POLLINATORS AS VECTORS OF BIOCONTROL AGENTS PETER KEVAN, JOHN SUTTON AND LES SHIPP pdf

1: The Grower February by The Grower - Issuu

The combined, simultaneous delivery of both fungal disease antagonists and pest insect biocontrol agents has resulted in suppression of plant pathogens and several serious insect pests, such as.

Box , Canberra, A. Lazarovits in et Biocontrol al. They faced many obstacles and not infrequently suffered from lack of support. Despite all encumbrances, they laboured on because they believed that what they were doing was important and potentially rewarding. Their stubbornness and perseverance led them to great discoveries, if not always the rewards. They made their way towards a goal and, in doing so, faced numerous and unexpected hurdles, which had to be addressed for them to complete their objectives. The field of biological control encompasses not only biology but, as we will learn, also dozens of other disciplines and human activities, including technology, art, business, psychology, economics, law, international trade, sociology and many more. The chapters presented here illustrate that one needs to master combinations of all these elements in order to deploy a successful biological control programme. In natural ecosystems, such events occur innumerable times and are a major component by which populations of an organism are regulated. This is much easier said than done because the constraints can be formidable. Scientists can argue about definitions for ever. We will avoid doing so here and let you choose from among the many presented in the following chapters. Entomologists started with the concept that biological control was the use of living organisms natural enemies to manage a pest population. Those working in other fields of pest management, however, find this concept difficult to work with and they provide additional concepts that expand the scope of activities that biological control may involve. We have divided the book according to the three broad categories of biological control, i. Classical, Inundative or Augmentative , and Conservation. In Classical Biological Control, a living organism is introduced to an area where it had not previously existed. The aim is to establish this organism, a natural enemy or competitor, in its new location in order to provide long-term control of a pest. The target pests are, in many cases, non-indigenous to the ecosystem in the first place. In Inundative or Augmentative Biological Control, the aim is to introduce sufficient numbers of the biological control organism s to reduce the pest population, at least temporarily. Such introductions would normally need to be repeated, in much the same manner as a traditional pesticide. Conservation Biological Control encompasses efforts to conserve or enrich the biological control agents that are already present, through either manipulation of the environment or crop and pest management practices. Facing Reality Those of us who have been working in the area of biological control for many years probably feel humbled by the complexities of the ecosystems we are attempting to impact. In the following chapters you will find examples from around the world as to why this is. These stories reveal the adventures that scientists experienced, starting from the initial search for suitable control agents e. Chapter 2 , to their release and introduction to the destined ecosystems, and to the outcomes that in some cases resulted in untold savings from damage caused by insects e. Chapters 3 and 4 , pathogens e. Chapters 20 and 27 and noxious weeds e. Chapters 8, 9 and In some cases, these efforts literally saved the staple food supply of several countries Chapter 5 or a crop vital to the economic survival of growers in a region Chapter In some cases, the introduction of the control agent was accidental or mysterious e. Chapter 7 , while other efforts prospered only after the public became involved in the dispersal of the control agent Chapter We also see cases where the work remains incomplete and the objectives are still only a hope Chapter Nevertheless, Classical Biological Control is a proven powerful management tool, which can provide great benefits if practised cautiously. This example of detrimental effects by an introduced predator occurred at a time when release of biological control agents was not as strictly regulated as it is today. Chapter 6, however, serves as an illustration of why we need to be cautious. Inundative Biological Control has also seen many successes. For instance, in greenhouses, pest management through biological control has become the foundation of integrated pest management programmes Chapters 12, 13 and This was brought about because there was a desperate need to control pests that rapidly developed resistance to chemical pesticides within closed ecosystems. In addition, introduction of bees as pollinators greatly increased yields of greenhouse-grown plants but bees proved to be highly sensitive to pesticides. This provided a huge incentive to growers to shift to biological-managed systems where bees were not harmed. This also prompted the search for novel control products, such as entomopathogenic nematodes, products that would have probably been discounted as potential control agents by most plant protection experts Chapter Such agents, however, are now also providing a means to control slugs Chapter Is it possible that the very success of this bacterial group as a biopesticide has misdirected our efforts at searching for other uses of this group? One of our authors makes a convincing case that this may be so Chapter We were also very sure at one time that resistance to biopesticides was not something that could happen easily. Here again, nature teaches us an important lesson: Many microorganisms are coming to market as commercial products for managing soil-borne diseases of trees Chapter 21 and agricultural crops e. Chapters 20, 22 and 24 , and for control of foliar plant diseases such as powdery mildew Chapter 25 and apple scab Chapter The exploitation of plant pathogenic microorganisms for weed control has had several stumbles Chapter 30 but is now successfully deployed for use in the management of deciduous brush Chapter Novel production and application methods have been developed to allow more products to reach market, and these are illustrated by articles on the mass fermentation of Chondrostereum purpureum Chapter 32 , the use of pollinators to disseminate microorganisms with biological control activity to plants Chapter 35 , and use 4 G. There are many plant diseases where control by chemicals was never an