire wheat, cod livers steam cooked, ground flaxseed, gluten meal, dried blood, shell lime and fine ground meat scraps. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 17 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Cackle Fine Chick Feed (No Grit). Hales & Edwards Co., Chicago, Ill. Composed of cracked wheat, cracked corn, cracked kaffir corn and millet seed. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Comb Fine Chick Feed (No Grit). Hales & Edwards Co., Chicago, Ill. Composed of cracked wheat, cracked corn, cracked kaffir corn, millet seed and steel cut oats. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Comb Coarse Chick Feed (No Grit). Hales & Edwards Co., Chicago, Ill. Composed of wheat, cracked corn, kaffir corn, millet seed and hulled oats. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Cackle Poultry Feed (No Grit). Hales & Edwards Co., Chicago, Ill. Composed of wheat, cracked corn, kaffir corn, barley, oats, and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Morning Glory Scratch Feed (No Grit). Hales & Edwards Co., Chicago, Ill. Composed of wheat, cracked corn, kaffir corn, barley, oats, wild buckwheat and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Comb Poultry Feed (No Grit). Hales & Edwards Co., Chicago, Ill. Composed of wheat, cracked corn, kaffir corn, barley, oats, sunflower seed and buckwheat. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Comb Chick Mash (With Dried Buttermilk). Hales & Edwards Co., Chicago, Ill. Composed of dried milk, wheat flour, barley meal, dried buttermilk, salt, linseed oil meal, blood flour, pea meal, bean meal, rice polish, locust bean meal, recleaned cottonseed meal, cocoanut meal, cocoa shell meal, fenugreek meal, anise seed meal, bone meal, ground oats, corn feed meal, wheat middlings, meat scrap and ground flaxseed. Contains not more than 8 per cent crude fiber, and not less than 5 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Red Comb Meat Mash (With Shell). Hales & Edwards Co., Chicago, Ill. Composed of linseed oil meal, corn feed meal, meat scrap, wheat bran, wheat middlings, ground oats, alfalfa meal and not over 5 per cent shell. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pound Squab Pigeon Feed (No Grit). Hales & Edwards Co., Chicago, Ill. Composed of wheat, corn, kaffir corn, hemp, peas, buckwheat and millet. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Dry Mash. J. B. Ham Co., Lewiston, Me. Composed of corn meal, ground oats, wheat bran, wheat middlings, linseed meal, meat scraps, charcoal and alfalfa. Contains not more than 12 per cent crude fiber, and not less than 3.5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; slightly high in fiber. No weed seeds found.
H H Dry Mash. E. P. Ham, Lewiston, Me. Composed of bran, gluten, meat meal, alfalfa, charcoal, salt, middlings, corn meal, and ground oats. Contains not more than 11 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of mustard and a few hulls of wild buckwheat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
H-8 Special Scratch Feed. E. T. Hathaway, Yarmouthville, Me. Composed of corn, cracked corn, oats, wheat, buckwheat, barley, kaffir corn, sunflower seed, and a little charcoal. Contains not more than 5 per cent crude fiber, and not less than 2 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Orono Brand Dry Mash. E. T. Hathaway, Yarmouthville, Me. Composed of corn meal, bran, middlings, gluten, ground oats, linseed meal, meat scrap, fish meal, alfalfa and a little charcoal. Contains not more than 8 per cent crude fiber, and not less than 5 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
The H-O Company's Chick Feed. The H-O Co., Buffalo, N. Y. Composed of cracked corn, cut oat meal, cracked wheat, cracked kaffir corn, cracked peas, millet, wild weed seed. Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
The H-O Company's Algrane Scratching Feed. The H-O Co., Buffalo, N. Y. Composed of wheat, oats, kaffir corn, buckwheat, wheat screenings, cracked corn, milo maize, sunflower seed, hulled oats, cracked peas, barley. Composed of 9 per cent crude fiber, and not less than 3.5 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained many seeds of various weeds including corn cockle, mustard, etc.
The H-O Company's Steam Cooked Chick Feed. The H-O Co., Buffalo, N. Y. Composed of cracked corn, cut oat meal, cracked wheat, cracked kaffir corn, cracked peas, millet, wild weed seeds. Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
The H-O Company's Dry Poultry Mash. The H-O Co., Buffalo, N. Y. Composed of oat middlings, corn gluten feed, wheat middlings, rolled oats, alfalfa meal, ground corn, hominy feed, cracked wheat, wheat bran, ground grain screenings. Contains not more than 11 per cent crude fiber, and not less than 3.5 per cent fat and 18 per cent protein. (1916 certificate gives 9 per cent as maximum crude fiber guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; nearly 2 per cent high in fiber. No weed seeds found.
The H-O Company's Poultry Feed. The H-O Co., Buffalo, N. Y. Composed of ground corn, corn gluten feed, wheat middlings, oat middlings, wheat bran, hominy feed, rolled oats, ground peas, ground grain screenings, and molasses. Contains not more than 9 per cent crude fiber, and not less than 4.5 per cent fat and 17 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Dirigo Little Chick Feed. Oscar Holway Co., Auburn, Me. Composed of wheat, kaffir corn, millet, corn, oat groats, pigeon grass and charcoal. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained very many seeds of various weeds, including wild buckwheat, mustard, etc.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Dirigo Scratch Grains. Oscar Holway Co., Auburn, Me. Composed of wheat, kaffir corn, barley, cracked Indian corn, buckwheat, and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Dirigo Egg Mash. Oscar Holway Co., Auburn, Me. Composed of alfalfa meal, bran, middlings, wheat meal, corn feed meal, ground corn, bran, linseed meal, meat scraps, salt ½ of 1 per cent. Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 16 per cent protein. Registered in 1916. Not registered in 1917.	One official sample. In accord with guaranty in fiber and fat; practically in accord in protein. No weed seeds found.
Hopkins Scratch Grains. A. R. Hopkins Co., Bangor, Me. Composed of cracked corn, wheat, kaffir corn, oats, barley, buckwheat, sunflower seed and grit. Contains not more than 4 per cent crude fiber, and not less than 3 per cent fat and 9½ per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Hopkins Dry Mash. A. R. Hopkins Co., Bangor, Me. Composed of corn meal, beef scraps, wheat bran, linseed meal, white middlings and gluten. Contains not more than 8 per cent crude fiber, and not less than 6½ per cent fat and 22 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
K. & W. Chick Feed. Kendall & Whitney, Portland, Me. Composed of corn, wheat, kaffir corn, hulled oats and millet. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of wild buckwheat, ragweed, corn cockle and yellow foxtail.
K. & W. Scratch Feed. Kendall & Whitney, Portland, Me. Composed of corn, wheat, barley, oats, kaffir corn, buckwheat, sunflower and linseed oil cake. Contains not more than 5 per cent crude fiber, and not less than 2.5 fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
K. & W. Mash Feed. Kendall & Whitney, Portland, Me. Composed of wheat bran, wheat middlings, alfalfa meal, corn bran, corn feed meal, linseed oil cake, meat scraps, and salt ½ of 1 per cent. On 1916 certificate: Contains not more than 10 per cent crude fiber, and not less than 2.5 per cent fat and 11 per cent protein. On 1917 certificate: Contains not more than 10 per cent crude fiber, and not less than 3 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pontiac Poultry Feed. Lapelle Poultry Food Co. No certificate filed. Claims on package: Contains not more than 5 per cent crude fiber, and not less than 1.5 per cent fat and 10 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects. Contained some seeds of various weeds including cow herb, corn cockle, etc.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Monmouth Dry Mash. E. M. Marks, Monmouth, Me. Composed of pure wheat bran, wheat middlings, ground oats, corn meal, ground alfalfa, beef scraps, gluten feed, cottonseed meal, fish meal, oat feed and ground feed. Contains not more than 10 per cent crude fiber, and not less than 5 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	One official sample. One-half per cent below guaranty in protein; nearly 3 per cent high in fiber; in accord with guaranty in fat. No weed seeds found.
Elm City Scratch Feed. Merrill & Mayo Co., Waterville, Maine. Composed of corn, wheat, rye, barley, oats, kaffir corn, buckwheat, sunflower and oil cake. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. The one examined for weed seeds contained some seeds of wild buckwheat and corn cockle.
Domino Chick Feed. (Registered in 1916 as Domino Justice Chick Feed). Nowak Milling Corporation, Buffalo, N. Y. Composed of cracked corn, cracked wheat, milo maize, hulled oats, split green peas and millet. Contains not more than 5 per cent crude fiber, and not less than 2 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Domino Developing Feed (Registered in 1916 as Domino Justice Developing Feed). Nowak Milling Corporation, Buffalo, N. Y. Composed of cracked peas, buckwheat, milo maize, wheat and cracked corn. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Domino Growing Mash. (Registered in 1916 as Domino Justice Growing Mash). Nowak Milling Corporation, Buffalo, N. Y. Composed of oat meal, corn gluten feed, linseed oil meal, corn feed meal, wheat bran and wheat middlings. Contains not more than 7 per cent crude fiber, and not less than 5 per cent fat and 15 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Domino Scratch Feed. (Registered in 1916 as Domino Justice Scratch Feed). Nowak Milling Corporation, Buffalo, N. Y. Composed of cracked corn, whole wheat, milo maize, whole barley, buckwheat, split green peas, and sunflower seeds. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Marathon Scratch Feed. Nowak Milling Corporation, Buffalo, N. Y. Composed of wheat, milo maize, cracked corn, barley and buckwheat. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Baby Buster Chick Feed. Park & Pollard Co., Boston, Mass. Composed of cracked: corn, wheat, kaffir corn, milo, whole millet seed oat groats, and shredded fish. Contains not more than 5 per cent crude fiber, and not less than 2 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Red Ribbon Chick Feed. Park & Pollard Co., Boston, Mass. Composed of cracked: corn, wheat, kaffir corn, milo and whole millet seed. Contains not more than 5 per cent crude fiber, and not less than 2 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of yellow foxtail, wild buckwheat, mustard, and pigweed.
Intermediate Chick Feed. Park & Pollard Co., Boston, Mass. Composed of cracked corn, wheat, buckwheat, oat groats, millet seed, kaffir corn, and milo. Contains not more than 5 per cent crude fiber, and not less than 1½ per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. Slightly below guaranty in protein; in accord with guaranty in fiber and fat. Contained a few seeds of corn cockle, ragweed, yellow foxtail, green foxtail, and lady's thumb.
Growing Feed. Park & Pollard Co., Boston, Mass. Composed of ground: Corn, wheat, oats, barley, kaffir corn, buckwheat, alfalfa meal, beet pulp and wheat bran with mill run of screenings, wheat middlings, calcium carbonate and salt. Contains not more than 8 per cent crude fiber, and not less than 1½ per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Pontiac Scratch Feed. Park & Pollard Co., Boston, Mass. Composed of cracked corn, wheat, barley, buckwheat, oats, kaffir corn and milo. Contains not more than 5 per cent crude fiber, and not less than 1½ per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained many seeds of corn cockle and wild buckwheat and a few of mustard, yellow foxtail, and ball mustard.
Red Ribbon Scratch Feed. Park & Pollard Co., Boston, Mass. Composed of cracked corn, wheat, buckwheat, barley, oats, kaffir corn, milo, and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 1½ per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of wild buckwheat and corn cockle and a few of ragweed, cow herb, yellow foxtail and mustard.
Screened Scratch Feed. Park & Pollard Co., Boston, Mass. Composed of cracked corn, wheat, buckwheat, barley, oats, kaffir corn, milo, and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 1½ per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of wild buckwheat, corn cockle and ragweed.
Lay or Bust (Dry Mash). Park & Pollard Co., Boston, Mass. Composed of ground: corn, wheat, oats, barley, kaffir corn, buckwheat, alfalfa, fish, meat, bone, beet pulp and wheat bran with mill run of screenings, wheat middlings, calcium carbonate and salt. Contains not more than 12 per cent crude fiber, and not less than 1½ per cent fat and 18 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. One contained a few seeds of giant ragweed; in the other, no weed seeds were found.
Protena Chick Feed. Purina Mills, Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of corn, millet, kaffir, and milo maize. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 9 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Purina Chick Feed. Purina Mills Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of wheat, corn, millet, kaffir, milo maize. Contains not more than 4 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. (1916 certificate gives 11 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
Purina Chicken Chowder Feed with Charcoal, not over 1%. Purina Mills, Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of wheat middlings, wheat bran, corn meal, alfalfa flour, linseed meal, granulated meat, not over 1 per cent salt. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 19 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; over one per cent high in fiber. Contained a few seeds of chess.
Protena Scratch Feed. Purina Mills, Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of wheat, corn, barley, kaffir, milo maize, and sunflower. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 9 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Guaranty on bag did not agree with guaranty as registered. Contained some seeds of wild buckwheat and a few of corn cockle, mustard, yellow foxtail, and charlock.
Purina Scratch Feed. Purina Mills Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of wheat, corn, barley, kaffir, milo maize, buckwheat, sunflower. Contains not more than 4 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained some seeds of wild buckwheat, corn cockle, mustard, and other weeds.
Purina Pigeon Feed. Purina Mills, Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Composed of wheat, millet, kaffir, milo maize and Canada peas. Contains not more than 4 per cent crude fiber, and not less than 2.5 per cent fat and 11 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Iowa Chick Feed. Purity Oats Co., Davenport, Iowa. Composed of cracked corn, cracked wheat, cracked kaffir corn or milo maize, steel cut oats, recleaned wheat screenings, and millet. Contains not more than 5 per cent crude fiber, and not less than 3.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Tom Boy Chick Feed (With & Without Grit). Purity Oats Co., Davenport, Iowa. Composed of cracked corn, cracked wheat, cracked kaffir corn or milo maize, steel cut oats, recleaned wheat screenings and millet and (with or without grit). Contains not more than 5 per cent crude fiber, and not less than 2.75 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein; not examined for fiber and fat. Contained about 10 per cent weed seeds, including wild buckwheat, mustard, pigweed, etc.
Iowa Scratch Feed. Purity Oats Co., Davenport, Iowa. Composed of cracked corn, buckwheat, hulled oats, kaffir corn or milo maize, barley, wheat and sunflower seed. (1916 certificate gives in addition, recleaned wheat screenings). Contains not more than 5 per cent crude fiber, and not less than 3.25 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Tom Boy Scratch Feed. Purity Oats Co., Davenport, Iowa. Composed of cracked corn, buckwheat, wheat, hulled oats, kaffir corn or milo maize, barley, and sunflower seed. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. (1916 certificate gives 2.75 per cent as minimum fat guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of wild buckwheat, mustard and several other weeds.
Tom Boy Poultry Mash. Purity Oats Co., Davenport, Iowa. Composed of ground: meat, wheat, oat meal, wheat middlings, milo maize, buckwheat, cornmeal, barley, oat middlings, millet, gluten feed, kaffir corn, alfalfa meal, hominy feed, wheat bran, oat germ meal, rock phosphate, salt, calcium carbonate and charcoal. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 15 per cent protein. Not registered in 1916. Registered in 1917.	One official sample. In accord with guaranty in all respects. Contained about 5 per cent weed seeds, including mustard, pigweed, etc.
Quaker Chick Feed. Quaker Oats Co., Chicago, Ill. Composed of cracked wheat, cracked kaffir and milo maize, cracked Indian corn, whole millet seed, oatmeal, charcoal, marble grit, wild buckwheat (with not to exceed ½ of 1 per cent miscellaneous wild seeds occurring in above seeds and grains). Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained about 7 per cent weed seeds of various kinds, mostly wild buckwheat.
Schumacher Little Chick Feed. Quaker Oats Co., Chicago, Ill. Composed of cracked wheat, cracked kaffir and milo, cracked Indian corn, whole millet seed, oatmeal, charcoal, marble grit, wild buckwheat (with not to exceed ½ of 1 per cent miscellaneous wild seeds occurring in above seeds and grains). Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Blue Ribbon Scratch Grains. Quaker Oats Co., Chicago, Ill. Composed of whole wheat, whole kaffir and milo, whole barley, cracked Indian corn, whole buckwheat, ½ of 1 per cent sunflower seeds. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Pansy Scratch Grains. Quaker Oats Company Chicago, Ill. (No certificate filed). Claims on package:—Fiber not over 5 per cent; fat not less than 2.50 per cent; protein not less than 10 per cent.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Quaker Scratch Grains. Quaker Oats Co., Chicago, Ill. Composed of whole wheat, whole kaffir and milo, whole barley, cracked Indian corn, whole buckwheat, ½ of 1 per cent sunflower seed. Contains not more than 5 pe cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. Both contained many seeds of various weeds, including wild buckwheat, mustard, pigweed, etc.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Schumacher Scratch Grains. Quaker Oats Co., Chicago, Ill. Composed of whole wheat, whole kaffir and milo, whole barley, cracked Indian corn, whole buckwheat, ½ of 1 per cent sunflower seeds. Contains not more than 5 per cent crude fiber, and not less than 2.5 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
American Poultry Feed. Quaker Oats Co., Chicago, Ill. Composed of hominy feed, cornfeed meal, by-product from the manufacture of hominy and cornmeal by degerminator process with partial extraction of oil, cottonseed meal, ground barley, wheat mixed feed and rye shorts. Contains not more than 9 per cent crude fiber, and not less than 3.5 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Quaker Poultry Mash. Quaker Oats Co., Chicago, Ill. Composed of meat scraps, oatmeal, wheat bran (with ground screenings not exceeding mill run), alfalfa meal, yellow hominy feed, cornfeed meal, by-product from manufacture of hominy and corn meal by degerminator process with partial extraction of oil, corn gluten feed, ground grain screenings. Contains not more than 10 per cent crude fiber, and not less than 4 per cent fat and 17.5 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Scribner's Laying Mash. D. & C. E. Scribner Co., Brunswick, Me. Composed of ground oats, corn meal, hominy, bran, middlings, cottonseed meal, fish scrap and meat meal, alfalfa, bone meal. Contains not more than 12 per cent crude fiber, and not less than 3 per cent fat and 14 per cent protein. Registered in 1916. Not registered in 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds. Guaranty on bag did not agree with registered guaranty.
Onondaga Scratch Grains. Syracuse Milling Co., Syracuse, N. Y. Composed of whole or cracked grains as follows: Corn, kaffir corn, milo maize, wheat, barley, buckwheat, oats and sunflower seed. Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Syragold Scratch Grains. Syracuse Milling Co., Syracuse, N. Y. Composed of whole or cracked grains as follows: Corn, kaffir corn, milo maize, wheat, barley, buckwheat, oats and sunflower seed. Contains not more than 9 per cent crude fiber, and not less than 3 per cent fat and 10 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Syragold Dry Mash. Syracuse Milling Co., Syracuse, N. Y. Composed of wheat bran and wheat middlings with screenings, corn meal, corn gluten feed, linseed meal and Heneta. Contains not more than 5 per cent crude fiber, and not less than 3 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Tioga Chick Feed. Tioga Mill & Elevator Co., Waverly, N. Y. Composed of cracked corn, cracked kaffir corn, cracked wheat, steel cut oat meal, millet seed. Contains not more than 4.75 per cent crude fiber, and not less than 3 per cent fat and 9 per cent protein.	No dealers' or official samples received.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Tioga Poultry Grain. Tioga Mill & Elevator Co., Waverly, N. Y. Composed of wheat, cracked corn, barley, kaffir corn, buckwheat, oats, sunflower seed. Contains not more than 4.79 per cent crude fiber, and not less than 2.08 per cent fat and 9 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Tioga Laying Food. Tioga Mill & Elevator Co., Waverly, N. Y. Composed of wheat middlings, wheat bran, corn gluten meal, hominy feed, kaffir corn meal, corn feed meal, oats, barley, buckwheat, meat and bone scrap, phosphosilicate of lime and soda. Contains not more than 6 per cent crude fiber, and not less than 2.5 per cent fat and 16 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Wentworth Bros.' Dry Feed for Young Chicks. Wentworth Bros., Cornish, Me. Composed of corn meal, wheat middlings, oat meal, charcoal, linseed meal and salt. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 16 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Not examined for weed seeds.
Wentworth Bros.' Dry Feed for Growing Chicks. Wentworth Bros., Cornish, Me. Composed of corn meal, wheat middlings, meat scraps, wheat bran, ground oats, charcoal and salt. Contains not more than 8 per cent crude fiber, and not less than 4 per cent fat and 18 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed.
Wentworth Bros.' Dry Feed for Laying Hens. Wentworth Bros., Cornish, Me. Composed of corn meal, feed flour, wheat bran, gluten meal, alfalfa meal, meat scraps, oil meal, charcoal and salt. Contains not more than 9 per cent crude fiber, and not less than 4 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. Contained a few seeds of pigweed.

