EARLY STUDIES OF MILKWEED UTILIZATION IN CANADA[1, 2]

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COMMON MILKWEED, *Asclepias syriaca* L., is a ubiquitous weed in much of Eastern Canada. It has long attracted attention because of the coma which is attached to the seed, making the plant most conspicuous when the pods open in early fall. The milky juice or latex, which the plant contains, has also long attracted attention.

For many years suggestions have been made that milkweed should be utilized in industry. These suggestions include the use of the bast fibre of the stem as commercial fibre for spinning or as tow, the floss or seed hairs as a buoyant material similar to kapok, the rubber or rubber-like substance contained in the plant as commercial rubber, the stems as raw material in paper-making and the seeds as a source of vegetable oil and meal. The young shoots of milkweed have been used as human food and the plant is reported to be a good source of nectar for bees. The literature referring to these many uses has recently been summarized by Whiting (1).

Despite the relatively voluminous literature on the potential utilization of milkweed it is only recently that an actual commercial industry has been set up based on one of its products. In the United States the Milkweed Floss Division of War Hemp Industries, Inc., an agency owned and controlled by the United States Department of Agriculture, has purchased wild milkweed pods in order to separate the floss and utilize it as a substitute for kapok in life preservers. The Milkweed Floss Corporation of America is carrying out the processing operation and has now erected a plant at Petoskey, Mich., with a capacity of approximately 1,500,000 pounds of floss per year. The floss produced is being used by the United States Navy.

Research workers in the U.S.S.R. have for some time been interested in the possibilities of utilizing milkweed as a rubber plant. In Canada both the Dominion Department of Agriculture and the National Research Council of Canada have carried out extensive investigations on the production and possible use of milkweed rubber and resins in the rubber industry. The possible uses of milkweed floss have also been studied. As a result of this preliminary work 571 acres of milkweed was planted in the vicinity of Peterborough, Ontario, in 1943, these plantings being made through the cooperation of the Agricultural Supplies Board of Canada and the Ontario Department of Agriculture. This is probably the largest acreage of cultivated milkweed in the world although figures for the U.S.S.R. are not available.

The Division of Botany and Plant Pathology of the Department of Agriculture has conducted experiments with some fifteen species of *Asclepias*, the most important of these being *Asclepias syriaca* L., Common Milkweed and *A. incarnata* L., Swamp Milkweed. The details of these experiments will be reported elsewhere. In view of the great current interest in milkweed, particularly in these two species, it is notable that Canadians many years ago studied their possibilities. Many of our wild plants have great potential value in industry but long years of arduous research are usually necessary to demonstrate these values and reach the stage of commercial production. Milkweed is a native plant which has now reached this stage. The possibilities of milkweed have been studied particularly in France, Germany, the U.S.S.R., the United States, and Canada. Only early Canadian studies are reviewed below.

BOTANICAL SOCIETY OF CANADA

On March 28, 1861, at the fifth meeting of the Botanical Society of Canada held at Kingston, Ontario, a paper entitled "On the *Asclepias incarnata* L., as a Fibre Producing Plant" was presented by Judge Alexander Logie of Hamilton (2). Logie described this

1. —Received for publication April 18, 1944.
2. —Contribution No. 775 from the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.

species, which is commonly known as swamp milkweed, and recounted his finding plants of it on the shore of Burlington Bay in 1859. He also reported that this species had been successfully cultivated on dry sandy loam by Mr. John Freed, a gardener in Hamilton.

Material of this plant had been sent to Mr. J. McMicking, Gore Paper Mills, Dundas, in the spring of 1860 in order to test its qualities for paper making. McMicking reported that the Asclepias fibre when bleached for three minutes was of a whiter and brighter colour than the Manilla fibre, then in use, bleached for twenty-four hours. He estimated its value as five cents per pound for making paper and ten cents for other purposes. He stated that there seemed no doubt concerning the utility and value of the fibre but questioned whether it could be cultivated successfully and profitably.

Judge Logie exhibited a number of specimens including the fibre in various stages of preparation and suggested that members of the Society attempt to cultivate the plant and estimate the yield which would be obtained. He recommended that the seed be sown in any good moist garden soil and the plants transplanted the following spring to the place where they were to remain. He suggested that they be set out in distances no less than 18″ apart each way.

The Annals of the Botanical Society of Canada concludes with a "communication from His Excellency Lord Monck (then Governor-General of Canada) on a fibre plant suited to the climate of Canada" (3). This consisted of a letter from Denis Godley, Secretary to Lord Monck, dated Quebec, May 16, 1862 and addressed to Professor George Lawson, Secretary to the Botanical Society of Canada. The letter transmitted a copy of a communication addressed to Lord Lyons by Frederic W. Hart, M.D., St. Louis, together with seeds sent by Dr. Hart. Lord Monck suggested that the Botanical Society of Canada might be interested in this problem and requested further that the seeds be sown in order to test the value of the plant.

