

Henry Robert Wallace 1924–2011

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Harry Wallace was born in Lancashire, England on 12 September 1924 and died at Murray Bridge, South Australia on 26 July 2011. He had a distinguished career, as a scientist at the University of Cambridge, Rothamsted Experimental Station and CSIRO's Division of Horticulture, and as Professor of Plant Pathology at the University of Adelaide. He was internationally recognised for his pioneering work on the movement of nematodes and for his work on the interactions between nematodes, the environment and the plant. He made a major contribution to Australian agriculture by providing a blueprint for research needed to understand cereal cyst nematode, which was a major pest that significantly reduced yield. The blueprint led to efficient methods of disease control.

The Man

Harry Wallace was a lovely person—kind, sympathetic, understanding. We came to know him well after he was appointed in 1971 to the chair of plant pathology at the Waite Agricultural Research Institute of the Faculty of Agricultural Science at the University of Adelaide. Normally there were about thirty postgraduate students in the department and most of them would have some troubles along the way—financial, marital, medical and so on. They would always go to Harry who gave them sympathy and, not infrequently, solved their problems. He also showed much compassion to academic staff going through personal crises and supported them until their problems were resolved. Once, he had to drive an overseas student to the airport to ensure that she boarded a plane to take her home. He was an enthusiastic participant in staff/student cricket matches, Christmas parties, and other departmental social occasions.

Perhaps my (AK) favourite story about Harry was when the plant pathology academics were invited to Government House for lunch. There was a visiting researcher in the department and he had been sponsored by the British Council; hence the invitation. The Governor was Sir Marcus Oliphant FAA and eight or nine male academics were present. At the table between the males were ladies-in-waiting. To make



conversation, Harry asked his neighbour how she got the job of lady-in-waiting. 'Well', she said, 'I trained as a nurse and things progressed from there'. 'That's interesting', says Harry, 'my sister is a nurse in the North-west Territories of Canada. All she seems to deal with are knife wounds and syphilis'. 'Oh' says the lady-in-waiting, 'Have some more avocado Professor'.

Harry was simply 'Prof.' to the students, post-doctoral fellows and technicians. He ran a happy

department in which people worked seriously but also had fun. This, and the affection we felt for him, is illustrated by the students' treatment of his birthdays. On one occasion, he arrived to find his office full of balloons and on another it was filled with crumpled up newspaper! Nothing seemed to faze him. He often joined students and others for a beer at a pub after work on Fridays, and actively joined in volleyball, cricket, soccer and other games that were played between staff and students and different departments on the Waite campus.

In summary, Harry Wallace was a kind, gracious, thoughtful man of great generosity and tolerance. He was a great teacher and a caring human being as well as an excellent communicator. This, together with his enthusiasm and insight, meant that he was much loved. He was a thinker who inspired generations of nematologists.

England

Family Background

Henry Robert ('Harry') Wallace was born on 12 September 1924 in Cleveleys, Lancashire, England, a small fishing town north of Blackpool. His father was Henry Harris Wallace, a graduate of Armstrong College, Durham, where he obtained his MSc in Physics. He became a senior physics master at Fleetwood Grammar School (now defunct), a position he held for forty years. Harry's mother was Cecelia Kitson Walker, who trained as a nurse and married Henry Wallace in 1923. Harry had one younger sister, Patricia, who trained as a nurse and emigrated to Canada.

Harry was always a keen naturalist. As a child, he had many collections of butterflies, birds' eggs, abandoned nests, beetles, jars of worms, even a small skull found on the beach. He loved camping holidays on a local farm where he would spend days in the field helping the farm hands. When he died there was still a collection of butterflies on his study wall.

Harry married Margaret Stevenson, a school teacher, on 10 August 1950. They had two daughters, Amanda and Sally.

Schooling

Harry attended infant and primary schools in Fleetwood, a nearby town, until he was eleven when he went to Fleetwood Grammar School

where his father was teaching. He studied physics, chemistry and mathematics as well as arts subjects, especially English literature, for which he had a great love. While he could not take biology—that was for girls—he retained his interest in the natural world. He finished sixth form in 1942 when the world was at war. He was too young to join the armed forces so he spent an extra year at school, in the upper sixth. He found it a very enlightening year, more like university than school. Harry finished as school captain and captain of rugby and cricket.

