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Echium plantagineum: Catalyst for Conflict and Change in Australia

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Abstract

A brief description is given of Australian agricultural research administration and the way this was used to resolve previous conflicts over the desirability of controlling *Chondrilla juncea* and the possible harm to sunflower from agents proposed for control of *Xanthium pungens*. The scale and complexity of the conflict over *Echium plantagineum* is described and the history of attempts to resolve the issue and final decision to proceed summarized. That the issue was not resolved was shown by subsequent court action which succeeded in preventing implementation of the program. Examination of the legal issues involved showed that legislation would be necessary to protect biological control programs in the future. The status of other weeds and the present interim approval system is briefly described, and the *Biological Control Act 1984* is discussed.

Echium plantagineum: Catalyseur de Conflits et de Changements en Australie

Ce rapport expose brièvement les méthodes de gestion des recherches agricoles en Australie et la façon dont elles sont utilisées pour régler les conflits antérieurs au sujet des avantages de la lutte contre *Chondrilla juncea* et des dommages que peuvent causer aux tournesols les agents biologiques proposés pour lutter contre *Xanthium pungens*. Le rapport décrit la portée et la complexité du conflit au sujet de *Echium plantagineum*, puis donne un bref historique des tentatives faites pour le régler et résume les mesures qui ont finalement été prises. Toutes les tentatives ont échoue; la preuve en est la décision de la cour qui a interdit la mise en oeuvre du programme. L'étude des aspects légaux de la question a montré qu'il fallait adopter des lois en vue de protéger à l'avenir les programmes de lutte biologique. Le document présente un aperçu du projet de loi qui comportera une vaste enquête. Les auteurs décrivent brièvement les méthodes actuelles de lutte contre les plantes nuisibles et le processus d'approbation provisoire.

Introduction

The early settler who first planted *Echium plantagineum* L. (Boraginaceae) in Australia, whether it was Mrs. Patterson in about 1880 (Piggin 1977*a*) or another enthusiast, could not have realized the magnitude of the repercussions that action was to produce a century later, not only with respect to agriculture in southeastern Australia, but for the whole legal framework surrounding the international field of biological control. The controversy over *E. plantagineum* was not the first, nor will it be the last, conflict of interest over biological control of a weed in Australia, but it has certainly been the most important. Appropriately, therefore, it forms the main subject of this account, the principal illustration of problems which have been faced, and changes it has catalyzed.

The biological control program for this species was accepted by a system of decision-making that was apparently effective for previous conflicts, but whose inadequacies became apparent with the *E. plantagineum* conflict. This account follows the evolution of changes in biological control in Australia, dealing first with resolution of earlier conflicts and concluding with discussion of the *Biological Control Act 1984* (Commonwealth of Australia 1984*a*), which should resolve future conflicts of interest in biological control in Australia.

Australian Agricultural Administration

A brief introduction to the administration of Australian agriculture and the environment is necessary to understand the complex history of conflict of interest in biological control in Australia.

For agriculture, the ultimate authority is the Australian Agricultural Council (A.A.C.), comprising the Ministers for Agriculture or Primary Industry from each State and chaired by the Federal Minister for Primary Industry. To A.A.C. are submitted the deliberations and recommendations of the Standing Committee on Agriculture (S.C.A.), made up of the State and Northern Territory Directors of Agriculture, representatives of the Federal Departments of Primary Industry, Health, Trade and Finance, and CSIRO (the national research organization). To this top professional body report other subsidiary committees with responsibility for different sectors of agriculture.

One such committee is the Plant Production Committee (P.P.C.), to which in turn report various technical committees, including the Australian Weeds Committee (A.W.C.), comprising representatives of Departments of Agriculture, Primary Industry and/or other groups of each State and the Northern Territory, plus representatives of CSIRO, the Federal Department of Primary Industry, and forestry interests. The A.W.C. is the principal initiator and co-ordinator of national weeds policies and is also a sounding board for CSIRO and for State reserach programs which are of concern to other States. If necessary (with S.C.A. approval), the A.W.C. may institute technical subcommittees or working parties to deal with specific problems or weeds. The subject of one such subcommittee was skeleton weed, *Chondrilla juncea* L. (Compositae). Thus, for some time there has been a mechanism in Australia for discussion of proposed national and regional biological control programs for weeds.

The system of approval for biological control agents for importation and release has been quite separate from that for target weed approval. The Commonwealth Department of Primary Industry (Plant Health and Quarantine Branch) administers plant and animal quarantine aspects of the *Quarantine Act 1908* (Commonwealth of Australia 1908). Under the provisions of this *Act*, each agent is the subject of an application to Plant Quarantine, which co-ordinates its review by a small committee of senior entomologists for an insect importation or plant pathologists for a pathogen importation. Recently a new act has come into force, the *Wildlife Protection (Regulation of Exports and Imports) Act 1982* (Commonwealth of Australia 1982), administered by the Commonwealth Department of Home Affairs and the Environment. This *Act* prevents international trade in native, particularly endangered, species, but also has control over importation and release of exotic species and has the power to order environmental impact statements. However, for biological control agents, at least for the present, the Department effectively follows the recommendations of Plant Quarantine.

Thus historically, the two areas for potential conflict of interest have been distinct: on one hand the target weed; and on the other, specificity (i.e. safety) of agents.

Previous Conflicts

The Skeleton Weed Conflict

When biological control of *C. juncea* was suggested to the subcommittee charged with co-ordinating research on the weed, it was opposed by one State on the grounds that the weed was no longer a serious problem and was in fact a good source of feed for fattening lambs for sale and for stock in dry seasons. Later, that State accepted that any loss which might be suffered would be small in relation to the gain elsewhere and the program commenced. In fact, later economic analysis demonstrated enormous economic benefits from control in that State also (Marsden *et al.* 1980).

