Annotated Bibliography on the Ecology and Management of Invasive Species:

Himilayan blackberry (*Rubus discolor, R. procerus*)

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March 2002

Amor, R.L., 1972.
TITLE: A study of the ecology and control of blackberry (Rubus fruticosus L. agg.).
SOURCE (BIBLIOGRAPHIC CITATION): Journal of the Australian Institute of Agricultural Science. 1972, 38: 4, 294.
ABSTRACT: Studies on the distribution and spread of 9 species of blackberry (Rubus fruticosus) in Victoria indicated that the agressiveness of the widespread R. procerus was due to its extensive lateral spread by formation of daughter plants at cane apices. The average increase in radius of thickets by cane tip rooting was 3.3 m / year but seedling establishment was poor (0.4 seedlings / m2 near thickets). Control measures include heavy grazing in autumn to prevent cane tip rooting, several foliage spray applications of picloram, 2,4,5 T or aminotriazole + ammonium thiocyanate in summer or picloram granules applied in late winter.
DESCRIPTORS: ecology ; colonizing ability; ecotypes ; competitive ability; picloram ; 2,4,5 T; usage ; weeds ; woody weeds; weed biology; taxonomy ; weed control; crop management; grazing ; seeds ; viability ; germination ; mowing ; blackberries

Amor, R.L., 1974.
TITLE: Ecology and control of blackberry (Rubus fruticosus L. agg.) 3. Responses of R. procerus to mechanical removal of topgrowth and to foliage applied herbicides.
SOURCE (BIBLIOGRAPHIC CITATION): Amor, R. L. : Ecology and control of blackberry (Rubus fruticosus L. agg.) 2. Reproduction. Weed Research. 1974, 14: 4, 239 243; 16 ref.
ABSTRACT: Cutting off the canes, either at ground level or at a height of 15 cm, stimulated the formation of suckers from lateral roots of Rubus procerus. The application of 2,4,5 T or picloram sprayed on the foliage killed many plants, suppressed shoot production from the crowns of others, but stimulated sucker formation. Within age groups of from 1 to 5 years, older plants were more resistant to 2,4,5 T (0.067% and

0.02%), sprayed to run off, and to picloram (0.067%) than were younger plants. Picloram (0.2%) was the most effective treatment and affected plants of all ages equally. It is suggested that the age of plants may be a major source of variation in the efficacy of herbicides on other perennial weeds. From summary.
DESCRIPTORS: Herbicides ; 2,4,5 T; picloram ; usage ; weeds ; woody weeds; weed control; crop management; felling ; weed biology; roots ; taxonomy ; shoots ; growth stages; ecology ; cultural control; ecotypes ; competitive ability; colonizing ability; blackberries

Amor, R.L., 1975.
TITLE: Ecology and control of blackberry (Rubus fruticosus L. agg.) 4. Effect of single and repeated applications of 2,4,5 T, picloram and aminotriazole.
SOURCE (BIBLIOGRAPHIC CITATION): Weed Research. 1975, 15: 1, 39 45; 14 ref.
ABSTRACT: On 3 year old thickets of R. procerus, sprays of 0.067% 2,4,5 T butyl ester reduced the density of live canes most when sprayed from the commencement of flowering in early summer through to autumn. However, on 7 year old thickets the time of spraying had no significant effect. Sprays of 0.067% picloram potassium were most effective on 3 year old thickets when applied just before and during flowering. Generally 2,4,5 T was more effective when sprayed twice a year, but some live plants remained after this was carried out for 2 years. Because of the higher density of plants in thickets of R. ulmifolius hybrid, this taxon is more difficult to eradicate than thickets of R. procerus. Although picloram was the most effective herbicide tested, picloram and activated aminotriazole have a more limited potential usage than 2,4,5 T on blackberry. From summary.See also WA, 24 1036See also WA, 24 1037
DESCRIPTORS: Crops ; Herbicides ; weeds ; woody weeds; picloram ; 2,4,5 T; AMITROLE ; usage ; weed control; growth stages; weed biology; flowering ; ecology ; competitive ability; colonizing ability