Royal Navy

In 1943, Harry decided to join up. He went to Preston, a nearby town, and volunteered for the army. They had enough soldiers and airmen but they wanted sailors so he finished up in the Royal Navy. He was chosen to train as an officer and spent some time at Rosyth on the Firth of Forth in Scotland. One of the officers on the training ship HMS *Dauntless* was Geoffrey Badger who was later appointed to the organic chemistry department of the University of Adelaide, and eventually became Vice-Chancellor of the university. Badger was also elected to the Australian Academy of Science and became its President.

Sub-Lieutenant Wallace served on an anti-submarine corvette that helped to protect convoys sailing to Murmansk in Russia. It also did escort duties in the English Channel. When the war ended, Harry was sent to Australia and put in charge of a ship on Sydney Harbour. He said it was more like a holiday than anything else and was probably a factor that influenced his decision to emigrate to Australia several years later.

Just before he was demobilized in 1946, Harry spent four months in Colombo, Ceylon (now Sri Lanka) at a naval shore base and was appointed baggage officer. He returned to England as a passenger on an aircraft carrier and straight away enrolled at the University of Liverpool.

University

Now Harry had an opportunity to study biology. He enrolled in the Zoology Department and in his first year studied zoology, botany, chemistry and physics. In his second and third years, he studied zoology and botany, thus completing an ordinary

science degree. In his fourth year he took Honours in Zoology. After graduating, he looked for a job and was offered one with the Government's Forest Management Department. However, he changed his mind and enrolled for a PhD in Entomology instead. At that time, the University of Liverpool was one of those places where postgraduate students were left very much on their own with minimal supervision. He chose an ecology field project—the ecology of insects on tree stumps. Starting with newly felled trees, he studied the succession of insects that broke down wood. He amassed a lot of data, described several insects and was able to work out the relationship between them. This work was published in the *Journal of Animal Ecology* (3) and has since been cited by other workers on 44 occasions, an indication of its significance. Two insects he studied in some detail and published the results in *Proceedings of the Royal Entomological Society of London* (2, 5). One was a wood-boring beetle that produced witchetty-like grubs in the stumps. He worked out its life history and the impact it had on the destruction of the wood. The other was a bug with sucking mouthparts. Its life history was also established. He got no help from supervisors and although he flourished in this situation, in later years he did query the wisdom of this approach to postgraduate studies.

After graduating, Harry applied for several jobs and went to twelve interviews that were unsuccessful. After interview thirteen, however, he was offered a position as Research Scientist in the Department of Agriculture at the University of Cambridge. The position was for a nematologist, not an entomologist. He remained a nematologist for the rest of his working life.

Cambridge and Rothamsted

The appointment at Cambridge was for a limited term and Harry was there for three years, 1952–5. He worked with Fred Jones on nematode problems in sugar beet, studying seasonal emergence and the effects of soil structure, particularly aeration, on hatching in *Heterodera schachtii*, the beet eelworm. After three years, Jones was appointed head of the Nematology Department at Rothamsted Experimental Station (as it was then known) and invited Harry to join him there. At that time, Rothamsted was one of the world's leading agricultural research centres.