The Noogoora Burr Conflict

A more serious debate arose over the proposed importation of two insect species for biological control of *Xanthium pungens* Wallr. (Noogoora burr; Compositae), an important weed of the extensive sheep grazing land in Australia (Wapshere 1974). In specificity tests, both species fed on *Helianthus annuus* L. (sunflower; Compositae) and Plant Quarantine could not therefore give permission for importation, but referred it to S.C.A., who then adjudicated on the balance of possible risk to a relatively small sunflower industry against the possibility of controlling an economically very important weed. Permission was given for release.

The Blackberry Conflict

Another major, controversial weed species is blackberry, *Rubus fructicosus* L. agg. (Rosaceae). Field and Bruzzese (1985) have reviewed this conflict of interest. The proposition of biological control of blackberry was advertised publicly in newspapers in the State with the strongest conflict, Tasmania, thus ensuring invitation for as much comment as possible. This was the first weed so advertised in Australia. It could have been a test of the workability of the approval procedure for target weeds and for quarantine (and thereafter S.C.A. adjudication on natural enemies), as it was possible that the major potential control agent, the rust fungus *Phragmidium violaceum* (Schultz) Winter (Uredinales), could have attracted opposition. As it was, with a warning of legal challenge to the program by apiarists in Tasmania it would more likely have become an early candidate for scrutiny under the *Biological Control Act 1984*. Unfortunately, this program has recently become an example of another aspect of this debate, that of the necessity for administrative and legislative procedures to be sufficiently quick and efficient to forestall impulsive action by the farming community, when possible control measures are known. Briefly, early in 1984, *P. violaceum*, the subject of considerable recent research (Bruzzese 1982), was found on blackberry in southern Victoria, almost certainly the result of deliberate, illegal introduction. Persons from other States visited these 'nursery areas', following widespread publicity (including a television program) of the introduction, and moved infected material to their own blackberry infestations. As a result of this movement, *P. violaceum* has been confirmed in northern N.S.W. (J. Walker, pers. comm., 1984).

The Nodding Thistle Conflict

Graziers from northern N.S.W., apparently unhappy at the lack of a biological control program for nodding thistle, *Carduus nutans* L. (Compositae), have threatened to illegally import the weevil *Rhinocyllus conicus* Froelich (Coleoptera: Curculionidae) from

New Zealand because they thought that the penalties of illegal importation (if caught) were less than the damage caused by nodding thistle. As the penalties for an individual for such illegal importation are now ten years in jail or a fine of $50,000, or both, either these people are unaware of the penalties, or they have quite a nodding thistle problem!

Other Potential Conflicts

There are several more weed species for which potential conflicts are seen, but their significance is as yet unknown. Several involve species recognized as sources of nectar and/or pollen; e.g. various thistles, and onion weed (*Asphodelus fistulosus* L.; Liliaceae). Others (e.g. capeweed, *Arctotheca calendula* [L.] M. Levyns; Compositae) may be used occasionally as forage, others for sand-dune stabilization (e.g. Bitou bush, *Chrysanthemoides monilifera* [L.] Norlindh; Compositae). These issues await resolution almost certainly under the terms of the *Biological Control Act 1984*.

Given the examples of rational settlement of disputes over skeleton weed and Noogoora burr, how was the *E. plantagineum* case different?

Nature and Scale of the *E. plantagineum* Conflict of Interest

As is clear from the brief summary of the conflict over *E. plantagineum* given by Delfosse and Cullen (1981), the issue was essentially whether on balance the species was detrimental or beneficial, rather than perceived danger to non-target species.

The biology of the plant has been comprehensively reviewed (Piggin 1982). It is a large, conspicuous annual, usually germinating in autumn to produce a broad, spreading rosette capable of blanketing the ground surface and thus restricting more desirable pasture species. It produces a showy inflorescence of generally mauve flowers in late spring, before dying off in summer. It contains pyrrolizidine alkaloids (Culvenor 1956), which are poisonous to grazing stock. Its flowers produce large quantities of nectar and pollen.

The most important claims and counterclaims to emerge from the recent, often bitter, debate can be summarized as follows.

Claimed Detrimental Effects

(*a*) Some pyrrolizidine alkaloids are hepatotoxic carcinogens (Culvenor 1983; Petersen and Jago 1984). Horses (Sharrock 1969; Seaman 1978; Peterson 1984) and pigs (Bull *et al.* 1956) are particularly susceptible to those in *E. plantagineum*, and the alkaloids have contributed to considerable mortality in sheep (Bull *et al.* 1956, 1968; St. George-Grambauer and Rac 1962) and cattle, although sometimes only a very low level of poisoning occurs (Culvenor *et al.* 1984). Verifiable veterinary evidence as to the real scale of this loss has been difficult to obtain.

The alkaloids occur in honey made from nectar of *E. plantagineum*, but at very low levels (Culvenor 1981), and possibly in milk from cows which graze the plant (Peterson 1984).

(*b*) The young plant is very competitive, particularly for moisture and light, hindering the establishment and growth of other species, particularly pasture legumes. It can 'completely crowd out recognized pasture plants such as subterranean clover and rye grass' (Piggin 1968). This in turn decreases the availability of such species for grazing and the input of nitrogen to the soil, the latter in turn decreasing productivity of other pasture species and subsequent crops.

(*c*) The plant is not accepted as good feed for stock. It is often refused when in flower, especially by cattle, and in summer 'leaves very little useful dry matter' (Piggin 1968), in contrast to the seed pods left by pasture legumes. Its undesirability as a forage species clearly compounds the problems of (*b*) above.

