

DOUGLAS FREW WATERHOUSE—A DEDICATION

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Dr. Douglas Frew Waterhouse of Australia was one of the most influential figures in the recent history of classical biological control and this First International Symposium on Biological Control of Arthropods is dedicated by the organizers to his memory.

EDUCATION AND EARLY WORK

On December 1, 2000, Douglas F. Waterhouse passed away in Canberra at the age of 84, after a life committed to entomology and to biological control, in particular. Known to everyone as Doug, his interests in entomology began as a school boy in Sydney, encouraged by his uncle Dr. George Athol Waterhouse, a founder of the study of Australian butterflies. Doug graduated with honors from Sydney University in 1937, with First Class Honors and the University Medal. He was later awarded an Masters degree by the University of Sydney for a thesis based on his work on physiological aspects of the sheep blowfly. In 1937 Doug joined the Commonwealth Department of Scientific and Industrial Research, later to become the Commonwealth Scientific and Industrial Research Organization (CSIRO), where he worked on the physiology of insects, particularly sheep blowfly. Doug's blowfly research earned him a doctorate from Sydney University and he was elected a Fellow of the Australian Academy of Sciences and of the Royal Society of London.

WORKING CAREER

In 1953, Doug was appointed as Assistant Chief of the Division of Entomology, CSIRO and in 1961 following the retirement of the Chief, Dr. A. J. Nicholson, Doug was appointed Chief, where he led the Division's research until his retirement in 1981. Early in his career Doug was most concerned with the chemical control of insect pests, in the age of a new generation of insecticides like DDT and dieldrin, but he became disillusioned later with the reliance on chemicals alone. He was especially concerned with the development of resistance, the injudicious use of chemicals leading to secondary problems (often promoted by chemical companies), and loss of the concept of working with nature rather than against it.

From 1964, Doug guided research in CSIRO by diversifying approaches to pest management towards cultural control, host resistance, genetic control, behavioral control, integrated pest management and of course, biological control. Impressed by several successes including control of prickly pear by the South American moth, *Cactoblastis cactorum* (Bergroth), in inland Australia in the 1930s, he encouraged his research staff to pursue biological control as safe, permanent and effective control of the weeds and arthropods that were rapidly gaining importance in Australia.

Doug backed a complete revitalization of the approaches to biological control. He established overseas stations for exploration, supported enormously innovative projects on *Sirex* wood wasp using nematodes, the use of dung beetles to control flies, as well as classical projects on citrus scales, *Sitona* weevil, green vegetable bug, several aphids, potato tuber moth, spider mites, and others.

POST RETIREMENT ACHIEVEMENTS

When Doug retired from his position as Chief in 1981, he continued his association with CSIRO as an Honorary Fellow. He became a crusader for biological control, particularly in the Pacific and South-east Asian nations. His lifelong commitment to the biological control of pests and weeds was stimulated by the many Pacific people he met in October 1982 in the Kingdom of Tonga, while attending a Sub-Regional Training Workshop. Sponsored by several agencies, this Workshop was the first of two in Tonga that had a major impact on biological control of pests and weeds in the region. Doug presented two papers at this Workshop, on the need to increase awareness of biological control in the Pacific and on the use of pheromones, hormones, and genetic methods for controlling insect pests. Doug gained a considerable appreciation of the significance of entomological problems in the Region, and the need to prioritize future research.

In 1983, Doug began his association with the Australian Centre for International Agricultural Research (ACIAR) soon after its establishment (1982). Doug and colleagues from ACIAR visited China in 1984, a stimulus for several major collaborative initiatives with CSIRO Entomology including projects on biological control of codling moth and stem borers in poplars (with nematodes).

During the 1980s, interest in biological control developed throughout the Pacific. Doug began reviewing previous biological control projects in the Region and examining their relative rate of success, helped by colleagues and others that he contacted through the South Pacific Commission (SPC). He began preparing dossiers on potential targets, to identify biological control projects that were most likely to be effective in the Pacific, and help facilitate projects with expertise from Australian agencies. He circulated for comment drafts of his pest and weed evaluation sheets, each headed by the scientific and common names, and ranked on a scale of increasing importance (P, ? uncertain, +, ++, +++, *top 10) for each country.

After the workshop in Tonga in 1982, another workshop aimed specifically towards biological control was proposed by Doug. ACIAR adopted a proposal that it should take the lead, and with support from the Government of Tonga, ACIAR, and GTZ through its the Tongan-German Plant Protection Project, a *Workshop on Biological Control in the South Pacific* was subsequently held at the Vaini Agricultural Station, Tongatapu in October 1985. Doug compiled dossiers on the pests and weeds discussed at the workshop, and published them in 1987 in his first book in the series, *Biological Control: Pacific Prospects*, soon followed by Supplement 1. Both were co-authored with CSIRO colleague Dick Norris in 1989; Supplement 2 was published in 1993. Copies of the books were distributed by ACIAR to the relevant agricultural and forestry agencies and libraries in all countries of the Pacific region.

