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Douglas J. Williams at 100—an appreciation

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FIGURE 1. Photograph of Doug Williams taken by a professional photographer in the early 1990s.

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Introduction

It is our privilege to recognise the remarkable contributions of Dr Douglas J. Williams to the field of coccidology (Hemiptera: Coccomorpha) in this, the year of his 100th birthday. However, this is not the first time that he has been acknowledged as a major contributor to the field. At the banquet of the VIIth International Symposium of Scale Insect Studies in 1994, to celebrate his 70th birthday, a presentation was given touting him as "the modern guru of coccidology" (Miller & Watson 1995). The purpose of the current paper is to move forward from 1994 with additional productivity statistics, to summarise the impact of his research, and to provide an opportunity for those who have benefitted from his research, knowledge, and assistance to explain how he has helped their careers and stimulated our interest in scale insects.

Before enrolling for a degree in agriculture, Doug served four years in the British Royal Navy working on radar. He has always been grateful to his supervisor for suggesting that he worked on scale insects for his Ph.D. thesis. After receiving his Ph.D. in 1952, Doug was hired by the Commonwealth Institute of Entomology (CIE) (later International Institute of Entomology, then CAB International or CABI) to work on scale insects. Wilfred J. Hall was the Director of the Institute and Doug was his replacement as the coccidologist. He was asked by J.P. Doncaster to curate the scale-insect collection. At that time, the British Museum (Natural History) contained separate collections compiled by the Natural History Museum, the Commonwealth Institute, Green, Newstead, Hall, and Donisthorpe. Doug merged all these collections, updated the nomenclature, and within each species sorted the specimens into colour-coded zoogeographical regions. He also takes great pride in the extensive coccidology literature library that he compiled, with bound sets of reprints for the most important authors.

In the early years of his career, Doug's primary responsibility was to identify specimens sent to CIE. This put him in a unique position because clients submitted thousands of specimens annually from diverse geographic locations and from all families of scale insects. He has often stated that the best way to understand a group is to be charged with the responsibility of identifying them. Doug had an insatiable curiosity about what would come to his desk next and he was excited about the new things that he discovered.

Even with one of the best reference collections in the world, the task of making identifications was difficult because most of the known species had been inadequately described, often in small papers that were difficult to locate or even know about. One of Doug's first research tasks was to redescribe as many of these species as possible. It is important to understand that research was not his primary responsibility. The prime motivation for publishing his findings was, and continues to be, his interest in helping others. Although Doug has comprehensive knowledge of scale insects in general and has written papers on most of the scale-insect families, his first love is the mealybugs (Pseudococcidae); he has published 103 papers on members of that family.

Although Doug did not redescribe all of the species known up to the 1950s and 1960s, he published on many of them and made redescriptions an integral part of his research programme; examples include species described by Maskell, Newstead, Cockerell, Green, Hall, Laing and Strickland (Williams 1958a, 1958b). After gaining a reasonable understanding of the described species, he needed to deal with the undescribed taxa that frequently came to him, especially from agricultural systems. Initially he attempted to assist researchers working in specific crop systems by publishing studies on the mealybugs of rice, sorghum, wheat, and coffee. He then broadened his research products to cover various parts of the world, beginning with the mealybugs of Australia (Williams 1985), followed by the three-volume work on the scale insects of the tropical South Pacific region with the assistance of Gillian Watson (Williams & Watson 1988a, 1988b, 1990); and the mealybugs of Central and South America with the assistance of Cristina Granara de Willink (Williams & Granara de Willink 1992). Most recently, he published yet another comprehensive book on the mealybugs of southern Asia (Williams 2004).

In addition to having the necessary knowledge and technical expertise, undertaking any one of these projects required extraordinary stamina and dedication to fulfil Doug's life-long mission to make major contributions to the science of coccidology. He travelled to many parts of the world to examine mealybug specimens in collections, especially type specimens. He also prepared many of the specimens on microscope slides; prepared amazingly detailed illustrations manually; described the character states important for the separation of species, genera and families; formulated identification tools such as keys; and prepared introductory sections on economic importance, morphology, and distribution. Doug also faced the sometimes-difficult task of making decisions about the significance of morphological variation. For many, this is too much to ask, but for Doug it was just plain fun.

Doug's research interests were not restricted to geographic compilations; he frequently undertook and completed monographic treatises on certain genera and even families that were often of agricultural importance,

including *Contigaspis* MacGillivray (Borchsenius & Williams 1963), *Lindingaspis* MacGillivray (Williams 1963), *Rastrococcus* Ferris (Williams 1986, 1989), Micrococcidae Silvestri (Miller & Williams 1995), Cerococcidae Balachowsky (Hodgson & Williams 2016), and *Paralecanium* Cockerell (Hodgson & Williams 2018). He is also very knowledgeable on nomenclatural issues and has written petitions to the International Commission on Zoological Nomenclature and assisted others in formulating names for new taxa. His paper on the scale insects described by Linnaeus solved many nomenclatural problems that had long plagued Coccomorpha research (Williams 2007). He and Giuseppina Pellizzari put considerable effort into making sure that the names of scale insects are consistent with the International Code of Zoological Nomenclature (Williams 2011; Pellizzari & Williams 2013; Favret *et al*. 2014; Williams & Pellizzari 2014).