(*d*) Despite precautions, it occurs as a serious problem in crops, requiring extra herbicide usage and extra cultivations, or producing contamination and decreased value of broad acre cereal crops and small, high-value seed crops destined for certification.

(*e*) The pollen of *E. plantagineum* is a significant contributor to hay fever problems in spring (Katelaris *et al.* 1981, 1982; Burdon and Burdon 1983), and the bristly epidermis of the dry stem has been accused of producing dermatitis in both cattle and human beings.

(*f*) Given that control is desirable, *E. plantagineum* is often difficult and expensive to control by herbicides. The herbicide 2,4-D can be used to control *E. plantagineum*, but the necessary high rate 'severely reduces the growth of any legumes in the pasture', and 'the weed also becomes more resistant to 2,4-D as it grows older' (Piggin 1968).

Claimed Beneficial Effects

(*a*) The flowers are an extremely good source of light, premium grade honey, used extensively for blending with stronger-flavored *Eucalyptus* honeys and also for direct export. Australia is a major honey producer and *E. plantagineum* can account for 10–15% of the national honey crop (Briggs 1985).

(*b*) In addition to its direct value, *E. plantagineum* is also a valuable source of both nectar and pollen for conditioning hives early in the season prior to the main *Eucalyptus* honey flows, which only occur in amounts significant to be an alternative to *Echium* for conditioning purposes in one out of four years (Briggs 1980, 1985).

(*c*) Nectar and pollen of *E. plantagineum* are of major importance to the maintenance of adequate commercial and feral honey bee colonies for the pollination of agricultural crops in general (Briggs 1980, 1985), and in some regions, no reduction at all in *Echium* populations can be tolerated, because 100% of nectar and pollen produced by all plants is utilized by bees.

(*d*) *E. plantagineum* is a productive, nutritious and useful species: particularly in drier regions (300–350 mm p.a. rainfall), where its early growth in autumn, and its persistence in late spring, provides forage when little other feed is available (Davies and Sim 1931; Trumble and Fraser 1932; McAuliffe 1953; Myers and Poole 1963; Pearce 1972; Piggin 1977*b*, 1978*a*, *b*).

(*e*) *E. plantagineum* can be controlled by integrated techniques, especially by spray-grazing (Pearce 1972; Piggin 1979).

(*f*) Aesthetically, it adds to the beauty of rural landscapes in spring when in flower.

Thus it is clear that the areas of disagreement covered a wide range of Australian agriculture: from stock health to cropping practice, grazing value, weed control, honey production, the pollination of Australian crops, human health and aesthetics. This, over a distribution of perhaps 0.8 million km^2 (Fig. 1), covering an enormous range in timing and extent of rainfall (250–1000 mm p.a.), temperature, soil type, farming practice and coexisting nectar flora. The potential financial scale of the conflict was significant, with figures of $3.5 million for the annual value of *E. plantagineum* honey, $7–8 million for the annual value of lost nitrogen input to the soil in one State, and from 'conservatively' $600,000 (BAE 1984) to an 'undoubtedly overstate[d]' $100–400 million (IAC 1984) to $250 million (Briggs 1980) to $350 million (Briggs 1985) for the annual

value of incidental pollination of Australian crops by honeybees, all being claimed at various times.

Doubts over the rights of apiarists to make money from a plant declared noxious in many areas and which caused problems to the actual landholder, and the possible environmental and human health hazards of herbicide use, all added bitterness to the discussion. To obtain reliable data covering all claims would have been an enormous task, and often discouraged people from making any attempt at gaining hard evidence or objectively examining the meagre data available. The situation also raises the question of how much it is justified to spend in quantifying a weed problem, in relation to the size of the problem and the cost of control. Thus in this case, judgements were made mostly on the basis of opinion, anecdotal information and casual observation, mixed with politics and supported by limited data.

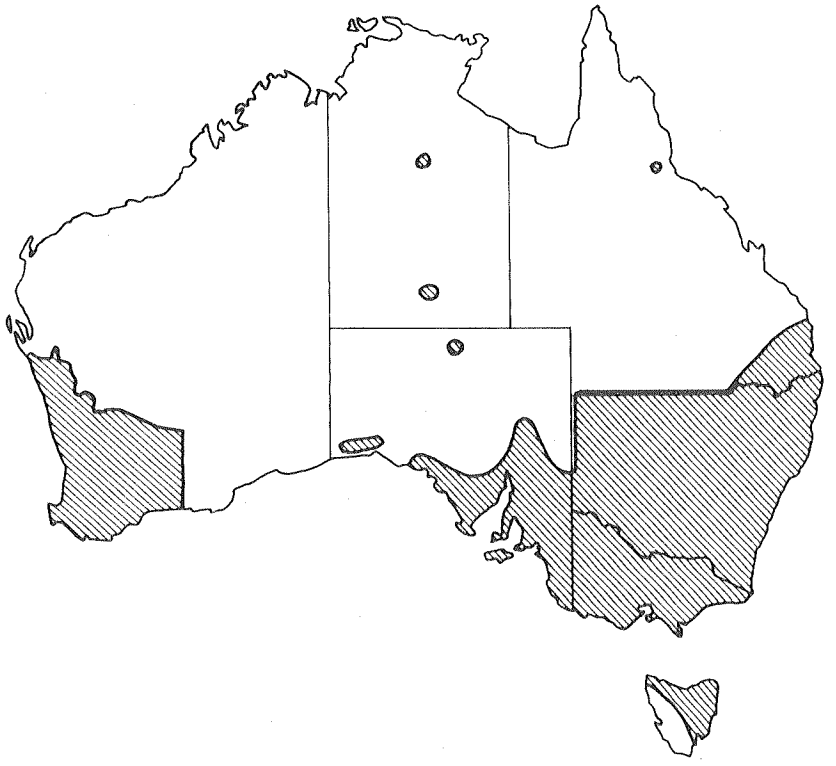

Fig. 1. Main distribution (shaded) of *Echium plantagineum* L. in Australia.