Whilst at Cambridge, Harry had extensive discussions with Sir James Gray, Professor of Zoology, who was an authority on animal locomotion and who was important in the development of experimental zoology. This led to his work on movement of nematodes. At both Cambridge and Rothamsted, Harry studied the behaviour of nematodes in soil in co-operation with soil physicists. He asked, how do nematodes move in soil? His classic research in this period led to the publication of more than twenty papers in which he examined the effects of soil particle size, soil moisture, temperature and oxygen on the movement in soil of juvenile *Heterodera schachtii*, *Ditylenchus dipsaci* and *Aphelenchoides ritzemabosi*. He also examined the relationship between nematode length, soil pore size and movement. Three of these papers (4, 8 and 60, the last with E. M. Reed)) were published in *Nature*. Understanding these factors helped to explain how nematodes are able to invade and damage plants. However, Harry also continued to investigate the effects of their environment on the hatching and infectivity of juveniles, including their attraction to roots, particularly in *Heterodera* spp. and *Ditylenchus dipsaci*. He worked collaboratively with Audrey Shepherd (61) on invasion of the host plant by *H. schachtii* and *H. gottingiana*, with C. C. Doncaster he compared animal and plant parasitic nematodes (28), and with Jack Hesling he investigated the behavioural phenomena in the host-parasite relationship of *A. ritzemabosi* (56). At Rothamsted he also supervised Cliff Blake's PhD project on *Ditylenchus*. Years later, Cliff was appointed Vice-Chancellor at the University of Adelaide.

In 1961, Harry was awarded a DSc by the University of Liverpool on the basis of published work submitted.

Harry's first book, *The Biology of Plant Parasitic Nematodes*, was published by Edward Arnold in 1963, and summarizes his ideas on nematode movement and on the behaviour of plant parasitic forms. It is a model for good science communication.

Harry was at Rothamsted as Principal Research Scientist for eight years. While there, he was visited by W. P. ('Buddy') Rogers FAA, professor of zoology at the University of Adelaide. Rogers was also a nematologist, studying animal not plant parasites, who had previously

worked for CSIRO. He asked Harry if he had ever thought of migrating to Australia. As Harry had enjoyed his time in Sydney after the war, he was interested. Rogers was aware that there was concern at the level of the CSIRO Executive and elsewhere within the Organisation that nematodes were probably a major factor limiting Australian crop production. Max Sauer (CSIRO, Merbein) had shown that root-knot nematodes were devastating replanted vineyards. In addition, after spending time overseas on a CSIRO overseas scholarship, the nematologist Alan Bird had been sent to the Waite Agricultural Research Institute, retained because CSIRO was questioning the importance of nematodes. John Possingham, Chief of CSIRO's new Division of Horticulture, was directed by the Executive to appoint Harry. It seemed logical to employ him since he was known to be 'on the market', to see whether CSIRO should take a serious interest in research into plant nematodes. Indeed, when Max Day (CSIRO Entomology) joined the CSIRO Executive, he wanted to create a Division of Nematology for Harry but failed to find the funding for this (J. Possingham, pers. com.).

Harry was appointed to the position of Chief Research Scientist. He did investigate the possibility of taking three years' leave without pay from Rothamsted in case things did not work out in Australia but the then Director of Rothamsted, Fred Bawden, would have none of it. Harry and Margaret and their two small daughters travelled to Australia on the *Oronsay*, one of the P&O liners.

Australia

CSIRO Division of Horticulture

This was a new Division of CSIRO located in Adelaide, and the laboratories were not quite ready for occupation when Harry arrived in 1963. He was therefore located temporarily in the Zoology Department of the University of Adelaide with Professor H. G. Andrewartha FAA and Rogers. Andrewartha was a keen tennis player and played every weekend on his private tennis court. He invited Harry to join the group which he did and played there for many years; they became close friends. Andrewartha had controversial theories on the ecology of animal populations and no doubt would have discussed these with Harry, although it is not clear how his

ideas influenced Harry's later work on nematode populations.

The CSIRO laboratories were finished after six months and Harry moved to the Waite campus at Urrbrae where the Division of Horticulture was located. The Chief of Division was John Possingham, a plant physiologist who went out of his way to help Harry and his family to settle in. Possingham found Harry a very friendly and able associate, always cheerful and co-operative. Harry became Deputy Chief and took over when Possingham was absent. Alan Bird, also a prominent nematologist, was already working in the Division, and they published a paper (53) and a review (54) together. Harry was with CSIRO for eight years.