Protecting agriculture from scale-insect pests has been an important area of Doug's concern. Some of the more noteworthy projects were discovering diagnostic character states that were critical in distinguishing the mango mealybug (*Rastrococcus invadens* Williams) and the papaya mealybug (*Paracoccus marginatus* Williams & Granara de Willink) from similar congeneric species (Williams 1986; Williams & Granara de Willink 1992). Mango mealybug is an invasive Asian species that became a serious pest of many fruit trees in Africa in the 1970s and is still spreading (FAO 2024); it causes losses of up to 90% of mango fruit, and up to 53% of citrus yield (Neuenschwander 2003). Initially the species was being misidentified, which misdirected the search for species-specific parasitoid wasps for use in classical biological control. Eventually, Doug described the species as new and predicted the most likely area to find control agents; the species is now under successful management.

The papaya mealybug, *Paracoccus marginatus,* a pest of tropical fruit trees, was described in a book that was written because another invasive Neotropical species, *Phenacoccus manihoti* Matile-Ferrero, the cassava mealybug (Matile-Ferrero 1977), decimated the staple food of millions of people in Africa in the 1970s. Cassava mealybug was eventually recognised to have originated from South America and, because of concern that more unknown Neotropical mealybugs might become invasive, funding was provided to Doug to research and write a comprehensive book on the mealybugs of Central and South America. Since that time, the fears of more Neotropical species becoming invasive have come true. *Paracoccus marginatus* was initially described in 1992, when it was known only in Mexico where it was not a pest; however, in about 2000, it spread to islands in the Caribbean and became invasive (Miller *et al.* 2001). Papaya mealybug is now widespread and wherever it is introduced it often reaches pest status, particularly on fruit trees (although it also attacks cassava and vegetables). However, because of Williams & Granara de Willink's (1992) book on the mealybugs of Central and South America, its identity and area of origin were already known so its natural enemies were quickly discovered and successful biological control implemented.

Both the cassava and papaya mealybugs have since spread to parts of Southeast Asia and Australasia, where the same biological control agents have been used to reduce their impact on cassava, papaya and vegetable crops on both smallholder and large-scale farms. Cassava (*Manihot esculenta* Crantz) is the sixth most important crop worldwide in terms of global annual production; it is an important staple for more than 800 million people, mostly in sub-Saharan Africa, but also in other parts of Africa, Asia, the Pacific and South America. It is a particularly important staple and cash crop, as it can be grown in dry soils with low fertility in tropical and subtropical areas and harvested when needed (not only at the end of the growing season). Cassava thus provides a food reserve in times of war and famine, so is becoming increasingly important for food security during a period of climate change (Burns *et al*. 2010; Watson 2019). The biological control agents used to control these pests continue to contribute to the food security of affected countries, saving many lives during the droughts that are happening with increasing frequency.

During Doug's career, he has published 246 papers and books comprising more than 6,000 pages. He has provided descriptions and illustrations of 686 new species and 95 new genera; see Table 1 for more productivity data. He has been a co-author with 85 collaborators and has visited collections in more than 20 countries. Doug's productivity would have been even greater had he not become severely sight-impaired in about 2006, which caused him to give up illustrating scale insects and become dependent on a magnifying glass to continue his research, at an ever-reducing pace. Amazingly, he published a paper in February 2024, not long after his 100th birthday (Williams & Denno 2024).

His impact has not gone unnoticed. Some of the accolades to Doug include the following. He has been recognised by 27 colleagues from 12 different countries, who have named 21 species and one genus in his honour. He was awarded a degree of Doctor of Science (D.Sc.) by the University of Newcastle in 1980. He was elected a Fellow of the Institute of Biological Sciences, U.K., in 1978; made a Scientific Associate of The Natural History Museum,

U.K., in 1988, after his retirement from CAB International (as it was then called); and a Correspondant du Muséum national d'Histoire naturelle, France, in 1999. Additionally, he received two substantial grants to research and write comprehensive books on the scale insects of the tropical South Pacific and on the mealybugs of Central and South America.

Doug has been an inspiration and/or mentor to many people. He has particularly gone out of his way to assist those in the early stages of studying this fascinating group of insects. We have asked several individuals to write about their experiences working with him, as well as a few people to contribute who have never met him, but have used the results of his work in their research and identifications. We had difficulty in limiting the number of testimonials, but the number of pages was restrictive. It is a testament to his impact that so many wanted to participate.

TABLE 1. Productivity of Douglas J. Williams in 10-year increments.

Date	Papers/year	Pages/year	Genera/year	Species/year
1953−1962	1.9	30	1.1	4.8
1963−1972	2.3	29	1.2	2.6
1973−1982	2.2	19	0.4	1.1
1983−1992	4.9	230	4.1	29.9
1993−2002	4.4	78	1.3	6.6
2003−2012	6.2	153.6	0.8	19.2
2013−2022	3.2	60.6	0.6	4.7
2023−2024	0.5	3	0	0

