

## **KLAMATH WEED (= ST. JOHN'S WORT)**

**Hypericum perforatum L. – Hypericaceae**

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Retrieved from: <http://faculty.ucr.edu/~legnerref/biotact/ch-66.htm>

This weed is of European origin, and was first reported as a pest in northern California near the Klamath River. It increased and spread rapidly and by 1944 had occupied over two million acres of rangeland in thirty counties of California. Not only were food forage plants greatly reduced but cattle and sheep lost weight when eating the weed because of its toxic effect, sensitizing them to sunlight. This resulted in such a great decrease in land values that it became almost impossible for ranchers to borrow money for development (DeBach 1974).

Chemical herbicides were available but not practical because of cost and the inaccessibility of most of the infested land. Dr. Harry S. Smith, head of biological control work in California, proposed the importation of insects that attacked the weed as early as 1922, but the thought of deliberately introducing a plant feeding insect was not acceptable at that time.

At the same time, in Australia phytophagous insects to control Klamath weed were being introduced from England and Europe beginning in 1929, and Dr. Smith in California followed the progress there with great interest through correspondence with Dr. A. J. Nicholson, Chief Entomologist for the Commonwealth Scientific and Industrial Research Organization (CSIRO). Authorization was finally obtained in 1944 to import three species of beetles that showed promise against the weed in Australia. It was not possible then to consider importations from Europe because of World War II, but rather simple to bring material from Australia through the cooperation of the United States Army Transport Command. The CSIRO offered to collect and prepare the material for shipment. Importations began in October 1944 but problems were soon encountered in changing the timing of the life cycle so the beetles would be in phase with seasons in the Northern Hemisphere. Two species of *Chrysolina* that were in aestivation responded rapidly in California to fine mist sprays of water to become active and lay eggs within three weeks. The third species, *Agrilus* sp., was lost. After starvation tests in quarantine on a variety of economic plants the beetles were released in the field.

*Chrysolina hyperici* (Förster) was liberated in the spring of 1945 and *Chrysolina quadrigemina* (Suffrian) in February 1946. Both were readily established but it soon became evident that *C. quadrigemina* was becoming dominant. Distribution throughout the entire infested areas was rapidly made from the original colonies. From one colony of 5,000 beetles released in 1945-6, more than 3 million beetles were collected for redistribution in California in 1950. There were also sent to Oregon, Washington, Idaho and Montana where they became established.

The Klamath weed was reduced to the status of an uncommon roadside weed in California after 10 years, its abundance having been reduced >99%. Land values immediately increased 3-4X, and weight losses in cattle and sheep ceased. It was estimated that at least \$20,960,000.00 in savings accrued to the agriculture industry in California for the period 1953-9 or about \$3,500,000.00 per year (DeBach 1974), and these savings continue to accrue each year without even taking inflation into account (Holloway 1964).

This effort was one of the few transfer projects during World War II. For example, the leaf beetle, *Chrysolina hyperici* (Förster) was transferred from Australia to New Zealand in 1943 for the biological control of St. Johnswort. In 1944 the introduction of several insect species from Australia was made to California for specificity testing and release during 1945-46 for the biological control of St. Johnswort, which became known as Klamath weed. J. K. Holloway of the USDA and H. S. Smith of UC, Riverside organized the work. Successful biological control of Klamath weed, primarily caused by the defoliating leaf beetle, *Chrysolina quadrigemina* (Suffrian), rivaled the Australian success with prickly pear cacti. This success primarily was responsible for fostering the establishment and expansion of biological noxious plant control in North America (Huffaker 1957). The first intentional introduction of an insect for plant control was made in Canada in 1950 with the importation of *Chrysolina quadrigemina* and *C. hyperici* from California to control St. Johnswort (Smith 1951). Within a decade after the liberation of *C. hyperici* and *C. quadrigemina*, the Klamath weed had been reduced in status from an extremely important rangeland scourge to that of an occasional roadside plant, and now occurs at less than 1% of its former density and has been removed from the list of noxious plants in California (Holloway & Huffaker 1949, 1951, Goeden & Andrés 1999). Its present occurrence primarily along roadsides is linked to disturbance there of the phytophagous biological control agents (E. [F. Legner](#), unpub. data).