Conant, P., 1995.
TITLE: New Hawaiian pest plant records for 1995.
SOURCE (BIBLIOGRAPHIC CITATION): Bishop Museum Occasional Papers. 1996, No. 46, 1 2.
ABSTRACT: First occurrences of Ulex europaeus, Miconia calvescens and Melastoma candidum in Hawaii, and range extensions of M. calvescens and Rubus discolor are reported.
DESCRIPTORS: weeds ; woody weeds; ecology ; geographical distribution; new geographic records

Dodd, J. and S. Lloyd, 1992.
TITLE: New leaf rust helps to control blackberry.
SOURCE (BIBLIOGRAPHIC CITATION): Journal of Agriculture, Western Australia. 1992, 33: 2, 47 50; 4 ref.

ABSTRACT: A highly virulent strain of Phragmidium violaceum from central France has been established on 20 sites where infestation by blackberries causes severe problems. Some evidence was obtained of specificity, the rust being effective on Rubus discolor and R. ulmifolius but not on R. aff. selmeri. Infection weakens growth and reduces the rate of spread of the weed, making it more manageable.
DESCRIPTORS: weed control; plant pathogenic fungi; plant pathogens; plant diseases; blackberries ; biological control; weeds ; control ; woody weeds; volunteer plants; fruit crops; plant pathology

Douglas, G.W., D. Meidinger and J. Pojar (eds.), 1999.
Illustrated Flora of British Columbia, Volume 4. Ministry of Environment, Lands and Parks, Ministry of Forests, Victoria, BC, page 348-349.
Description and illustration of Rubus discolor.

Dutson, V.J., 1973.
Use of the Himalayan blackberry, *Rubus discolor*, by the roof rat *Rattus rattus*, in California. California vector View 20: 59-68.

Evans, K.J., D.E. Symon and R.T. Roush , 1998.
Title: Taxonomy and genotypes of the Rubus fruticosus L. aggregate in Australia.
Source: Plant Protection Quarterly. 1998; 13 (4) 152 156.
Language: English
Abstract: Blackberry (Rubus fruticosus L. aggregate) is an important weed of agricultural and natural ecosystems in Australia. Weed managers require accurate taxonomic keys for Rubus so that they can identify which taxa are contributing to the weed problem. Blackberry comprises a few diploid sexual species (e.g. R. ulmifolius) and a large number of polyploid agamospecies (e.g. taxa in Australia named R. polyanthemus, R. laciniatus and the widespread R. affin. armeniacas (= R. discolor sensu auct. aust. non Weihe & Nees)). We review the status of Rubus taxonomy in Australia and present some new information regarding existing taxa based on collections made in South Australia and examined by Rubus specialists in Europe. The utility of Rubus taxonomy for research workers and weed managers is also examined. Whereas the biological species concept may be useful for weed managers, research workers often require more precise information regarding the amount and distribution of genetic variation within Rubus. We present the use of DNA fingerprinting as a tool for (i) determining the genotype of an individual plant, (ii) estimating the genetic variation within and among Rubus taxa, and (iii) clarifying some taxonomic problems in the genus Rubus. Twenty different genotypes were identified among 13 different Rubus taxa. No genetic variation was observed among 50 plants of R. affin. armeniacas sampled from 29 locations throughout Australia, suggesting that this common blackberry is probably a single clone. In contrast, seven different genotypes were observed among 26 plants of R. ulmifolius sens. lat. sampled from six locations in

Victoria. Two of these genotypes were sampled from a single thicket of R. ulmifolius sens. lat. We illustrate the utility of genotyping Rubus plants in studies to identify virulent strains of the European rust fungus for improved biological control of blackberries.