ALFALFA MEALS.

Alfalfa Meal. Albert Dickinson Co., Chicago, Ill. Alfalfa hay. Contains not more than 35 per cent crude fiber, and not less than 1 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects. No weed seeds found.
Alfalfa Meal. Empire State Alfalfa Mills, Inc. No certificate filed. Claims on package: Contains not more than 35 per cent crude fiber, and not less than 1 per cent fat and 12 per cent protein.	One official sample. Practically in accord with guaranty in protein; slightly high in fiber; in accord with guaranty in fat. No weed seeds found.
Purina Alfalfa Meal. Purina Mills, Branch, Ralston Purina Co., St. Louis, Mo., and Buffalo, N. Y. Pure alfalfa hay. Contains not more than 35 per cent crude fiber, and not less than 1.5 per cent fat and 12 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Park & Pollard Alfalfa. Park & Pollard Co., Boston, Mass. Ground alfalfa hay. Contains not more than 30 per cent crude fiber, and not less than 1½ per cent fat and 12 per cent protein. Registered in 1916 and 1917.	Two official samples. Both in accord with guaranty in protein; the one examined, in accord in fiber and fat. No weed seeds found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
DRIED MEAT AND FISH WASTES.	
Protox Pure Ground Meat Scraps. (Registered in 1916 as Ground Meat Scraps). American Agricultural Chemical Co., New York. Contains not less than 10 per cent fat and 55 per cent protein. (1916 certificate gives 45 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
Armour's Blood Meal. Armour Fertilizer Works, Chicago, Ill. Dried blood. Contains not more than 2 per cent crude fiber, and not less than 80 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Armour's Meat Meal. Armour Fertilizer Works, Chicago, Ill. Meat residue. Contains not more than 2 per cent crude fiber, and not less than 6 per cent fat and 60 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in protein and fat; practically in accord in fiber.
Beach's Star Brand Beef Scraps. Beach Soap Co., Lawrence, Mass. Contains not less than 10 per cent fat and 40 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Bowker's Ground Meat Scraps. Bowker Fertilizer Co., Boston, Mass. Contains not less than 10 per cent fat and 45 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
Breck's Ground Beef Scraps. Jos. Breck & Sons, Boston, Mass. No certificate filed. Claims on package: Contains not less than 12 per cent fat and 43 per cent protein. Unregistered.	One official sample. Slightly below guaranty in protein; in accord with guaranty in fat.
B. & M. Poultry Feed or Fish Scrap. Burnham & Morrill Co., Portland, Me. Fresh codfish and haddock trimmings, cooked, dried and ground. Contains not less than 1.5 per cent fat and 55 per cent protein. (1916 certificate gives 60 as minimum protein guaranty). Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
Dow's Beef Scrap. John C. Dow Co., Boston, Mass. Meat scraps. Contains not more than 5 per cent crude fiber, and not less than 12 per cent fat and 43 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Dow's Favorite Poultry Meal. John C. Dow Co., Boston, Mass. On 1916 certificate: Composed of dried meat and bone. On 1917 certificate: Composed of dried meat, bone, fenugreek seed and cottonseed meal. Contains not more than than 5 per cent crude fiber, and not less than 10 per cent fat and 30 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
J. D. Grant & Son's Poultry Food. J. D. Grant & Son, Bangor, Me. Composed of bone and meat scraps. Contains not less than 25.5 per cent fat and 35.56 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Greene's Meat Scraps. (Registered in 1916 as Greene's Old Fashioned Meat Scraps). Greene Chick Feed Co., Marblehead, Mass. Meat, bone and gristle. On 1916 certificate: Contains not more than 3 per cent crude fiber, and not less than 5 per cent fat and 30 per cent protein. On 1917 certificate: Contains not more than 5 per cent crude fiber, and not less than 5 per cent fat and 35 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Lord's Egg Maker. Lord Bros. Co., Portland, Me. Fish scraps. Contains not more than 2½ per cent crude fiber, and not less than 2½ per cent fat and 45 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Poultry Scraps. New England Dressed Meat & Wool Co., Boston, Mass. Animal food products and bone meal. Contains not less than 10 per cent fat and 50 per cent protein. Registered in 1916 and 1917.	No dealers' or official samples received.
Ground Meat Scraps. Carroll S. Page, Hyde Park, Vt. No certificate filed. Claims on package: Contains not less than 15 per cent fat and 50 per cent protein. Unregistered.	One official sample. Slightly below protein guaranty; in accord with guaranty in fat.
Portland Bone Meal. Portland Rendering Co., Portland, Me. Contains not less than 5 per cent fat and 20 per cent protein. Registered in 1916 and 1917.	One official sample. Slightly below guaranty in protein; in accord with guaranty in fat.
Portland Bone & Meat Meal. Portland Rendering Co., Portland, Me. Contains not less than 8 per cent fat and 35 per cent protein. Registered in 1916 and 1917.	One official sample. Over 1½ per cent below guaranty in protein; in accord with guaranty in fat.
Portland Cracked Bone. Portland Rendering Co., Portland, Me. Contains not less than 5 per cent fat and 20 per cent protein. (1916 certificate gives 10 per cent as minimum protein guaranty). Registered in 1916 and 1917.	No dealers' or official samples received.
Portland Poultry Feed Prepared from Cooked Meat and Bone Scraps. Portland Rendering Co., Portland, Me. Contains not less than 8 per cent fat and 40 per cent protein. Registered in 1916 and 1917.	Two official samples. One in accord with guaranty and one slightly below in protein; both in accord with guaranty in fat.
Chic-Chuk Concentrated Poultry Food. Russia Cement Co., Gloucester, Mass. Composed of pure fish meal made only from portions of wholesome food of fish, as cod, haddock and hake. Contains not more than 1 per cent crude fiber, and not less than 2 per cent fat and 50 per cent protein. Not registered in 1916. Registered in 1917.	No dealers' or official samples received.
Whitman & Pratt's Animal Meal. Whitman & Pratt Rendering Co., Boston, Mass. Selected meat tankage and bone. Contains not less than 10 per cent fat and 33 per cent protein. Registered in 1916 and 1917.	One official sample. In accord with guaranty in all respects.
Cracked Bone. Whitman & Pratt Rendering Co., Lowell, Mass. No certificate filed. Claims on package: Contains not less than 5 per cent fat and 20 per cent protein. Unregistered.	One official sample. In accord with guaranty in all respects.
Whitman & Pratt's Beef Scraps. Whitman & Pratt Rendering Co., Boston, Mass. Beef scrap, bone. Contains not less than 10 per cent fat and 45 per cent protein. Registered in 1916 and 1917.	One official sample. Over two per cent below guaranty in protein; in accord in fat.
Whitman & Pratt's Extra Quality Beef Scraps. Whitman & Pratt Rendering Co., Boston, Mass. Beef scraps. Contains not less than 10 per cent fat and 55 per cent protein. Registered in 1916 and 1917.	One official sample. Nearly two per cent below guaranty in protein; in accord in fat.

December, 1917

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director

ANALYSTS.

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Official Inspections

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COMMERCIAL FERTILIZERS, 1917

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 addressed 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 6 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. Organic nitrogen. In this column is given the percentage of nitrogen found by subtracting the mineral nitrogen (the sum of the nitrate+ammonia nitrogen) from the total nitrogen found. Organic nitrogen is devised from organic materials such as dried blood, bone, tankage, cottonseed meal or any organic material carrying nitrogen.

4. Total nitrogen found.

5. 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.

6. 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, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
	AMERICAN AGRICULTURAL CHEMICAL CO., NEW YORK CITY, N. Y.	
4527	A. A. C. Co. Ammoniated AAAA	Caribou
4711	A. A. C. Co. General Crop Grower 1916	Fairfield
4385	Ammoniated Fertilizer A	Bangor
4411	Ammoniated Fertilizer A	Belfast
4599	Ammoniated Fertilizer A	Portland
4404	Ammoniated Fertilizer "AA"	Belfast
4594	Ammoniated Fertilizer AA	Portland
4380	Ammoniated Fertilizer AAA	Bangor
4431	Ammoniated Fertilizer AAA	Belfast
4596	Ammoniated Fertilizer AAA	Portland
4359	Ammoniated Fertilizer AAAA	Bangor
4415	Ammoniated Fertilizer 5A	Bangor
4611	Ammoniated Fertilizer 5A	Portland
4410	Ammoniated Fertilizer VX	Belfast
4419	Ammoniated Fertilizer Five X	Bangor
4834	Aroostook Complete Manure 1916	Vassalboro
4355	Bradley's Complete Manure for Potatoes and Vegetables	Bangor
4572	Bradley's Complete Manure for Potatoes and Vegetables 1916	Bangor
4625	Bradley's Complete Manure for Potatoes and Vegetables 1916	Portland
4438	Bradley's Corn Phosphate 1916	Farmington
4412	Bradley's Eclipse Phosphate 1916	Bangor
4439	Bradley's Eclipse Phosphate 1916	Farmington
4727	Bradley's Eclipse Phosphate 1916	Sebago Lake
4830	Bradley's Extra Quality Potato Manure	Belfast
4373	Bradley's General Fertilizer	Bangor
4423	Bradley's General Fertilizer	Belfast
4602	Bradley's General Fertilizer	Portland
4384	Bradley's Grain Fertilizer	Bangor
4426	Bradley's Grain Fertilizer	Belfast
4600	Bradley's Grain Fertilizer	Portland
4575	Bradley's High Grade Fertilizer 1916	Bangor
4770	Bradley's High Grade Fertilizer 1916	Gardiner
4367	Bradley's Maine Potato Special	Bangor
4574	Bradley's Maine Potato Special	Bangor
4811	Bradley's Maine Potato Special	Rockland
4824	Bradley's Maine Potato Special	Dixfield
4413	Bradley's 1916 Corn Phosphate	Bangor
4482	Bradley's Northland Potato Grower	Fort Fairfield
4448	Bradley's Potato Fertilizer 1916	Bangor
4578	Bradley's Potato Fertilizer 1916	Bangor
4771	Bradley's Potato Fertilizer 1916	Gardiner
4697	Bradley's Potato Fertilizer	Saco
4363	Bradley's Potato Manure 1916	Bangor
4437	Bradley's Potato Manure 1916	Farmington
4417	Bradley's Root Crop Manure	Bangor
4422	Bradley's Root Crop Manure	Belfast