PERSONAL THOUGHTS AND EXPERIENCES

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The geographical proximity of our two institutions, the Natural History Museum in London (NHM) and the Muséum national d'Histoire naturelle in Paris (MNHN), gave me the opportunity to meet Doug Williams and learn about the important collections of this prestigious institution. Doug showed great empathy towards me, which immediately put me at ease and enabled me to discuss with him all the coccidological concerns of the young beginner that I was, in addition, of course, to all the knowledge that Alfred Serge Balachowsky had already passed on to me. We developed a great friendship in the 1960s, and during my visits to the British Museum, Doug invited me to stay at his home. Each day, we left very early in the morning so that he would be sure of finding a parking space for his car at the NHM. These journeys were very good opportunities for me to listen to him and enrich myself with his knowledge. A tireless worker, Doug had his microscope installed in his living room and every evening he would tirelessly illustrate scale insects, while keeping his wife Diana company. His talent for illustrating the morphological characters of scale insects always impresses me, and it is his publications devoted to describing new species of scale insects, mainly Pseudococcidae, Diaspididae and Coccidae, that are permanently on my desk. In 1977, Doug and I were invited to participate in the "International workshop on the cassava mealybug" held in Zaire and, with extreme generosity, Doug gave me priority to describe the undescribed mealybug pest on cassava, *Phenacoccus manihoti* Matile-Ferrero. Following this study trip, Doug and I went to Ibadan, Nigeria, to visit the International Institute of Tropical Agriculture (IITA), that important centre for applied research. Our collaboration intensified and we published 21 articles between 1994 and 2020. After his retirement, Doug, in turn, came regularly to visit us at the MNHN, meeting, among others, his great friend Raymond Mamet, a Mauritian coccidologist who left his island permanently in 1977 to live near Paris with his daughter. I am grateful to Louisie Mamet, who has provided a photograph of the "Visit of the Commonwealth entomologists to the pest infestation laboratory, July 1954", where we see Raymond and Doug, side by side, on the right side of the picture (Fig. 2). Doug embodies the legendary British calm, always even-tempered and with a lot of humour which he shared especially with my husband Loïc

Matile, a dipterist: "…Loïc was a great friend for many years. I have happy memories of long discussions with him on a wide variety of subjects. Loïc's remarkable command of the English language helped in many ways." (Williams 2001).

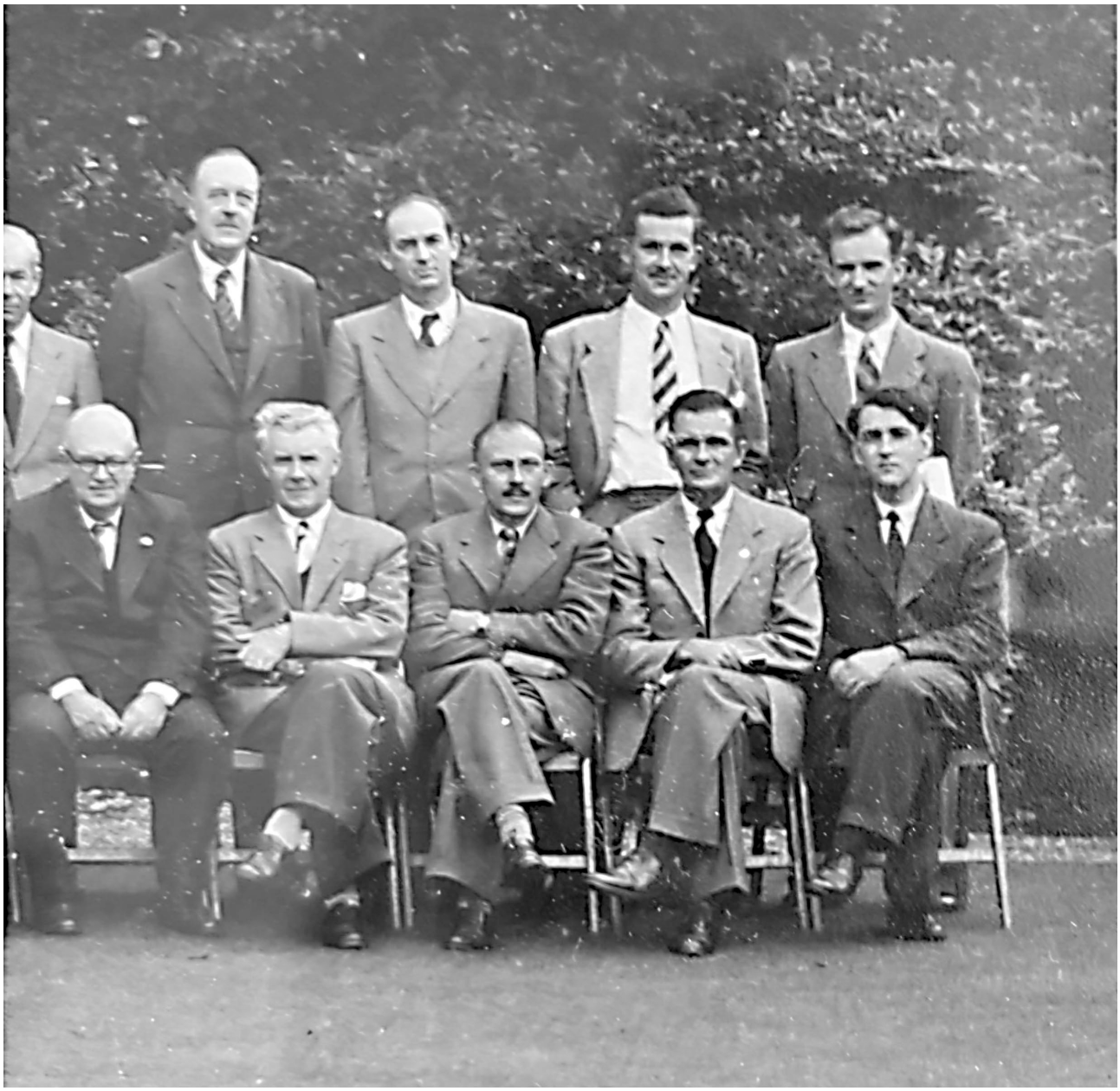

FIGURE 2. Part of a group of Commonwealth entomologists visiting the Pest Infestation Laboratory, Slough, UK, July 1954. Dr Raymond Mamet and Doug Williams are in the front row on the right [Photograph provided by Louisie Mamet].