Fechtig, A.D. and W.R. Furtick, 1964.
TITLE: Control of giant Himalaya Blackberry (Rubus procerus P. J. Muell.) with organic chemical compounds.
SOURCE (BIBLIOGRAPHIC CITATION): 1964, Res. Progr. Rep. West. Weed Control Conf. 1964 (40). From abstr. in Weed Abstr. 14 (4), 1965 (1163).
ABSTRACT: Of the herbicides tested, only picloram at rates 2 lb./acre gave complete control of R. procerus on assessment 5 months after treatment. Lower rates of picloram (1 lb./acre) gave 95 % control, while 2,4,5 T at 1, 2 and 4 lb./acre gave respectively 75, 85 and 93 % control. Treatments giving less than 40% control of R. procerus included 2,4 D solubilized and emulsiflable acids, and endothal mono N,N dimethylcocoamine and di NNdimethyltridecylamine [rates not stated] and amitrole at 8 lb./acre.
DESCRIPTORS: Protection, forest; Rubus procerus; Weedkillers amitrole T; Weedkillers endothal; Weedkillers picloram; Weelkillers, application, effects &c.

Gervais Jennifer; Anna Traveset; Mary F. Willson, 1998.
TITLE: The potential for seed dispersal by the banana slug (Ariolimax columbianus).
SOURCE (BIBLIOGRAPHIC CITATION): American Midland Naturalist. 1998, 140: 1, 103 110; 28 ref.
ABSTRACT: Wild banana slugs (Ariolimax columbianus) were observed eating fruits of several Pacific Northwest plant species. Slime trails and direct observations indicated that slugs are capable of reaching the fruits of many wild plants. To determine whether slugs may act as seed dispersers, captive slugs were fed the fruits of Rubus spectabilis, R. discolor, Vaccinium ovatum, V. parvifolium, Gaultheria shallon and Disporum smithii to determine the effects of slug ingestion on seed germination. At least some seeds of each species germinated after the fruits were consumed by the slugs, but the effects on germination were species specific. Seeds of Rubus spectabilis were less likely to germinate after passage through the guts of slugs, and significant evidence was found that the two fruit colour morphs reacted differently over time. Disporum smithii seeds did not statistically differ in germination behavior between treatments, although the trend suggested possible germination enhancement following rasping of the seeds by slugs. All other species of seeds tested germinated following consumption by slugs, but results could not be tested statistically. Gut passage times of R. discolor seeds were determined (mean = 25.4 h, SE = 3.6 h). It is concluded that despite the short distances slugs are likely to disperse seeds, their generalist habits and ubiquity suggest that they may have complex and ecologically significant effects on seed dispersal in Pacific Northwest forests.

DESCRIPTORS: seed dispersal; forests ; fruits ; seed germination; wild plants; ingestion

Gordon S.C; J.A.T. Woodford and A.N.E. Birch, 1997.
Title: Arthropod pests of Rubus in Europe: Pest status, current and future control strategies.
Source: Journal of Horticultural Science. Nov., 1997; 72 (6) 831 862.
Language: English
Abstract: Arthropod pests of raspberry (Rubus idaeus L.), cultivated blackberry (R. laciniatus Willd., R. procerus P. J. Mull.) and Rubus hybrids, e.g. Tayberry and Loganberry in Europe are reviewed and economic damage and chemical and cultural control strategies described. Particular consideration is given to the most damaging pests, including aphids (Amphorophora idaei (Borner) and Aphis idaei van der Goot), raspberry beetle (Byturus tomentosus Degeer), clay coloured weevil (Otiorhynchus singularis L.), raspberry cane midge (Resseliella theobaldi (Barnes)), raspberry moth (Lampronia rubiella (Bjerkander)) and two spotted spider mite (Tetranychus urticae Koch.). New pest species or biotypes continue to be discovered on Rubus, as a result of changes in pesticide usage, the cultivation of new varieties, or insect host range, e.g. Graphiphora augur (Fabr.), Cantharis obscura L. and Agrilus aurichalceus Redt. The potential entomological problems associated with protected cultivation, pesticide usage and application in cane fruit crops are considered. Many of the most important pest species attacking cultivated Rubus in Europe are host specialists. Novel stategies for their control are discussed, based on defence chemicals found in Rubus leaves and canes, and the use of biotechnology to enhance resistance. Mechanical harvesting of cane fruit is increasing in importance, and fruit harvested by machine may be contaminated by a range of arthropods which require additional control measures. The withdrawal from use of existing pesticides and the increasing public demand for the production of fruit without pesticides are considered as powerful external pressures determining the future direction of crop protection in raspberry and blackberry crops. The prospects for developing Integrated Pest Management systems for cane fruit crops are discussed in relation to biological, technical and socioeconomic factors.