At CSIRO, Harry concentrated his efforts on the root-knot nematode *Meloidogyne javanica* and continued his work on environmental factors affecting movement of infective juveniles, studying the development, hatching and survival of eggs. He also became interested in factors affecting reproduction of *M. javanica*, and the effects of the nematode on its hosts. Seymour Van Gundy (University of California, Riverside) spent a sabbatical with Harry Wallace and Alan Bird in 1966 and collaborated with them on a study of aging and starvation in juveniles of *M. javanica* and *Tylenchulus semipenetrans* (67).

In 1965, Harry published a review paper (30) that was important in crystallizing ideas about the direction to be taken for research on the cereal cyst nematode (CCN), *H. avenae*. At the time, CCN was a serious problem on cereal crops throughout southern Australia. Harry's paper set out the issues to be resolved before growers could be provided with 'recommendations based on scientific facts relevant to Australian conditions'. The ten key research topics he listed were: (i) the distribution of the nematode in Australia, especially in areas outside South Australia and Victoria; (ii) an estimate of losses in yields; (iii) the influence of environmental conditions on survival, dormancy, hatching, infection and population increase in relation to the Australian climate; (iv) the factors in different soil types affecting distribution and abundance; (v) the taxonomic status of Australian populations of *H. avenae* and whether different races existed; (vi) host preferences of different populations and races; (vii) changes in population density with

season, soil type and crop locality; (viii) the relationship between crop damage and nematode population density under different environmental conditions; (ix) the testing of wheat varieties for resistance to the nematode; and (x) the use of nematicides in badly-infested areas. It is a tribute to his insight that within two years of arriving in Australia and having had no previous experience with CCN, he was able to present such an astute plan of action. All of Harry's suggestions were acted upon and CCN is now managed through a combination of resistant and tolerant varieties and crop rotation.

The 1960s were 'golden years' for plant nematology. Chemical nematicides developed in the post-war period increased awareness of the importance of nematodes as crop pests and many nematological research and teaching positions were established, particularly in North America and Europe. Although Harry was relatively isolated in Australia, he was at the forefront of the new discipline and was known and respected around the world.

Professor of Plant Pathology, University of Adelaide

The Chair of Plant Pathology at the University of Adelaide became vacant in 1971 when the former incumbent Noel Flentje was appointed Deputy Vice-Chancellor of the university. Harry really wanted to be associated with students and that was probably a major factor in his decision to apply for the chair. He was appointed, joining another plant nematologist, John Fisher, at the university. This was a period when Adelaide was a major centre for nematological work, with Alan Bird in CSIRO, W. P. Rogers in the Department of Entomology, 'Slim' Somerville in the Department of Zoology, Harry and John Fisher at the Waite, and associated post-graduate students.

Harry was an outstanding success as Professor and Head of Department. He did everything he could to enable and encourage staff and students to do research with minimum administrative chores; he did all the administration. Harry Wallace was a particularly able administrator. On most days, his desk was cleared by lunch-time and the door to his office was then opened—a signal to everyone that he was available for advice and discussions. In this way, he

helped and influenced countless people, including undergraduate and postgraduate students and academics. Even Sir Thomas Playford, former Premier of South Australia, dropped in to discuss disease problems in his cherry orchard. It was really a very happy department.

Harry also provided generous support to Professor Jim Quirk FAA, who was Director of the Waite Agricultural Research Institute where the Department was located. Again, Harry was acting Director and took over when Quirk was absent. For two years, he was Chairman of the Education Committee, the highest academic committee in the University of Adelaide. It was not an easy job because there was considerable tension between Waite Institute staff and those at the main campus on North Terrace, largely due to the fact that academic staff at the Waite had much lighter teaching loads and were able to do more research. In addition, promotions and research grants were largely determined by number and quality of publications. Harry's calming influence was a great asset.

He gave practical support to Alan Dube's group in the South Australian Department of Agriculture (later SARDI), providing space in the Hannaford building (also known as the departmental field laboratory) on the Waite campus. Without this support, Dube's group could not have developed in the way it did, delivering significant contributions to South Australia and to Australian agriculture through work on CCN, the seed-gall nematode *Anguina*, and later the root-lesion nematode *Pratylenchus*.