option, such as the control of mycotoxin contamination of diverse crops by Aspergillus species Chapter However, application of atoxigenic strains at a few kilograms per hectare protected plants from colonization by toxin-producing isolates. Chapter 28 brings insights into how the regulatory bodies came to evaluate and register the release of these unique products for wide-scale agricultural use. In such areas, chemical spraying would be much too expensive. Often when chemicals are less expensive than biologicals, their potential non-target impacts are rarely factored into the real costs of use. We find new hope for developing more effective products as our ability to genetically modify biological control agents improves. For instance, transgenic microorganisms can provide more rapid kill times Chapters 36 and But, as with introductions of generalist predatory ladybeetles, genetic modifications can produce unexpected results Chapter The search for new means to improve biological control agents and for new agents is potentially a signal of a renaissance for biological control technology. Discovery of a novel bacterium that was commercially developed to control grass grubs in New Zealand Chapter 17 suggests that biological pest control is alive and thriving. Biological control successes are almost always associated with the tenacity, communication, team-building ability, and inventiveness of a principal investigator. These investigators invariably have had long-term support from grower groups and enlightened administrators. Many of the products reaching market did so because long-term funding was provided by governments or grower groups, and occasionally by small companies. For the most part, the multinational companies have stayed away from biocontrol products. Yet there is continuing pressure to attract the large companies, with the primary objective being to bring in royalties from commercialization. However, several examples demonstrate that this paradigm is just not working as there is not enough money in such products to lure big companies into this market e. Chapters 15 and Others are family-run operations, where the motivation for continuation is not primarily the immediate return of the investment but a passion to succeed and bring forth a new biocontrol agent to market e. Very likely we would have a lot more successes and products on the market if funding agencies and research organizations justified the money spent on such research as a way of improving the environment, as well as providing an alternative pest control strategy to producers. Products such as Rhizobium inoculants have been marketed for over half a century, yet few, if any, are protected by patents. Adventures in Biocontrol 5 Conservation Biocontrol is probably the oldest approach to biological control but, in the modern sense, is also an under-explored realm. Increasing the presence of fungi or bacteria may reduce the activity of a pest by competition or by inducing resistance mechanisms in the host. Fungi that can kill aphids reduce not only the damage these pests cause but can also eliminate the need for pesticide application Chapter Management practices have been developed to conserve beneficial organisms in orchards Chapter 41 and vineyards Chapter These examples provide evidence to demonstrate that Conservation Biocontrol has much potential but has been little explored. The ultimate objective in plant protection is to create an environment where pests or pathogens are held in check by competitors or by natural enemies that are already in the environment. Bringing about the balances that create such community relationships and maintaining them such that crop losses are kept below injury thresholds has been most difficult in soil. We have a superb example to show that even here one can tip the equilibrium toward the control agents, and when this occurs long-term disease suppressive conditions are created Chapter Interestingly, this is achieved by planting the same crop year after year, a practice rarely, if ever, recommended to growers. One may then ask why funding agencies have made such a modest effort globally to develop strategies toward this objective. Finally, in our last chapter Chapter 45 , we present the adventures experienced in the formation of a Biocontrol Network. It is because of this Network that the idea of this book was born, and many of the chapters are by Network Researchers. We are grateful to the Natural Sciences and Engineering Research Council of Canada and to the Network for financing the creation of this book. This is yet another example of the importance of providing scientists with the opportunities to share resources and ideas in a team effort atmosphere. The originality of our book is that it showcases clear examples that biocontrol is widely used globally with great success in diverse agro-ecosystems. It is possible that biological control has been oversold for the sake of funding and we as biological control researchers have become deluded by our own rhetoric. The chapters in this book, however, provide convincing arguments that such a view is mistaken. Biological control on a global perspective is a great success. About Choice of Chapters and Format We asked authors to explore the positives, impediments and deterrents in getting biological control implemented or in bringing products to market. We wanted the chapters to reflect personal experiences and to include not only the science being pursued but also the mindset and the social environment of the researcher. We believe that these chapters will be a highly valuable resource for teachers, 6 G. Science managers and regulators will find excellent guidance as to how to help and foster researchers in their efforts to implement biological control or bring products to market. We are very grateful to all the authors who contributed to this book for so willingly sharing with us their knowledge and life lessons. We have captured only a few examples of the many efforts that exist in the field of biological control and hope that other experiences that have not made it into this edition can be included in future versions. The publishers presented us with a strict page limit for this book. In order to provide the maximum number of stories, we had to strictly limit the size of each contribution. Although in the past books were an important source of pertinent literature citations, we felt that in this age of the Internet readers now have very easy access to the literature through excellent search engines such as Google Scholar. Consequently, we asked authors to limit the references to about 20 citations.