Hill B.L; A. H. Purcell, 1997.
Title: Populations of Xylella fastidiosa in plants required for transmission by an efficient vector.
Source: Phytopathology . Dec., 1997; 87 (12) 1197 1201.
Language: English
Abstract: Xylella fastidiosa, a xylem limited bacterium that causes Pierce's disease (PD) of grapevine and other diseases, is transmitted efficiently by xylem feeding leafhoppers. Acquisition of a PD strain of X. fastidiosa by the blue green sharpshooter (BGSS) from five plant host species grapevine (Vitis vinifera), Himalayan blackberry (Rubus discolor), California mugwort (Artemisia douglasiana), watergrass (Echinochloa crus galli), and Bermuda grass (Cynodon dactylon) was tested at various time intervals

after vector inoculation. The minimum incubation periods in plant hosts before BGSS acquired X. fastidiosa were 4, 22, 29, and 25 days for grapevine, blackberry, mugwort, and watergrass, respectively. There were no transmissions by vectors or recoveries of X. fastidiosa by culturing from Bermuda grass in 133 attempts, including 80 attempts with the green sharpshooter, Draeculacephala minerva. The first acquisitions and subsequent transmissions by BGSS occurred after X. fastidiosa multiplied to a population of about 104 CFU / g of stem tissue. Higher populations of bacteria in plants resulted in higher rates of transmission. In grapevine, the rate of transmission increased over time (4.5% in the first 10 days to 55% after day 25) as the maximum number of viable CFU of X. fastidiosa recovered by culturing also increased (from 5 X 105 CFU / g during the first 10 days to 5 X 108 after day 25).

Hoshovsky, M. 1998.
Element Stewardship Abstract for *Rubus discolor (Rubus procerus)* Himalayan blackberry. The Nature Conservancy.
http://tncweeds.ucdavis.edu/esadocs/documnts/rubudis.html

Howden, J.S., 1961.
TITLE: Weeds of industrial sites (3 reports).
SOURCE (BIBLIOGRAPHIC CITATION): 1961, Res. Rep. West. Sect. Nat. Weed Comm. Can. 1961 (122 3). From abstr. in Weed Abstr. 12 (5), 1963 (1346).
ABSTRACT: Benzabor (2,3,6 TBA + borate) at 0.5 lb. / 1OO sq. ft. gave 95% control of Rubus parviflorus. 2,3,6TBA applied to the soil at 10 lb. / acre was equally effective, but a rate of 6 lb. / acre applied as a foliar spray gave only 75% control. Amitrole at 2.5 lb. / acre + either monuron or atrazine at 6.32 lb. / acre in 100 gal. spray gave good control of Poa and Agrostis spp. on railway tracks, up to 2 years from treatment in June 1959. Dalapon at 15 lb. / acre and Calmix (dalapon + fenoprop) at 6 gal. / acre gave 90'/. control of grasses in the year of treatment. Simazine, atrazine and diuron applied at 20 lb. / acre in mid March gave almost complete control of Phalaris arundinacea on ditch banks, but had no effect on R. lacinialus or R. procerus. Benzabor at 3 lb. / acre, however, combined good control of grasses with 94% kill of the Rubus spp.
DESCRIPTORS: Grass control chemical; Protection, forest; Regeneration, natural by coppicing; Roots grafts; Rubus Iaciniatus; Rubus parviflorus; Rubus procerus; Weedkillers Benzabor; Weedkillers Calmix; Weedkillers TBA; Weedkillers aminotriazole; Weedkillers atrazine; Weedkillers borates; Weedkillers dalapon; Weedkillers fenuron; Weedkillers monuron; Weedkillers simazine; Weeds, herbaceous control on railway tracks

Loewen, D. (no date)
Brochure: Invader Plants of Greater Victoria.