The Decision to Proceed

In 1971, among a small group of priority weeds suggested by members of the A.W.C. as possible targets for biological control were common heliotrope (*Heliotropium europaeum* L.) and *E. plantagineum*, both Boraginaceae. The suitability of *E. plantagineum* as a target weed, in light of the known conflict of interest, was checked with the State where it was most controversial, which gave agreement, and work commenced. Each year the desirability of the program was confirmed by the A.W.C. During 1974–75, following comments about the readjustments which might be necessary in one State if the plant were controlled, all State Directors of Agriculture were asked whether, on balance, control was desirable, particularly with respect to the honey industry. All responded affirmatively, though with varying degrees of enthusiasm. Thus

effectively, the decision had the approval of individual members of S.C.A., but formally the discussion had remained at the level of the A.W.C.

However, although information was available at the Department of Agriculture level and the possibility of biological control was raised in an Australian beekeeping journal in 1974 (Clemson 1974), beekeepers claim that they did not become aware of this program until 1978 (Briggs 1980, 1985). The controversy then erupted, with the apiarists' associations lobbying Ministers and the CSIRO to stop the program. Thus in August 1978, the CSIRO Division of Entomology proposed to A.W.C. that S.C.A. should be asked to form a working party to resolve the dispute, and said that they would not release agents unless all States unanimously recommended to proceed (Briggs 1985). The 1978 A.W.C. meeting recommended an expert inquiry to assess the validity of the claims and the new information put forward. The S.C.A. rejected the proposal for an inquiry, recommending initially that the program should not proceed. A.A.C. subsequently did not accept this S.C.A. recommendation, and referred the matter back to S.C.A. for a full report. Six months later, following consideration of a report prepared by one State which included material from a public inquiry held by another State, S.C.A. recommended and A.A.C. accepted, that the program should proceed. In response to further lobbying by the apiarists, the decision was reconsidered six months later but confirmed again. A small element of doubt expressed by one State Minister disappeared with a change in government of that State, and in October 1979 CSIRO was authorized to proceed, with the unanimous agreement of A.A.C.

Legal Action

Meanwhile, the supporters of *E. plantagineum*, who generally refer to the plant as Salvation Jane rather than Paterson's curse, considered the decision of A.A.C. unacceptable, and that they had been overruled by 'big government' without a fair hearing. All avenues of appeal were apparently exhausted and in 1979, the Federal Council of Australian Apiarists' Associations voted to 'support the proposed legal action by the C.A.A. [Commercial Apiarists' Association] of N.S.W. to stop the introduction by CSIRO of biological control agents to control Salvation Jane/Paterson's curse if and when such action becomes necessary.' (Anon. 1979). The *Salvation Jane Preservation and Legal Defence Committee* was formed, with representation from apiarists and graziers from dry areas. After taking legal advice, an application was made to the High Court of Australia by four plaintiffs seeking a permanent injunction, which would in effect prevent biological control of the plant. The immediate result was the granting of an interim injunction on 10 July 1980 and an agreement with CSIRO that it would maintain the *status quo* (no further releases of agents and bagging of plants containing immature stages of one species already released) (Delfosse and Cullen 1981) while the legal situation was examined. In fact the interim injunction remained in force throughout all further exchanges and protracted negotiations.

The Legal Basis for Challenge and Defence

An appreciation of the significance of this court action and its far-reaching effects requires a brief examination of the legal framework within which considerable discussion took place over the next three years.

The onus was initially on one or more of the plaintiffs to establish a cause of action; i.e. a legal basis for complaint. The four plaintiffs (significantly two apiarists and two graziers) made various claims about the value of *E. plantagineum* to them, and therefore the loss they would suffer if it was controlled. While many of these claims were based

on anecdotal evidence and could have been difficult to substantiate, there was a strong possibility that some could have been accepted in court. In the case of the two grazier plaintiffs this would have led to the establishment of a cause of action in law, which the CSIRO would then have been obliged to answer. The position of the two apiarists was different, in that whatever their claims, as they were not the owners or leaseholders of the land on which their claims of a significant contribution to their livelihood were based, their chances of success in court were much reduced. They had in fact received legal advice beforehand to this effect and had enlisted the support of graziers.

Given that there was a case to answer (i.e. that an individual with legal standing and substantive claims could legally oppose the program), was there authority to proceed? An A.A.C. resolution in fact carries no legal authorization, nor does the statute governing CSIRO give a legal warrant for biological control. Each State's noxious weeds legislation is a source of positive legal authority to enforce control on an individual's property, but unless it covers all areas where biological control might have an effect (i.e. throughout the distribution of a weed), some areas will remain where control (chemical or biological) has no legal authority.

Noxious weeds legislation in Australia is usually applicable on a regional basis and framed to provide a legal obligation to control a weed where it is recognized that control is desirable and economically feasible. Much of the distribution of *E. plantagineum* is not covered by such legislation (Fig. 2), which is unlikely to change because of these two considerations. Both grazier plaintiffs were in regions where the legislation was not in force. It should be emphasized that what was being sought was a legal authority for positive action (i.e. release of biological control agents) not simply compliance with existing regulatory laws (e.g. those governing quarantine). Compliance with quarantine measures is necessary, but does not give an authority to overrule other objections.