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen. As nitrate.	Nitrogen. As ammonia.	Nitrogen. As organic.	Nitrogen. Total.	Nitrogen. Active.	Nitrogen. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.
4527	9.48	1.42	1.12	0.94	3.48	3.23	3.29	10.03	10.00	11.48	11.00	------	------
4711	7.08	0.70	0.54	1.01	2.25	2.03	1.65	8.57	9.00	10.80	11.00	1.16	1.00
4385	8.00	0.50	0.20	0.45	1.15	1.05	0.82	9.21	10.00	10.27	11.00	------	------
4411	9.48	0.56	0.38	0.54	1.48	1.30	0.82	9.85	10.00	10.54	11.00	------	------
4599	8.79	0.26	0.24	0.70	1.20	1.20	0.82	10.36	10.00	11.10	11.00	------	------
4404	9.81	0.76	0.68	1.32	2.08	2.02	1.65	10.18	10.00	10.81	11.00	------	------
4594	8.24	0.46	0.48	1.12	2.06	1.69	1.65	9.08	10.00	12.04	11.00	------	------
4380	9.69	1.06	0.74	0.90	2.70	2.41	2.47	9.68	10.00	11.63	11.00	------	------
4431	8.78	0.94	0.82	0.86	2.62	2.44	2.47	9.81	10.00	10.88	11.00	------	------
4596	8.77	0.94	0.86	1.14	2.94	2.62	2.47	10.14	10.00	11.72	11.00	------	------
4359	8.55	1.62	0.98	0.74	3.34	3.15	3.29	9.76	10.00	12.43	11.00	------	------
4415	8.72	1.52	1.40	1.31	4.23	4.07	4.11	8.19	8.00	9.17	9.00	------	------
4611	8.24	1.70	1.30	1.04	4.04	3.67	4.11	8.68	8.00	10.21	9.00	------	------
4410	9.79	1.54	1.58	1.18	4.30	4.09	4.11	10.48	10.00	11.79	11.00	------	------
4419	10.06	1.52	1.42	1.22	4.16	3.97	4.11	10.57	10.00	11.90	11.00	------	------
4834	8.53	0.84	0.74	1.22	2.80	2.59	2.47	8.90	9.00	10.43	10.00	1.12	1.00
4355	9.31	1.38	0.86	1.10	3.34	3.10	3.29	8.87	9.00	10.18	10.00	1.12	1.00
4572	9.51	1.02	1.08	1.24	3.34	3.11	3.29	8.61	9.00	9.82	10.00	1.10	1.00
4625	13.29	1.34	0.94	1.04	3.32	2.96	3.29	9.00	9.00	9.89	10.00	1.06	1.00
4438	11.36	0.74	0.46	0.72	1.92	1.69	1.65	10.35	10.00	11.45	11.00	1.14	1.00
4412	14.18	0.52	0.38	0.48	1.38	1.25	1.23	9.91	10.00	10.78	11.00	1.21	1.00
4439	10.91	0.58	0.34	00.70	1.70	1.62	1.23	11.02	10.00	12.17	11.00	1.19	1.00
4727	14.56	0.48	0.16	0.73	1.37	1.16	1.23	9.78	10.00	11.23	11.00	1.10	1.00
4830	9.32	1.42	1.40	1.32	4.14	3.91	4.11	9.97	10.00	11.36	11.00	------	------
4373	8.35	0.76	0.42	0.72	1.90	1.77	1.65	9.69	10.00	11.83	11.00	------	------
4423	8.39	0.86	0.66	0.60	2.12	1.99	1.65	9.69	10.00	10.77	11.00	------	------
4602	9.06	0.56	0.56	0.78	1.90	1.73	1.65	9.51	10.00	10.81	11.00	------	------
4384	9.31	0.58	0.18	0.48	1.14	1.04	0.82	9.61	10.00	10.21	11.00	------	------
4426	8.70	0.48	0.24	0.66	1.38	1.38	0.82	9.99	10.00	11.34	11.00	------	------
4600	8.15	0.42	0.20	0.54	1.16	0.92	0.82	10.28	10.00	10.96	11.00	------	------
4575	10.99	0.90	0.72	1.18	2.80	2.38	2.47	8.73	9.00	10.26	10.00	1.09	1.00
4770	11.03	1.00	0.96	1.25	3.21	2.98	2.47	8.95	9.00	10.10	10.00	1.20	1.00
4367	9.43	1.62	1.42	1.10	4.14	3.96	4.11	9.51	10.00	11.74	11.00	------	------
4574	8.76	1.40	1.28	1.44	4.12	3.88	4.11	9.84	10.00	11.64	11.00	------	------
4811	9.60	1.40	1.30	0.62	4.32	4.10	4.11	9.57	10.00	12.03	11.00	------	------
4824	9.18	1.40	1.42	1.69	4.41	3.75	4.11	9.88	10.00	12.00	11.00	------	------
4413	13.31	0.64	0.40	0.62	1.66	1.50	1.65	10.35	10.00	11.18	11.00	1.18	1.00
4482	8.66	1.48	1.00	0.90	3.38	3.05	3.29	7.88	8.00	8.58	9.00	3.98	4.00
4448	8.74	0.84	0.74	0.60	2.18	1.99	2.06	9.08	8.00	9.95	9.00	1.04	1.00
4578	9.22	0.64	0.56	1.00	2.20	2.08	2.06	7.56	9.00	9.09	10.00	1.07	1.00
4771	11.05	0.78	0.54	0.88	2.20	1.92	2.06	8.75	8.00	10.19	9.00	1.31	1.00
4697	8.12	0.58	0.62	1.32	2.52	2.08	2.08	8.05	8.00	9.63	9.00	3.01	3.00
4363	8.75	0.96	0.64	0.86	2.46	2.19	2.47	8.49	9.00	10.30	10.00	1.03	1.00
4437	10.09	0.82	0.88	0.77	2.66	2.47	2.47	9.41	9.00	10.86	10.00	1.23	1.00
4417	9.35	1.22	1.18	0.96	3.36	3.21	3.29	10.12	10.00	11.40	11.00	------	------
4422	8.79	1.18	1.14	0.96	3.28	3.13	3.29	10.09	10.00	12.03	11.00	------	------

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4381	Bradley's Special Corn Phosphate without Potash	Bangor
4427	Bradley's Special Corn Phosphate without Potash	Belfast
4810	Bradley's Special Niagara	Thomaston
4472	Bradley's Special Niagara Superphosphate 1916	Gardiner
4379	Bradley's Special Potato Fertilizer without Potash	Bangor
4430	Bradley's Special Potato Fertilizer without Potash	Belfast
4424	Bradley's Special Potato Manure without Potash	Belfast
4361	Bradley's Special Potato Manure without Potash	Bangor
4360	Bradley's Special XL Superphosphate without Potash	Bangor
4428	Bradley's Special XL Superphosphate without Potash	Belfast
4622	Bradley's Special XL Super-Phosphate without Potash	Portland
4345	Bradley's XL Superphosphate of Lime	Bangor
4440	Bradley's XL Superphosphate of Lime	Farmington
4656	Bradley's Triplex Potato Special	Lincoln
4372	Bradley's Universal Crop Phosphate	Bangor
4604	Bradley's Universal Crop Phosphate	Portland
4577	Bradley's Universal Crop Phosphate 1916	Bangor
4382	Cereal & Root Fertilizer	Bangor
4626	Cereal & Root Fertilizer	Portland
4827	Cereal & Root Fertilizer	Dixfield
4822	Crocker's New Rival Ammoniated Superphosphate	Belfast
4819	Crocker's Revised Special Potato Manure	Belfast
4454	Darling's A-1 Fertilizer	Houlton
4550	Darling's A-1 Fertilizer	Caribou
4368	Darling's Blood Bone & Potash 1916	Bangor
4376	Extra Quality Potato Manure	Bangor
4425	Extra Quality Potato Manure	Belfast
4709	Extra Quality Potato Manure	Waterville
4828	Extra Quality Potato Manure	Dixfield
4618	Grain & Lawn Top Dressing 1916	Portland
4414	Grain and Seed Fertilizer	Bangor
4621	Grain & Seeding Fertilizer	Portland
4837	Grain & Seeding Fertilizer	No. Vassalboro
4821	Great Eastern General	Belfast
4405	Great Eastern Northern Corn Special	Belfast
4823	Great Eastern Potato Manure	Belfast
4421	Great Eastern Revised High Grade Potato Manure	Belfast
4446	Great Eastern Revised High Grade Potato Manure	Houlton
4819	Great Eastern Revised High Grade Potato Manure	Belfast
4444	Great Eastern Superior Potato Grower	Houlton
4547	Great Eastern Superior Potato Grower	Caribou
4449	Great Harvester Potato Manure 1916	Bangor
4378	High Grade Acid Phosphate	Bangor
4406	High Grade Acid Phosphate	Belfast
4595	High Grade Acid Phosphate	Portland
4362	High Grade Fertilizer 1916	Bangor
4725	High Grade Fertilizer 1916	West Falmouth
4825	High Grade Grass Top Dressing without Potash 1916	Dixfield

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen. As nitrate.	Nitrogen. As ammonia.	Nitrogen. As organic.	Nitrogen. Total.	Nitrogen. Active.	Nitrogen. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.
4381	10.37	0.78	0.48	0.66	1.92	1.79	1.65	11.28	10.00	12.19	11.00	------	------
4427	8.89	0.72	0.40	0.70	1.82	1.70	1.65	9.78	10.00	11.87	11.00	------	------
4810	15.05	0.10	0.24	0.71	1.05	0.90	0.82	7.03	10.00	8.66	11.00	1.00	1.00
4772	6.97	0.36	0.22	0.70	1.28	1.10	0.82	8.57	8.00	10.37	9.00	1.37	1.00
4379	10.23	0.84	0.52	0.42	1.78	1.67	1.65	11.20	10.00	12.12	11.00	------	------
4430	8.75	0.68	0.46	0.78	1.92	1.78	1.65	9.86	10.00	11.90	11.00	------	------
4424	8.56	1.02	0.74	0.96	2.62	2.47	2.47	9.54	10.00	11.48	11.00	------	------
4361	8.57	0.98	0.78	0.84	2.60	2.44	2.47	9.33	10.00	11.69	11.00	------	------
4360	7.57	0.86	0.76	0.90	2.52	2.37	2.47	9.00	10.00	11.77	11.00	------	------
4428	8.92	0.90	0.78	0.80	2.48	2.35	2.47	10.01	10.00	11.82	11.00	------	------
4622	9.50	0.94	0.78	0.92	2.64	2.39	2.47	9.87	10.00	11.24	11.00	------	------
4345	8.55	1.10	0.64	0.78	2.52	2.23	2.47	8.82	9.00	10.53	10.00	1.00	1.00
4440	10.17	0.78	0.80	0.96	2.54	2.41	2.47	9.52	9.00	11.01	10.00	1.22	1.00
4656	9.62	1.64	1.36	1.18	4.18	3.98	4.11	9.80	10.00	11.23	11.00	3.58	4.00
4372	8.47	1.20	0.78	0.62	2.60	2.40	2.47	9.90	10.00	12.07	11.00	------	------
4604	9.98	0.90	0.64	1.30	2.84	2.54	2.47	9.56	10.00	11.58	11.00	------	------
4577	9.43	0.96	0.82	0.90	2.68	2.49	2.47	9.22	10.00	11.34	11.00	------	------
4382	8.96	1.04	0.80	0.72	2.56	2.40	2.47	9.91	10.00	11.87	11.00	------	------
4626	10.12	1.04	0.72	0.90	2.66	2.41	2.47	10.55	10.00	11.83	11.00	------	------
4827	9.63	0.96	0.78	1.06	2.80	2.53	2.47	9.26	10.00	11.90	11.00	------	------
4822	10.25	0.34	0.26	0.79	1.39	1.09	0.82	10.80	10.00	12.04	11.00	0.92	1.00
4819	8.99	1.44	1.14	1.27	3.85	3.49	3.29	10.19	10.00	11.25	11.00	3.15	3.00
4454	9.87	1.70	1.40	1.22	4.32	3.98	4.11	9.97	10.00	11.50	11.00	------	------
4550	8.82	1.74	1.36	1.15	4.25	3.96	4.11	10.27	10.00	11.76	11.00	------	------
4368	9.93	1.22	1.56	1.46	4.24	3.82	4.11	8.21	8.00	9.63	9.00	1.12	1.00
4376	8.20	1.98	1.36	0.86	4.20	3.91	4.11	10.27	10.00	11.52	11.00	------	------
4425	9.44	1.54	1.46	1.16	4.16	3.89	4.11	10.13	10.00	11.29	11.00	------	------
4709	10.02	1.50	1.30	1.41	4.27	3.92	4.11	10.19	10.00	12.38	11.00	------	------
4828	9.60	1.60	1.32	1.32	4.24	3.99	4.11	9.96	10.00	11.96	11.00	------	------
4618	12.20	1.22	1.14	1.28	3.64	3.38	3.70	7.37	8.00	9.81	9.00	0.98	1.00
4414	9.74	0.74	0.50	0.70	1.94	1.78	1.65	9.79	10.00	12.00	11.00	------	------
4621	11.01	0.76	0.36	0.74	1.86	1.69	1.65	10.63	10.00	11.91	11.00	------	------
4837	11.37	0.62	0.44	1.01	2.07	1.81	1.65	9.72	10.00	12.09	11.00	------	------
4821	8.99	0.18	0.16	0.90	1.24	1.08	0.82	9.64	8.00	11.36	9.00	0.97	1.00
4405	10.01	0.56	0.56	1.10	2.22	2.07	2.06	9.67	8.00	10.53	11.00	0.97	1.00
4823	9.56	0.64	0.62	1.02	2.28	2.12	2.06	10.71	10.00	11.93	11.00	1.11	1.00
4421	9.35	1.44	1.14	0.70	3.28	3.03	3.29	10.09	10.00	10.93	11.00	2.71	3.00
4446	9.77	1.42	1.18	0.66	3.26	3.04	3.29	10.10	10.00	11.20	11.00	3.08	3.00
4819	8.99	1.44	1.14	0.84	3.42	3.06	3.29	10.26	10.00	11.28	11.00	3.15	3.00
4444	10.38	1.32	1.18	0.76	3.26	3.05	3.29	8.92	8.00	9.70	9.00	4.01	4.00
4547	10.56	1.38	1.14	0.74	3.26	3.11	3.29	8.39	8.00	10.02	9.00	3.88	4.00
4449	11.26	1.46	1.38	1.36	4.20	3.76	4.11	8.18	8.00	9.65	9.00	1.12	1.00
4378	9.57	------	------	------	------	------	------	16.49	16.00	17.15	17.00	------	------
4406	8.55	------	------	------	------	------	------	16.70	16.00	17.21	------	------	------
4595	10.16	------	------	------	------	------	------	16.29	16.00	16.88	17.00	------	------
4362	8.95	0.92	0.76	0.84	2.52	2.31	2.47	8.56	9.00	10.24	10.00	1.08	1.00
4725	9.09	0.56	1.36	1.21	3.55	3.25	2.47	8.86	9.00	10.67	10.00	1.27	1.00
4825	8.42	3.54	1.90	0.93	6.37	6.02	6.58	8.66	8.00	9.67	9.00	------	------

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4348	Lister's High Grade Special for Spring Crops 1916	Bangor
4364	Lister's Standard Pure Superphosphate of Lime 1916	Bangor
4347	Lister's Superior Ammoniated Superphosphate 1916	Bangor
4447	Northern Maine Potato Special 1916	Houlton
4833	Northern Maine Potato Special 1916	Vassalboro
4829	Packers Union Animal Brand Fertilizer	Belfast
4842	Packers Union Animal Corn Fertilizer 1916	Norway
4820	Packers Union Potato Manure	Belfast
4841	Packers Union Potato Manure 1916	Norway
4407	Packers Union Universal Fertilizer	Belfast
4843	Packers Union Universal Fertilizer 1916	Norway
4726	Pacific Special Grass & Grain Fertilizer	West Falmouth
4836	Pacific Special Potato Fertilizer without Potash	No. Vassalboro
4693	Plain Superphosphate	Saco
4724	Quinnipiac Climax Phosphate 1916	West Falmouth
4887	Quinnipiac Corn Manure 1916	Yarmouth
4886	Read's Vegetable & Vine Fertilizer 1916	Yarmouth
4445	Revised Aroostook High Grade	Houlton
4497	Revised Aroostook High Grade	Presque Isle
4539	Revised Aroostook High Grade	Presque Isle
4835	Special Soluble Pacific Guano without Potash	Vassalboro
4844	Special Soluble Pacific Guano without Potash	Monmouth
4382	Special Vegetable Fertilizer	Bangor
4623	Special Vegetable Fertilizer	Portland
4826	Special Vegetable Fertilizer	Dixfield
4884	Special Vegetable Fertilizer	So. China
4749	Standard Fertilizer 1916	Auburn
4712	Standard Guano	Fairfield
4803	Standard Guano 1916	Canton
4804	Standard Special for Potatoes 1916	Canton
4508	Williams & Clark Americus Corn Phosphate without Potash	Portland
4597	Williams & Clark Americus Potato Manure without Potash	Portland
4601	Williams & Clark Americus High Grade Special for Potatoes & Root Crops 1916	Portland
	ARMOUR FERTILIZER WORKS, BALTIMORE, MARYLAND.	
4645	Armour's Acid Phosphate Fertilizer	Portland
4643	Armour's Bone Meal Fertilizer	Portland
4597	Armour Fertilizer 4-8-4	Mars Hill
4443	Armour's 5-8-2	Houlton
4650	Armour's 5-8-2	Bucksport
4442	Armour's 5-10-0	Houlton
4535	Armour's 5-10-0	Crouseville
4639	Armour's 4-8 Fertilizer	Portland
4686	Armour's 4-8 Fertilizer	Madison
4751	Armour's 4-8 Fertilizer	New Auburn
4763	Armour's 4-8 Fertilizer	Farmington
4495	Armour 4-8-4	Presque Isle