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When Dr Williams invited me to participate in the Central and South American Mealybugs project, it was a great surprise, but difficult for me. At that time, I had 4 children and that was a problem for my family but, at the same time, it was a great opportunity for me to strengthen my career and perhaps also for my husband (a biologist too), who was trained in the field of biological control. Fortunately, thanks to Douglas' arrangements, everything was resolved favourably: schools were found for the 3 teenagers and the little one (who was in first grade), and a possible internship for my husband at the Commonwealth Institute of Biological Control. So, after a few months I arrived in

London, very afraid but eager to work. Doug and Diana made everything easy for my work at the Museum and for my family life, for which I will be eternally grateful.

The first genus I worked with was *Rhizoecus*. I think it was my litmus test and my recurring dreams for a long time. When the revision of the genus was finished (separating the slides from all the collections, identifying the 50 species and illustrating 30 of them), we went to a laboratory that no one used and laid out the illustrations, in groups according to the characters; I showed him the species key for the region (written in Spanish) and, after some corrections, Doug's "Good Cristina" was a joy. From there on, all the other genera seemed so easy! …. Being able to study such a collection, all the material that passed under my gaze, under Dr Williams' supervision, gave me security and confidence.

Many know that my command of the English language is a disaster, so there are several anecdotes from that time that have brought more than a smile to Dr Williams—I hope he remembers those occasions.

But the important thing now is to tell Dr Williams that the two years we spent in London were unforgettable for me and my family. He was very generous with his knowledge and let me work freely. The scale insect families that I studied when I returned to Argentina were because of his wise advice: study large groups, particularly starting with the Coccidae, which needed revision. Perhaps most importantly—and a sign of his great generosity—he obtained permission for me to borrow slides from the various Museums in Argentina of the species that we could not study during the two years of the Project, so that I could continue with the research. He also dedicated a species of *Phenacoccus* to my son Adrian who passed away a few years ago.

Douglas, it gives me great satisfaction to know that you are 100 years old!!!! **One hundred years well lived!!!!**

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I started studying scale insects in 1989 when I joined the laboratory of Tropical Plant Protection, Department of International Agricultural Development, at Tokyo University of Agriculture under the supervision of Dr. Shozo Kawai. For my Masters' thesis (1994–1996), I worked on the scale insects on mango worldwide, for which I travelled to several mango-producing countries. Doug's books on the mealybugs of Central and South America co-authored with Maria Cristina Granara de Willink and his three-volume treatise on the scale insects of the Tropical South Pacific Region co-authored with Gillian Watson were fundamental for my work. When I contacted Doug about mealybugs of the genus *Rastrococcus* which I had collected on mango, he kindly sent me copies of his beautiful line drawings and an easy-to-use key to species. Since the start of my career as a coccidologist, Doug has been a role model. He has always been available for discussions and will answer any questions related to scale insects, which he did when he visited our lab at UC Davis in 2007 (Figs 3 and 4). Doug is a rich source of knowledge, not only on the morphology of scale insects but also on the life histories of many of the species. I have had the pleasure of co-authoring several papers with Doug including a review on Coccidology, a redescription of the tuliptree scale, *Toumeyella liriodendri* and on the breadfruit mealybug, *Icerya aegyptiaca* in the Ryukyu Archipelago, Japan. When redescribing the tuliptree scale, Doug advised me to draw the detailed distribution of the various pores and ducts, which are sometimes only partially illustrated by some workers. Since then, I have followed his advice throughout my career.

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Doug often visited our laboratory in MNHN Paris, and we were happy to take a coffee together each morning. This was a very good moment for me and we discussed many diverse subjects but principally scale insects. Day after day, I discovered his fantastic knowledge on scale insects as he explained everything with his natural style and courtesy of a true British gentleman. I was very happy to talk with him and I offered him coffee and a fine Parisien

pastry every morning, which he much appreciated, to prolong our coffee time! At that time, I was working on the ultrastructure of scale insects and Doug drew my attention to some morphological structures that were likely to be useful for taxonomic coccidologists and he was very interested to discover the true structure and function of each structure. I have always been impressed by his human and professional qualities and I have loved meeting him. Congratulations on reaching 100 years of age!

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Dr Doug Williams is my teacher and a good lifelong friend: when I was a M.Sc. graduate student, I decided to do my thesis on the taxonomy of scale insects. So, I searched for the names of experts in the field of scale insects and sent letters to them. Unbelievably, Dr Williams answered my letter and gave me some excellent advice. At the time, I was working at the Iranian Research Institute of Plant Protection (IRIPP) and had the opportunity to invite experts from abroad to visit Iran, so my Institute invited Dr Williams. He accepted and came to Iran for two weeks in 1999. During his stay, he taught me the basic principles of identifying scale insects, how to illustrate them and how to prepare microscopic slide mounts. In addition, we made a 4-day trip to Fars province in the south of Iran, collecting and talking about scale insects.