Dr. Hart's letter under date of May 1, 1862, stated that during a recent sojourn of three years in the Rocky Mountains, he had discovered a plant bearing a fibre fine as silk and, as he thought, definitely superior to cotton. He cultivated this plant and found that the pods grew to the size of a turkey or goose egg. Four pounds of silk and a quantity of seed were harvested. When Hart was returning to the United States he was robbed by the Indian Kiowas on the plains who stole the silk but left him the seed. He described the plant from which the seed was obtained and suggested that it might be cultivated on the St. Lawrence bottoms, Canada, and in Upper Canada. The plant to which Dr. Hart referred must almost certainly have been the showy milkweed, *Asclepias speciosa* Torr.

Professor Lawson replied to His Excellency Lord Monck stating that the seeds of the plant had been sown in the Botanic Garden at Kingston and that seeds had also been distributed to other members of the Botanical Society in various parts of Canada. He stated further that an examination of the seed showed the plant to be an *Asclepias* and then proceeded to describe some of the uses of closely related plants. He mentioned the use in India and in England of the silk-cotton obtained from *Calotropis gigantea*, the Mudar Plant of Bengal. He discussed the study which had been given to the use of *Asclepias incarnata* in Canada, and mentioned as well that certain Indian Asclepiads contained products similar to caoutchouc or gutta percha.

Professor Lawson considered that both *Asclepias* flax (stem fibre) and *Asclepias* cotton might ultimately become important materials of export from Canada. He stated that the cultivation of Asclepiads required "not a tithe of the field-labour necessary for the growth of common flax". Also accompanying Professor Lawson's letter were samples of Mudar silk-cotton from *Calotropis gigantea*, Canadian silk cotton from both common milkweed and swamp milkweed and Canadian *Asclepias* flax from swamp milkweed.

ALEXANDER KIRKWOOD

On February 15, 1867, Alexander Kirkwood, (1823-1901), read a paper on milkweed before the Ottawa Natural History Society. His paper (4) was subsequently published independently in Ottawa and has become one of the relatively rare early Canadian botanical publications. Kirkwood was appointed second class clerk in the office of the Commissioner of Crown Lands in Toronto on March 31, 1854. He evidently had extensive interests in the fields of agriculture and forestry as

indicated by the publication of a number of pamphlets on these subjects [3].

Common Milkweed —

Kirkwood discussed *Asclepias syriaca*, common milkweed, or *Asclepias cornuta* Decaisne, as it was known at that time. Following a detailed description of the plant he proceeded to enumerate its medical properties, pointing out that although it had been removed from the secondary catalogue of the U.S. Pharmacopoeia it was still used by regular practitioners. He quoted an analysis of the milky juice showing that it contained five parts of caoutchouc. He also mentioned the occurrence of asclepione in the juice. Various claims were cited that milkweed root might be used in treating scrofula and dyspepsia. It was supposed to have anodyne properties and to have been useful for asthma and in the case of typhus fever and accompanying catarrh.

Kirkwood next considered milkweed fibre as a textile material. He reported microscopic examinations of the fibre and comparisons with flax, wool, cotton and silk. He suggested that the fibre might be used in making warm cloth which was light, soft and pliable and also suggested its use in mixed fabrics.

Considerable attention was given to methods of cultivation but no actual experiments on cultivation were reported. It was suggested that the best soil would be a deep dry loam with a clay sub-soil. Kirkwood considered that it might be possible to cut the plant twice a year, in which case the first cutting would be done in June. In order to secure both the stem fibre and floss it was suggested that cutting should be done in September. The task of removing the seeds from the floss was considered to be one which could be "best done by hand round the fire-side in the long November nights."

This author intimated that the rubber from the stem might be useful suggesting that the green stems be crushed between rollers and the juice collected. "The profits resulting therefrom, may, however, remunerate him for his toil, as the juice thus obtained will thicken into a semi-elastic substance, and form a kind of caoutchouc. When evaporated and dry, it may be worked up in hot water with a wooden kneader, and will, no doubt, prove a valuable product, either alone, or mixed with other substances".

The process of retting and breaking the fibre was discussed at some length. Water retting and snow retting were both described as well as actual experiments conducted by the author.

The uses of the floss from the seed were also discussed, mention being made of cloth which had been prepared from it both with or without cotton, silk or wool. These had been exhibited in New York. The possibility of using milkweed in the paper industry was also mentioned. It was suggested that by the treatment known as "carroting" the milkweed floss might acquire felting properties and be used in the making of hats.