In summary, no mechanism existed in Australia to give a legal warrant for release of a self-dispersing and self-perpetuating biological control agent, which might eventually disadvantage an individual or section of the community, nor are we aware that any such mechanism existed anywhere at that time. In its absence, the rights of the individual in common law are the important factors and the principle of private nuisance allows the individual to take action to prevent the 'unlawful interference with a person's use or enjoyment of land, or some right over, or in connection with it'. The logical defence would be that of public or national benefit, but this has rarely been acceptable to courts, and would not have applied in this case.

Expert legal advice was that CSIRO was likely to lose the case on points of law, quite apart from the difficulty of proving national benefit in such a diffuse area in a court of law. The adversarial approach of the legal process and agricultural and environmental science make very poor bedfellows. Further advice confirmed that the same principle was applicable to biological control programs in general and equally relevant to possible harm to a non-target species, if this was a demonstrated possibility and the non-target species was considered desirable by an individual with a legal basis ('standing') for objection. For example, a sunflower grower could almost certainly have obtained an injunction to prevent importation of insects for *X. pungens*, a rabbit-trapper to prevent importation of myxomatosis virus, and graziers to prevent importation of skeleton weed agents, etc. Thus the most satisfactory solution was appropriate legislation.

Subsequent Developments

The diffusion of this message among the agricultural and political community amidst the atmosphere of a pending court case created some difficulties. Negotiations started

two days before the court proceedings produced an agreement not to go to court, but to have the appropriateness of biological control of *E. plantagineum* decided by an independent inquiry. Both sides agreed that a long, expensive and widely publicized court battle would be disadvantageous.

However, continued disagreement over the detailed form and composition of this inquiry, influenced by the plaintiffs' fear of governmental or political influence, resulted in this agreement being rescinded and CSIRO finally agreeing to a perpetual injunction of the court on 22 June 1983, stopping it from proceeding with the program. This injunction also contained the option of seeking a variation in, or complete lifting of the injunction at a later date if authority was given to proceed under future legislation (the groundwork for which was already underway), but required that CSIRO pay the legal fees for the plaintiffs (*c.* $93,000).

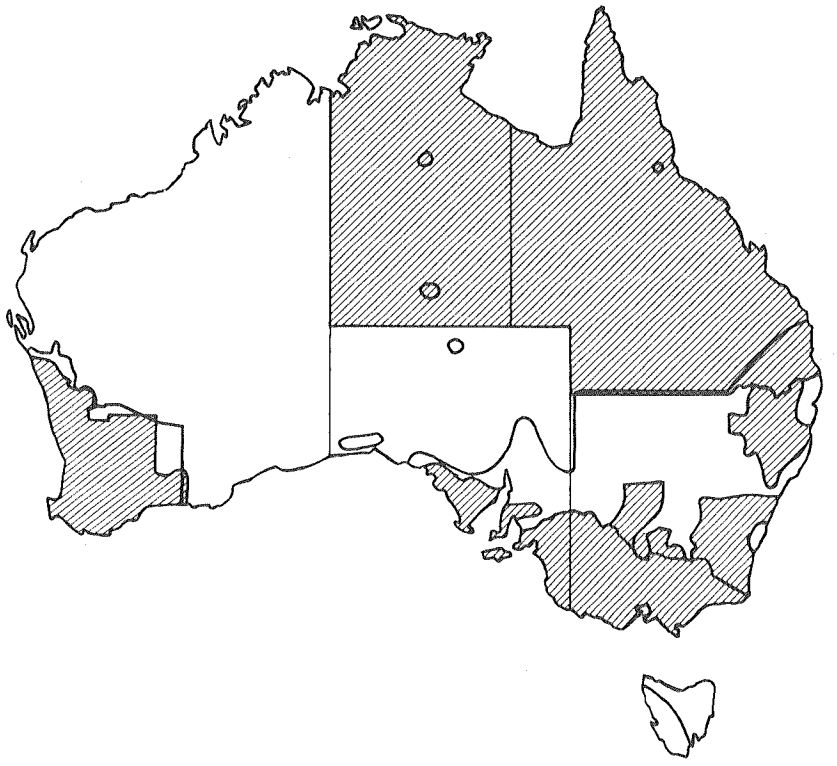

Fig. 2. Main areas of infestation of *Echium plantagineum* L. in Australia (outlined; see Fig. 1), and areas where it is proclaimed noxious (shaded).

After five years of intense debate, including three years of legal sparring, thus ended this very significant phase of the conflict. The old system of 'approval' was left in shreds and a complete rethink was necessary, which eventually resulted in legislation (the *Biological Control Act 1984*). However, an important initial effect was an attempt by S.C.A. in 1978 to defuse future conflicts by proposing that a new system of approval be found. This is currently in force and several target species have been subject to it during the last five years.

Current Approval Procedures

The system as originally introduced in 1979 with regard to approval of candidate weed species for biological control had several aspects in common with relevant aspects of procedures adopted in Canada (Harris, pers. comm., 1983) and in the U.S.A. (Klingman and Coulson 1982). The organization requesting approval prepared a report on the weed, basing it primarily on points previously adopted by Australia in the production of guidelines for the importation of pathogens for the biological control of weeds, and a little later in the series on the biology of Australian weeds, both derived originally from the series on Canadian Weeds (Cavers and Mulligan 1972).

The principal topics on which information was requested were: taxonomy; related species in the Australian region (both cultivated and endemic); original and present distribution; detrimental and beneficial aspects; and control measures. This report was circulated to each member of the A.W.C., who was responsible for ensuring its circulation within his or her own and other Departments of the State. Comments and possible objections were returned to the proposer, who could then modify the report accordingly. The proposal would then be the subject of a recommendation from A.W.C. as a whole; e.g. acceptance, rejection, or that a conflict existed, which may require adjudication at a higher level. In the latter case, it was the A.W.C.'s responsibility to ensure that all available information was assembled so that an informed decision could be made. The final approval was essentially that of S.C.A.