My work on scale insects has remained my main field of research since meeting Dr Williams and, with his effective guidance, I have been able to undertake a revision of the scale insect fauna of Iran which I could not have managed without his great help and guidance.

In addition to being a world expert who has published numerous books and papers on this group, Dr Williams' publications provide a very effective main source for identifying mealybugs and I use them constantly. He has been a friend and companion throughout all my working years, and I am extremely grateful to him also for introducing me to so many other world specialists on scale insects. So, I shall always be extremely grateful to him and hope that, as a student, I have been able to make some small advances on the Iranian scale insect fauna under his guidance.

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Even though I have not had the privilege of meeting Doug in person, he has had an undeniable impact on my life ever since I entered the mysterious realm of scale insect systematics some 13 years ago as an Insect Biosystematist for the Plant Pest Diagnostic Center of the California Department of Food and Agriculture. His landmark volumes including 'Mealybugs of Asia', 'Mealybugs of Central and South America', and the 'Scale Insects of the Tropical South Pacific Region' series became familiar daily companions of inestimable value in my work. I quickly learned to appreciate his many high-quality scientific contributions that have encompassed all the families of Coccomorpha. They provide taxonomic clarity and make it easier for future students to become acquainted with this difficult group of insects. When he learned of my interest in mealybug research, Doug emailed me suggesting some much-needed studies and provided advice in a very kind and generous manner. I continue to rely on his publications every day to reliably identify scale insect samples and to further my specific areas of research interest. My very best wishes on his centennial!

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In 1961, I arrived in London with a Commonwealth scholarship to do a Ph.D. on male scales of the family Coccidae at Imperial College, University of London, under the supervision of Dr Boratynski. The aim was to build on the work

of my predecessors, both of whom had studied under Boratynski: J.G. Theron, who worked out the morphology of male scale insects, and M.S.K. Ghauri, who studied male Diaspididae. During my studies, I walked every day from South Kensington station to my lab. in a building behind the Albert Hall. This route took me past the Natural History Museum where I knew Doug Williams, the famous coccidologist, worked. So, I looked him up and found that he was very willing to help me and guide me along my way—not that my supervisor was very happy with the idea of my getting external assistance! While my supervisor provided the specimens of 20-odd male Coccidae species to describe, Doug helped me with the mounting and staining techniques. As my studies progressed, I popped in regularly to see Doug to discuss the study of scale insects in general and to tap into his great knowledge in this field. He was always willing to share his knowledge and I became good friends with this kind and generous expert in the field of coccidology.

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I had the chance to meet Doug for the first time at the International Scale Insect meeting held in Portici (Naples) in 1986. At that time, I was a beginner in scale insect studies, and he was a great coccidologist: I didn't have the courage to introduce myself to him, we just exchanged some courtesy words. From that year onwards, he started to send me his valuable papers, year after year, and I met him regularly at international symposia. He was always extremely kind and helpful. From 2010, when he attended his last International Scale Insect Symposium in Crete (Greece) and until the present, we are just "pen friends", each exchanging good wishes and news from time to time.

Our first collaborative paper originated when I collected several strange mealybugs in the Botanical Garden in Padova on roots of Aloaceae. In the attempt to identify my specimens, I checked almost all the published keys or descriptions on pseudococcid genera, without any success. In the end, I gave up and sent some specimens to Doug, asking his opinion. Of course, he solved the situation, and the "strange" mealybug proved to be a new genus: *Trochiscococcus* Williams & Pellizzari, 1997.

When I was uncertain or confused on something regarding scale insect taxonomy, I said to myself "Let's see what Douglas says about…" and reading and checking his many papers and books I cleared my mind.

I knew that Douglas was fond of the Latin language when he told me that he was a collector of old Latin dictionaries. The shared knowledge of the basic rules of Latin was a "trait d'union" between us. I suppose that he was annoyed, as I was, at discovering trivial mistakes in the Latin binomial names given to new species or erroneous name combinations attributed for a long time to scale insect species. That was probably why he proposed writing a paper on the Latin rules on adjectival endings in zoological nomenclature, and on correcting the erroneous species-name combinations, according to the rules of International Code of Zoological Nomenclature. I had fun checking ScaleNet and discovering the incorrect combinations of binomial names reported in it and I am quite sure it was the same for Douglas. This paper was followed by another one on the meaning of Latin abbreviations used in zoological nomenclature.

I am rather shy, and Douglas is a reserved person. That is why I have never found the courage to express my great esteem, gratitude and affection to him, a great scientist, a mentor, and a friend. I do so now, with these few lines.