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4348	8.86	0.88	0.54	0.66	2.08	1.82	2.06	10.11	10.00	11.48	11.00	1.11	1.00
4364	8.04	0.86	0.84	0.86	2.56	2.25	2.47	8.67	9.00	10.26	10.00	------	------
4347	7.81	1.34	1.00	0.98	3.32	3.02	3.29	10.46	10.00	12.03	11.00	------	------
4447	9.90	1.44	1.14	0.70	3.28	3.03	3.29	9.17	9.00	10.22	10.00	1.07	1.00
4833	8.97	1.16	0.96	1.16	3.36	3.01	3.29	9.23	9.00	10.53	10.00	1.25	1.00
4829	10.14	0.62	0.34	0.99	1.95	1.74	1.65	10.82	10.00	12.06	11.00	1.07	1.00
4842	11.67	0.62	0.56	1.00	2.18	2.02	1.65	10.70	10.00	12.54	11.00	1.06	1.00
4820	11.40	0.74	0.70	0.90	2.34	2.11	2.06	10.13	10.00	11.60	11.00	1.18	1.00
4841	9.78	0.86	0,60	0.93	2.39	2.19	2.06	9.97	10.00	11.76	11.00	1.03	1.00
4407	8.33	0.16	0.20	0.84	1.20	1.20	0.82	9.88	8.00	11.31	9.00	0.98	1.00
4843	9.76	0.14	0.18	0.87	1.19	1.04	0.82	9.77	8.00	11.48	9.00	0.95	1.00
4726	12.44	0.26	0.16	0.60	1.02	0.84	0.82	7.98	8.00	9.33	9.00	1.06	1.00
4836	11.05	0.60	0.44	1.07	2.11	1.89	1.65	9.64	10.00	12.15	11.00	------	------
4693	7.40	------	------	------	------	------	------	15.28	14.00	16.08	15.00	------	------
4724	8.89	0.12	0.16	0.82	1.10	0.90	0.82	9.86	8.00	11.66	9.00	1.03	1.00
4887	11.50	0.52	0.44	0.90	1.86	1.61	1.65	9.57	10.00	11.39	11.00	1.20	1.00
4886	12.24	0.80	0.74	1.01	2.55	2.22	2.47	8.92	9.00	9.95	10.00	0.97	1.00
4445	10.91	1.80	1.58	0.90	4.22	3.96	4.11	9.94	10.00	10.94	11.00	3.97	4.00
4497	9.94	1.62	1.34	1.28	4.24	3.92							
4539	10.54	1.44	1.28	1.37	4.09	3.78	4.11	9.77	10.00	11.07	11.00	4.03	4.00
							4.11	9.84	10.00	10.86	11.00	3.99	4.00
4835	11.39	0.56	0.44	1.09	2.09	1.94	1.65	9.89	10.00	12.20	11.00	------	------
4844	8.74	0.50	0.50	0.85	1.85	1.67	1.65	9.22	10.00	11.21	11.00	------	------
4383	9.18	1.44	1.22	0.64	3.30	3.20	3.29	10.18	10.00	11.52	11.00	------	------
4623	9.64	1.42	0.94	1.00	3.36	3.12	3.29	9.63	10.00	11.76	11.00	------	------
4826	10.87	1.28	1.16	1.12	3.56	3.23	3.29	9.81	10.00	12.14	11.00	------	------
4884	10.23	1.16	1.04	1.21	3.41	3.16	3.29	9.88	10.00	11.47	11.00	------	------
4749	9.30	0.60	0.44	0.97	2.07	1.89	1.65	10.08	10.00	11.69	11.00	1.20	1.00
4712	4.31	0.34	0.22	0.53	1.09	0.98	0.82	7.77	8.00	8.98	9.00	1.16	1.00
4803	7.01	0.30	0.42	0.48	1.20	1.00	0.82	7.77	8.00	9.67	9.00	1.20	1.00
4804	9.41	0.66	0.74	1.04	2.44	2.13	2.00	8.00	8.00	9.74	9.00	1.09	1.00
4598	10.25	0.70	0.44	0.72	1.86	1.70	1.65	10.20	10.00	11.48	11.00	------	------
4597	9.79	0.52	0.50	0.80	1.92	1.79	1.65	10.03	10.00	11.66	11.00	------	------
4601	13.27	1.10	1.02	1.22	3.34	3.10	3.29	8.86	9.00	9.60	10.00	1.30	1.00
4645	10.59	------	------	------	------	------	------	17.24	16.00	17.72	16.50	------	------
4643	3.79	------	------	------	2.52	------	2.47	------	------	24.53	22.00	------	------
4507	9.85	1.38	0.10	1.82	3.30	2.83	3.29	8.47	8.00	8.93	8.50	4.44	4.00
4443	8.99	1.90	1.30	0.86	4.16	3.70	4.11	8.01	8.00	8.52	8.50	------	2.00
4650	8.97	1.34	1.64	1.29	4.27	3.74	4.11	8.12	8.00	9.22	8.50	2.16	2.00
4442	11.26	2.40	0.12	1.64	4.16	3.51	4.11	10.24	10.00	11.45	11.50	------	------
4535	13.01	1.12	0.06	1.98	4.16	3.39	4.11	10.10	10.00	11.16	10.50	------	------
4760	4.34	0.34	0.90	1.20	2.44	1.96	3.29	7.64	8.00	8.79	8.50	------	------
4630	7.64	1.04	0.10	2.16	3.30	2.72	3.29	7.97	8.00	9.00	8.50	------	------
4686	7.93	1.32	0.06	2.20	3.58	3.11	3.29	8.22	8.00	9.27	8.50	------	------
4751	4.60	0.92	1.02	1.63	3.57	3.08	3.29	7.18	8.00	8.71	8.50	------	------
4495	9.95	1.38	0.06	2.16	3.60	3.08	3.29	8.30	8.00	8.95	8.50	4.44	4.00

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4455	Armour 4-8-2 Fertilizer	Houlton
4556	Armour's 4-8-2	Caribou
4637	Armour's 4-8-2	Portland
4890	Armour's 4-10 Fertilizer	Augusta
4631	Armour's 2-8-3 Fertilizer	Portland
4758	Armour's 2-8-3 Fertilizer	Farmington
4641	Armour's 2-8-2	Portland
4687	Armour's 2-8-2	Madison
4761	Armour's 2-8-2 Fertilizer	Farmington
4638	Armour's 2-11	Portland
	BAUGH & SONS CO., BALTIMORE, MARYLAND.	
4461	Baugh's Aroostook 4-8-4	Houlton
	BOWKER FERTILIZER CO., BOSTON, MASS.	
4452	Bowker's All Round Fertilizer 1916	Houlton
4492	Bowker's Blood, Bone & Potash 1916	Presque Isle
4335	Bowker's Brighton Phosphate	Belfast
4377	Bowker's Brighton Phosphate	Bangor
4396	Bowker's Corn Phosphate 1916	Belfast
4756	Bowker's Corn Phosphate 1916	Farmington
4802	Bowker's Corn Phosphate 1916	Canton
4583	Bowker's Farm & Garden Phosphate 1916	Portland
4356	Bowker's Four-Ten Hill and Drill	Bangor
4397	Bowker's Hill & Drill 4-10	Belfast
4340	Bowker's One-Ten Sure Crop	Belfast
4386	Bowker's One-Ten Sure Crop	Bangor
4787	Bowker's One-Ten Sure Crop	Portland
4862	Bowker's One-Ten Sure Crop	Pejepscot
4451	Bowker's Potato Phosphate 1916	Houlton
4696	Bowker's Potato and Vegetable Fertilizer Revised	Saco
4586	Bowker's Soluble Phosphate	Portland
4337	Bowker's Superphosphate Ammonia 1%	Belfast
4349	Bowker's Superphosphate with Ammonia 3%	Bangor
4371	Bowker's Superphosphate with Ammonia 2%	Bangor
4794	Bowker's Sure Crop Phosphate	Sabattus
4418	Bowker's Sure Crop Phosphate 1916	Bangor
4333	Bowker's Three-Ten All Round	Belfast
4351	Bowker's Three-Ten All Round	Bangor
4352	Bowker's Two-Ten Corn	Bangor
4398	Bowker's Two-Ten Corn	Belfast
4339	Bowker's Two-Ten Farm and Garden	Belfast
4354	Bowker's Two-Ten Farm and Garden	Bangor
4579	Bowker's Two-Ten Farm & Garden	Portland
4334	Bowker's Two-Ten Potato	Belfast
4353	Bowker's Two-Ten Potato	Bangor
4338	Stockbridge Cereal Manure without Potash	Belfast
4358	Stockbridge Cereal Manure without Potash	Bangor
4475	Stockbridge Complete	Ft. Fairfield

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4455	8.96	1.44	0.86	1.17	3.47	2.78	3.29	7.69	8.00	8.49	8.50	2.23	2.00
4556	8.87	1.26	0.72	1.54	3.52	2.94	3.29	7.65	8.00	8.61	8.50	2.16	2.00
4637	11.46	1.26	0.24	1.92	3.42	2.72	3.29	8.22	8.00	9.22	8.50	2.09	2.00
4890	10.48	1.88	0.06	2.06	3.50	2.65	3.29	10.18	10.00	11.55	10.50	------	------
4631	9.46	0.38	0.26	1.01	1.90	1.36	1.65	8.88	8.00	10.30	8.50	2.32	3.00
4758	8.28	0.46	0.28	1.20	1.94	1.36	1.65	8.12	8.00	9.60	8.50	2.67	3.00
4641	7.42	0.72	0.30	0.74	1.76	1.46	1.65	8.07	8.00	9.54	8.50	1.99	2.00
4687	8.40	0.40	0.42	1.41	2.23	1.88	1.65	8.06	8.00	9.73	8.50	2.05	2.00
4761	9.45	0.56	0.22	0.79	1.57	1.19	1.65	8.02	8.00	9.65	8.50	2.33	2.00
4638	8.54	0.14	0.16	1.34	1.64	1.12	1.65	10.02	11.00	12.34	11.50	------	------
4461	10.14	0.92	1.48	1.08	3.48	3.03	3.30	8.57	8.00	10.11	9.00	3.81	4.00
4452	12.52	0.96	0.56	0.66	2.18	1.90	2.06	9.64	10.00	10.62	11.00	1.17	1.00
4492	10.63	1.60	1.44	1.08	4.12	3.95	4.11	8.67	8.00	9.82	9.00	1.23	1.00
4335	8.18	0.32	0.06	0.82	1.20	1.13	0.82	9.05	8.00	10.38	10.00	1.39	1.00
4377	11.57	0.46	0.26	0.38	1.10	0.98	0.82	8.97	8.00	9.70	9.00	1.24	1.00
4396	10.76	0.78	0.56	0.50	1.84	1.71	1.65	10.90	10.00	11.30	11.00	1.03	1.00
4756	10.91	0.70	0.66	0.83	2.19	2.00	1.65	9.56	10.00	10.94	11.00	1.37	1.00
4802	10.08	0.56	0.36	1.10	2.02	1.91	1.65	9.57	10.00	10.97	11.00	1.18	1.00
4583	10.63	0.72	0.58	0.67	1.97	1.81	1.65	10.91	10.00	12.38	11.00	1.04	1.00
4356	7.79	1.30	1.20	0.80	3.30	3.04	3.29	9.58	10.00	11.50	11.00	------	------
4397	9.92	1.20	1.12	0.94	3.26	3.12	3.29	10.14	10.00	11.48	11.00	------	------
4340	9.77	0.60	0.22	0.32	1.14	1.14	0.82	11.28	10.00	12.68	11.00	------	------
4386	8.02	0.44	0.26	0.46	1.16	1.02	0.82	10.02	10.00	11.02	11.00	------	------
4587	9.70	0.18	0.34	0.88	1.40	1.33	0.82	9.87	10.00	11.19	11.00	------	------
4862	8.31	0.36	0.20	0.59	1.15	1.05	0.82	9.88	10.00	11.98	11.00	------	------
4451	15.40	0.74	0.40	0.64	1.78	1.51	1.65	9.67	10.00	10.54	11.00	1.12	1.00
4696	10.08	1.12	0.88	0.99	2.99	2.51	2.88	8.18	8.00	9.49	9.00	3.84	4.00
4586	9.16	------	------	------	------	------	------	14.41	14.00	15.25	15.00	------	------
4337	7.54	0.56	0.30	0.40	1.26	1.26	0.82	9.68	10.00	11.82	11.00	------	------
4349	8.53	1.02	0.94	0.78	2.74	2.48	2.47	10.14	10.00	11.61	11.00	------	------
4371	8.74	0.72	0.64	1.08	1.74	1.57	1.65	9.75	10.00	10.67	11.00	------	------
4794	8.56	0.38	0.28	0.51	1.17	1.00	0.82	9.57	10.00	10.85	11.00	1.09	1.00
4418	12.66	0.34	0.24	0.54	1.12	1.00	0.82	10.04	10.00	11.60	11.00	1.18	1.00
4333	8.52	0.92	0.76	0.98	2.66	2.55	2.47	9.15	10.00	12.27	11.00	------	------
4351	8.32	0.96	0.78	0.66	2.40	2.35	2.47	10.06	10.00	12.15	11.00	------	------
4352	8.67	0.62	0.62	0.64	1.88	1.74	1.65	9.70	10.00	12.14	11.00	------	------
4398	9.61	0.92	0.62	0.74	2.28	2.17	1.65	10.07	10.00	11.88	11.00	------	------
4339	9.43	0.84	0.40	0.60	1.84	1.77	1.65	9.93	10.00	12.07	11.00	------	------
4354	7.81	0.62	0.54	0.58	1.74	1.62	1.65	9.46	10.00	11.96	11.00	------	------
4579	9.63	0.54	0.52	0.84	1.90	1.81	1.65	9.56	10.00	11.28	11.00	------	------
4334	7.82	0.76	0.38	0.70	1.84	1.79	1.65	10.08	10.00	12.25	11.00	------	------
4353	8.28	0.78	0.60	0.46	1.84	1.71	1.65	10.19	10.00	12.30	11.00	------	------
4338	8.74	1.20	1.18	0.88	3.26	3.12	3.29	9.60	10.00	12.33	11.00	------	------
4358	8.55	1.28	1.28	0.78	3.34	3.08	3.29	9.65	10.00	11.39	11.00	------	------
4470	12.05	1.66	1.12	1.26	4.04	3.68	4.11	9.62	10.00	10.64	11.00	3.85	4.00