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2: Table of contents for Biological control

Pollinators as vectors of biocontrol agents - the B52 story August Pollinating and flower-visiting insects can carry some plant diseases and can themselves be infected while foraging at flowers.

And, plentiful applies to more than our selection of seed. Our premium varieties deliver plenty of grower Funding satisfaction as well. We like to say, we deliver unbelievable results made believable. The management of all these issues is costing more, yet operational funding is decreasing. As a result, Smith reports individual commodity groups will not receive funds in for research and promotion. This season, plant Rupp. It is an honour to hold a position that has been held by so many outstanding farm leaders over the past years, the most recent being Mac James. Thank you Mac for your leadership over the past year. It is the accomplishments of these men and women that elevate this position and give it a respected voice in government. Some of you will know me, most will not. I work with three generations of our family on our farm in Niagara-on-the-Lake. We have been growing grapes and tender fruit for more than 50 years. I have been involved with farm organizations for the past 20 years. This year will have its challenges. We have commodities recovering from massive crop losses and commodities coping chairs and directors. It is important that I also speak to the future leaders. I do not know who you are, what role you will take on, or what part of the province you will come from, I do know you are the ones that will step up and not simply presume the work will get done. I urge you to take the leadership courses offered through OMAFRA and get involved with your commodities and farm organizations. I thank you in advance for continuing this important work. I would like to thank the provincial and federal governments for the successes over the past year. Rain and wash water continue to be an onerous issue for growers in Ontario. The cost of compliance is putting an undue burden on growers who cannot recover these costs from the market place. The OFVGA will work together with all impacted commodities and organizations to shift edible horticulture under the umbrella of the Nutrient Management Act. There are major issues facing each of our sections: I have confidence that the section chairs elected at the annual meeting will face these issues with competence and integrity. I look forward to working with you to make edible horticulture in Ontario competitive in a global market. I purposely did not thank people by name. I would, however, like to thank Chris Kowalski for attending the entire OFVGA convention despite some serious personal challenges. Chris, you show the dedication and commitment we need from the growers of Ontario. I wish you all the best and a full recovery. Loblaws, we are told, expects to receive up to 40 per cent of its total produce in RPCs. Rigid containers can be stacked higher than cardboard. That translates into less shrinkage. As well, they are faster to assemble. First they are an oil-based product and not, as is cardboard, made from a renewable resource. These containers must get shipped from the retail outlets back to the States where they are sanitized. Here again an even greater environmental footprint as there are only two washing facilities -- one in Chicago and one in the southern U. Next, the farmer now needs to carry and store two different types of masters. Do you have the extra space? The next issue pertains to market flexibility. What happens when the retailer turns down the product that they ordered just because they no longer require it? It means taking it home and repacking into cardboard for another retailer; to add insult to injury, this product now needs to be repacked and that expense is borne by the farmer. The next issue is the lack of brand recognition. Many consumers look to see which farmer produced the product and where. Often cardboard containers are used to conceal the RPCs in the store; a practice that is very common in the store just down the street from our office. Two bigger issues are of food safety and biosecurity. Imagine a container-borne disease or pest entering a greenhouse and the damage that could present. Food safety is a priority for farmers, retailers and government alike. One-time use of cardboard containers may not be perfect but the inherent risk is much, much less. They did so to provide greater freedom for the industry mostly for processing to use whatever size container they wished to meet consumer demand. The problem is that it opens up the market to imports of products in non-traditional packaging not currently offered by Canadian manufacturers. If the new package size is widely accepted, Canadian processors will have to retool in order to be able to produce similar sized consumer packages or close up shop. From a retailer and consumer standpoint, this sounds like a positive move but what are the consequences for Canadian manufacturers and the producers who supply them? The processing sector sees this as a very real threat to their operations. Some internationals have said that they will be forced to abandon their Canadian operations in favour of their U. If that happens, Canadian producers lose their market. All you have to do is look at what happened to the Canadian fruit canning and grape juice sectors. I expect that is to provide them with incentives to keep their operations in Canada rather than move their production to the U. Karen Davidson, , kdavidson ecomente. Herb Sherwood, , hsherwood cogeco. Any errors that are the direct result of The Grower will be compensated at our discretion with a correction notice in the next issue. No compensation will be given after the first running of the ad. Client signature is required before insertion. The contents of this publication may not be reproduced either whole or in part without the prior written consent of the publisher. Others may subscribe as follows by writing to the office: If the issue is claimed within four months, but not available, The Grower will extend the subscription by one month. No refunds on subscriptions. Under the existing rules, importers are required to request an M. I would do the same in their shoes. But unlike the limited run from single wineries you now find in some grocery stores, the Express stores are to offer a wide range of products. The nomenclature is a little awkward, but the idea is sound â€” that is, to offer LCBO customers an expanded selection of Ontario VQA wines, including hard-tofind wines from smaller Ontario producers. You might think producers would be happy with the change. But producers still want more. Indeed, despite being the most populated province, Ontario has the lowest number of alcohol retail stores per capita in Canada. Complaints about the discrepancy in alcohol availability between provinces, not to mention countries, has yielded few results. So the wine sector wants Ontario to take the next step and let independent wine stores open. Among the proponents of this approach is University of Guelph alumnus and accomplished Niagara region winemaker Sue-Ann Staff. And what would that be? Conservative Ontario has long balked at easier access to alcohol. Minister Duncan acknowledges Ontarians have a growing interest in local wines. Thomas C91 2 row harvester, field ready, TTT warranty. Grimme GB potato harvester. The purpose of this brief is to keep you up-todate on the issues that the OFVGA is working on, as well as projects and initiatives the organization is involved in. The Board did not renew funding for the OFVGA Research and Promotion Fund for , but will make a decision annually depending on the financial position of the organization. A pilot fund had been in place for the last two years as a mechanism of returning retained earnings through member associations in a way that would directly benefit Ontario fruit and vegetable growers. No changes will be made for FARMS has been named in a wrongful dismissal lawsuit involving an Ontario farm and several seasonal workers. FARMS is requesting to be removed from the case. The next wave will focus on Jamaica and the benefit of the program to workers in their home country. Property The initial phase of a wildlife damage study for the horticulture sector has been completed. The largest losses are in small fruit and berries although all participating commodities reported that losses have been increasing. An update on the study will be provided at the annual general meeting this month during the Property section meeting. Growers are reminded to review their Municipal Property Assessment Corporation MPAC assessment notices to ensure bunkhouses are classified as farm and not residential buildings. The provincial government announced this change last year but the classification change is not automatic. OFVGA continues to work towards having horticulture regulated under the Nutrient Management Act with respect to waste and wash water issues. The goal is to bring together producer groups and representatives from across the value chain to define priority areas for research and innovation. Prior to the meeting, each commodity group will be required to consult with their members to fill out a questionnaire that will form the basis of the discussion. The outcome of this session will be a list of research needs that includes the top five priorities for each commodity group. CHC administration fees will also be split with government.