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I first met Doug in 1967. I was in London on leave from Rhodesia and asked if I could look at the scale insect collection in the Natural History Museum. Doug and I had probably corresponded before this but I have no memory of doing so unless it was through borrowing material for study. I was rather nervous. I had started taking an interest in scales only 3 years previously and Dr D.J. Williams was one of my "heroes" at that time. I imagined Museum workers as old, frail, white-haired, rather bent and probably with a wobbly voice, so I was somewhat surprised when

I entered Doug's room and there was this quite young man, smartly dressed, clearly anything but frail. I like to think we quickly became friends. I know I had a few wonderful months that leave. At that time, the coccid collection was on the top floor under a glass roof. There were many benches, a good microscope, and I had access to the collection and could come and go more-or-less as I wished. What a start to a career studying scale insects! And with Doug always on hand to give friendly advice and encouragement (Fig. 5). Sadly, conditions are less convenient in the Museum today and so clearly I was blessed.

Shortly after, I returned to the U.K., took up a lectureship in Agricultural Entomology, and spent about the next 10 years doing a doctorate on aphid behaviour. However, my teaching load became very heavy and, with only occasional short periods for research, I returned to scale insect taxonomy. What should I do? Of course, the answer was to ask Doug. Almost without hesitation, he suggested that I redescribe the type species of all the soft scale genera. This seemed a wonderful suggestion; I became very excited by the idea although I did not know what I had let myself in for! This was a big project and, because journals like *Zootaxa* did not exist then, there was the question of how to publish the results! Again, Doug came to my assistance, approached CABI and, almost before I knew it, they had agreed to publish a book (Hodgson 1994)! By this time, I had managed to see type material of almost all the type species. However, there was one that I thought I would not be able to see: *Myzolecanium kibarae* Beccari. The type material was considered lost, and the original description was poor—but it did have a figure of a twig with a gall. I asked Doug (obviously!) what I should do. He remembered that Beccari's plant specimens were stored in the NHM! So, he "took me by the hand" and we went down to the Botany section and asked to see Beccari's specimens of *Kibara formicarum.* And there, in the herbarium, was THE gall—and clearly still with some scale insects inside it. Thank you, Doug! You have always been there when I have needed you and it has been a huge privilege to work with you since.

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My first interactions with Douglas were after I collected several very small and very round mealybugs living with *Acropyga epedana* ants in southeast Arizona (U.S.A.) in August, 2001. He was excited to receive the specimens, and it turned out to be a new record for the mealybugs and the ants as symbiotic partners. Douglas quickly put together a short note for publication, in which he kindly included me as a coauthor. He encouraged me to keep looking for mealybugs in *Acropyga* nests, which I did. A few years later I collected several ant nests that had even stranger-looking mealybugs (I would later learn they belonged to the xenococcid genus *Neochavesia*) from Guyana. They also turned out to be new species, one of which he generously named after me. By that time, I had learned that Douglas was the leading expert on *Acropyga*-associated mealybugs and that he had pioneered the study of this fascinating symbiosis.

In my subsequent interactions with Douglas over the years, as more and more interesting scale insect partners were discovered with *Acropyga*, the thing that has stood out most to me was how Douglas was in awe of the twists and turns nature throws at us as we dig in deeper to understand a system. When he visited the Systematic Entomology Lab. in Beltsville, Maryland (U.S.A.) in 2007, I showed him an unusual scale insect that had been collected from an *Acropyga* nest in Australia. It turned out to belong to a very different group of scale insects (Ortheziidae) that had both Douglas Williams and Dug Miller stumped for a bit (but not too long!) as to what family they belonged. We named the ortheziid in Douglas's honour, *Acropyorthezia williamsi* LaPolla & Miller.

Douglas has always been very encouraging of my studies and took the time to help me understand how to collect and prepare mealybug specimens. He also carefully instructed me on scale insect morphology. This was critically important because I began studying the *Acropyga*-scale insect symbiotic system from the ant side of things; having a mentor in Douglas helped propel me and later my first graduate student (Scott Schneider) to look more closely at the scale insects to really begin to understand their morphology.

As we celebrate Douglas's centennial year, I am so happy and grateful to have met him. My career has revolved around studying *Acropyga* ants and their scale insect partners. I can confidently say that without Douglas's help early in my career, I doubt I would have continued those studies. His enthusiasm and mentorship for this topic have enriched my life and my career. Thank you, Douglas, for all that you have given, both through your scientific publications, but also equally through your limitless kindness in inviting people into this fascinating topic.

FIGURES 3–8. 3: Doug visiting Penny's lab at the University of California, Davis, in 2007. From left to right: Nate Hardy, Takumasa (Demian) Kondo, Doug and Cory Unruh [Photograph by Peter Cranston]. **4:** Penny Gullan and Doug in Penny's laboratory in Davis, 2007 [Photograph by Takumasa Kondo]. **5:** Doug with Yair Ben-Dov and Chris Hodgson in the Hodgson's garden in Kent, UK, May 1993 [Photograph by Yair Ben-Dov]. **6:** Doug with Ray Gill, Ben Normark and Dug Miller on a scale insect collecting trip in Del Puerto Canyon, California, U.S.A., Spring 2000 [Photograph by Penny Gullan]. **7:** Peter Cranston with Doug at the International Scale Insect Symposium at Wye, U.K., 1998 [Photograph by Penny Gullan]. **8:** Ferenc Kozár and Doug the International Scale Insect Symposium in Crete, 2010 [Photograph by Penny Gullan].