Harry continued to do research but because of his heavy administrative duties he was given a personal research assistant, Frances Reay. She was a nematode taxonomist and travelled widely in Australia collecting material. With Frances, Harry investigated the susceptibility to and effects of *M. javanica* on various native plants (65) and investigated the biodiversity of nematodes associated with the Australian bush (66). Frances described many new species (including *Hemicycliophora wallacei*, named after Harry), with a particular focus on criconematid nematodes.

Harry's appointment to the Chair of Plant Pathology meant he had to contribute to undergraduate teaching. He was a practical and innovative lecturer, and many undergraduates will remember the piece of ribbed vacuum hose that

he used to illustrate how nematodes move. It also meant an increased administrative load and hence less personal time for research, but the positive side was that he had PhD students and could broaden his research interests. Harry continued his work on root-knot nematode and its effects on photosynthesis and nutrient demand in host plants. With Saria Meon, he investigated the physiological effects of infection with *M. javanica* on tomato plants (58, 59), and compared them with those of infection with *Agrobacterium*. With Sitepu, he attempted to diagnose the multiple causes of retarded growth in an apple orchard (62). This was followed by a major study with Brian Stynes (64, 65) that involved the use of a synoptic approach to assess the relative importance of various environmental factors on the growth and yield of plants. With Greg Walker (69) and Joe Kimpinski (57) he examined interactions between nematodes, environmental factors and host plants; and with Gordon Grandison (55) and Anthony Smith (63) he investigated the distribution and abundance of the root-rot nematode *Pratylenchus* and the spiral nematode *Helicotylenchus*. With Jackie Nobbs, he investigated the biodiversity of nematodes in desert soils in Australia.

The individual projects of the postgraduate students were usually quite separate from Harry's special area of interest. Harry was a multi-factorial man—that is, he believed that any disease problem was influenced by several factors. He and I (AK) had mild disagreements about this. My approach was always analytical, breaking things down, whereas Harry was building them up. Our disagreements were never acrimonious and never interfered with our research. He encouraged his students to take the holistic approach. Some became highly competent in statistics and were able to identify the most important factors that influenced disease incidence. Another area of mild disagreement between Harry and me was the philosophy of science of Karl Popper. Harry was a disciple whereas I had my doubts.

Other Activities

One of Harry's great strengths was his ability to write with clarity and enthusiasm. He was able to integrate, to summarize effectively, to examine critically and to review large amounts of information. His first book, *The Biology of Plant*

Parasitic Nematodes (1963) was based on his studies of cyst nematodes in England during the 1950s and examined the effects of factors such as soil structure, soil moisture, temperature and aeration on hatch and nematode motility. This work was essential to understanding of the ecology of free-living and plant-parasitic soil nematodes, both for Harry and for others working in the field. His ideas on many aspects of plant nematology gradually evolved as he came to recognize the ecological complexity of cropping systems. Since nematodes were only one of many factors contributing to plant disease, his later papers considered the effects of nematode/environment interactions on the reproduction of *M. javanica* and on the growth of the host plant (38, 40, 43). From these studies he concluded that, in a given ecological situation, nematode numbers and environmental factors affected nematode reproduction but host tolerance and numerous environmental stresses influenced the response of the plant to nematode attack.

This theme was expanded in *Nematode Ecology and Plant Disease* (1973), which should remain required reading for any student of plant nematology. In this work, Harry outlined the various ways that nematodes caused damage to plants, considered the way plants responded to nematode infection and discussed the environmental factors that influence both nematodes and their hosts. He pointed out that disease problems in the field were complex, that nematodes were only one of many factors (both biotic and abiotic) contributing to the problem, and suggested that a multidisciplinary approach was needed when diagnosing diseases and developing strategies to reduce losses caused by a disease. Later papers with Brian Stynes (64, 65) provide a detailed example of the use of such an approach to determine the relative importance of various environmental factors on the growth and yield of wheat in South Australia.

Harry contributed chapters to three books (42, 46, 49), and was also invited to write three review papers for the *Annual Review of Phytopathology* (36, 47, 52). This is a measure of the respect he was given by his peers in plant pathology.

