CONFLICT OF INTEREST

JOHN J. DREA

ENTOMOLOGY RESEARCH DIVISION, AGR. RES. SERV.

USDA, SEVRES, FRANCE

To most of us, I think, the phrase "a conflict of interest" brings to mind the conflict that arises between the proponents of a control program directed towards the suppression of a particular organism and those who consider the organism in question to be valuable, at least from their point of view. What may be a weed pest to you is not necessarily the case from my standpoint. For example, the destruction of Opuntia spp. in Australia by Cactoblastis cactorum (Berg) was generally considered to be an outstanding success for biological control. However, the proposal to attempt the same thing in Hawaii met with considerable opposition from cattlemen who considered one species of Opuntia, O. megacantha Salm-Dyck, to be useful as a source of water during periods of drought (DeBach 1964).

Similarly conflicting interests held up research with Centaurea spp., the star-thistle or Knapweed group, for several years until the difficulties were resolved between the cattle industry which considered these plants as pests, and the beekeepers who considered Centaurea vital to their interests.

In the two examples cited we have a conflict between two or more parties "outside of" the field of biological control such as the cattle industry and the beekeepers. In such cases the success of the program is first contingent on the resolution of questions arising from conflicting economic interests related to a single target species.

Today I wish to discuss the actual and possible conflict of interest that may occur "within" the field of biological control; that between the consideration of entomophagous insects and of phytophagous insects when both are used as biological control agents. Here the success of a program may be affected by conflicts of interests involving an interaction between parasites that are effective in control of an insect pest but also attack an insect that is successful as a weed suppressent.

As the emphasis on non-chemical means of controlling pest organisms continues to increase the number of insects and plants that are designated as targets of biological control are increasing. This in turn will result in greater numbers of insects studied, cultured, and eventually released into new geographical areas. Can we afford to continue this increase in the introduction of biotic agents into new areas without a more detailed consideration of previous or concurrent programs conducted by other national or international agencies involved in the same sort of research? Do we risk endangering or even nullifying the efforts and successes of other biological control projects by an untimely or ill-advised release of an entomophagous or phytophagous arthropod?

1 Presented at the 2nd International Symposium on Biological Control of Weeds. Rome, Italy, Oct. 4-7, 1971.

That such a situation has arisen in the past was demonstrated by the introduction of Opius tryoni (Cameron) into Hawaii for the control of the Mediterranean fruit fly, Ceratitis capitata (Wiedemann). Unfortunately,the braconid parasite also attacked the eupatorium gall fly Procecidochares utilis (Stone) previously introduced to control the weed, Eupatorium adenophorum Sprengel (DeBach 1964).

Another example was the deleterious effect of the coccinellid, Cryptolaemus montrouzieri Mulsant on the mealybug, Pactylopius tomentosus (Lamarck) and the Opuntia spp. in Africa reported by Petty (1948). Simmonds (1947, 1948) demonstrated a similar conflict with his studies of the effect of the eulophid, Tetrastichus sp. and the tachinid, Chaetonodexodes marshalli Aldrich, on the galerucid, Schematiza cordiae Barber attacking black sage, Cordia macrostachya (Jacquin) Roemer & Schultes in Trinidad and Mauritius. His cage studies showed that Tetrastichus and C. marshalli reduced the effectiveness of S. cordiae in Trinidad whereas the galerucid was quite effective when introduced into Mauritius where the two parasites were not present.

Angalet (1964) reported that the braconid, Bracon greeni Ashmead was the most important natural enemy of the pink bollworm, Pectinophora gossypiella (Saunders) in India. Unfortunately this parasite also attacks the weevil Microlarinus lareynii (Jacquelin du Val), an important insect for the control of puncture vine, Tribulus terrestris L. As a result of a combination of the lack of success in rearing B. greeni in the laboratory and later, the consideration of its attack on M. lareynii this braconid was never released in the U. S. However, if this braconid should be reconsidered for introduction at some future date it would be necessary to resolve the conflict of interest that would arise between cotton production and weed control. A critical evaluation of the potential benefits to the cotton industry compared to the probable reduction in puncture vine control would be necessary in order to reconcile all interests involved.

It appears to me that similar situations involving different interests are inevitable and will be encountered with increasing frequency as the research by agencies of different countries increases in scope often on closely related programs with the subsequent widespread distribution of the biotic agents involved.