More recently, a slight change was introduced to streamline the system for weeds where there is no conceived opposition to their control. In the first step, the secretary of A.W.C. circulates minimal information on the weed directly to the States, and a full-scale report is prepared only if opposition is signalled. If there is no opposition, the weed can be approved at A.W.C. and P.P.C. level, and S.C.A. informed. If there is opposition, the system is as given above. It should be emphasized that this is only concerned with the potential target weed. Approval for *introduction* of individual biological control agents for weeds is the responsibility of the Plant Health and Quarantine Branch of the Department of Primary Industry. (Approval for *release* of agents for weeds can be obtained, if desired, using the *Biological Control Act* 1984; see below.) To date also, only target species attracting no significant opposition have been through this system. Six such species have recently been approved with five more in line for approval.

Australian Legislation: the *Biological Control Act 1984*

This *Act* preserves the historical distinction between deciding the status of a particular weed species and assessing the possible harm to non-target species by biological control agents. The *Act* is presented in Appendix 1. The date of commencement of the *Act* was 22 November 1984. It applies only to the Australian Capital Territory (including the Jervis Bay Territory) but complementary legislation is expected to be passed by all States and the Northern Territory.

A basic principle is that if the right of an individual to protest an action in common law is to be controlled by legislation, the legislation should ensure that all issues are canvassed, possibly involving a public inquiry, before a decision is taken. However, if a decision to proceed is then made, the program should be able to continue without hindrance and without liability on the part of the individual or the organization involved. Provision for considering compensation is included.

The basic procedures of the *Act* are essentially formalization and broadening of current procedures for approval of a target weed, but applied to all targets for biological

control (weeds, arthropods, vertebrates, etc.), followed by a second step to deal with individual agents.

The main procedures set out in the *Act* are summarized below (legal jargon translanted). See Appendix 1 for details.

Definitions and Other Preliminary Material

Several sections of Part I of the *Act* deal with definitions of important terms, biological control, extension of the *Act* to external Territories, references to other laws, etc.

The Commonwealth Biological Control Authority and Target Organisms

Organisms can be declared by the *Biological Control Authority* (B.C.A.) as target organisms for biological control programs. The B.C.A. is established by the *Act* (Part I, section 8), and will be the Commonwealth Minister for Primary Industry from commencement of the *Act* until 1 April 1985. Before 1 April of each subsequent year, the Commonwealth Minister, in consultation with A.A.C., shall designate the Commonwealth Minister, or a Minister of a State who is administering a relevant State law (i.e. complementary biological control legislation) as the B.C.A. for that year.

Action for declaration of target organisms can be commenced in two ways (Part II, section 12): (1) a recommendation to the B.C.A. by A.A.C.; or (2) an application under section 13 of the *Act*.

In the latter case, a signed, written target application can be submitted to the B.C.A. by an individual or a representative of an individual, and must contain particulars such as given above under the current system of approval. An application can be withdrawn any time before it is referred to A.A.C. (section 14). If it is not withdrawn, the B.C.A. must refer the application to A.A.C. for consideration, unless action has been already taken on the organism (or is in train), under this *Act* or a relevant State law (section 15).

If A.A.C. informs the B.C.A. that A.A.C. does not recommend declaration of the organism as a target organism, notice of the outcome is given to the applicant (and to later applicants, if any) by the B.C.A. The B.C.A. must either give the applicant the reasons for rejection (if A.A.C. gave reasons) and the B.C.A. must indicate circumstances under which it feels the organism might be recommended by the A.A.C. for approval (section 16).

A.A.C. can also recommend to the B.C.A. that the organism should be a target organism for biological control (section 17). In this case, the B.C.A. must publish the intent to declare in the Government *Gazette and* in 'appropriate' (widely circulated) newspapers or journals in each State and the A.C.T., giving relevant information and inviting comment (normally within six weeks) from individuals who support or oppose the intended declaration.

The B.C.A. must consider all submissions regarding the intended declaration (section 18). If the B.C.A. decides (after consultation with A.A.C. and considering other information) 'that there is evidence that a person or the environment would be adversely affected' by biological control of the proposed target organism, 'but an adequate investigation or inquiry' into these effects has not been held, the B.C.A. can initiate one (or more) of three types of inquiry (section 19). Until the results of the inquiry (or inquiries) are known, the B.C.A. cannot take any further action on the recommendation to declare the organism as a target organism.

Inquiries

The three types of inquiry which may be called are: (1) under provision of Part VII; (2) under the *Industries Assistance Commission* (I.A.C.) *Act 1973* (Commonwealth of Australia 1973), arranged by the Minister responsible for the I.A.C., at the request of the B.C.A.; and (3) under the *Environment Protection (Impact of Proposals)* (E.P.I.P.) *Act 1974* (Commonwealth of Australia 1974), arranged by the Minister who administers this *Act*, at the request of the B.C.A.

(1) *Part VII Inquiry.* The B.C.A., in consultation with A.A.C., appoints one or more Commissioners to form the Commission of Inquiry, and can appoint one or more advisors (section 38). The Commission is directed to conduct an inquiry into matters that it feels necessary to investigate to determine if a potential program is in the national benefit, matters approved by the A.A.C., including whether assistance (compensation) should be given to persons if they are adversely affected by declaration of target or agent organisms, or any other matters it judges appropriate.