Retirement

Harry retired in 1989. He had had enough of nematology and plant pathology but retained a

keen interest in ecology. He busied himself with environmental matters and became very concerned at the condition of the lower Murray River. His concerns were particularly related to the natural wetland system at the mouth of the river known as the Coorong. This is a scenically beautiful region, of great cultural significance to the Aboriginal people and an important habitat for many animals and waterbirds. Harry and his wife Margaret became founding members of the Friends of the Coorong. They used to travel down from Adelaide to the Coorong and go bushwalking. They became so involved that they bought a house in Meningie, a small town on the banks of Lake Albert, where they lived for six years. Harry became a committee member (1990–4) and President (1994–7) of the Friends of the Coorong. He collated a herbarium for the Coorong region that won the South Australian Department of the Environment's Best Public Education Award in 1996. He was also an active member of the Friends of the Parks Inc., which supported South Australia's National Parks. He served as a member of various government committees including the Upper South-East Water Conservation and Drainage Advisory Committee (1996), the Coorong National Park Community Reference Group (2006), and the Coorong Consultative Committee (member 1992–2005, Chairperson 1996–2004). Thus for many years after retirement, Harry was closely involved with the environment and conservation. His last home was in a retirement village in Murray Bridge, South Australia, not far from the Murray River.

Recreation

Harry was a keen sportsman (Figure 1). In his youth he played rugby, cricket and tennis; his tennis-playing continued for many years. Although Harry always seemed calm and even-tempered, we are told that his character changed on a tennis court when he became hard-hitting and aggressive. He used to be an enthusiastic pipe-smoker but when the dangers of smoking became apparent, he gave that up and started long-distance running. He once told his daughter Amanda that he thought his greatest achievement in life had been to run a marathon at the age of 61 and again the following year. We disagree with that assessment; but it was undoubtedly a magnificent achievement.



Figure 1. Harry Wallace—'Captain' (November 1973).

Professional Activities and Honours

In 1975, Harry Wallace was elected to the Fellowship of the Australian Academy of Science. He served on the Council of the Academy, 1978–81.

Harry was a member of the Australasian Plant Pathology Society and its President in 1971. He was also a member of the (American) Society of Nematologists and was awarded honorary life membership in 1973. He was President of the Medical Sciences Club of South Australia, which publishes the *Australian Journal of Experimental Biology and Medical Science*.

In addition, Harry was an advisory editor for the international journal, *Nematologica*. He served as an adviser to the Food and Agricultural Organization of the United Nations on integrated control of pests. Harry was also chair of the Flora and Fauna Handbooks Committee of South Australia.

Finally

Harry Wallace began his work in plant nematology at a time when awareness of nematodes and

the damage they could cause to plants had been raised by the availability and use of nematicides in the 1940s. In addition, the first comprehensive textbook on plant and soil nematodes had been published by the Chitwoods in 1950. The 1950s and 1960s were a period when there was great interest in nematology, and Harry was at the forefront of the pioneering nematologists of this time, particularly in his work on nematode movement. The numbers of times a work is cited by other scientists can be used as an indication of the originality and importance of a publication, and the citation of Harry's papers is impressive given the small size of the nematology discipline. Harry's comprehensive analysis of the research needed to understand the biology of cereal cyst nematode provided a blueprint for the work that led to control of this serious pest, and resulted in significant yield increases for Australian grain growers via the development of cereal varieties with both resistance and tolerance to the nematode. The economic benefits that flowed from this to farmers and to the Australian economy have not been estimated but are obviously very substantial, given the increase in size of the industry since the 1980s. Harry will be remembered for his research publications, including his pioneering work on nematode locomotion. Harry's influence and practical, down-to-earth advice would have been invaluable to the many committees on which he served. He also provided advice and encouragement to the many nematologists and other plant pathologists who worked under his leadership, and was a mentor for many students. Most of the people now prominent in nematology in Australia began in Adelaide, and were influenced by 'Prof'. However, his friends and colleagues especially remember him for his humanity and compassion.

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