The following is an example of just such a situation that conceivably could lead to a conflict between two introduction programs. The U. S. Department of Agriculture is presently conducting research on the coleophorid moth, Coleophora parthenica Meyrick from Egypt with the possibility of eventual introduction of the moth into the western U. S. for use in the control of Salsola kali var. tenuifolia Tausch. At the same time in Europe the Commonwealth Institute of Biological Control is studying the parasite complex of several Coleophora species, including C. laricella (Hübner), the larch casebearer, as a part of their biological control program of forest pests in Canada. Although we are dealing with species of Coleophora that have widely separated hosts, botanically rather than geographically, it is not too unlikely that a parasite introduced for one species would readily attack the other. This may be an instance where cross tests of host-parasite relationships could be made.

Even within my research branch we have the "makings" of a possible conflict, although in more or less the reverse order. For several years my research branch, as well as other agencies,have been actively engaged in the biological control of the cereal leaf beetle, Oulema melanopus (L.). As a result three European species of parasites, Tetrastichus julis (Walker), Anaphes flavipes (Foerster), and Diaparsis carinifer (Thomson) have been established in the Great Lakes area of the U. S. A fourth species, Lemophagus curtus Townes, also from Europe, has been liberated many times but as yet is not established.

Recently the weed investigations laboratories of our branch has been considering the introduction of Lema cyanella (L.), a chrysomelid closely related to O. melanopus, from Europe into the U. S. for the control of Canada thistle, Cirsium arvense (L.) Scop. However, B. Miczulski, Agric. Univ. of Lublin, Poland (personal communication to R. J. Dysart of this laboratory, 1969) reared T. julis from field-collected larvae of L. cyanella in Poland. Also he was able to rear A. flavipes on the eggs of L. cyanella in the laboratory. Although it has not yet been determined, the other two parasites of O. melanopus may use L. cyanella as an alternate host.

Since Canada thistle is a common pest in and about grain fields where the cereal leaf beetle and its parasites already occur, what will be the effect on the overall value of the introduction of L. cyanella into an area where some of its natural enemies are already well established? Will it increase the effectiveness of the O. melanopus parasites by serving as a reservoir host and increasing the parasite population? If the latter is the case then the introduction of Lema cyanella could result in the establishment of Lemophagus curtus which appears to require an alternate host in order to become established. Or is it also conceivable that the introduction of Lema cyanella could reduce the effectiveness of one or more of the parasites of O. melanopus by serving as a more favorable host for the parasites?

In general, will the introduction of L. cyanella within the area infested by O. melanopus result in a benefit or a loss to either one, or both programs?

Admittedly these questions are mainly hypothetical but this possible conflict does point out that we must be aware of the interactions of the entomophagous and phytophagous organisms that we are striving to introduce. The main theme of classical biological control is the transfer of beneficial organisms from one area to another. As more countries become involved in biological control programs and more material crosses international boundaries we must keep informed of this interchange of organisms. This requires a constant review of literature. Yet I know of no way by which we, in this field of research are informed of the overall current work being done in the world. Fortunately, many agencies are very liberal with the dissemination of unpublished data in the form of quarterly reports, progress reports and similar summaries of current research projects. However, these are not available to all of us or they may reach our desks sometime after a project has been terminated. More often we read about an introduction or establishment of a species in a paper published 2 or 3 years after the research has been completed. By this time the seeds of conflict may have already been sown.

I would like to submit for consideration or discussion at this time the proposition that a check list be published periodically in one of the internationally recognized journals. This check list would contain the names and additional information of insects and other biotic agents that are being transported and released on an international basis either at the present time or in the immediate future. Such a list would contain a) the name of the organism, b) the family and subfamily or tribe to which it belongs, c) the geographic area where the organism originated, d) the target host, e) the geographic area of its intended or actual release, and f) the agency collecting the material for introduction.

The following examples indicate what would normally be included in the proposed list:

1. a) Lema cyanella (L.), b) Chrysomelidae: Criocerinae, c) Europe, d) Cirsium arvense (L.) Scop., e) U.S.A., f) U.S.D.A., Rome, Italy.

2. a) Tetrastichus julis (Walker), b) Eulophidae: Tetrastichinae, c) Europe, d) Oulema melanopus (L.) e) U.S.A., f) U.S.D.A., Sèvres, France.

How would this list be compiled? It would have to originate from numerous sources, chiefly the research organizations directly associated with the international transfer of biotic agents. Each agency would be requested to fill out periodically a prepared form giving the previously mentioned information for each species currently being collected or cultured for shipment. These reports would be sent to a central location where they would be compiled, arranged in alphabetical order, and then submitted to the editor of the selected journal for publication as soon as possible.