Commissioners are paid (section 39). Notice of inquiries are to be published in the *Gazette and* in newspapers or journals (section 40). Inquiries are conducted in public (except when it is in the public interest to hold them in private), results are to be made public (except in the case of confidential information or for 'any other reason' the Commission feels is suitable) (section 41), and the Commission is not bound by the rules of evidence. The Commission can summon witnesses, evidence is to be taken in public on oath or affirmation, etc. (sections 42–51),

Not being bound by the rules of evidence is important, and has positive and negative aspects. Essentially, this means that anecdotal evidence ('hearsay') can be presented. For example, a District Weeds Officer, Agronomist or similar person can report on the status of a weed in his or her District under this provision. If the Commission were to be bound by rules of evidence, each farmer in the District Weeds Officer's area of responsibility would have to report separately. This is a sensible and necessary provision, in that only a minimal number of witnesses need be called. However, it will allow presentation of unsubstantiated claims of varying quality about beneficial or detrimental aspects of a weed's status. The Commission could have a difficult job in evaluating such information. Similarly, unsubstantiated information concerning potential agent organisms during inquiries on the agents would require adjudication by the Commission.

(2) *I.A.C. Act 1973 Inquiry (subsections 19(f) and 28(f)).* Inquiries under this *Act* are conducted to enable the Temporary Assistance Authority (established by the Govenor-General to conduct inquiries under this *Act*) to determine the level of assistance (compensation) appropriate in a given case. The conduct of an inquiry under this *Act* is essentially the same as a Part VII inquiry.

(3) *E.P.I.P. Act 1974 Inquiry (subsections 19(g) and 28(g)).* Inquiries under this *Act* are conducted on environmental matters. The Minister administering this *Act* appoints one or more Commissioners and advisors. The conduct of an inquiry under this *Act* is essentially the same as a Part VII inquiry.

Declaration of target organisms (section 20). If the B.C.A. (after considering reports, results of an inquiry, etc.) is satisfied that the proposed organism is a pest in the A.C.T., and is controllable by biological control, and that control *throughout Australia* would not cause 'significant harm to any person or to the environment', or any harm so caused by successful biological control 'would be significantly less than the harm caused, or

likely to be caused', by the organism in the absence of biological control, it shall declare the organism as a target organism by publishing a notice to that effect in the *Gazette*.

Agent Organisms (Part III)

The procedure leading to declaration of potential agent organisms (= biological control agents) is essentially identical to that for declaration of target organisms, except in one critical point. Action for declaration of potential agent organisms can be commenced by a recommendation to the B.C.A. by the A.A.C., or by application to the B.C.A. (as above) (sections 21 and 22). Applications can be withdrawn at any time up to referral to A.A.C. (section 23). Provisions for referral (or not) to A.A.C., rejection of applications, consideration of submissions, inquiries and declaration are similar to those covering target organisms (sections 24–5, 27–9).

The one critical point of difference between the procedure leading to declaration of agent organisms as compared to target organisms is in the level of advertising (section 26). Following a recommendation from B.C.A. to A.A.C. to declare the organisms as agent organisms, the B.C.A. is required to advertise the intent to declare only in the *Gazette*, not also in newspapers or journals (although the B.C.A. *may* also advertise in 'appropriate' newspapers or journals).

This notice in the *Gazette* still invites comment and could result in an inquiry *on each potential biological control agent* (section 28), in addition to the target organism. Also, the B.C.A. may set conditions on the release of agent organisms, such as who may release them, and circumstances in which they may be released (subsection 29(2)(a) and (b)). Both of these points are areas of significant potential problems (see below).

Other Provisions (Parts IV–VII)

If the B.C.A. is satisfied that an emergency situation exists that may be solvable by biological control (e.g. discovery of a new aphid species with the potential to become a major pest), it can declare by notice in the *Gazette* that pest to be a target organism and its specified natural enemies as agent organisms (section 30). Again, conditions can be specified as to who may release to agent organisms, and how they may be released.

The B.C.A. can declare by notice in the *Gazette* that previously released biological control agents are agent organisms, and the pests against which the agents were released are target organisms, if it is likely that they would have been so declared under the *Act* had it been in effect prior to release of agents (section 31). However, before such a declaration can be made, the B.C.A. may advertise in the *Gazette and* in newspapers or journals that it considers appropriate, that such declaration is being contemplated (section 32). As with other advertisements discussed above, persons are invited to comment on the proposal, and if necessary, the B.C.A. can call an inquiry (section 33).

A provision for reciprosity with relevant state laws is also included, and again, release conditions can be set (section 34).

Declared agent organisms for declared target organisms can be released in the field, following any conditions that may have been set (section 35). This represents legal approval for release, and is an important clause. Significantly, 'no action or other proceeding shall be instituted or continued in any court' to prevent release of declared agent organisms in the A.C.T., or to recover damages caused by their release, subject to certain conditions. For example, if a court order is in place preventing release of agent organisms in the A.C.T. (such as the perpetual injunction on the *Echium* program)

it cannot be enforced (section 36). A similar section is included which covers State laws (section 37).

Four important points are contained in Part VIII of the *Act*. First, it is not compulsory to have target or agent organisms declared for a biological control program to be conducted (section 52); however, any program not so approved would, of course, be open to legal action. Second, the B.C.A. can revoke declaration of target organisms (and therefore agent organisms; there can be declared target organisms without declared agent organisms, but not vice versa) (section 53). Third, once declared, agent organisms can be released *in perpetuity*, unless declaration is revoked (section 54). Fourth, appeal provisions are included (section 56), covering many of the decisions detailed above.

Possible Remaining Problems

From the point of view of biological control research workers, some of the *Act*'s provisions have potential to cause several problems.

Advertising agent organisms. Some people contributing to the draft legislation felt that the requirement to advertise agents in the Government *Gazette*, and hence invite the possibility of an inquiry, would not impede biological control programs, because declarations of intent to declare potential target organisms and agent organisms can be made concurrently, and if an inquiry is needed, targets and agents can be investigated at the same time (section 28(2)). This, unfortunately, does not consider sufficiently the different nature of judgements over agents, and from a practical point of view would often be logistically impossible.