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4357	Stockbridge Five-Eight General Crop	Bangor
4435	Stockbridge Five-Eight General Crop	Farmington
4585	Stockbridge Five-Eight General Crop	Portland
4336	Stockbridge Five-Ten Early Crop	Belfast
4350	Stockbridge Five-Ten Early Crop	Bangor
4453	Stockbridge General Crop Manure 1916	Houlton
4801	Stockbridge General Crop Manure 1916	Canton
4450	Stockbridge Market & Garden Manure	Houlton
4472	Stockbridge Market & Garden Manure	Ft. Fairfield
4481	Stockbridge Market & Garden Manure	Ft. Fairfield
4563	Stockbridge Market & Garden Manure	Van Buren
4499	Stockbridge Potato Manure "A" without Potash	Presque Isle
4589	Stockbridge Potato Manure "A" without Potash	Portland
4343	Stockbridge Potato Manure "A" without Potash 1916	Bangor
4420	Stockbridge Potato Manure "B" without Potash	Bangor
4480	Stockbridge Potato Manure "B" without Potash 1916	Ft. Fairfield
	CHESAPEAKE CHEMICAL COMPANY, BALTIMORE, MARYLAND.	
4516	C. C. Company's Special Improved Mixture	Mapleton
4477	Maine Special	Houlton
4499	Potato Compound	Presque Isle
4498	Potash Special	Presque Isle
	E. D. CHITTENDEN CO., BRIDGEPORT, CONN.	
4469	Chittenden's Potato & Grain	Ft. Fairfield
4523	Chittenden's Potato & Grain	Mapleton
	COE-MORTIMER CO., NEW YORK CITY, N. Y.	
4329	Aroostook Potato Special	Belfast
4327	E. Frank Coe's Celebrated Special Potato Fertilizer Revised	Belfast
4532	E. Frank Coe's Celebrated Special Potato Fertilizer Revised	Washburn
4321	E. Frank Coe's Columbian Corn & Potato Fertilizer	Belfast
4410	E. Frank Coe's Columbian Corn & Potato Fertilizer 1916	Bangor
4315	E. Frank Coe's Double Strength Potato Manure	Belfast
4375	E. Frank Coe's Double Strength Potato Manure 1916	Bangor
4540	E. Frank Coe's Double Strength Potato Manure 1916	Presque Isle
4333	E. Frank Coe's Excelsior Potato Fertilizer 1916	Belfast
4458	E. Frank Coe's Excelsior Potato Fertilizer 1916	Houlton
4320	E. Frank Coe's Extra Special Potato Fertilizer Revised	Belfast
4531	E. Frank Coe's Extra Special Potato Fertilizer Revised	Washburn
4542	E. Frank Coe's Extra Special Potato Fertilizer Revised	Presque Isle
4318	E. Frank Coe's Gold Brand Excelsior Guano	Belfast
4331	E. Frank Coe's High Grade Ammoniated Superphosphate 1916	Belfast
4365	E. Frank Coe's High Grade Ammoniated Superphosphate 1916	Bangor
4328	E. Frank Coe's High Grade Potato Fertilizer Revised	Belfast
4838	E. Frank Coe's High Grade Soluble Phosphate	South Paris
4764	E. Frank Coe's High Grade Soluble Phosphate	West Farmington
4317	E. Frank Coe's New Englander Special 1916	Belfast
4675	E. Frank Coe's New Englander Special 1916	Skowhegan
4094	E. Frank Coe's New Englander Special 1916	Saco

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4357	7.61	1.60	1.36	1.22	4.18	3.92	4.11	7.88	8.00	9.28	9.00	------	------
4435	8.86	1.44	1.46	1.42	4.32	3.98	4.11	8.68	8.00	9.89	9.00	------	------
4585	8.76	1.68	1.26	1.18	4.12	3.88	4.11	7.97	8.00	9.67	9.00	------	------
4336	8.46	1.42	1.54	1.28	4.24	4.05	4.11	10.16	10.00	12.04	11.00	------	------
4350	8.77	1.60	1.20	1.34	4.14	3.86	4.11	9.42	10.00	11.88	11.00	------	------
4453	10.22	1.48	1.00	0.92	3.40	3.06	3.29	9.31	9.00	10.14	10.00	1.04	1.00
4801	9.89	1.16	1.00	1.46	3.62	3.18	3.29	8.89	9.00	10.45	10.00	1.06	1.00
4450	12.33	1.54	0.76	1.08	3.28	2.86	3.29	8.43	8.00	9.57	9.00	4.03	4.00
4472	9.48	1.66	1.00	1.06	3.72	3.33	3.29	8.56	8.00	9.38	9.00	4.01	4.00
4481	10.67	1.54	1.18	1.50	3.22	2.97	3.29	8.61	8.00	10.19	9.00	3.97	4.00
4563	10.97	1.06	1.14	1.10	3.30	3.12	3.29	9.06	8.00	9.60	9.00	3.99	4.00
4490	9.96	1.54	1.38	1.44	4.26	4.03	4.11	8.55	10.00	9.47	11.00	------	------
4589	9.03	1.28	1.60	1.14	4.02	3.77	4.11	8.47	8.00	9.31	9.00	------	------
4343	9.31	1.54	1.28	1.32	4.14	3.72	4.11	8.65	8.00	10.21	9.00	------	------
4420	10.10	1.78	1.44	1.20	4.02	3.82	4.11	10.21	10.00	11.23	11.00	------	------
4480	9.28	1.88	1.52	0.66	4.06	3.79	4.11	10.32	10.00	11.60	11.00	------	------
4516	10.94	2.04	0.16	0.94	3.30	3.14	3.28	9.39	9.00	13.64	10.00	------	------
4477	11.93	0.24	2.64	0.36	3.24	3.06	3.28	9.64	8.00	10.85	9.00	------	------
4499	10.74	2.28	1.20	0.64	4.12	3.88	4.10	10.28	10.00	11.44	11.00	------	------
4498	10.77	2.14	0.84	1.14	4.12	3.08	4.10	9.20	10.00	10.53	11.00	0.97	1.00
4469	15.80	1.76	0.32	1.10	3.28	2.90	3.30	9.21	8.00	11.58	9.00	2.87	3.00
4520	13.66	0.22	1.66	1.45	3.33	2.82	3.30	8.91	8.00	10.38	9.00	2.59	3.00
4329	8.16	1.64	1.84	0.70	4.18	3.96	4.11	8.89	8.00	10.29	9.00	------	------
4327	9.57	1.26	1.10	0.98	3.34	3.24	3.29	8.27	8.00	10.49	9.00	3.99	4.00
4532	11.29	1.38	1.10	0.80	3.28	3.16	3.29	7.85	8.00	9.78	9.00	4.19	4.00
4321	9.32	0.52	0.40	0.66	1.58	1.44	1.23	10.13	10.00	11.80	11.00	1.10	1.00
4416	14.03	0.48	0.42	0.66	1.56	1.45	1.23	9.62	10.00	10.54	11.00	1.19	1.00
4315	9.37	1.56	1.26	0.94	3.76	3.48	3.70	7.78	8.00	9.74	9.00	1.27	1.00
4375	11.80	1.82	0.86	0.72	3.40	3.11	3.70	8.06	8.00	9.20	9.00	1.12	1.00
4540	8.67	1.66	0.98	1.12	3.76	3.39	3.70	8.42	8.00	9.95	9.00	1.27	1.00
4330	7.86	1.42	1.38	1.12	3.92	3.70	4.11	10.65	10.00	12.28	11.00	------	------
4458	9.60	1.68	1.42	1.00	4.10	3.84	4.11	10.53	10.00	11.50	11.00	------	------
4326	9.20	1.64	1.54	1.06	4.24	3.96	4.11	9.88	10.00	10.91	11.00	4.09	4.00
4531	10.40	1.52	1.54	1.10	4.16	3.59	4.11	9.94	10.00	11.37	11.00	4.36	4.00
4542	10.46	1.54	1.46	1.08	4.08	3.88	4.11	9.81	10.00	11.01	11.00	4.12	4.00
4318	9.27	1.06	1.00	0.82	2.88	2.65	2.47	8.46	9.00	10.37	10.00	1.28	1.00
4331	8.86	1.00	0.84	0.80	2.64	2.56	2.47	9.81	10.00	11.55	11.00	------	------
4365	9.53	1.14	1.08	0.36	2.58	2.45	2.47	9.82	10.00	11.61	11.00	------	------
4328	10.57	1.12	1.16	0.94	3.22	3.05	3.29	10.24	10.00	11.85	11.00	3.03	3.00
4838	6.14	------	------	------	------	------	------	14.07	14.00	15.86	15.00	------	------
4764	6.98	------	------	------	------	------	------	14.17	14.00	15.98	15.00	------	------
4317	5.32	0.50	0.34	0.29	1.13	1.13	0.82	7.17	8.00	8.66	9.00	1.03	1.00
4675	6.23	0.42	0.30	0.51	1.23	1.13	0.82	7.43	8.00	8.77	9.00	1.29	1.00
4694	7.04	0.42	0.34	0.88	1.64	1.57	0.82	8.99	8.00	10.14	9.00	1.24	1.00

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4332	E. Frank Coe's Prolific Crop Producer	Belfast
4457	E. Frank Coe's Prolific Crop Producer	Houlton
4366	E. Frank Coe's Prolific Crop Producer 1916	Bangor
4840	E. Frank Coe's Prolific Crop Producer 1916	South Paris
4316	E. Frank Coe's Red Brand Excelsior Guano	Belfast
4319	E. Frank Coe's Reliable Crop Grower	Belfast
4839	E. Frank Coe's Reliable Crop Grower 1916	South Paris
4325	E. Frank Coe's 16% Superphosphate	Belfast
4324	E. Frank Coe's Standard Potato Fertilizer	Belfast
4374	E. Frank Coe's Standard Potato Fertilizer 1916	Bangor
4765	E. Frank Coe's Standard Potato Fertilizer 1916	West Farmington
432	E. Frank Coe's Universal Fertilizer	Belfast
4763	E. Frank Coe's Universal Fertilizer 1916	West Farmington
466	High Grade Ammoniated Superphosphate 1916	E. Newport
432	Packers Union Potato Manure	Belfast
4323	Standard Fertilizer	Belfast
	CONSUMERS CHEMICAL CORPORATION, NEW YORK CITY, N. Y.	
4503	Consumers Pure-Sure Potato & Vegetable with 4% Potash	Ft. Fairfield
4508	Consumers Pure-Sure Potato & Vegetable with 3% Potash	Westfield
4504	Consumers Pure-Sure Potato with 1% Potash	Ft. Fairfield
	DOMINION FERTILIZER CO., LTD., ST. STEPHEN, N. B., CAN.	
4548	Dominion Complete Potato Manure	Caribou
4500	Dominion 4-8-4	Presque Isle
4534	Dominion 4-8-4	Crouseville
4657	Dominion 4-8-4	Lincoln
4672	Dominion 4-8-3	Pittsfield
4449	Dominion General Crop 4-10-0	Belfast
4545	Dominion General Crop 4-10	Caribou
4673	Dominion General Crop 4-10	Pittsfield
4546	Dominion King Brand 5-10-0	Caribou
4655	Dominion King Brand 5-10	Lincoln
4680	Dominion Special Vegetable Manure 3-10-0	Skowhegan
4408	Dominion Vegetable Corn and Grain Manure 2-9-1	Belfast
4662	Dominion Vegetable Corn and Grain Manure 2-9-1	Lincoln Center
4674	Dominion Vegetable Corn and Grain Manure 2-9-1	Pittsfield
	ESSEX FERTILIZER CO., BOSTON, MASS.	
4775	Essex Grain, Grass & Potato Fertilizer	Winthrop
4745	Essex Grain, Grass & Potato Fertilizer	Bowdoinham
4800	Essex Grain, Grass & Potato Fertilizer	Mexico
4744	Essex High Grade 5-8	Bowdoinham
4723	Essex Market Garden & Potato Manure	Saco
4793	Essex Market Garden & Potato Manure	Sabattus
4799	Essex Market Garden & Potato Manure	Mexico
4813	Essex Market Garden & Potato Manure	Rockland
4774	Essex Potato Corn & Vegetable	Winthrop
4511	Essex Potato Corn & Vegetable	Houlton
4513	Essex Potato Corn & Vegetable	Presque Isle

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4332	8.39	1.22	1.06	0.96	3.24	3.13	3.29	9.62	10.00	11.64	11.00	------	------
4457	9.19	1.74	1.12	0.56	3.42	3.20	3.29	10.21	10.00	11.83	11.00	------	------
4366	8.12	1.34	1.28	0.68	3.30	3.16	3.29	9.56	10.00	11.23	11.00	------	------
4840	8.85	0.86	0.60	1.33	3.53	3.46	3.29	9.64	10.00	11.52	11.00	------	------
4316	8.67	1.86	1.72	0.57	4.15	3.98	4.11	8.01	8.00	9.57	9.00	1.42	1.00
4319	8.50	0.76	0.62	0.92	2.30	2.10	2.06	7.54	8.00	9.73	9.00	1.18	1.00
4839	9.78	0.50	0.68	1.00	2.18	2.07	2.06	9.42	8.00	10.85	9.00	1.00	1.00
4325	9.56	------	------	------	------	------	------	15.86	16.00	16.92	------	------	------
4324	8.62	1.52	1.24	0.58	3.34	3.21	3.29	8.91	9.00	10.73	10.00	1.18	1.00
4374	10.44	1.54	0.94	0.80	3.28	3.05	3.29	8.94	9.00	9.79	10.00	1.29	1.00
4765	9.85	1.50	1.24	0.86	3.60	3.38	3.29	8.81	9.00	10.30	10.00	1.25	1.00
4320	7.12	0.68	0.44	0.80	1.92	1.76	1.65	9.10	9.00	11.05	10.00	1.18	1.00
4763	8.23	0.70	0.56	0.90	2.16	1.91	1.65	9.13	9.00	10.75	10.00	1.20	1.00
4667	8.71	1.06	0.96	0.86	2.88	2.72	2.47	10.14	10.00	11.80	11.00	------	------
4322	9.48	0.92	0.62	0.74	2.28	2.17	2.06	9.70	10.00	11.64	------	1.19	1.00
4323	9.29	0.68	0.54	0.70	1.92	1.85	1.65	9.36	10.00	11.36	11.00	1.22	1.00
4503	9.84	1.42	0.26	1.74	3.42	2.83	3.29	9.01	8.00	10.69	9.00	3.98	4.00
4508	8.52	0.28	1.28	0.96	3.52	3.20	3.29	8.70	8.00	10.89	9.00	3.13	3.00
4504	8.66	1.08	1.46	1.54	4.08	3.60	4.12	8.61	8.00	9.89	9.00	1.03	1.00
4548	11.33	1.86	0.10	1.50	3.46	2.96	3.30	8.71	9.00	10.33	10.00	1.17	1.00
4500	12.63	1.62	0.06	1.56	3.24	2.79	3.30	8.84	8.00	9.25	9.00	4.15	4.00
4534	12.20	1.64	0.10	1.46	3.20	2.67	3.30	8.78	8.00	9.19	9.00	4.33	4.00
4657	9.86	1.06	0.80	1.45	3.31	2.93	3.30	8.33	8.00	9.41	9.00	3.81	4.00
4672	9.93	1.04	0.78	1.63	3.45	2.88	3.30	8.67	8.00	9.82	9.00	2.66	3.00
4409	11.45	1.48	0.30	1.56	3.36	2.86	3.30	10.32	10.00	10.96	11.00	------	------
4545	10.40	1.10	0.90	1.64	3.64	3.19	3.30	10.62	10.00	11.00	11.00	------	------
4673	11.96	0.94	0.72	1.83	3.44	2.86	3.30	10.39	10.00	11.74	11.00	------	------
4546	9.28	1.12	0.84	2.16	4.12	3.58	4.10	10.31	10.00	11.80	11.00	------	------
4655	8.39	1.20	0.60	2.57	4.37	3.84	4.11	9.50	10.00	11.63	11.00	------	------
4680	10.03	0.68	0.66	1.49	2.83	2.44	2.50	9.18	10.00	9.89	11.00	------	------
4408	7.61	0.14	0.26	1.50	1.90	1.60	1.60	9.25	9.00	9.62	10 00	1.10	1.00
4662	9.22	0.32	0.40	1.01	1.73	1.51	1.60	8.83	9.00	9.90	10.00	1.23	1.00
4674	12.41	0.54	0.12	1.13	1.79	1.55	1.60	10.16	9.00	11.12	10.00	1.24	1.00
4775	3.23	0.08	0.08	1.05	1.21	1.09	0.82	12.18	12.00	12.82	13.00	------	------
4745	7.88	0.18	0.00	0.86	1.04	0.90	0.82	11.26	12.00	13.03	13.00	------	------
4800	8.70	0.00	0.14	1.16	1.30	1.24	0.82	11.36	12.00	13.22	13.00	------	------
4744	6.27	0.78	1.46	1.92	4.16	3.54	4.10	7.13	8.00	9.73	9.00	------	------
4723	5.06	0.32	0.92	1.85	3.09	2.77	2.87	8.96	10.00	10.85	11.00	------	------
4793	7.10	0.38	1.00	1.46	2.84	2.48	2.87	9.29	10.00	10.72	11.00	------	------
4799	5.70	0.42	0.94	1.76	3.12	2.58	2.87	9.22	10.00	10.94	11.00	------	------
4813	7.19	0.50	0.78	1.67	2.95	2.63	2.87	9.18	10.00	11.21	11.00	------	------
4774	6.07	0.48	1.86	1.83	4.17	3.52	4.10	9.77	10.00	11.24	11.00	------	------
4511	5.60	------	------	------	4.04	------	4.10	10.07	10.00	12.15	11.00	------	------
4513	4.59	0.54	1.84	1.98	4.36	3.86	4.10	10.20	10.00	11.72	11.00	------	------