For greater detail on biological control efforts, and biologies of host plant and natural enemies, please see the following (Froggatt 1919, Tryon 1919, Tillyard 1927a,b,c, 1930a,b, 1934; Currie & Garthside 1932, Currie & Fyfe 1938, Currie 1940, Moore & Cashmore 1942, Wilson 1943, 1953, 1960, 1963; Wilson & Campbell 1943, Miller 1944, 1945, 1946, 1947, 1948, 1951; Cashmore & Campbell 1946, Holloway 1948, 1964; Huffaker 1948, 1967; Abrams 1951, Smith 1951, 1955, 1958; Clark & Clark 1952, Clark 1953, Holloway & Huffaker 1952, 1953; Huffaker & Kennett 1953, Holloway 1957, 1964; Parsons 1957, Marco 1959, Munz & Keck 1959, Villaneuva & Faure 1959, 1964, Douglas & Schmidl 1960, Harris 1962, 1967; Johansson 1962a,b; McLeod 1962, Nelson 1962, Hoy 1963, Kingsbury 1964, Davis & Krauss 1966, 1967; Henderson & Anderson 1966, Ritcher 1966, Given 1967, Davis 1968, Goeden 1970).

## REFERENCES:

Abrams, L. 1951. Illustrated Flora of the Pacific States. III. Stanford Univ. Press, Stanford, Calif. 866 p.

Bellows, T. S. & T. W. Fisher (eds.). 1999. *Handbook of Biological Control: Principles and Applications*. Academic Press, San Diego, New York. 1046 p.

- Cashmore, A. B. & T. G. Campbell. 1946. The weed problem in Australia: A review. Austral. Council Sci. & Indus. Res. J. 19: 16-31.
- Clark, L. R. 1953. The ecology of *Chrysomela gemellata* Rossi and *C. hyperici* Forst., and their effect on St. John's wort in the Bright District, Victoria. Aust. J. Zool. 1: 1-69.
- Clark, L. R. & N. Clark. 1952. A study of the effect of *Chrysolina hyperici* Forst. on St. John's wort in the Nannus Valley, N.S.W. Austral. J. Agric. Res. 3: 29-59.
- Clark, N. 1953. The biology of *Hypericum perforatum* L. var. *angustifolium* DC. (St. John's wort) in the Ovens Valley, Victoria, with particular reference to entomological control. Aust. J. Bot. 1: 95-120.
- Currie, G. A. 1940. Some Australian weed problems. *In*: Commonwealth Bur. Pasture and Field Crops, Herb. Publ. Ser. Bull. 27: 113-30.
- Currie, G. A. & R. V. Fyfe. 1938. The fate of certain European insects introduced into Australia for the control of weeds. Austral. Council Sci. & Indus. Res. J. 11: 289-301.
- Currie, G. A. & S. Garthside. 1932. The possibility of the entomological control of St. John's wort in Australia--progress report. Austral. Council Sci. & Indus. Res. Pam. 29: 1-25.
- Davis, C. J. 1968. Report of the Entomology Branch. Hawaii Dept. Agric. Rept., 10 p. (Mimeo).
- Davis, C. J. & N. L. H. Krauss. 1966. Recent introductions for biological control. Hawaii. Ent. Soc. Proc. 19: 201-07.
- Davis, C. J. & N. L. H. Krauss. 1967. Recent introductions for biological control in Hawaii--XI. Hawaii. Ent. Soc. Proc. 19: 375-80.
- DeBach, P. 1974. Biological Control by Natural Enemies. Cambridge University Press, London & New York. 323 p.
- Douglas, G. W. & L. Schmidl. 1960. A review of biological control of noxious weeds in Victoria. 2nd Austral. Weed Conf. 1 Proc., Paper 1. 6 p.
- Froggatt, W. W. 1919. Insects and St. John's wort. New South Wales Agric. Gaz., Misc. Publ. 2192: 470-72.
- Given, B. B. 1967. Biological control of weeds and insect pests in New Zealand. Mushi 39 (Sup.): 17-22.