An alternative procedure discussed during the formulation of the *Act* was to leave the option of advertising each agent to the B.C.A. who would act on advice (essentially that of Plant Quarantine) for exotic agents for weeds. We feel this would have been preferable, in that questions of specificity and the possibility of damage to non-target species are essentially technical, and Plant Quarantine has a long history of successfully evaluating them. It seems unnecessary to advertise every agent organism (no matter how well researched) and invite comment and some further opportunities to elements of the community opposed to a declared program to further delay and hinder its implementation.

Naturally, if there is doubt over specificity and an evaluation is required of the relative merits of weed control and possible harm to other species, public advertisement and the possibility of inquiry is more necessary. This could also apply to use of indigenous species in inundative programs, over which Plant Quarantine has no control.

The dividing line between technical judgements (best made by competent scientists) and judgements of community implications (best made by the community) is always indistinct, but the decision to invite comment on all decisions, including the technical, could well yield further problems without compensating benefits.

From the point of view of timing, all potential biological control agents may not be known in sufficient detail at the time an inquiry is called to enable them to be proposed as agent organisms. This is the situation with the agents for *E. plantagineum*: of the 13 potential biological control agents (Wapshere 1984; Delfosse 1985), only eight are sufficiently well known in terms of safety (e.g. host range) to have them subjected to an inquiry (Delfosse, unpubl. data). Under the present conditions of the *Act*, a separate inquiry could be called for each species as testing is completed. This situation is typical for most weeds, so this provision could very well result in unreasonable delays and expense, without any increase in safety. The alternative is, of course, not to seek

declarations of agents for declared weeds, but this could lead to other problems, particularly for programs with significant conflict of interest.

Past programs. This provision also appears unnecessary since programs that have been in operation over 60 years such as St. John's wort (*Hypericum perforatum* L.; Clusiaceae) or lantana (*Lantana camara* L.; Verbenacae), which have no detrimental aspects, would unwisely be open to challenge. The obvious course to follow for existing programs is not to apply for target or agent organism status.

Release conditions for agent organisms. The provisions in the *Act* to specify release conditions also seem unnecessary, and possibly inhibitory.

For a particular agent organism, generally only trained personnel (usually the people involved in mass-rearing the agent) who know the species well should release it. This is essentially an experimental procedure and could involve testing different methods, different times, different sites, etc. This is a scientific matter, and the investigator should have complete freedom to determine what is done, and how, when and by whom it is done. In fact, under provisions of the *Act* (section 35(2)), it would be illegal to release declared agent organisms 'otherwise than in accordance with those conditions'.

Conclusions

As pointed out by Andres (1981), for biological control programs to continue in situations where conflicts exist, it is firstly vital that mechanisms be found to get conflicting sides together, and secondly, that good information is available concerning the target weed and possible impact on non-target species.

This account has dealt with a legislative means of addressing the first point, or at least ensuring that all views are taken into account and a decision made — a system brought on largely by a massive breakdown in the previous consultative process. It is unfortunate that the *Act* was necessary, because it will certainly add to the cost (perhaps $100,000 p.a.; Commonwealth of Australia 1984*b*) and time-delays of implementing biological control.

Certain provisions of the *Act*, especially gazetting of potential biological control agents, could result in what should be scientific decisions, being made by lay people in a public forum.

The second point, that of providing good information, remains, and will continue to be a problem until researchers can provide better predictions of both the likely benefits from introductions in terms of effect on the target, and the possibilities of significant damage to non-target species.

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Note Added in Proof

On 26 October 1984, following assent to the *Biological Control Act 1984* on 25 October, Senator J.N. Button, then Minister for Industry and Commerce, referred the topic of 'whether *Echium* sp. ... should be a target for biological control' to the Industries Assistance Commission (IAC). The Biological Control Authority (BCA) also called an Inquiry on this subject in late December 1984 (Delfosse and Cullen 1985).

Initially, the IAC Final Report was due on 26 July 1985. However, about 600 submissions were made to these Inquiries, all of which had to be evaluated carefully by the IAC. As a result, the IAC sought, and obtained, an extension of the date of submission of their Final Report of the *Echium* Inquiry to 30 September 1985.

The IAC Draft Report of the *Echium* Inquiry was released on 25 July 1985 (IAC 1985). The Draft Report contained five draft recommendations: '(1) the Biological Control Authority declare *Echium* spp. a target for biological control; (2) the Biological Control Authority declare *Dialectica scalariella*, *Phytoecia coerulescens*, *Dictyla echii*, and *D. nassata* as control agents as soon as practicable, and declare *Ceutorhynchus geographicus*, *C. larvatus*, *Longitarsus aeneus* and *L. echii* as control agents subject to approval from the quarantine authorities; (3) CSIRO resume its program for biological control of *Echium* and, in conjunction with State governments, undertake release and monitoring of control agents; (4) no special adjustment assistance be made available at the time of implementation of biological control to those who might be adversely affected by biological control; and (5) the need and justification for any adjustment assistance be reviewed two years after implementation of biological control and if adjustment assistance is then seen as desirable, it be provided through the Rural Adjustment Scheme on the same terms as for other agricultural activities.'

Public hearings will be held on the IAC Draft Report at four locations in Australia during August 1985, and supplementary submissions can be lodged. However, in the Draft Report, the IAC found that there would be a 10.5:1 benefit:cost ratio in the first 15 years after implementation of a successful biological control program for *Echium* (total benefits, $A155.1 million; total costs, $A14.8 million; 5% discount rate after inflation), and that the ratio would become more favorable in succeeding years.

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