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I first had the pleasure of meeting Doug in 1978 when he visited Australia to borrow specimens from museum collections and to collect fresh material for his book on Australian mealybugs. I was still completing my Ph.D. at Monash University in Victoria at that time and it was a great honour for me to spend time with the renowned Dr Williams. I fondly remember that we collected mealybugs and other scale insects together in areas to the east of Melbourne. Then in 1981, he was an examiner for my Ph.D. thesis. We kept in contact via letter and met again at the scale insect symposium held in Budapest, Hungary, in August 1983. Then, after that symposium, when I visited the Natural History Museum in London in September, Doug and his wife Diana hosted my visit. I learnt a lot staying with them and discussing scale insects for hours with Doug. We went into the Museum together each day and I still remember him taking me once to the Senior Common Room, which at morning teatime was a smoke-filled room of older men. He had suggested strongly that I did not wear jeans on that day; I probably complied but a return visit to that room was of no interest to me anyway. After my U.K. visit, Doug and I corresponded regularly by letter and later by email and saw each other at subsequent scale insect symposia, such as those held at Wye in the U.K. and in Crete (Figs 7 and 8).

I rarely visit the U.K. but managed to visit Doug and Diana at their home in Hindhead, Surrey, a couple of times and of course Doug and I spent time in his amazing office full of scale insect literature. Although my rate of taxonomic publication is very slow compared with Doug's taxonomic heyday, I am happy that we have published seven papers jointly, including on *Protortonia* (Monophlebidae), *Puto* (Putoidae) and *Ceroputo* (Pseudococcidae), and most recently on two genera of unusual Australian eriococcids. The first we named *Aolacoccus* after the late Aola Richards who had provided the first specimens of this species to Doug decades previously and with whom he'd kept in contact. The second genus, *Fimbriaticoccu*s, was named for a strange species that superficially resembles a *Rastrococcus* mealybug and which Doug wanted redescribed because he had transferred it from Pseudococcidae to Eriococcidae in his landmark 1985 book, *Australian Mealybugs*. This book and Doug's other regional books on scale insects are used widely in diagnostic labs all over the world, as each is comprehensive, the keys are easy to use, and the illustrations are excellent. I have always aspired to emulate Doug's illustrations because they are extremely accurate and yet capture the essence of each species. Doug continues to be the fountain of knowledge on scale insects, providing advice on everything from the formation of names for new taxa, to suggestions for literature, to probable identifications of mystery scale insects. Coccidology needs another century of Doug's taxonomic expertise.

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Over 50 years ago Doug Williams and I first encountered each other awaiting the lift (elevator) in the Entomology wing of the British Museum (Natural History), as it was then known (now The Natural History Museum). Doug took the lift to his fourth-floor office and I to the open-plan third floor that housed the Diptera collections. We often arrived at the lift at similar times, he from rural Cookham, me from across-town. If Doug anticipated the lift I waited, otherwise the alternative was the stairs. Doug stood out for his north-east English accent amongst the southerners who sounded like members of the royal family. I had been schooled in the north-east (Durham) and Doug's dialect and candid conversations even with junior staff was a breath of fresh air. He followed the famed Newcastle United and knew St James' Park and many other football teams in the area (Sunderland, Middlesborough, even Darlington) that I watched as an absconding schoolkid; always a topic for discussion that continues to this day.

I got to know Doug's research as winged male scale insects often lurked amongst the unsorted Diptera accessions. I took them to Doug's office and quickly understood that he was not a Museum employee but, together with several other entomologists, belonged with the Commonwealth Institute of Entomology (C.I.E.). They all worked in the Museum collections, although their HQ then was just across the road in Queen's Gate. Doug shared with several

colleagues a strong interest in the biology and economic effects of the insects on which each worked, in particular Roger Crosskey, Victor Eastop, Keith Harris and Laurence Mound, all of whom had done earlier service as economic entomologists in the tropics. It was more than a different source of salary that differentiated these entomologists from others on the Museum staff. As epitomised by Doug, they valued the collections for a clear purpose, to aid in economic studies in which accurate identifications are essential. All had had a 'life before' the Museum, often in the colonial service, were widely travelled and retained contacts with a wide field of applied entomologists—and they all published copiously—from short notes to monographs and books, linking taxonomy to the biology of their specialist groups. Their connections were enormous—after all, the 'Commonwealth' had painted a swathe of the globe pink—but pest insects do not follow politics, and collegiality overruled maps.

Post-retirement, Doug maintained a huge contact list to assist his continuing research and, when I visited Hindhead with Penny Gullan, I saw a home and library to be envied. I saw this resource in action after Penny and I had visited the Canary Islands on a succulent plant quest. *Antenna*, the quarterly magazine of the Royal Entomological Society, was encouraging more 'general interest' pieces and ceasing the obituaries and book reviews. With minimal Spanish, and confronted with much dubious information, we tried to understand the plantation cactus from which 'cochineal' was being harvested. A first draft, replete with post-it notes, asked Doug for help. It turned out that Doug had 'been there, done that' 30 years prior, and had photographic evidence for the peak demand for cochineal. If you want to know the ins and outs of cochineal as a food colorant, you can read about it on ResearchGate ('A dyeing business'). Now I raise a Campari to congratulate Doug on his centenary, hoping that the colour is a scale insect pigment not carrot extract. Cheers, Doug!