I would suggest that "Entomophaga" be chosen as the journal to be considered. It is to be the official publication of the International Organization for Biological Control and as such will be a journal readily available to biological control research organizations.

What are the benefits of such a list? I believe that it would help us keep informed of the various projects that are in progress and the people involved in this research. Not only would it serve to signal a possible conflict of interest, it would also indicate a possible source of material for a research project. This could reduce the expenditures for exploratory travel and eliminate a duplication of effort.

Although there are many obstacles and difficulties that would accompany such an undertaking my purpose today is to submit this proposal to the participants of this symposium for consideration and to determine if the subject should be pursued any further.

Admittedly much of the material covered in this presentation is hypothetical and fortunately we do not have dramatic or drastic conflicts of interest to cite as unhappy examples. Nevertheless, I do feel that, we, in biological control should be more and more aware of this potential danger, and, I hope, this awareness may cause us to forsake the attitude of "let's liberate and see what happens" that tends to creep in to our research at times.

References

Angalet, G. W. 1964. Bracon greeni (Hymenoptera: Braconidae), a potential parasite of the boll weevil.
Indian J. Entomol. 26: 447-52.

DeBach, P. 1964 ed. Biological Control of insect pests and weeds.
Reinhold Publ. Co., N. Y., 844 pp.

Petty, F. W. 1948. The biological control of prickly pears in South Africa.
Union S. Africa Dept. Agric. Sci. Bull. 271. 163 pp.

Simmonds, F. J. 1948. The effective control by parasites of Schematiza cordiae Barber in Trinidad.
Bull. Entomol. Res. 39: 217-20.

1949. Initial success of attempts at the biological control of the weed Cordia macrostachya (Jacq.) R. and S. in Mauritius.
Trop. Agric. 26: 135-6.

DISCUSSION

SANKARAN As a start, I have discussed two points. Bracon greeni has also been bred by me from a species of weevil Nanophyes sp. nr. nigritulus which breeds in the fruit of an aquatic weed Ludwigia adscendens, so that is a point for consideration when you evaluate Bracon greeni for possible introduction against the pink bollworm. The second point concerns the risk of an introduced entomophagous insect attacking native beneficial insects. Probably this risk is no greater than that of a native entomophagous insect itself attacking the introduced one.

DREA Well, I think in this case we are bringing in a genus of parasites from a new area, a generic group that may not exist in the area of introduction. You may have a conflict arise when both the target organism (the weed insect) and the parasites that are being introduced are new to the area. Admittedly, there may be native parasites that can move over, and there are several examples of this. However, if it is possible to avoid the risk of a conflict, I don't think we should add to the danger.

BENNETT It's a question of whether we can design laboratory tests to screen parasites much the same way we screen insects for weeds. Obviously, there are many parasites in the field which because of habitat preferences never encounter species which in the lab. will serve as suitable hosts. Therefore the difficulty would be to devise laboratory tests, which would be meaningful. Dr. F. Legner's work on the parasitoids of muscids showed that many of these species in the laboratory will very readily attack a very wide range of Diptera, including Tachinids (and in fact one of the species that has been utilized actually has the unfortunate name of Tachinaephagus the inference being that it was bred from a tachinid although there was probably a mistake in the original host record). We tend to consider this group of parasites habitat orientated rather than being specific to a genus or even a family of flies. Therefore, when you mention parasites of native Coleophora I wonder whether we should draw too much inference from this if they are parasites of a species of Coleophora occurring in a quite different habitat from a Coleophora being introduced for weed control.

DREA In a case like this, will you begin to examine the broad-spectrum parasites or just the one that is more limited in its range? There are some Apanteles species that will attack several species in a group and some that are very specifically adapted to the life history of the host insect. A parasite that readily attacked (admittedly under laboratory conditions) an insect you were trying to introduce, or you had already introduced, for a weed program may be worthwhile giving a second thought to before liberating it.

BENNETT I agree, you certainly have to take into consideration the habitat as well as the generic relationships of insects being considered for weed or insect control.

DREA I was just wondering, as we drastically increase our transportation of insect organisms back and forth, whether or not we are going to run into more of this than we have so far. I admit it's a hypothetical case and I just put it before the group for discussion.

BENNETT We have often considered this. Is it the sole decision of the country importing a species or should neighboring countries be consulted or should an international agency be asked to advise? This topic is well worth discussing at meetings of this type.