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3: Full text of "At Guelph, Vol. 35, No. 1 to No. 10, "

Professor Peter G Kevan, Dr Les Shipp and Professor Vernon G Thomas are exploring the potential of using pollinators as biovectors as a viable alternative of the infection process in the target host), bee vectoring of microbial agents must be applied early.

How do you protect the safety of pollinators carrying the It is also not a curative control measure, and is vulnerable to a number of different variables: Bee vectoring is not a silver bullet and, as such, should be used as part of a more holistic pest management programme. Dr Les Shipp Can you elucidate the process of bee vectoring? Bee vectoring, in its simplest terms, is using managed pollinating bees to deliver beneficial microbial agents to flowering plants for the control of insect pests and suppression of plant diseases. These beneficial agents include fungi, bacteria and viruses that target arthropod pests such as insects and mites or plant pathogens. The bee picks up the microbial inoculum on its body and hairs, and then spreads the inoculum powder to flowers during the pollination process or whilst self-grooming on plant leaves. How do you protect the safety of pollinators carrying the biocontrol material? We have to be sure that the active biocontrol agent does not stress or kill the pollinators, so we must get the dose and formulation right to accommodate that whilst still suppressing the pest or pathogen incidence. The safety of the pollinators must be part of the evaluation process when we are investigating the possibility of an agent being bee vectored. The dispenser is designed so that the bee picks up the inoculum when it leaves the hive, but re-enters through another VT: Professor Vernon G Thomas entrance hole, thus ensuring it does not bring the inoculum into the hive. Furthermore, not every hive requires a dispenser, and the inoculum can be rotated amongst the hives when there is a possibility of an agent having a negative effect. Is bee vectoring compatible with different types of agriculture, such as organic and conventional growing? Yes; the only problem is that, for conventional chemical-based agriculture, more care would have to be exercised with insecticides. It is compatible with both, but especially organic approaches. Biovectoring can be seen as a vital adjunct to any type of organic agriculture because it does not rely on synthetic control agents or involve energy-intensive spraying; the control agents are all naturally-occurring and ubiquitous materials. What are the advantages and disadvantages of using vector biocontrol as an alternative to conventional insecticides and fungicides? Greenhouse cage and field trials have shown that bee vectoring is as effective as chemical spraying. However, as chemical pesticides work faster than microbial agents due to the nature Could you elucidate your plans to expand pollinator biocontrol vector technology PBVT into coffee production? My main goal is to get biovectoring assessed and, hopefully, deployed widely in coffee production. Trials already indicate that it has the potential to control several fungal diseases of coffee plants, as well as the coffee berry borer. I have a wide interest in several areas but, as a largely retired professor, I will focus on the coffee situation because globally it represents a vast crop that is in need of a new approach. In what ways does PBVT still need refining? Like any technology, there will always be constant refining to improve efficiency. We have demonstrated that two fungal biocontrol agents can be combined in the same inoculum for both pest control and disease suppression. There is no reason why other combinations of microbial agents cannot be used. We need to explore a range of biocontrol agents that could be used against other pests and diseases, and on other crops. We also need to refine the technology so that it can be better used with honey bees. There is potential to use biovectoring to control viral diseases in crops. Subject to funding, this will be a focus of subsequent research. For instance, grey mould can blight fruit crops such as strawberries and raspberries; the fungus that causes mummy berry can obliterate blueberry crops if left unchecked; and greenhouse tomatoes and sweet peppers can be affected by tarnished plant bug TPB , western flower thrips, whiteflies and green peach aphids. These pests and diseases have the potential to ruin crops, with significant financial implications for farmers. To combat pests and diseases, farmers often rely on the labour-intensive and costly process of spraying pesticides and fungicides. Whilst these are