- Goeden, R. D. 1977. Chapter 4: Biological control of weeds, p. 43-47. *In*: B. Truelove (ed.), Research Methods in Weed Science. S. Weed Sci. Soc., Auburn Printing, Auburn, Georgia.
- Goeden, R. D. 1978. Hypericaceae. *In*: C. P. Clausen (ed.), Introduced Parasites and Predators of Arthropod Pests and Weeds: A World Review. U. S. Dept. Agric., Agric. Handbk. No. 480. 545 p.
- Goeden, R. D. & L. A. Andrés. 1999. Biological control of weeds in terrestrial and aquatic environments. *In*: Bellows, T. S. & T. W. Fisher (eds.). *Handbook of Biological Control: Principles and Applications*. Academic Press, San Diego, New York. 1046 p.
- Harris, P. 1962. Effect of temperature on fecundity and survival of *Chrysolina quadrigemina* (Suffr.) and *C. hyperici*(Forst.) (Coleoptera: Chrysomelidae). *Canad. Ent.* 94: 774-80.
- Harris, P. 1967. Suitability of *Anaitis plagiata* (Geometridae) for biocontrol of *Hypericum perforatum* in dry grassland of British Columbia. *Canad. Ent.* 99: 1304-10.
- Henderson, M. & J. G. Anderson. 1966. Common weeds in South Africa. So. Africa Dept. Agric. Tech. Serv., Bot. Res. Inst. Bot. Survey, Mem. 37: 1-440.
- Holloway, J. K. 1948. Biological control of Klamath weed--progress report. *J. Econ. Ent.* 41: 56-7.
- Holloway, J. K. 1957. Weed control by an insect. *Scien. Amer.* 54: 57-62.
- Holloway, J. K. 1964. Projects in biological control of weeds. *In*: P. DeBach (ed.), Biological Control of Insect Pests and Weeds, p. 650-70. Reinhold Publ. Corp., New York. 844 p.
- Holloway, J. K. & C. B. Huffaker. 1949. Klamath weed beetles. *Calif. Agric.* 3: 3-10.
- Holloway, J. K. & C. B. Huffaker. 1951. The role of *Chrysolina gemellata* in the biological control of Klamath weed. *J. Econ. Ent.* 44: 244-47.
- Holloway, J. K. & C. B. Huffaker. 1952. Insects to control a weed. U. S. Dept. Agric. Yearbk. 1952: 135-40.
- Holloway, J. K. & C. B. Huffaker. 1953. Establishment of the seed weevil, *Apion ulicis* Forst., for the suppression of gorse in California. *J. Econ. Ent.* 50: 498-99.
- Hoy, J. M. 1963. Present and future prospects for biological control of weeds. *New Zeal. Sci. Rev.* 22: 17-19.
- Huffaker, C. B. 1948. Kalmath weed. *Calif. Agric.* 2: 12.

- Huffaker, C. B. 1967. A comparison of the status of biological control of St. John's wort in California and Australia. *Mushi* 39 (Sup.): 51-73.
- Huffaker, C. B. 1957. Fundamentals of biological control of weeds. *Hilgardia* 27: 101-57.
- Huffaker, C. B. & C. E. Kennett. 1953. Ecological tests on *Chrysolina gemellata* (Rossi) and *C. hyperici* Forst. in the biological control of Klamath weed. *J. Econ. Ent.* 45: 1061-64.
- Johansson, S. 1962a. Insects associated with *Hypericum* L. 1. Host plant and Coleoptera. *Opuscula Ent.* 27: 128-46.
- Johansson, S. 1962b. Insects associated with *Hypericum* L. 2. Lepidoptera, Diptera, Hymenoptera, Homoptera, and general remarks. *Opuscula Ent.* 27: 175-92.
- Kingsbury, J. M. 1964. *Poisonous Plants of the United States and Canada*. Prentice-Hall, Inc., New Jersey. 626 p.
- Marco, R. I. 1959. Notes on the biological control of pests of agriculture in Chile. *Food & Agric. Organ. Plant Protect. Bull.* 8: 25-30.
- McLeod, J. H. 1962. A review of the biological control attempts against insects and weeds in Canada. Part I. Biological control of pests of crops, fruit trees, ornamentals, and weeds in Canada up to 1959. *Commonwealth Inst. Biol. Control, TEch. Commun.* 2: 1-33.
- Miller, D. 1944. Entomological investigations. *Cawthron Inst. (Nelson, New Zeal.) Ann. Rept.* 1943-1944: 25-26.
- Miller, D. 1945. Entomological investigations. *Cawthron Inst. (Nelson, New Zeal.) Ann. Rept.* 1944-1945: 24-25.
- Miller, D. 1946. Entomological investigations. *Cawthron Inst. (Nelson, New Zeal.) Ann. Rept.* 1945-1946: 310-31.
- Miller, D. 1947. Entomological investigations. *Cawthron Inst. (Nelson, New Zeal.) Ann. Rept.* 1946-1947: 34-35.
- Miller, D. 1948. Control of St. John's wort by imported beetle. *New Zeal. J. Agric.* 76: 351-52.
- Miller, D. 1951. Entomological investigations. *Cawthron Inst. (Nelson, New Zeal.) Ann. Rept.* 1950-1951: 31-32.