ZWOLFER I think one of the conclusions which we may draw from Dr. Drea's paper is that we should pay a little more attention to the parasites attacking our insects under field conditions, because that may give some indication of the vulnerability of the insect to attack by parasites.

DREA I think Lema cyanella may be one such incident.

ZWOLFER Did you get any parasites from Lema cyanella?

DREA Lema cyanella, no, we haven't worked on it ourselves, did you?

ZWOLFER No we didn't, it is a very scarce species in our region.

DREA It was Dr. B. Miczulski in Poland who discovered Tetrastichus julis emerging from field collected material.

LITTLE Dr. Ramsay at the beginning of his talk on conflict of interest referred to the case of Opuntia in Australia and the attitudes in Australia to biological control of this genus which are different from those in Hawaii. I don't think that anyone has made the point yet that if an isolated country or state, as Australia and Hawaii, with no other countries contiguous, make wrong decisions, they are their own look out. But in a case like Africa, for example, there are 40 odd countries all more or less contiguous in one land mass, thus, any introduction of organisms for biological control into country A may have a profound effect on countries B, C, D, E, and F who may have had no say whatever in the introduction. I would like to suggest that there is great responsibility in introductions under these conditions. As I recall, an example of this occurred in Kenya where there is a small problem of Opuntia spp. and it seemed a good idea to introduce Cactoblastis. In fact, it was introduced into the laboratory, where breeding up was attempted. Later a conflict of interest arose because some other people felt that another species of Opuntia, the spineless one, might well prove to be a useful plant in arid regions the north of Kenya. The release of Cactoblastis was opposed. A reply came that this spineless species of cactus is not attacked by Cactoblastis, but a paper from South Africa stated that spineless cactus is indeed attacked by Cactoblastis. I just raise this case to indicate that a very real responsibility is involved when you have countries neighboring each other. This is particularly true in countries with a very large range of ecological conditions where a decision in one part of the country might be wrong in another part of the same country and definitely wrong in a neighboring country.

DYSART I want to go back to the Lema cyanella problem here. As Dr. Zwölfer mentioned, Lema cyanella attacking thistle seems to be quite rare. One may go out and hunt for parasites and find only 10 eggs or larvae in a season. Dr. Miczulski in Poland was losing his host culture of Oulema melanopa and just by chance he had some eggs of Lema cyanella in the laboratory. He was able to use these instead of the Oulema eggs to rear the parasite Anaphes flavipes. However, the rearing of the larval parasite Tetrastichus julis from field collected Lema is more significant. The question we are all wondering now is, should we introduce the weed insect into North America where a known parasite and possible repercussions on the weed program and the parasite programs already exists?

GERLING I would like to make a comment on what Dr. Little mentioned. Of course, the involuntary problems are much more severe in the small countries which are adjacent to each other and one should always consider their neighbors, but sometimes there is a conflict of interest. What is better, to control ones weeds or to take the five or six neighboring countries into consideration.

I don't know what the answer is, but it depends on individual requirements and individual cases. I do think that in such cases a good organization of the information is essential and would aid very much both in the preliminary consideration of what to introduce. When there are two large countries adjacent like Canada and the United States there is there more centralization of knowledge than if you have five or six sovereign countries adjacent, each of which have completely different organizations of information among themselves. Secondly, once a thing is introduced, if you have the

right knowledge you know what to expect, you know what ways to work with it. I don't know exactly how this can be managed but having a centralized body of information would be most helpful.

COEDEN I think that relative to this question of entomophagous insects being introduced with the possibility of their attacking an established, imported, weed-feeding insect, what probably is needed is a good, clear-cut test case. Actually, only if the entomophage under consideration for importation was rather host-specific to the phytophage in question would the need for concern arise. And this event seems highly unlikely, not only from the standpoint of the unlikelihood of such an entomophage being considered for importation in the first place, but also considering the relatively few species of weed control agents now established and likely to be established in the foreseeable future. Parasitism of imported weed control agents by previously established, generally rather polyphagous, imported entomophages has been reported, of course, but this is an entirely different situation and a matter beyond our control.

ANDRES I just want to make one comment. In one sense we consider ourselves to have allegiance to bio-control of insects or bio-control of weeds but we really should consider the overall benefits to the ecosystem. If a weed feeding insect will support a parasite which in turn will aid in the control of a serious insect pest, our decision whether the weed insect or parasite is to be introduced should be based on the projected overall benefits to the ecosystem.

END OF DISCUSSION

* * *