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4566	Essex Potato Phosphate for Potatoes & Roots	Van Buren
4510	Essex Potato Phosphate for Potatoes & Roots 4-10	Westfield
4721	Essex XXX Fish Fertilizer for all Crops 3-10	Saco
4743	Essex XXX Fish Fertilizer for all Crops 3-10	Bowdoinham
4773	Essex XXX Fish Fertilizer for all Crops 3-10	Winthrop
4792	Essex XXX Fish Fertilizer for all Crops 3-10	Sabattus
4812	Essex XXX Fish Fertilizer for all Crops 3-10	Rockland
4512	Essex 4-8-4	Houlton
	J. J. GREGORY & SON, MARBLEHEAD.	
4831	Sheeps' Head Brand Pulverized Sheep Manure	Richmond
	HUBBARD FERTILIZER CO., BALTIMORE, MD.	
4392	Hubbard's Aroostook Gem	Searsport
4521	Hubbard's Aroostook Gem	Mapleton
4543	Hubbard's Aroostook Gem	Caribou
4390	Hubbard's Excelsior Mixture	Searsport
4391	Hubbard's Maine Favorite	Searsport
4459	Hubbard's Maine Favorite	Houlton
4388	Hubbard's Potash Mixture	Searsport
4519	Hubbard's Potash Mixture	Mapleton
4389	Hubbard's Potato Grower	Searsport
4518	Hubbard's Potato Grower	Mapleton
4387	Hubbard's Special Compound	Searsport
4493	Hubbard's Special Compound	Presque Isle
4514	Hubbard's Special Compound	Mapleton
	INTERNATIONAL AGRICULTURAL CHEMICAL CORPORATION, BUFFALO FERTILIZER WORKS, HOULTON, MAINE.	
4525	Buffalo Five-Eight-Four	Washburn
4562	Buffalo Five-Eight-Four	Houlton
4652	Buffalo Five-Eight-Naught	Lincoln
4560	Buffalo Five-Ten-Naught	Houlton
4462	Buffalo Four-Eight-Four	Bridgewater
4489	Buffalo Four-Eight-Four	Ft. Fairfield
4494	Buffalo Four-Eight-Four	Presque Isle
4558	Buffalo Four-Eight-Four	Houlton
4561	Buffalo Four-Eight-Naught	Houlton
4653	Buffalo Four-Eight-Naught	Lincoln
4486	Buffalo Four-Nine-One	Ft. Fairfield
4555	Buffalo Four-Nine-One	Caribou
4654	Buffalo Four-Nine-One	Lincoln
4441	Buffalo Three-Nine-One	Houlton
4870	Buffalo Three-Ten-Naught	Corinna
4666	Buffalo Two-Nine-One	Newport
	LISTERS AGRICULTURAL CHEMICAL WORKS, NEWARK, N. J.	
4607	Listers Bone Meal	Portland
4370	Listers Corn & Potato Fertilizer 1916	Bangor
4609	Listers Corn & Potato Fertilizer 1916	Portland
4395	Lister's 5-10-4 Fertilizer	Searsport
4608	Listers High Grade Special for Spring Crops 1916	Portland
4369	Listers Potato Manure 1916	Bangor
4606	Listers Potato Manure 1916	Portland

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4566	7.50	0.46	1.16	1.92	3.54	2.96	3.28	9.53	10.00	11.10	11.00	------	------
4510	5.96	0.42	1.68	1.34	3.44	3.16	3.28	9.91	10.00	11.50	11.00	------	------
4721	7.35	0.42	0.52	1.57	2.51	2.21	2.46	8.71	10.00	11.24	11.00	------	------
4743	7.57	0.42	0.34	1.60	2.36	2.12	2.46	9.94	10.00	11.60	11.00	------	------
4773	5.84	0.34	0.50	1.84	2.68	2.47	2.46	8.77	10.00	10.88	11.00	------	------
4792	7.40	0.38	0.46	1.69	2.53	2.22	2.48	8.54	10.00	10.45	11.00	------	------
4812	7.08	0.32	0.48	1.74	2.54	2.31	2.46	9.53	10.00	11.44	11.00	------	------
4512	8.44	------	------	------	3.36	------	3.28	7.11	8.00	9.28	9.00	3.80	4.00
4831	9.59	------	------	------	2.40	------	2.25	------	1.50	1.67	1.25	1.91	1.50
4392	9.62	2.66	1.28	0.24	4.18	3.96	4.10	10.68	10.00	11.55	11.00	------	------
4521	11.07	2.30	1.12	0.70	4.12	3.91	4.10	10.39	10.00	11.69	11.00	------	------
4543	9.50	2.30	1.16	0.82	4.28	4.17	4.10	10.66	10.00	11.66	11.00	------	------
4390	7.62	0.20	0.10	1.30	1.60	1.19	1.64	9.17	10.00	11.61	11.00	------	------
4391	13.35	2.72	0.34	0.21	3.27	3.08	3.28	10.48	8.00	12.97	9.00	2.00	2.00
4459	10.96	2.70	0.30	0.32	3.32	3.12	3.28	9.66	8.00	12.71	9.00	2.05	2.00
4388	10.87	2.32	0.76	1.02	4.10	3.64	4.10	9.29	10.00	10.57	11.00	0.97	1.00
4519	12.30	2.26	0.80	1.14	4.20	3.84	4.10	9.28	10.00	10.57	11.00	0.97	1.00
4389	9.78	2.84	------	0.43	3.27	1.88	3.28	8.93	8.00	10.49	9.00	2.18	2.00
4518	9.71	2.64	0.08	0.84	3.56	3.37	3.28	8.70	8.00	10.05	9.00	2.38	2.00
4387	9.63	2.32	0.16	0.88	3.36	3.05	3.28	9.18	9.00	12.73	10.00	------	------
4493	10.19	2.26	0.52	0.82	3.60	3.48	3.28	10.26	10.00	14.00	11.00	------	------
4514	10.42	2.34	0.10	1.22	3.60	3.35	3.28	9.34	9.00	13.40	10.00	------	------
4525	10.25	1.66	0.50	1.84	4.00	3.31	4.10	8.11	8.00	9.28	9.00	4.11	4.00
4562	9.89	2.30	0.12	1.60	4.02	3.56	4.10	8.04	8.00	9.70	9.00	4.21	4.00
4652	8.67	1.42	1.20	1.60	4.22	3.76	4.11	8.21	8.00	8.80	9.00	------	------
4560	9.95	1.68	0.16	2.40	4.24	3.58	4.10	9.90	10.00	11.71	11.00	------	------
4462	9.09	1.46	0.48	1.46	3.40	2.90	3.30	8.08	8.00	9.27	9.00	4.11	4.00
4489	11.48	1.28	0.54	2.02	3.84	3.53	3.29	8.89	8.00	9.68	9.00	3.96	4.00
4494	11.46	1.10	0.46	1.60	3.16	2.91	3.30	8.15	8.00	8.80	9.00	3.36	4.00
4558	8.44	2.06	0.10	1.58	3.54	3.10	3.30	7.63	8.00	9.30	9.00	3.96	4.00
4561	7.95	1.16	0.10	1.82	3.08	2.75	3.30	8.01	8.00	9.73	9.00	------	------
4653	7.83	0.88	1.00	1.46	3.34	2.84	3.30	8.46	8.00	9.00	9.00	------	------
4486	9.21	1.38	0.44	1.44	3.26	2.83	3.29	9.31	9.00	10.02	10.00	1.16	1.00
4555	8.92	1.96	0.12	1.32	3.60	3.17	3.30	8.10	9.00	9.67	10.00	1.67	1.00
4654	11.11	1.00	0.48	1.79	3.27	2.78	3.30	9.53	9.00	10.29	10.00	1.27	1.00
4441	10.78	1.14	0.18	1.04	2.36	2.15	2.46	9.43	9.00	9.98	10.00	1.19	1.00
4870	9.37	0.84	0.26	1.60	2.70	2.17	2.46	8.08	10.00	12.25	11.00	------	------
4666	9.22	0.54	0.14	1.18	1.86	1.60	1.60	8.99	9.00	9.95	10.00	1.17	1.00
4607	5.10	------	------	------	2.60	------	2.47	------	------	23.07	22.88	------	------
4370	7.68	0.76	0.68	0.68	2,12	1.98	2.06	8.37	8.00	9.28	9.00	1.04	1.00
4609	8.82	0.64	0.50	1.12	2.32	2.10	2.06	9.17	8.00	10.83	9.00	1.10	1.00
4395	10.49	1.94	1.54	0.54	4.02	3.78	4.11	9.94	10.00	10.86	11.00	3.86	4.00
4608	12.81	0.70	0.48	0.88	2.06	1.94	2.06	9.81	10.00	11.00	11.00	1.24	1.00
4369	8.32	1.38	1.62	1.22	4.22	3.79	4.11	8.28	8.00	9.62	9.00	1.16	1.00
4606	10.10	1.46	1.24	1.34	4.04	3.63	4.11	8.51	8.00	9.54	9.00	1.10	1.00

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4346	Listers Special Potato Fertilizer 1916	Bangor
4488	Listers Special Potato Fertilizer 1916	Ft. Fairfield
4526	Listers Special Potato Fertilizer 1916	Washburn
4605	Listers Success Fertilizer 1916	Portland
4863	Listers Success Fertilizer 1916	Bath
4344	Listers Success Fertilizer 1916	Bangor
4610	Listers Superior Ammoniated Superphosphate 1916	Portland
	LOWELL FERTILIZER CO., BOSTON, MASS.	
4402	Lowell Animal Brand	Belfast
4855	Lowell Animal Brand	North Leeds
4307	Lowell Animal Brand	Bangor
4670	Lowell Animal Brand	East Newport
4858	Lowell Bone Fertilizer for Corn, Grain, Grass and Vegetables	North Leeds
4869	Lowell Bone Fertilizer for Corn, Grain, Grass and Vegetables	Foxcroft
4483	Lowell 4-8-4	Ft. Fairfield
4486	Lowell 4-8-4	Ft. Fairfield
4592	Lowell Ground Bone	Portland
4302	Lowell Potato, Corn & Vegetable	Bangor
4400	Lowell Potato, Corn & Vegetable	Belfast
4854	Lowell Potato Grower	North Leeds
4304	Lowell Potato Manure	Bangor
4785	Lowell Potato Manure	Danforth
4403	Lowell Potato Phosphate	Belfast
4301	Lowell Potato Phosphate	Bangor
4786	Lowell Potato Phosphate	Danforth
4777	Lowell Potato Phosphate	Wiscasset
4852	Lowell Potato Phosphate	North Leeds
4684	Lowell Sterling Phosphate	Anson
	MORISON BROTHERS, BANGOR, MAINE.	
4313	Acid Phosphate	Bangor
4314	Fine Dry S and S Tankage	Bangor
4312	Morison Bros. 3-8-2	Bangor
4872	Morison Bros. Special Potato Fertilizer	Bangor
4311	Morison Bros. Special Potato Fertilizer without potash	Bangor
4310	Morison Bros. War Brand Potato Fertilizer	Bangor
4871	Morison Bros. War Brand Potato Fertilizer	Corinna
4342	Nitrate of Soda	Bangor
	NATIONAL FERTILIZER CO., NEW YORK CITY, N. Y.	
4496	National Extra High Grade Potato Fertilizer	Presque Isle
4536	National Extra High Grade Potato Fertilizer	Presque Isle
4668	National Nitrogen Phosphate Mixture No. 3	Lincoln
4660	National Nitrogen Phosphate Mixture No. 4	Lincoln
4393	National Nitrogen Phosphate Mixture No. 6	Searsport
4475	National Nitrogen Phosphate Mixture No. 6	Houlton
4394	National Pine Tree State Potato Fertilizer	Searsport
4469	National Pine Tree State Potato Fertilizer	Houlton

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4346	9.49	1.56	1.30	1.46	4.32	3.94	4.11	10.34	10.00	11.71	11.00	------	------
4488	10.23	1.60	1.36	1.12	4.08	4.08	4.11	10.26	10.00	11.31	11.00	------	------
4526	10.03	1.90	1.16	0.81	4.16	3.87	4.11	10.13	10.00	12.12	11.00	------	------
4605	9.88	0.30	0.34	0.76	1.40	1.25	1.23	10.69	10.00	11.90	11.00	1.14	1.00
4863	9.86	0.40	0.28	0.75	1.43	1.33	1.23	10.87	10.00	12.12	11.00	1.08	1.00
4344	10.01	0.54	0.36	0.56	1.46	1.37	1.23	10.47	10.00	11.68	11.00	1.01	1.00
4610	8.96	1.28	1.00	1.04	3.32	3.03	3.29	9.63	10.00	11.26	11.00	------	------
4402	5.37	0.42	0.84	1.22	2.48	2.17	2.87	9.62	10.00	10.64	11.00	------	------
4855	5.47	0.32	0.64	1.94	2.90	2.28	2.87	9.60	10.00	11.07	11.00	------	------
4307	4.89	0.40	0.86	1.68	2.94	2.72	2.87	9.44	10.00	10.88	11.00	------	------
4670	7.07	0.42	0.86	1.76	3.04	2.49	2.87	9.60	10.00	11.79	11.00	------	------
4853	3.43	------	------	2.48	2.48	2.00	2.05	9.85	10.00	11.48	11.00	------	------
4869	7.71	0.52	0.34	1.50	2.36	1.97	2.05	9.09	10.00	10.89	11.00	------	------
4485	9.35	0.90	0.86	1.64	3.40	2.91	3.28	7.14	8.00	9.08	9.00	4.09	4.00
4483	9.22	0.94	0.94	1.40	3.28	2.85	3.29	7.21	8.00	9.17	9.00	3.77	4.00
4592	4.65	------	------	------	2.46	------	2.46	------	10.00	27.21	20.00	------	------
4302	6.18	0.48	1.70	1.97	4.15	3.70	4.10	9.64	10.00	11.83	11.00	------	------
4400	6.24	0.46	1.74	2.14	4.34	4.01	4.10	9.87	10.00	11.66	11.00	------	------
4854	4.50	0.70	0.88	1.97	3.55	3.20	3.28	10.45	10.00	11.48	11.00	1.19	1.00
4304	7.42	0.46	0.42	1.58	2.46	2.32	2.46	9.28	10.00	11.45	11.00	------	------
4785	9.80	0.52	0.44	1.89	2.75	2.19	2.46	9.57	10.00	11.71	11.00	------	------
4403	4.63	0.32	0.94	2.04	3.30	2.84	3.28	9.60	10.00	11.26	11.00	------	------
4301	10.27	0.90	0.70	1.70	3.30	2.83	3.28	9.21	10.00	11.80	11.00	------	------
4786	6.17	0.44	1.20	1.72	3.36	2.97	3.28	10.02	10.00	11.96	11.00	------	------
4777	5.77	0.42	1.20	1.92	3.54	3.22	3.28	9.50	10.00	11.16	11.00	------	------
4852	4.41	0.38	0.90	2.17	3.45	3.04	3.28	9.74	10.00	11.02	11.00	------	------
4684	5.63	0.10	0.06	1.29	1.45	1.37	0.82	11.12	12.00	13.40	13.00	------	------
4313	11.32	------	------	------	------	------	------	16.51	16.00	17.40	------	------	------
4314	7.66	------	------	------	5.86	------	6.66	------	12.00	14.55	------	------	------
4312	7.01	0.86	0.08	1.72	2.66	2.16	2.46	7.44	8.00	9.76	------	2.07	2.00
4872	9.98	1.54	0.18	2.29	4.01	3.29	4.11	8.38	10.00	12.44	11.00	------	------
4311	10.78	1.70	0.10	2.22	4.02	3.53	4.11	8.90	10.00	12.63	------	------	------
4310	7.99	1.34	0.04	1.96	3.34	2.81	3.29	7.24	8.00	10.35	------	4.34	4.00
4871	9.19	1.08	0.22	2.17	3.47	2.69	3.29	7.42	8.00	10.27	9.00	4.57	4.00
4342	1.18	15.57	------	------	15.57	15.57	15.00	------	------	------	------	------	------
4496	9.71	1.78	1.46	3.98	4.22	3.93	4.11	10.17	10.00	11.09	11.00	3.82	4.00
4536	10.40	1.64	1.50	0.98	4.12	3.58	4.11	9.90	10.00	10.86	11.00	4.06	4.00
4658	9.70	0.94	0.96	0.87	2.77	2.57	2.47	10.30	10.00	11.28	11.00	------	------
4660	8.84	1.14	1.20	1.21	3.55	3.32	3.29	9.74	10.00	11.68	11.00	------	------
4393	9.64	1.76	1.46	0.83	4.05	3.83	4.11	10.29	10.00	11.37	11.00	------	------
4475	9.40	1.84	1.24	1.04	4.12	3.88	4.11	10.03	10.00	11.91	11.00	------	------
4394	10.04	1.42	1.14	0.70	3.26	3.08	3.29	8.42	8.00	9.44	9.00	4.00	4.00
4460	10.88	1.50	1.16	0.72	3.38	3.08	3.29	8.70	8.00	10.03	9.00	3.36	4.00