Kirkwood stated that no flowers were produced the first year milkweed was grown, but he gave estimates of yields and profits per acre as follows:

1st Year:
200 lb. fibre - 30 lb. tow - 600 lb. shoves $24.50

2nd Year:
300 lb. fibre - 50 lb. tow - 700 lb. shoves
200 lb. pod fibre - 200 lb. empty pods $58.00

3rd and Successive Years:
1st Cutting in June:
200 lb. fibre - 30 lb. tow - 600 lb. shoves $24.50

2nd Cutting in September:
200 lb. fibre - 30 lb. tow - 600 lb. shoves
200 lb. pod fibre - 200 lb. empty pods $46.50

These figures took no account of the cost of production.

Swamp Milkweed

Asclepias incarnata, called swamp silkweed, was also fully described. Kirkwood stated that it was sometimes employed in medicine being regarded anodyne and diaphoretic. He reported experiments in cultivation conducted by Robert Bell, Esq., of Carleton Place. Bell grew the plant from seed in the spring on dry ground reporting that it grew most luxuriantly, flowering, and

3. —Kirkwood, Alexander. Flax and Hemp. Printed at the steam press establishment of W. C. Chewett & Co., King St. East, Toronto, 8 vo. 79 pp. 1864? Ibid. Algonquin Forest and Park, Ontario. Letter to Honourable T. B. Pardee, M.P.P., Commissioner of Crown Lands, Ontario. Warwick and Sons, Toronto. 8 pp. 1866.
Ibid. An Account of the Forest of Russia. By P. N. Werekha. 1873. Translated by Kirkwood. Warwick and Rutter, Toronto. 29 pp. 1896.
Ibid. The Art of Observing. A Fragment. 177. Translated by Kirkwood. Warwick and Rutter, Toronto. 1900.

coming to maturity the second year. He stated, however, that when the plants were about half grown a large number of caterpillars of the Archippus butterfly (*Danais Archippus*) appeared and destroyed some of the plants. Kirkwood considered that the preparation of fibre would be simpler from *A. incarnata* than from *A. syriaca* due as he says, to the lack of milky juice.

The reports of successful cultivation of *A. incarnata* on relatively dry ground have been justified by recent experiments despite many opinions (unsupported by experiment) to the contrary.

SAUNDERS

At the meeting of the American Pharmaceutical Association held in Boston, Massachusetts, September, 1875, William Saunders then of London, Ontario, presented a paper (5) dealing with the manufacture of rubber from common milkweed. William Saunders subsequently became the first Director of the Dominion Experimental Farms. He stated that experiments had been underway in London for a few years to demonstrate the fact that an elastic vulcanizable gum could be obtained from common milkweed. He gave details of experiments on methods of extracting the gum. These involved the fermentation of the plant material followed by extraction with an organic solvent. Many experiments indicated that the most satisfactory solvent was carbon bisulphide but he described a fire which occurred as a result of using this solvent. One experiment indicated that Saunders obtained a yield of gum of approximately 5%, the plants having first been fermented. He also stated that the gum obtained from the fermented material was superior in quality and elasticity to that obtained from the non-fermented material. He concluded "This elastic gum is vulcanizable, and it is claimed by some who have used it to be superior for some purposes to the ordinary rubber of commerce, being tougher, and possessed of more elasticity".

Literature Cited

1. Whiting, A. Geraldine. A Summary of the Literature on Milkweeds (*Ascelpias* spp.) and their utilization. *United States Dept. Agr. Bibliographical Bull.* No. 2, 41 pp. 1943.
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3. Communication from His Excellency Lord Monck, on a fibre plant suited to the Climate of Canada. *Ann. Bot. Soc. Canada* 1: 193-196. Date of publication uncertain.
4. Kirkwood, Alexander. A short treatise on the Milk-Weed or Silk-Weed and the Canadian Nettle, viewed as industrial resources. Printed and published by Hunter, Rose & Co., Ottawa, 1867.
5. Saunders, William. On the Manufacture of Rubber from a Milkweed. *Amer. Pharm. Assoc. Proc.* 23: 655-658. 1875.

CURRENT LITERATURE

SPECIES BATORUM. THE GENUS RUBUS IN NORTH AMERICA VII CANADENSES. *By L. H. Bailey. Gentes Herbarum Vol. V, Fasc. VII. pp. 465-503. pls. 211-228. February, 1944.*

This fascicle is a continuation of Dr. Bailey's monumental monograph on the genus Rubus. It treats Section 7, Canadenses, the smooth and the thornless blackberries. Seventeen species are described and, as in previous fascicles superbly illustrated with black and white drawings.

The following species from Canada and Newfoundland are included.....: *R. canadensis* in N.S., N.B., P.E.I., Que. and Ont.; *R. amicalis* in N.B.; *R. Kennedyanus* in Nfdl.; *R. Lepagei* sp. nov. in Que.; *R. quaesitus* sp. nov. in P. E. I. and N. B.; *R. ulterior* sp. nov. in Nfdl.; *R. russeus* sp. nov. in N. S.

—HAROLD A. SENN,

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