effective in the short term, their ecological viability is often highly contentious, due to the potential negative impacts of chemical pesticides and fungicides on pollinators and natural enemies in the agro-ecosystem, and the possible long-term implications of chemical control methods on the health of consumers and farmworkers. Additionally, pests and diseases can develop Using pollinators for crop protection Bees are crucial to the pollination of crops around the world, but widespread pesticide use in recent decades has significantly harmed pollinators. Now a team of researchers in Canada is working on a novel solution to this issue resistance to pesticides and fungicides over time, meaning that chemical control methods can become redundant within a mere matter of years. Moreover, use of synthetic pesticides prevents growers from obtaining organic status. However, a number of naturally occurring microbial agents have been identified that successfully suppress plant pests and diseases, and studies suggest that there are few incidences where pests and plant pathogens have developed a resistance to them. Applied to crops, these microbial agents have the potential to provide an ecologically sound method of biocontrol. Studies in the s showed that as well as pollen, bees incidentally carry fungal spores and bacterial cells, including bee and plant pathogens, from flower to flower. By embracing plant pathology and crop protection with Sutton, Kevan is able to unite his interests in pollination biology and community and applied ecology with his passion for apiculture. Evidently, PBVT is already inspiring optimism in many. Since then, Kevan and his colleagues have continued to investigate the potential of bees as vectors of various microbial agents for pest control and disease suppression, identifying a number of microbial agents which can be applied to crops via PBVT to control a certain pest or disease. In , having discovered that bees could be used to deliver the entomopathogen Beauveria bassiana to control TPB and thrips on greenhouse-grown sweet peppers, the researchers determined the optimal concentration of bee vectored Beauveria to be used for both peppers and tomatoes infected with whiteflies, thrips, aphids and TPB. More recent research, meanwhile, has expanded the potential of bees as agents of PBVT, for example by demonstrating that bumble bees can vector Clonostachys rosea, Beauveria bassiana and Bacillus thuringiensis in outdoor crops strawberries, blueberries and sunflowers for disease and pest management, and also can be treated with two microbial agents Beauveria bassiana and Clonostachys rosea in a single inoculum as a means of controlling both crop pests and disease simultaneously. However, the potential applications of PBVT could be of much broader international significance. In order to promote and develop the potential of PBVT in agriculture around the world, Kevan, Shipp and colleagues have been working with Professor Vernon G Thomas, a specialist in wildlife ecology with expertise in the transfer of science into conservation policy and legislation. Thomas hopes to garner support for the concept from the International Coffee Organization, having already secured support from the International Union of Biological Sciences in to apply PBVT to coffee production and other types of agricultural production. According to Thomas, things are looking positive so far: Greenhouse pepper and tomato trials using an AcMNPV baculovirus for cabbage looper control, for example, are planned for the near future in association with a number of different private organisations. Meanwhile, another key focus for the researchers is the dissemination of information regarding PBVT, so that pest management specialists can learn how it can be adapted to their needs. As well as having several workshops across Ontario planned for the upcoming year, Kevan, as President of the International Commission for Plant Pollinator Relations, also plans to visit the EU: With the combined efforts of these dedicated scientists, along with the support of such a powerful body of partners, it seems likely that their efforts to take PBVT global will be successful. His area of research is greenhouse pest management with the emphasis on biological control.

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4: Biological control : a global perspective (Book,) [www.enganchecubano.com]

Note: Citations are based on reference standards. However, formatting rules can vary widely between applications and fields of interest or study. The specific requirements or preferences of your reviewing publisher, classroom teacher, institution or organization should be applied.