Parker, R., 1991.
TITLE: Blackberry control with systemic herbicides.
SOURCE (BIBLIOGRAPHIC CITATION): Extension Bulletin Cooperative Extension, College of Agriculture and Home Economics, Washington State University. 1991, No. EB1327, 4 pp.
ABSTRACT: The correct methods and rates of application, precautions and restrictions governing the treatment of blackberries (Rubus discolor, R. laciniatus and R. ursinus) in crops and non crop situations in Washington State, USA, with amitrole (Amitrole T or Amizol), dicamba (Banvel), fosamine (Krenite), glyphosate (Roundup), metsulfuron (Escort), triclopyr (Garlon 3A, Garlon 4 or Redeem) and triclopyr + 2,4 D (Crossbow) are reported.
DESCRIPTORS: Woody weeds; control ; chemical control; Amitrole ; Dicamba ; Fosamine ; Glyphosate ; Metsulfuron ; Triclopyr ; 2,4 D; Weeds ; Herbicides

Parsons, W.T., R.P. Field, E. Bruzzese and R.W. Madin, 1984.
TITLE: A research project with an unexpected development.
SOURCE (BIBLIOGRAPHIC CITATION): Proceedings of the seventh Australian weeds conference, 1984, Volume I. 1984, 121 124; 1 ref.
ABSTRACT: A number of rust strains collected from plants of Rubus procerus and R. ulmifolius growing in SW Europe were shown to be specific to introduced blackberry taxa occurring in Victoria, Australia. These studies indicated that the Phragmidium violaceum now occurring in Victoria would be unlikely to affect commercial berry fruit without European blackberry in their ancestry. The distribution of the rust throughout the blackberry areas of Victoria was investigated and approval sought for blackberry as a candidate for biological control.
DESCRIPTORS: Woody weeds; Weeds ; control ; biological control

Percival, Joe, 1996.
A Himalayan Legacy of Thorny Proportions: A Restoration Proposal for the Disturbed Vegetation Community of Witty's Lagoon Regional Park. Paper prepared for the University of Victoria Restoration of Natural Systems Program, ER311, December 1996.

Playfair, L. [Editor], 1956.
TITLE: Control of woody plants (4 abstracts).
SOURCE (BIBLIOGRAPHIC CITATION): 1956, Res. Rep. West. Sect. nat. Weed Comm. Can. 1956 (81 2). From abstr. in Weed Abstr. 6(5), 1957(563).
ABSTRACT: Monuron at 3 oz./100 sq. ft. and concentrated Borascu (89% anhydrous borax) at 9 lb./100 sq. ft. were applied to woody growth along a fence line (chiefly Rose [Rosa sp.] and Snowberry [Symphoricarpos sp.]) after the vegetation had been cut to within 3 in. of ground level. Observations up to 18 months later showed Borascu to be much more effective on woody growth than monuron; the reverse was the case for herbaceous growth. 2,4,5 T, with or without 2,4 D, was applied to fence row areas as

follows: (1) 1.5 lb. / acre 2,4 D plus 2 lb. / acre 2,4,5 T (butoxy ethanol esters); (2) 2 lb. 2,4 D plus 1 lb. 2,4,5 T (butoxy ethanol esters); (3) 4 lb. 2,4,5 T; (4) 6 lb. 2,4,5 T. (1) and (2) were applied to an area containing Alder (Alnus spp.), Silver Poplar (Populus sp.), Blackberry (Rubus laciniatus and R. procerus) and Hawthorn (Crataegus sp.); (3) and (4) were applied to areas containing Hardhack (Spiraea sp.), Blackberry and Alder. Treatment (1) gave sporadic control; (2) ex!
cellent control of all species except Hawthorn; (3) and (4) excellent control of Blackberry but very little control of Spiraea sp. 2,3,6 TBA was applied at 2 and 4 lb. / acre (1) in 15 and 30 gal. water as a foliage spray and (2) in 15 gal. diesel fuel oil as a dormant over all spray. Effects were very slow to appear; after about 15 months White Poplar (Populus sp.) Ash (Fraxinus sp.), Hawthorn (Crataegus sp.), Willows (Salix sp.) and Wild Rose (Rosa sp.) were dead from treatment (1), Burr Oak (Quercus macrocarpa) developed some deformed leaves and other Quercus spp. were dying. Hazel (Corylus sp.) showed regrowth from roots; Dogwood (Cornus sp.) showed only slight effects. After 12 months, more or less similar results were showing on the same species from treatment (2).
DESCRIPTORS: Alnus spp. control, chemical; Cornus spp.; Corylus spp. control, chemical; Crataegus spp. control, chemical; Fraxinus spp. control, chemical; Populus spp. and hybrids control, chemical; Protection forest; Quercus macrocarpa; Quercus spp. control chemical; Rosa spp.; Rubus laciniatus; Rubus procerus; Salix spp. control, chemical; Spiraea sp; Symphoricarpos spp.; Weed trees and shrubs chemical control; Weed killers