The first project compiled for a dossier, the biological control of passion fruit scale, *Pseudaulecaspis pentagona* (Targioni-Tozzetti), in Samoa (then Western Samoa), was seen by Doug to be relatively straight-forward because previous attempts to control this pest in other countries had been successful. The scale insect had attracted considerable research effort by GTZ entomologists in Samoa since 1984. Subsequently in 1987, ACIAR supported a collaborative project between Samoa and CSIRO Entomology, and thus began a series of successful biological control projects involving collaboration between Pacific countries and Australian scientists.

In 1988, Doug proposed a 'mega-project' Project entitled 'Biological Control in the Pacific,' comprising dossiers on several insect pests and their natural enemies: fruit piercing moths (*Eudocima fullonia* [Clerck]), leucaena psyllid (*Heteropsylla cubana* Crawford), banana aphid (*Pentalonia nigronervosa* Coquerel), banana weevil (*Cosmopolites sordidus* [Germar]), and banana skipper (*Erionota thrax* L.), and the weeds lantana (*Lantana camara* L.) and mimosa (*Mimosa invisa* Martius). This project involved scientists from CSIRO Entomology, Queensland Department of Lands (now De-

partment of Natural Resources), and NSW Department of Agriculture. The countries initially involved were Papua New Guinea, Tonga, Vanuatu, Western Samoa, Fiji, Solomon Islands, Niue, Cook Islands, and Kiribati. Support for work for some of these species had been received earlier from GTZ and AIDAB in the 1980s.

In 1991, Doug published *Guidelines for Biological Control Projects in the Pacific*, which provided short, simple summaries on methods for selecting projects, importing agents and conducting quarantine procedures, designing facilities, assessing an agent's safety, estimating host-specificity of agents, and handling conflicts of interest. This book was reprinted in 1998 and continues to be a very useful reference for biological control practitioners.

Doug frequently participated at conferences in the South Pacific and attended several workshops, including *Exotic Pests in the Pacific—Problems and Solutions*, held in Guam in 1990 and sponsored by the Pacific Science Association and University of Guam. At this workshop he proposed renewed attempts to control breadfruit fluted scale, *Icerya aegyptiaca* (Douglas), a major problem on central Pacific atolls. Doug prepared a dossier on the scale for a project involving CSIRO, Kiribati and Federated States of Micronesia (FSM) where the pest has persisted since its introduction during World War II. The scale was eventually controlled throughout the Pacific by an Australian predatory ladybird, *Rodolia limbata* Blackburn, originally collected from Darwin. It was especially effective when introduced into the FSM in 1994 and Kiribati in 1995. The predator was later introduced into the Marshall Islands and Palau.

Doug participated in publication of biological control work carried out in the Pacific. He and Agnes Vargo from American Samoa edited the papers from a plenary session in Beijing in 1992, for Supplement (4) of *Micronesica* in 1993, entitled *Biological Control of Exotic Pests in the Pacific*. This publication included biological control presentations from the northwestern Pacific as well as the southwestern islands.

Doug helped start a project on the Asian banana skipper, *E. thrax*, in Papua New Guinea (PNG), and he published a dossier on the pest in 1989. Doug considered this would be one of several “fast track” subprojects and his prediction for speedy control of this pest proved to be accurate. The Project by CSIRO and ACIAR began in 1988 and the exotic larval parasitoid *Cotesia erionotae* (Wilkinson) from Thailand was released in Port Moresby, PNG, in 1990. Following establishment of the parasitoid, the pest greatly declined in abundance, and since 1992, damage to bananas has no longer been of major importance. This project undoubtedly reduced the chances of the pest invading Australia. In 1999, Doug with co-authors Birri Dillon and David Vincent, re-visited the banana skipper project and analyzed the economic benefits of the project in Papua New Guinea (PNG) and Australia. They calculated that the net value of damage prevented by biological control of the pest would be \$424.7 million for both countries by the year 2020, a benefit-cost ratio of 607:1, and an internal rate of return of 190%.

In 1997, Doug published an important work on the invertebrate pests and weeds of agriculture and forestry in the southwestern Pacific. The book consisted mainly of tables listing all known Pacific pests, their common names, principal crops attacked, the countries of each pest's occurrence, and its importance. He similarly compiled data on the distribution and importance of weeds, and the distribution and importance of plantation trees and their pests.

In 1998, Doug and Don Sands began writing a book on the classical biological control of arthropods in Australia. An earlier publication by Wilson (1960) had covered pests and weeds of Australia and PNG but many projects had been carried out since in Australia, and summaries could not be obtained without extensive literature searches. They found that 98 pest species or groups of pests had been targets for biological control projects. Despite his progressing illness, Doug worked

with his usual energy and enthusiasm until the text reached its final stage in November 2000, when ACIAR began editing and formatting. He did not see the book published but he felt that the final text had achieved his objectives. *Classical Biological Control of Arthropods in Australia*, Doug's final work, was published by ACIAR in April 2001.

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