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
	NATIONAL GUANO CO., AURORA, ILLINOIS.	
4644	Sheeps Head Brand Pulverized Sheep Manure	Portland
	NEW ENGLAND FERTILIZER CO., BOSTON, MASS.	
4524	New England Complete Manure	Washburn
4769	New England Corn & Grain Fertilizer	Randolph
4308	New England Corn & Grain Fertilizer	Bangor
4864	New England Corn & Grain Fertilizer	Bath
4882	New England Corn Phosphate for Grain & Vegetables 2½-10	Belgrade
4612	New England 5-10-4	Limestone
4522	New England 4-8-4	Washburn
4533	New England 4-8-4	Crouseville
4463	New England 4-8-4	Bridgewater
4401	New England High Grade Potato Fertilizer	Belfast
4303	New England High Grade Potato Fertilizer 4-10	Bangor
4679	New England High Grade Potato Fertilizer 4-10	Skowhegan
4523	New England High Grade Special 4-9-4	Washburn
4759	New England Market for Vegetables. Top Dressing and Lawns	Farmington
4880	New England Phosphate for Grain & Vegetables 2½-10	China
4309	New England Potato, Corn & Vegetable Manure 5-10	Bangor
4515	New England Potato, Corn & Vegetable Manure 5-10	Mapleton
4767	New England Potato Fertilizer	Randolph
4781	New England Potato Feritlizer	Newcastle
4779	New England Potato Fertilizer 3-10	Wiscasset
4766	New England Standard Phosphate 1-12	Randolph
4881	New England Superphosphate 3½-10	China
4305	New England Superphosphate	Bangor
4399	New England Superphosphate	Belfast
4678	New England Superphosphate	Skowhegan
4768	New England Superphosphate	Randolph
	NITRATE AGENCIES CO., NEW YORK CITY, N. Y.	
4865	High Grade Acid Phosphate	Dexter
4866	N. A. C. Brand Nitrate of Soda	Dexter
	PARMENTOR & POLSEY FERTILIZER CO., BOSTON, MASS.	
4856	P. & P. Grain Grower 1½-10	Lisbon
4306	P. & P. Plymouth Rock Brand for all Crops 3½-10	Bangor
4432	P. & P. Potato Fertilizer	Farmington
4297	P. & P. Potato Phosphate 4-10	Bangor
4755	P. & P. Potato Phosphate 4-10	Farmington
4456	P. & P. Potato Phosphate 4-10	Houlton
4552	P. & P. Special Potato Fertilizer 5-10	Caribou
4300	P. & P. Special Potato & Corn Fertilizer 5-10	Bangor
4551	P. & P. Special Potato & Corn Fertilizer 5-10	Caribou
4617	P. & P. Special Potato & Corn Fertilizer 5-10	Stockholm
4681	P. & P. Special Potato & Corn Fertilizer 5-10	Skowhegan
	PORTLAND RENDERING CO., PORTLAND, MAINE.	
4778	Portland Organic Cumberland Garden Manure	Wiscasset
4299	Portland Organic Fertilizer Animal Brand	Bangor
4700	Portland Organic Fertilizer Animal Brand	Portland

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4644	4.41	------	------	------	2.44	------	2.25	------	1.00	2.28	1.25	2.20	1.50
4524	9.45	0.28	1.30	2.04	3.62	3.14	3.29	11.03	10.00	12.41	11.00	1.24	1.00
4769	6.54	0.00	0.16	1.36	1.52	1.34	1.50	9.19	10.00	11.55	11.00	------	------
4308	6.98	0.20	0.06	1.32	1.58	1.44	1.28	9.55	10.00	11.80	11.00	------	------
4864	4.24	0.06	0.08	1.18	1.32	1.04	1.23	8.71	10.00	10.19	11.00	------	------
4882	8.60	0.10	0.34	1.77	2.11	1.99	2.05	9.71	10.00	11.36	11.00	------	------
4612	9.81	0.82	1.48	1.78	4.06	3.59	4.10	9.91	10.00	11.80	11.00	3.28	4.00
4522	9.59	1.06	0.90	1.56	3.52	3.00	3.28	7.14	8.00	9.31	9.00	3.97	4.00
4533	9.34	0.52	1.24	1.88	3.64	3.07	3.28	7.84	8.00	9.63	9.00	4.41	4.00
4463	9.21	0.96	0.80	1.64	3.40	2.81	3.28	7.48	8.00	9.36	9.00	3.75	4.00
4401	5.35	0.48	1.58	1.26	3.32	3.07	3.28	9.68	10.00	11.26	11.00	------	------
4303	5.63	0.38	1.76	1.36	3.50	3.25	3.28	9.85	10.00	10.96	11.00	------	------
4679	8.32	0.58	1.00	2.12	3.70	3.00	3.28	9.39	10.00	11.23	11.00	------	------
4523	7.30	0.54	1.60	1.16	3.30	2.82	3.29	8.71	9.00	10.24	10.00	1.52	1.00
4759	9.17	2.14	0.52	1.55	4.21	3.90	4.10	8.77	8.00	8.84	9.00	1.14	1.00
4880	8.79	0.14	0.32	1.67	2.13	1.69	2.05	9.27	10.00	11.16	11.00	------	------
4309	4.41	0.44	1.70	2.02	4.16	3.78	4.10	10.24	10.00	12.70	11.00	------	------
4515	8.81	0.92	1.52	1.72	4.16	3.74	4.10	8.62	10.00	11.04	11.00	------	------
4767	3.74	0.28	0.58	1.98	2.84	2.42	2.46	9.86	10.00	11.93	11.00	------	------
4781	5.65	0.14	0.56	2.03	2.73	2.23	2.46	10.29	10.00	11.87	11.00	------	------
4779	6.24	0.18	0.54	1.93	2.65	2.20	2.46	10.00	10.00	11.68	11.00	------	------
4766	3.63	0.08	0.08	1.07	1.23	1.15	0.82	11.74	12.00	13.14	13.00	------	------
4881	6.16	0.26	0.84	1.83	2.93	2.89	2.87	8.98	10.00	11.29	11.00	------	------
4305	5.03	0.38	0.80	1.48	2.66	2.46	2.87	9.57	10.00	11.64	11.00	------	------
4399	5.88	0.38	0.96	1.60	2.94	2.78	2.88	10.24	10.00	11.44	11.00	------	------
4678	6.09	0.36	0.90	1.73	3.09	2.79	2.87	8.85	10.00	10.89	11.00	------	------
4768	4.55	0.48	0.90	1.74	2.92	2.70	2.87	9.91	10.00	11.79	11.00	------	------
4865	5.97	------	------	------	------	------	------	17.39	16.00	18.09	17.00	------	------
4866	1.91	15.34	------	------	15.34	15.34	15.00	------	------	------	------	------	------
4856	3.60	0.00	0.34	1.38	1.72	1.52	1.23	9.22	10.00	11.01	11.00	------	------
4306	5.19	0.40	0.82	1.68	2.90	2.64	2.87	9.59	10.00	11.48	11.00	------	------
4432	10.50	0.88	0.88	1.70	3.46	3.03	3.28	9.22	10.00	11.39	11.00	0.37	1.00
4297	6.04	0.36	1.64	1.42	3.42	3.23	3.28	9.46	10.00	11.37	11.00	------	------
4755	8.59	0.84	0.86	1.88	3.58	3.02	3.28	8.88	10.00	11.32	11.00	------	------
4456	7.28	0.62	0.84	1.98	3.44	3.08	3.28	9.61	10.00	10.69	11.00	------	------
4552	7.35	1.52	1.90	1.90	4.32	3.84	4.10	9.93	10.00	11.13	11.00	------	------
4300	6.40	0.40	1.56	2.20	4.16	3.80	4.10	9.91	10.00	12.50	11.00	------	------
4551	6.92	0.48	2.04	1.80	4.32	3.77	4.10	9.77	10.00	11.01	11.00	------	------
4617	7.08	0.34	1.66	2.32	4.32	3.77	4.10	9.56	10.00	11.26	11.00	------	------
4681	9.05	0.82	1.38	1.78	3.98	3.60	4.10	9.53	10.00	10.81	11.00	------	------
4778	7.81	0.82	1.68	2.50	5.00	4.47	4.39	10.07	9.00	11.18	10.00	------	------
4299	7.43	0.48	0.68	1.90	3.06	2.53	2.88	10.64	10.00	12.90	11.00	------	------
4700	6.18	0.80	1.68	------	4.87	------	3.50	10.01	10.00	11.18	11.00	------	------

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4298	Portland Organic Fertilizer Potato Grower	Bangor
4671	Portland Organic Fertilizer Potato Grower	E. Newport
	PULVERIZED MANURE COMPANY, CHICAGO, ILL.	
4873	Wizard Brand Manure. Pulverized Sheep	Freeport
	ROGERS & HUBBARD CO., PORTLAND, CONN.	
4847	Hubbard's "Bone Base" Oats and Top Dressing	Monmouth
4874	Hubbard's "Bone Base" Oats and Top Dressing	Monmouth
4848	Hubbard's "Bone Base" Soluble Corn and General Crops	Freeport
4875	Hubbard's "Bone Base" Soluble Corn & General Crops Manure	Freeport
4850	Hubbard's "Bone Base" Soluble Potato Manure	Monmouth
4879	Hubbard's "Bone Base" Soluble Potato Manure	Freeport
4876	Hubbard's Pure Fine Ground Bone	Freeport
4846	Rogers & Hubbard All Soils-All Crops Phosphate	Monmouth
4877	Rogers & Hubbard All Soils-All Crops Phosphate	Freeport
4849	Rogers & Hubbard Complete Phosphate	Monmouth
4845	Rogers & Hubbard Potato Phosphate	Monmouth
4878	Rogers & Hubbard Potato Phosphate	Freeport
	SAGADAHOC FERTILIZER CO., BOWDOINHAM, MAINE.	
4740	Acid Phosphate	Bowdoinham
4707	Sagadahoc Dirigo Fertilizer for Grass and Grain	Waterville
4734	Sagadahoc Dirigo Fertilizer for Grass & Grain	
4796	Sagadahoc Dirigo Fertilizer for Grass and Grain	Livermore Falls
4832	Sagadahoc 5-10-0 Fertilizer	Richmond
4736	Sagadahoc 5-10-0 Fertilizer	Bowdoinham
4706	Sagadahoc 5-10-1 Fertilizer	Waterville
4728	Sagadahoc 5-10-1 Fertilizer	Bowdoinham
4732	Sagadahoc 4-8-5 Fertilizer	Bowdoinham
4807	Sagadahoc 4-8-5 Fertilizer	Winslow's Mills
4468	Sagadahoc 4-8-4 Fertilizer	Easton
4473	Sagadahoc 4-8-4 Fertilizer	Ft. Fairfield
4615	Sagadahoc 4-8-4 Fertilizer	Limestone
4717	Sagadahoc 4-8-2 Fertilizer	Fairfield
4731	Sagadahoc 4-8-2 Fertilizer	Bowdoinham
4746	Sagadahoc 4-8-2 Fertilizer	Lewiston
4729	Sagadahoc High Grade 2-10-2	Bowdoinham
4795	Sagadahoc High Grade 2-10-2	Livermore Falls
4716	Sagadahoc Q & L Brand Bone Lime & Potash Fertilizer	Fairfield
4737	Sagadahoc Q & L Brand Bone Lime & Potash Fertilizer	Bowdoinham
4885	Sagadahoc Q & L Brand Bone Lime & Potash Fertilizer	Palermo
4808	Sagadahoc Special Corn Fertilizer 3-10-3	Winslow's Mills
4708	Sagadahoc Special Corn Fertilizer 3-10-3	Waterville
4738	Sagadahoc Special Corn Fertilizer 3-10-3	Bowdoinham
4851	Sagadahoc Special Corn Fertilizer 3-10-3	Wayne
4809	Sagadahoc 3-8-4	Winslow's Mills
4704	Sagadahoc 3-8-3	Etna
4689	Sagadahoc 3-8-3 Fertilizer	Skowhegan
4735	Sagadahoc 3-8-3 Fertilizer	Bowdoinham

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4298	7.98	0.72	1.08	2.30	4.10	3.54	4.10	10.25	10.00	13.27	11.00	------	------
4671	7.18	0.64	1.22	2.60	4.46	3.58	4.10	11.06	10.00	13.27	11.00	------	------
4873	8.24	------	------	------	2.24	------	1.80	------	1.00	1.95	1.00	3.67	1.00
4847	9.67	4.02	0.38	0.68	5.08	4.89	6.00	3.87	6.00	13.27	12.00	------	------
4874	7.30	5.14	0.24	0.52	5.90	5.80	6.00	3.54	6.00	12.36	12.00	------	------
4848	10.75	0.32	0.72	1.49	2.53	2.07	2.50	6.67	10.00	12.60	12.00	------	------
4875	10.99	0.40	0.66	1.32	2.38	2.32	2.50	8.40	10.00	14.12	12.00	------	------
4850	9.08	1.38	1.02	1.80	4.20	3.88	4.25	8.25	10.00	13.53	12.00	1.24	1.00
4879	13.78	1.82	0.80	1.43	4.05	3.64	4.25	7.08	10.00	12.90	12.00	------	------
4876	10.55	------	------	------	2.03	------	2.00	------	------	28.15	25.00	------	------
4846	9.39	0.72	1.46	1.19	3.37	3.10	3.30	5.61	7.00	9.03	9.00	------	------
4877	9.53	2.24	0.38	1.08	3.70	3.31	3.30	6.95	7.00	11.16	8.00	------	------
4849	3.66	0.14	0.10	0.81	1.05	0.86	1.00	6.87	8.00	10.00	9.00	------	------
4845	9.92	0.22	0.58	1.38	2.18	1.97	2.00	11.57	13.00	16.38	14.00	------	------
4878	10.34	0.48	0.34	1.35	2.17	1.88	2.00	11.61	13.00	15.92	14.00	------	------
4740	9.96	------	------	------	------	------	------	16.22	16.00	16.96	------	------	------
4707	8.29	0.18	0.04	0.91	1.13	0.87	0.82	5.81	6.00	9.08	8.00	1.95	1.00
4734	6.59	0.20	0.04	1.07	1.31	1.00	0.82	5.81	6.00	8.69	8.00	2.23	1.00
4796	7.16	0.64	0.16	0.96	1.76	1.40	0.82	6.52	6.00	8.31	8.00	2.28	1.00
4832	11.93	1.42	1.46	1.48	4.34	4.07	4.12	10.14	10.00	10.83	11.00	------	------
4736	9.45	2.88	------	0.96	3.84	3.50	4.12	10.47	10.00	10.83	11.00	------	------
4706	9.61	2.48	0.30	0.11	3.89	3.42	4.12	10.32	10.00	10.61	11.00	1.97	1.00
4728	10.13	3.08	0.28	0.96	4.32	3.99	4.12	10.24	10.00	10.72	11.00	1.26	1.00
4732	7.74	1.98	0.42	0.93	3.33	3.10	3.29	8.82	8.00	9.28	9.00	4.76	5.00
4807	7.67	2.22	0.40	0.80	3.42	3.25	3.25	8.70	8.00	9.12	9.00	5.01	5.00
4468	8.37	2.24	0.36	0.54	3.14	3.05	3.29	8.67	8.00	9.03	9.00	4.07	4.00
4473	9.46	2.10	0.30	0.84	3.24	3.01	3.29	8.70	8.00	9.06	9.00	4.19	4.00
4615	9.48	1.94	0.36	1.02	3.32	2.96	3.29	8.10	8.00	8.61	9.00	4.15	4.00
4717	8.94	2.90	0.56	0.63	4.09	3.94	3.28	8.09	8.00	8.52	9.00	2.35	2.00
4731	9.46	2.00	0.62	0.74	3.36	3.16	3.29	10.53	8.00	11.16	9.00	2.33	2.00
4746	8.72	1.96	0.60	1.08	3.64	3.40	3.28	8.38	8.00	8.80	9.00	2.28	2.00
4729	8.51	0.86	0.36	0.46	1.68	1.38	1.65	11.69	10.00	12.20	11.00	2.05	2.00
4795	11.29	1.24	0.40	0.63	2.27	2.05	1.65	10.67	10.00	11.10	11.00	2.18	2.00
4716	3.17	0.38	0.04	0.76	1.18	1.00	0.82	3.50	3.00	6.52	10.00	1.27	1.00
4737	3.11	0.28	0.06	0.96	1.30	1.10	0.82	3.49	3.00	6.60	9.00	1.14	1.00
4885	4.35	0.46	0.04	0.95	1.45	1.35	0.82	3.80	3.00	6.30	5.00	1.60	1.00
4808	7.56	1.88	0.34	0.68	2.90	2.73	2.47	8.72	10.00	9.06	11.00	3.17	3.00
4708	10.93	1.86	0.38	0.34	2.58	2.43	2.47	10.15	10.00	10.61	11.00	2.75	3.00
4738	9.85	1.74	0.30	0.74	2.78	2.62	2.47	8.36	10.00	8.79	11.00	2.99	3.00
4851	10.61	1.92	0.54	0.62	3.08	3.00	2.47	9.94	10.00	10.46	11.00	3.44	3.00
4809	15.72	1.20	0.48	0.96	2.64	2.29	2.47	7.68	10.00	8.13	11.00	3.17	4.00
4704	7.26	2.36	0.12	0.26	2.74	2.48	2.47	8.44	8.00	8.80	9.00	3.36	3.00
4689	7.11	2.74	0.04	0.15	2.93	2.78	2.47	8.24	8.00	8.60	9.00	3.54	3.00
4735	7.09	2.26	0.08	0.36	2.70	2.55	2.47	8.39	8.00	8.72	9.00	3.42	3.00