Richardson, R.G., 1976.
TITLE: Changes in the translocation and distribution of 2,4,5 T in blackberry (Rubus procerus P.J. Muell.) with time.
SOURCE (BIBLIOGRAPHIC CITATION): Weed Research. 1976, 16: 6, 375 378; 7 ref.
ABSTRACT: The distribution of 2,4,5 T in Rubus procerus was measured 24 h and 7 days after application to the leaves at 60% of the normal concentration used in the field. There was no significant difference in the amount translocated at these times. At 24 h after treatment there was a very large concentration gradient across the crown but 6 days later the concentration gradient was much smaller. It was concluded that, at the rate used, the amount of 2,4,5 T translocated to the roots was insufficient to prevent regeneration from the root system.
DESCRIPTORS: 2,4,5 T; usage ; weeds ; woody weeds; physiology ; translocation

Richardson, R.G. and R.L. Amor, 1975.
TITLE: Effect of 2,4,5 T and picloram on the regeneration of blackberry (Rubus procerus P.J. Muell) from root segments.
SOURCE (BIBLIOGRAPHIC CITATION): Weed Research. 1975, 15: 4, 227 231; 10 ref.
ABSTRACT: The formation of roots and shoots on root segments of Rubus procerus was prevented by soaking the segments for 24 h in a 10 4M solution of 2,4,5 T or a 10 5M

solution of picloram. Shoot numbers were significantly increased after treatment with 10 9M and 10 10M 2,4,5 T, but picloram did not cause a significant increase in shoot numbers. Measurement of the concn. of 2,4,5 T in the extra cambial tissue showed that roots treated with 10 4M 2,4,5 T contained 5 X 10 8 mmole 2,4,5 T/mg dry wt., and by extrapolation, roots treated with 10 9M, 2,4,5 T contained 2 X 10 12 mmole/mg dry wt. From summary.
DESCRIPTORS: 2,4,5 T; picloram ; usage ; weeds ; woody weeds; physiology ; uptake

Sainty, G; L. Tanner and P. Nolan, 1995.
TITLE: Streambank weeds.
SOURCE (BIBLIOGRAPHIC CITATION): Better planning for better weed management. Proceedings of the 8th biennial noxious weeds conference, Goulburn, NSW, Australia, 19 21 September 1995: volume 1. 1995, 85 86; Agdex 640.
ABSTRACT: The control of streambank weeds in Australia is reviewed. Topics discussed include: the need to control exotic plants; problems of erosion as a consequence; a case study example of Salix spp. on the Nambucca River, New South Wales; problems caused by invasion of camphor laurel [Cinnamomum camphora], Gleditsia tri[a]canthos, Erythrina crista galli, Tamarix aphylla and Rubus discolor; and an outline of management methods.
DESCRIPTORS: woody weeds; aquatic weeds; weeds ; weed control; streams ; canal banks; erosion ; invasion ; volunteer plants

Useful Websites

http://www.geog.ubc.ca/richmond/city/vasiveplants.htm
The Natural History of Richmond, BC. Contextualising biodiversity.

www.rbg.ca/cbcn/en/invasives/I_shrub2.html
Canadian Botanical Conservation Network. Information on invasive shrub and vine species.

http://aws.lbcc.cc.or.us/orecol/ross/himalayan-blackberry.htm
Pictures, general information.

www.wschs-grf.pon.net/himalaya.htm
Pictures, general information.

www.friendsoftrees.org/old_site/html/trinvasives.shtml
Friends of Trees website, information on several invasives.