Dark-winged fungus gnats in the genus Bradysia Diptera: Sciaridae are especially abundant in greenhouse plant production. Although it is thought adult fungus gnats generally do not feed in the greenhouse setting, sciarid larvae feed mainly on microorganisms in the soil, including various Oomycetes, Ascomycetes, Basidiomycetes, and Myxomycetes. However, larvae of several species have also been observed consuming root, stem, and sometimes leaf tissue of apparently healthy vascular plants in greenhouses, and have been implicated in the transmission of certain root pathogens. In this laboratory study, Bradysia impatiens larvae chose to associate with oomycetal cultures of Pythium aphanidermatum, Pythium ultimum, or Pythium irregulare more frequently than the medium on which each of these pathogens was grown. Developments in greenhouse horticultural production systems J. A short overview of recent developments in Dutch horticultural industry is presented focussing on four topics: Study of the efficacy of different concentrations of insecticidal soap, in comparison oxydemeton-methyl Metasystox to control Aphis gossypii in greenhouse cucumber Valiollah Baniameri Abstract: Insecticidal soaps have been used to control insects and mites because of low toxicity and environmental pollution with no residual effect. At present time, because of limitation in the use of chemical insecticides in greenhouse vegetables, it is needed to use an alternative product without poisoning active ingredient such as soaps. In this study, the effect of an insecticide soap named Palizin Kimiasabzavar product with three different concentrations 1. Mortality percentage was calculated using Henderson-Tilton formulae and the arcsine transformed mortality percentage of aphids were analysed by SAS software. The comparison of the mean effectiveness of all treatments showed that there was no significant difference among treatments, but there is a significant difference to the control. The maximum and minimum mean effect of insecticide soap were and percent in concentrations of 2. According to the results, insecticidal soap Palizin is recommended in 2. Within a few years time Dutch cut-chrysanthemum growers switched to IPM. In this paper we describe the causes that account for this change, and we summarize our research on thrips and spider mite control that contributed to it. Following Canadian research and experience on the potential of Atheta coriaria, for biological control of sciarid flies, shore flies and western flower thrips WFT , further research was done in the UK to develop a practical grower rearing-release system for the predator for low cost biological control of various pests. The system gave promising reductions in numbers of WFT on Impatiens and of sciarid flies on potted parsley. A method for manipulating A. Further development and testing of the rearing-release system is needed before grower uptake can be recommended. Within the framework of a ministerial program to encourage organic farming, a knowledge dissemination project on biological pest control was started. Organic sweet pepper growers participating in this project have adopted a more preventive strategy, especially with respect to aphid control. Natural enemies were released at much higher rates and frequencies, and repairing sprays with natural pyrethrum could be omitted. Crops still suffer from honeydew pollution and yield losses. Results of scouting both aphids and natural enemies in a representative case are presented. Potential of alternative prey in the conservation and establishment of Orius insidiosus Say Hemiptera: Orius species can be found in both managed and natural ecosystems, mainly in association with thrips. The objective of this study was to evaluate O. During the nymphal stage, O. Females fed thrips laid a greater number of eggs Thrips were more suitable for O. The relationships between the predatory mites, Amblyseius swirskii Athias-Henriot and Neoseiulus cucumeris Oudemans , and their prey, western flower thrips Frankliniella occidentalis Pergande , were investigated to determine the effects of predation on intra-guild or extra-guild prey. Life history characteristics of both predatory mites were measured when fed eggs and larvae of the other predator species, and compared to data obtained when the predators were fed thrips larvae. In addition, choice tests were conducted to determine if the predators had a preference for any of the different prey or if they were indiscriminate predators. Release rates of Orius insidiosus to control Frankliniella occidentalis on protected potted gerbera Alessandra R. Reductions of Frankliniella occidentalis populations using Orius insidiosus were obtained in several ornamentals, such as saintpaulia, impatiens, and gerbera. The purpose of this study was to determine the action of this predator on the biological control of the thrips F. The experiment was conducted during the entire cultivation cycle, for a total of 16 weeks. The population dynamics of F. Eight releases of O. It was observed that under a release rate of 1. The use of O. Anthocoridae at low temperature Livia M. Storage at low temperatures is an important step during the process of mass rearing and use of natural enemies, since it allows greater flexibility in the rearing, transport, and release of beneficial agents. In Brazil, biological studies have been conducted with different species of Orius. Their use in biological control programs against thrips is promising in many protected crops. This study aimed to evaluate the influence of storage periods at low temperatures on the reproductive capacity and longevity of the predators Orius insidiosus and Orius thyestes. It was observed that O. These results may be helpful to plan the processes by which these predators are mass reared and transported to the sites where they should be released. Control of Frankliniella occidentalis Thysanoptera: Phytoseiidae and Orius insidiosus Hemiptera: Despite the widespread use of insecticides, western flower thrips, Frankliniella occidentalis Pergande , are still difficult pests to control on floriculture crops. As an alternative to chemical control, we evaluated the use of the predatory mite, Amblyseius swirskii Anthias- Henriot , alone and together with the predatory bug, Orius insidiosus Say , for suppressing F. In greenhouse trials simulating thrips