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I first met Doug Williams in 1996, when we shared an office on the 4th floor of the Natural History Museum. It was a long office with a series of about 5 desks, in which I was the only postdoc; everyone else, including Vic Eastop and Doug, was retired. It was referred to fondly as the geriatric ward. At the time I was working on aphids and didn't interact much with Doug, who only came in on Wednesdays. But we all did gather for 10 am coffee and 4 pm tea with the rest of the 4th floor inmates, including Gillian Watson, Jon Martin, and my postdoc advisor Roger Blackman.

My first experience of working directly with Doug came 4 years later. Having studied weevils and aphids through a PhD and 3 postdocs, I rashly decided that what I really wanted to study as a university faculty member was armoured scale insects. I contacted Dug Miller, who kindly invited me to a what felt like a scale insect summit meeting, which even included a collecting trip (Fig. 6). Penny Gullan was hosting the Dougs (Miller and Williams) in her lab on their visit to U.C. Davis to help sort the scale insect material in the Bohart Museum collection. I remember sitting with the three of them, learning to sort dry diaspidid material to subfamily. Thus, within a few weeks of mentioning that I was interested in scale insects, I had 3 of the world's leading experts giving me a private tutorial. The idea of working on scale insects suddenly seemed much more tractable and even more appealing.

For the next decade, I knew Doug as the grand old man at International Scale Insect Symposia and other coccidological gatherings (like Scale Camp in 2003, again organized by Penny at UC Davis). You could take your most difficult specimens to him; he would peek at them under the microscope, and without consulting any references, he would hazard a tentative identification that my other senior colleagues (though never Doug himself) assured me could be regarded as definitive. He was always delighted to chat to anyone and was full of astonishing first-hand anecdotes and opinions about the leading figures in 20th-Century coccidology. And Doug's appetite for professional gossip has never faded; to the present day, he remains vividly curious about what you are up to and full of information about what else is new.

On my last trip to the U.K., in 2017, I had the privilege of visiting Doug at his house in Surrey. Apart from his failing eyesight, he was in fine form. Very generously, he first took me to lunch and then offered me the pick of his library, and I confess I carted away several fine volumes of Balachowsky. (It's pronounced Bala-CHOV-sky -- a fact which, like so many other facts of terminology and biography, I learned from Doug).

It is a privilege to know the world's greatest coccidologist, and I am full of gratitude for all that he has taught and given me. I wish him the very best on his hundredth birthday.

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As an undergraduate, I became aware that although scale insects were economically important pests in agriculture, horticulture and forestry, they were relatively poorly studied mainly because many entomologists lack the necessary slide-making skills. I met Doug Williams while I was researching for a Ph.D. in aphid taxonomy at the Natural History Museum in London, U.K. in the late 1970s. When I finished my degree, there were very few research job opportunities available and I went into teaching at a sixth-form college in London. During this time, Doug invited me to work as a demonstrator on the scale insect sections of several International Institute of Entomology insect taxonomy courses, which gave me a useful grounding in scale insect morphology, taxonomy, morphology and slide-mounting skills.

Doug meanwhile was awarded U.K. Overseas Development Administration funding to prepare three monographs on *The Scale Insects of the Tropical South Pacific Region*, and asked me to be his Research Assistant on the project. At a time when I feared that I would never be able to get back into research, this made it possible for me to do so; it changed the course of my career. Our collaboration provided me with a 4-year apprenticeship on Coccomorpha with the best of teachers, so when Doug retired I was qualified to fill his position. This led to a satisfying career working on scale insects, firstly for CAB International (1986–2000) and then for California Department of Food and Agriculture (2004–2015), before continuing into retirement. Without Doug's kind encouragement, patience, mentorship and friendship none of this would have been possible. Thank you for everything, Doug!

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Douglas Williams always was, and continues to be, an inspiration. He has such deep knowledge of the world fauna of scale insects that, whenever I was responsible for identifying some mystery bug intercepted at a United States port-of-entry, the first person that I consulted was Douglas. If he didn't know what it was, then it was likely that it was undescribed. This then gave impetus for us to undertake several joint publications. Beginning in 1976, we wrote 23 publications together varying from petitions to the Commission on Zoological Nomenclature, to descriptions of single species, to revisions of genera and even small families. One of the more fascinating discoveries was an adult gynandromorph of *Micrococcus similis* Leonardi, as part of our paper on the Micrococcidae (Miller & Williams 1995). Who would have thought that a scale insect which normally has winged adult males and neotenic adult females could be male on one side and female on the other? This is only possible in *Micrococcus* because the males are apterous. As far as I know this is the only record of an adult gynandromorph in the Coccomorpha.

Douglas and I are not only long-term colleagues, but we also have become great friends, even though we live in two different countries thousands of miles apart. While he was working on his several books, it was always important for him to spend many days examining the holdings of the U.S. National Collection of Scale Insects originally housed in Washington, D.C. and then in Beltsville, Maryland. Whenever this happened, he always stayed in what is sometimes called the Miller Hotel. After long days of examining specimens and gathering material for loans, we took the opportunity for a bit of a diversity of beverages (especially bourbon), food prepared by my wife Judith or Barbara Denno, and long coccidology discussions. He became a close member of our family because he spent many days and weeks with us. My daughters often ask about him and my daughter Scotia even visited him in the U.K. I have also had the opportunity to stay with Douglas and Diana and they made traditional steak-and-kidney pie, just for me!

I am most grateful for the time that Douglas has spent with my family and friends and for all of the interesting things that he has taught me about scale insects.

THANK YOU, Douglas!!!

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