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4690	Sagadahoc 3-10-1 Fertilizer	Skowhegan
4733	Sagadahoc 3-10-1 Fertilizer	Bowdoinham
4747	Sagadahoc 3-10-1 Fertilizer	Lewiston
4705	Sagadahoc 2-10-2 High Grade	Waterville
4730	Sagadahoc Yankee 1-8-1 Fertilizer for all Crops	Bowdoinham
4797	Sagadahoc Yankee 1-8-1 Fertilizer for all Crops	Livermore Falls
	STANDARD GUANO COMPANY, BALTIMORE, MARYLAND.	
4816	Farmers Union of Maine 5-8-1	Belfast
4883	Farmers Union of Maine 5-8-1	South China
4659	Farmers Union of Maine 4-8-4	Lincoln
4691	Farmers Union of Maine 4-8-4	Skowhegan
4702	Farmers Union of Maine 4-8-0	Waterville
4789	Farmers Union of Maine 4-10-0	Danforth
4692	Farmers Union of Maine 4-10-0	Skowhegan
4776	Farmers Union of Maine 4-10-0	Woolwich
4817	Farmers Union of Maine 2½-10-2	Belfast
	CHAS. STEVENS, NAPONEE, ONT., CAN.	
4584	Potash & Bone Wood Fertilizer	Portland
	I. P. THOMAS & SON CO., PHILADELPHIA, PA.	
4868	Farmers Choice Fertilizer	Dover
4466	Fish Guano	Easton
4467	Potato Manure with 2% Potash	Easton
4867	I. P. Thomas Fish Guano	Dover
	TUSCARORA FERTILIZER CO., CHROME, N. J.	
4642	Tuscarora Acid Phosphate	Portland
4464	Tuscarora Fertilizer 5-8-3	Ft. Fairfield
4502	Tuscarora Fertilizer 5-8-3	Ft. Fairfield
4616	Tuscarora Fertilizer 5-8-2	Limestone
4633	Tuscarora 5-10-0	Portland
4517	Tuscarora 5-10-0	Mapleton
4538	Tuscarora 5-10-0	Presque Isle
4632	Tuscarora 4-8	Portland
4465	Tuscarora 4-8-4 Fertilizer	Ft. Fairfield
4474	Tuscarora 4-8-4 Fertilizer	Ft. Fairfield
4646	Tuscarora 4-8-4 Fertilizer	Portland
4634	Tuscarora Standard	Portland
	VIRGINIA-CAROLINA CHEMICAL CO., NEW YORK, N. Y.	
4668	V. C. C. Co.'s Beef, Blood & Bone 4%	Newport
4669	V. C. C. Co.'s Beef, Blood & Bone 1%	E. Newport
4505	V. C. C. Co.'s Beef, Blood & Bone BBB with 4% Potash	Mars Hill
4509	V. C. C. Co.'s Beef, Blood & Bone BBB with 1% Potash	Mars Hill
4501	V. C. C. Co.'s Beef, Blood & Bone BBB with 3% Potash	Presque Isle
4553	V. C. C. Co.'s Beef, Blood & Bone BBB with 3% Potash	Caribou

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4690	8.79	1.52	0.16	1.33	3.01	2.70	2.47	9.88	10.00	10.85	11.00	1.43	1.00
4733	10.09	1.30	0.30	1.20	2.80	2.36	2.47	10.05	10.00	10.78	11.00	1.41	1.00
4747	9.52	1.24	0.22	1.38	2.84	2.50	2.47	10.02	10.00	10.40	11.00	1.56	1.00
4705	8.90	1.16	0.32	0.27	1.69	1.40	1.65	11.17	10.00	11.69	11.00	2.07	3.00
4730	8.33	1.24	0.22	0.49	1.95	1.76	0.82	9.31	8.00	9.82	9.00	2.16	1.00
4797	6.71	0.52	0.06	0.71	1.29	1.10	0.82	8.30	8.00	8.77	9.00	2.07	1.00
4816	10.71	2.90	0.18	1.21	4.29	4.17	4.10	9.34	8.00	10.27	9.00	0.98	1.00
4883	11.97	2.68	0.30	1.00	3.98	3.90	4.10	9.19	8.00	9.78	8.50	0.41	1.00
4659	15.33	2.42	0.16	0.94	3.52	3.29	3.28	8.81	8.00	9.54	8.50	3.93	4.00
4691	15.42	2.42	0.08	1.07	3.57	3.39	3.28	8.60	8.00	9.62	8.50	3.86	4.00
4702	10.37	2.10	0.24	1.24	3.58	3.34	3.28	8.62	8.00	9.31	8.50	------	------
4789	12.91	1.32	0.38	1.61	3.31	3.07	3.28	9.29	10.00	11.71	11.00	------	------
4692	12.54	1.66	0.20	1.52	3.38	3.18	3.28	10.62	10.00	11.58	11.00	------	------
4776	11.03	1.64	0.28	1.38	3.30	3.09	3.28	10.56	10.00	11.64	10.50	------	------
4817	13.62	1.66	0.16	0.72	2.54	2.40	2.05	10.98	10.00	12.15	11.00	2.30	2.00
4584	3.01	------	------	------	------	------	------	0.87	------	1.95	2.00	3.98	4.00
4868	11.12	0.84	0.84	0.96	2.64	2.42	2.45	9.52	10.00	11.61	10.50	------	------
4466	8.92	1.28	1.82	1.04	4.14	3.84	4.10	9.69	10.00	11.40	10.50	------	------
4467	9.77	1.36	1.04	0.92	3.52	3.27	3.45	9.94	8.00	11.02	8.50	2.10	2.00
4867	10.91	1.48	1.16	1.61	4.25	3.78	4.10	9.92	10.00	12.55	11.50	------	------
4642	10.19	------	------	------	------	------	------	17.38	16.00	17.83	16.50	------	------
4464	7.67	1.98	1.38	0.70	4.06	3.73	4.11	8.91	8.00	9.79	8.50	2.69	3.00
4502	6.82	2.14	1.54	0.48	4.16	3.81	4.11	8.18	8.00	9.01	8.50	2.92	3.00
4616	8.66	1.54	1.50	0.96	4.00	3.31	4.11	8.45	8.00	9.67	8.50	2.13	2.00
4633	10.74	2.34	0.10	1.73	4.17	3.15	4.11	10.02	10.00	10.91	10.50	------	------
4517	7.59	1.68	1.36	1.22	4.26	3.61	4.11	10.51	10.00	10.96	10.50	------	------
4538	11.76	2.46	0.12	1.66	4.24	3.65	4.11	10.47	10.00	11.68	10.50	------	------
4632	7.66	1.20	0.12	2.40	3.72	3.01	3.29	7.60	8.00	8.90	8.50	------	------
4465	8.04	1.70	0.90	0.76	3.36	3.01	3.29	8.45	8.00	9.09	9.00	3.97	4.00
4474	9.05	1.66	0.20	0.64	3.10	2.83	3.29	8.54	8.00	9.22	9.00	3.71	4.00
4646	6.85	0.20	1.02	2.08	3.30	2.68	3.29	8.63	8.00	10.85	8.50	4.24	4.00
4634	7.74	0.54	0.32	1.18	2.04	1.38	1.85	8.13	8.00	9.19	8.50	1.94	2.00
4668	11.26	1.30	0.18	2.04	3.52	2.88	3.29	8.71	8.00	10.96	9.00	4.39	4.00
4669	9.83	0.76	1.36	1.46	3.58	3.13	3.29	8.23	8.00	9.63	9.00	1.16	1.00
4505	9.70	0.74	1.10	1.54	3.38	2.93	3.29	7.64	8.00	10.89	9.00	4.45	4.00
4509	10.15	0.98	0.96	1.38	3.32	2.84	3.29	8.88	8.00	10.33	9.00	1.20	1.00
4501	9.69	0.32	1.26	2.02	3.60	3.13	3.29	8.90	8.00	10.48	10.00	3.16	3.00
4553	10.26	1.10	0.84	1.67	3.61	3.08	3.29	7.94	8.00	11.32	9.00	3.38	3.00

Descriptive List of Fertilizer Samples, 1917.

Station number.	Manufacturer, place of business and brand.	Sample taken at
4790	V. C. C. Co.'s Beef, Blood & Bone without Potash	Danforth
4478	V. C. C. Co.'s 20th Century Potato Manure	Mars Hill
	WHITMAN & PRATT RENDERING CO., LOWELL, MASS.	
4640	Ground Bone	Portland
4713	Whitman & Pratt 5-8-1	Fairfield
4857	Whitman & Pratt 5-8-1 Brand	Lisbon
4710	Whitman & Pratt 5-10 Brand	Fairfield
4719	Whitman & Pratt 5-10 Brand	Saco
4753	Whitman & Pratt 5-10 Brand	Farmington
4762	Whitman & Pratt 4-8-4 Brand	W. Farmington
4859	Whitman & Pratt 4-10-1 Brand	Lisbon
4698	Whitman & Pratt 1½-10 Brand	Saco
4754	Whitman & Pratt 1½-10 Brand	Farmington
4858	Whitman & Pratt 1½-10 Brand	Lisbon
4718	Whitman & Pratt 3-8-1 Brand	Saco
4860	Whitman & Pratt 3-8-1 Brand	Lisbon
4720	Whitman & Pratt 3-10 Brand	Saco
4752	Whitman & Pratt 3-10 Brand	Farmington
4861	Whitman & Pratt 3-10 Brand	Lisbon

Analysis of Fertilizer Samples, 1917.

Station number.	Water.	Nitrogen.						Phosphoric Acid.				Potash.	
								Available.		Total.			
		As nitrate.	As ammonia.	As organic.	Total.	Active.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
4790	8.92	0.16	1.44	2.07	3.67	3.37	3.29	10.51	10.00	12.23	11.00	------	------
4478	9.47	0.74	1.50	1.94	4.18	3.80	4.12	8.57	8.00	9.92	9.00	1.02	1.00
4640	6.32	------	------	------	2.47	------	2.46	------	10.00	26.73	20.00	------	------
4713	5.37	0.82	1.42	1.73	3.97	3.25	4.10	6.80	8.00	9.22	9.00	1.25	1.00
4857	7.18	0.70	1.46	1.87	4.03	3.44	4.10	6.83	8.00	9.38	9.00	1.18	1.00
4710	2.43	0.14	1.22	2.03	4.39	3.86	4.10	10.27	10.00	12.30	11.00	------	------
4719	6.94	0.40	1.82	2.15	4.37	3.72	4.10	9.30	10.00	11.24	11.00	------	------
4753	5.67	0.42	1.94	1.90	4.26	3.77	4.10	9.58	10.00	11.12	11.00	------	------
4762	9.28	0.70	0.86	1.86	3.42	3.04	3.28	7.29	8.00	9.33	9.00	3.84	4.00
4859	10.29	0.84	0.76	1.89	3.49	2.73	3.28	9.04	10.00	11.55	11.00	0.90	1.00
4698	6.20	0.26	0.06	0.95	1.37	1.10	1.23	8.82	10.00	11.28	11.00	------	------
4754	5.56	0.22	0.10	1.23	1.55	1.41	1.23	9.41	10.00	11.96	11.00	------	------
4858	6.87	0.12	0.20	1.39	1.61	1.34	1.23	9.01	10.00	11.42	11.00	------	------
4718	7.80	0.46	0.44	1.69	2.59	2.34	2.40	8.95	8.00	11.04	9.00	0.24	1.00
4860	10.16	0.48	0.30	1.73	2.51	2.04	2.46	7.59	8.00	9.17	9.00	1.02	1.00
4720	7.89	0.54	0.36	1.65	2.55	1.94	2.46	7.82	10.00	9.38	11.00	------	------
4752	6.66	0.48	0.40	1.78	2.66	2.40	2.46	8.96	10.00	10.91	11.00	------	------
4861	7.54	0.34	0.50	1.70	2.54	2.24	2.46	8.59	10.00	11.23	11.00	------	------

Table Showing the Results of Examination of Samples of Lime and Limestone Collected by the Inspectors in 1917

Station number.	Name of Maker	Brand	Per Cent Calcium Oxide	
			Found	Claimed
4635	A. J. Bird,	Ground Limestone	58.12	
4715	Edward Bryant Company,	Agricultural Lime	43.80	
4815	J. A. Creighton & Co.	Creighton's Agricultural Lime	50.92	60.00
4703	Dominion Lime Co.	Dudwell Pulverized Agricultural Limestone	53.86	
4818	Dominion Lime Co.	Dudswell Pulverized Limestone	53.18	
4557	The Limestone Company,	Ground Limerock	80.23	
4639	Pownal Lime Company	Fine Ground Limestone	49.30	45.00
4591	Rockland & Rockport Lime Co.,	R. R. Ground Limestone	54.06	51.00
4688	Rockland & Rockport Lime Co.,	R. R. Ground Limestone	53.74	51.00
4742	Rockland & Rockport Lime Co.,	R. R. Ground Limestone	53.20	51.00
4590	Rockland & Rockport Lime Co.,	R. R. Land Lime, A High Calcium Lime	62.14	60.00
4714	Rockland & Rockport Lime Co.,	R. R. Land Lime	59.14	

LAND PLASTER

Two brands of land plaster were collected. A sample from Plaster Rock, N. S., carried 22.40 per cent calcium oxide and a sample from the United States Gypsum Company carried 26.90 per cent. Neither of these samples carried guaranties as required by law.

MUSSLIZER

This material which claimed to be dried mussel bed mud was made and offered in the State. A sample collected by the inspectors showed it to carry .63 per cent of total nitrogen, .29 per cent total phosphoric acid and .54 per cent potash. Thirty six per cent was ground fine enough to pass through a sieve 60 meshes to the inch, 17 per cent passed a 40 mesh sieve, 29 per cent a 20 mesh sieve and 18 per cent was too coarse to go through a 20 mesh sieve.