infestations of cut rose crops, we compared control of F. Roses with or without predators produced similar numbers of harvestable flowers, but roses without predators had, on average, two to three times more thrips than roses with predators. Concurrent releases of O. Insecticide resistance in Ontario strains of the American serpentine leafminer Liriomyza trifolii Burgess in Ontario L. Growers rely heavily on chemicals to provide acceptable pest control and, as a result, ASL has developed resistance to many insecticides. Only a few are registered for use in Canada and growers have been reporting difficulty in achieving effective ASL control. The objectives of this study were to determine if ASL in Ontario has developed resistance to currently registered insecticides and to evaluate the potential of 2 newer reduced risk insecticides for inclusion in future ASL management programs. Two ASL cultures were established one collected from greenhouses near Vineland, Ontario, the other being an insecticide susceptible strain never exposed to any of the test insecticides. Insecticide effectiveness was assessed using a leaf dip bioassay technique. Insecticides tested were cyromazine and abamectin both currently registered; and, 2 novel reduced risk products - spinosad and chlorantraniliprole. It also was significantly more tolerant to spinosad 2. The LC95 for chlorantraniliprole was much lower than the suggested application rate. Nevertheless, the low level tolerance shown by the Ontario strain suggests that this highly effective insecticide has the potential to develop a higher level of resistance and that, if registered for use, it should be in the context of a multifaceted IPM program. The appearance of insecticide-resistant American serpentine leafminer Liriomyza trifolii Burgess ASL in Ontario floriculture greenhouses has accelerated the search for alternative pest control methods. Chrysanthemum plants sprayed with varying concentrations of WP were placed in a cage with a non-treated plant and exposed to ASL for 24 h. Residual activity of WP was evaluated over 3 and 6 d by placing treated chrysanthemums in one ASL cage and non-treated plants in another. Assessments following 24 h exposure indicated that ASL consistently chose non-treated or water treated over WP treated plants in both 3 and 6 d nochoice tests. Artificial production of arthropod biological control agents Patrick De Clercq Abstract: Augmentative biological control should be based on a cost effective and reliable production of high-quality natural enemies Bolckmans, To reduce costs, alternatives have been proposed for a number of tritrophic rearing systems i. Currently, several species of mites and insects are being used as factitious prey or hosts for the complete or partial commercial production of arthropod predators and parasitoids, including bran mites and dried fruit mites for phytoseiids, lepidopteran eggs for heteropteran, coleopteran and chrysopid predators and for trichogrammatid parasitoids, and brine shrimp cysts for heteropteran predators De Clercq, Only very few of these artificial diets are nowadays routinely used in commercial insect cultures e. It deserves emphasis that the development of artificial foods for beneficial arthropods is not about nutrition alone. The complexity of designing artificial media requires inputs from nutritionists, food technologists and process engineers, microbiologists, insect ecologists, physiologists and geneticists see the potential of genomics and other omics as tools in diet development. Assessing development and particularly reproduction of natural enemies reared on an unnatural food is often a time consuming activity. In this respect, increasing attention is given to the development of rapid tools to assess reproductive potential, including dissection tests e. Arguably, excellent field performance of the artificially produced natural enemy against the target pest remains the ultimate quality criterion. Besides animal foods, many natural enemies require plant materials for moisture, supplementary nutrients or growth factors, or as an oviposition substrate. Replacement of plant substrates for oviposition by artificial substrates constitutes a further challenge for the rationalisation of rearing processes for several predatory insects that deposit their eggs in plants tissues, like mirid and anthocorid bugs. Combined use of predatory mites for biological control of Tetranychus urticae Acari: Tetranychidae in commercial greenhouse cucumber Gillian Ferguson Abstract: Two types of predators were used for biological control of spider mites Tetranychus urticae in commercial greenhouse cucumber crops. Initial general releases of Neoseiulus californicus were followed by targeted releases of Phytoseiulus persimilis in areas with higher populations of T. This strategy combined the biological traits of the less specialized N. Oils are known to act as highly effective spray stickers and have been claimed to improve efficacy of fungal pathogens under dry conditions. Oil formulation is thus considered one of the most promising technologies for improving efficacy of mycoinsecticide spray applications. The objective of this study was to investigate effects of oil vs. In laboratory tests, formulation in emulsifiable oil did not significantly increase virulence of the fungus nor increase its capacity to infect aphids under dry conditions compared to unformulated fungus. Nevertheless, the oil formulation was consistently more effective than a wettable powder. The results support a hypothesis that oils function primarily as spray stickers, improving the efficiency of spray applications. The effect of reduced risk pesticides for use in greenhouse vegetable production on bumble bees Bombus impatiens Cresson A. In recent years, bumble bees Bombus impatiens Cresson have increasingly been used commercially for pollination in greenhouses and now play an essential role in Canadian greenhouse vegetable production. Effective pest control also is crucial to producing high, marketable yields of greenhouse vegetables and pesticides remain an important tactic in greenhouse integrated pest management IPM programs. Many pesticides are toxic to other bee species, yet pesticide toxicity data on bumble bees are lacking. We examined the toxicity of reduced risk pesticides for use in greenhouse vegetable production to bumble bees.