- Moore, R. M. & A. B. Cashmore. 1942. The control of St. John's wort (*Hypericum perforatum* L. var *angustifolium* D.C.) by competing pasture plants. Austral. Council Sci. & Indus. Res. Bull. 151: 1-23.
- Munz, P. A. & D. D. Keck. 1959. A California Flora. Calif. Univ. Press. 1681 p.
- Nelson, H. S. 1962. Untersuchungen zur biologischen Bekämpfung von *Hypericum perforatum* L. mit Hilfe von Insekten, *Chrysomela varians* Schall., Coleoptera, und *Semasia hypericana* Hb., Lepidoptera. Ztschr. f. angew. Ent. 50: 290-327.
- Parsons, W. T. 1957. St. John's wort in Victoria. History, distribution, control. Victoria Dept. Agric. J. 55: 781-88.
- Ritcher, P. O. 1966. Biological control of insects and weeds in Oregon. Oreg. Agric. Expt. Sta. Tech. Bull. 90. 39 p.
- Smith, J. M. 1951. Biological control of weeds in Canada. Canadian National Weed Commission, East Sector Proceedings 5: 95-7.
- Smith, J. M. 1955. Biological control of common St. John's wort in British Columbia in 1954. Canad. Nat. Weed Comm., East Sect. Proc. 8: 84-8.
- Smith, J. M. 1958. Biological control of Klamath weed, *Hypericum perforatum* L., in British Columbia. 10th Internatl. Cong. Ent. Proc. 4: 561-65.
- Tillyard, R. J. 1927a. Biological control of St. John's wort. New Zealand J. Agric. 35: 42-5.
- Tillyard, R. J. 1927b. St. John's wort--possibility of biological control. Austral. Council Sci. & Indus. Res. J. 1: 78-80.
- Tillyard, R. J. 1927c. Insect control of noxious weeds. Joint scheme initiated against blackberry and other species. New Zealand J. Agric. 34: 84-90.
- Tillyard, R. J. 1929. The biological control of noxious weeds. 4th Internatl. Cong. Ent. Trans 2: 4-9.
- Tillyard, R. J. 1930a. The biological control of noxious weeds. Roy. Soc. Tasmania Proc. (1929): 41-86.
- Tillyard, R. J. 1930b. Entomological control of St. John's wort. First liberations of *Chrysomela* beetles. Austra. Council Sci. & Indus. Res. J. 3: 231-32.
- Tillyard, R. J. 1934. The entomological control of noxious weeds in the Pacific Region. 5th Pacific Sci. Cong. Proc. 5: 3547-57.

Tryon, H. 1919. The St. John's wort pest. Proposal to utilize insect enemies for its eradication. Queensland Agric. J. 11: 122-23.

Villanueva, H. L. & G. O. Faure. 1959. Biological control of St. John's wort in Chile. Food & Agric. Organ. Plant Protect. Bull. 7: 144-46.

Wilson, F. 1943. The entomological control of St. John's wort (*Hypericum perforatum* L.) with special reference to the insect enemies of the weed in southern France. Austral. Council Sci. & Indus. Res. Bull. 169: 1-87.

Wilson, F. 1960. A review of the biological control of insects and weeds in Australia and Australian New Guinea. Commonwealth Inst. Biol. Control, Tech. Commun. 1. 102 p.

Wilson, F. 1953. Progress in the entomological control of St. John's wort in Australia. 7th Pacific Sci. Cong. Proc. 4: 300-03.

Wilson, F. 1963. The results of biological control investigations in Australia and New Guinea. 9th Pacific Sci. Cong. Proc. (191)9: 112-23.

Wilson, F. & T. G. Campbell. 1943. Recent progress in the entomological control of St. John's wort. Austral. Council Sci. & Indus. Res. 16: 45-56.