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Shipp has also shown that bee biovectoring can complement the use of other biocontrol agents used in commercial greenhouses, such as predatory mites and parasitic wasps that prey on whiteflies and thrips.

Many farmers worldwide rely on using pesticides and fungicides to protect their crops, which can be harmful and unsustainable. Professor Peter G Kevan, Dr Les Shipp and Professor Vernon G Thomas are exploring the potential of using pollinators as biovectors as a viable alternative of the infection process in the target host , bee vectoring of microbial agents must be applied early. It is also not a curative control measure, and is vulnerable to a number of different variables: Bee vectoring is not a silver bullet and, as such, should be used as part of a more holistic pest management programme. Could you elucidate your plans to expand PK: Dr Les Shipp VT: Can you elucidate the process of entrance hole, thus ensuring it does not bring bee vectoring? My main goal is to get biovectoring not every hive requires a dispenser, and the assessed and, hopefully, deployed widely in LS: Bee vectoring, in its simplest terms, is using inoculum can be rotated amongst the hives coffee production. Trials already indicate that managed pollinating bees to deliver beneicial when there is a possibility of an agent having a it has the potential to control several fungal microbial agents to lowering plants for the negative effect. I have a wide interest in several diseases. These beneicial agents include fungi, Is bee vectoring compatible with different areas but, as a largely retired professor, I will bacteria and viruses that target arthropod types of agriculture, such as organic and focus on the coffee situation because globally pests such as insects and mites or plant conventional growing? The bee picks up the microbial new approach. Yes; the only problem is that, for spreads the inoculum powder to lowers during conventional chemical-based agriculture, more In what ways does PBVT still need refining? Like any technology, there will always be VT: It is compatible with both, but especially constant reining to improve eficiency. We How do you protect the safety of pollinators organic approaches. Biovectoring can be seen as have demonstrated that two fungal biocontrol carrying the biocontrol material? We have to be sure that the active agents or involve energy-intensive spraying; the There is no reason why other combinations of biocontrol agent does not stress or kill the control agents are all naturally-occurring and microbial agents cannot be used. We need to explore a range of biocontrol still suppressing the pest or pathogen incidence. What are the advantages and disadvantages agents that could be used against other pests of using vector biocontrol as an alternative and diseases, and on other crops. We also need LS: The safety of the pollinators must be to conventional insecticides and fungicides? Greenhouse cage and ield trials have shown bee vectored. The dispenser is designed so that bee vectoring is as effective as chemical VT: There is potential to use biovectoring to that the bee picks up the inoculum when it spraying. However, as chemical pesticides work control viral diseases in crops. Subject to funding, leaves the hive, but re-enters through another faster than microbial agents due to the nature this will be a focus of subsequent research. Moreover, use of synthetic pesticides the fungus that causes mummy berry can prevents growers from obtaining organic status. Applied to examine the problems of pollination to crops, these microbial agents have the decline and management in agricultural and To combat pests and diseases, farmers often potential to provide an ecologically sound natural ecosystems. In addition, this research rely on the labour-intensive and costly method of biocontrol. Network of Canada, as well as NSERC-Engage Whilst these are effective in the short term, Studies in the s showed that as well as â€” a programme that gives companies across their ecological viability is often highly pollen, bees incidentally carry fungal spores Canada access to the wealth of expertise contentious, due to the potential negative and bacterial cells, including bee and plant available at Canadian universities. The impacts of chemical pesticides and fungicides pathogens, from lower to lower. As well as having several workshops across Ontario planned for the upcoming year, Kevan, as President of the International Commission for Plant Pollinator Relations, also plans to visit the EU:

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Paving the way in the field of pollinator biocontrol vector technology (PBVT) are Professors Peter G Kevan and John C Sutton of the University of Guelph, Canada. By embracing plant pathology and crop protection with Sutton, Kevan is able to unite his interests in pollination biology and community and applied ecology with his passion for apiculture.

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9: What's the buzz? Using Pollinators for crop protection | Peter Kevan and Les Shipp - www.enganchecub

BVT's work is based on 20 years of research initiated at the University of Guelph by entomologist John Sutton, plant pathologist Peter Kevan and agronomist Todd Mason.

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