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From Linnaeus to 2024—a history of Thysanoptera taxonomic diversity studies

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Abstract

The number of recognized Thysanoptera genera and species worldwide increased from one and four in 1758, to 36 and 135 in 1900, and almost 790 and 6500 in 2024. In this essay the work of the authors who have been particularly significant in this growth of knowledge about thrips diversity is discussed, decade by decade.

Key words: Thrips, systematics, taxonomists, Terebrantia, Tubulifera

Introduction

This review essay focuses solely on morphological taxonomy, as this has been the primary focus of thrips studies during most of the period considered here. In the future, molecular taxonomy will progressively have a major impact on species concepts and species relationships, but most molecular studies on thrips until 2020 focused on the single gene CO1. Although highly useful in many groups for identifying known pest species, reliance on this gene alone has problems (Lindner *et al*. 2023). More recent studies are indicating increasing problems in interpreting the genome of Thysanoptera, in view of remarkable differences in the mitochondrial gene order in Thysanoptera from other insects. This involves in thrips species the multiplication of the control region with resultant gene rearrangement (Li *et al*. 2024), although the significance of this for species diversification rates remains unclear.

Mankind has probably always given names to the surrounding animals and plants, and such names varied greatly between local communities. To facilitate communication between scientists of different generations and nationalities the date of 1758 was adopted by Zoologists as the baseline for the formal names of all animals, this being the date of publication by Linnaeus of "*Systema naturae*…". As a result of this decision, the many pre-Linnaean names that were applied to organisms are considered unavailable for the purposes of scientific communication in Zoology. In the insect group commonly known as thrips (Thripse; Tripes) Linnaeus recognised just four species, and these he placed under the formal generic name *Thrips*. He placed this as the last genus within the Hemiptera, immediately following the genus *Coccus*. Linnaeus indicated that two of his four *Thrips* species had been referred to previously by de Geer (1744) under the name *Physapus*, but as that name was published prior to 1758 it is now considered unavailable for scientific nomenclature and communication, despite its usage by a few later authors.

Following Linnaeus there were no further substantial taxonomic studies on this group for almost 80 years, before a sudden flowering of interest. An eminent Dipterist from Ireland, AH Haliday, published in 1836 an Epitome of the genera of thrips that he knew from Britain. In this he proposed the name Thysanoptera as the Ordinal name for this group of insects, and within this Order he recognised two stirps, Tubulifera and Terebrantia. Moreover, he erected nine new generic level names in this Order Thysanoptera, of which four were placed as sub-genera of *Thrips* Linnaeus.

At about the same time that Haliday was working, CJB Amyot and A Serville in France were working on a major book on insects. This was published in 1843 and to their book they added as an Appendix the group Physopodes, a name they considered had priority over Thysanoptera. In addition to the Haliday names, Amyot and

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Serville provided five further generic names, two in the Tubulifera and three in the Terebrantia; they also included *Physapus* as a valid genus. Subsequently, in 1852, Haliday designated the two stirps as Families, and recognised an eleventh genus, *Idolothrips*, that he placed in the family Tubulifera. The only other active thrips workers pre-1900 were OM Reuter in Finland and F Trybom in Sweden, both of whom published several notes on the Thysanoptera of their two countries. At the end of the decade Reuter (1899) published a complete revision of the Thysanoptera of Finland, including three new genera.

The culmination of this upsurge in interest in thrips diversity was the issue in 1895 by Uzel from Bohemia of a magnificent compendium of all known published information on thrips. This included not just taxonomy with illustrated keys to taxa, but also sections on host plants, anatomy, development, fossils, economic significance, plus a review, in date order, of all thrips publications by previous authors. This impressive scholarly work has earned Uzel the title of 'Father of Thysanoptera Studies' (Fedor *et al*. 2010). The 500-page book was published in Czech and German, and distinguished 36 genera of Thysanoptera, including 11 new genera, together with 135 species of which 63 were newly described.

These numbers contrast with a recent list of all generic names used within Thysanoptera (Mound & Hastenpflug-Vesmanis 2021) in which 850 genera were accepted, with 420 genus-group names in synonymy. These authors also noted that the number of known species had risen from 135 to almost 6500 in the 120 years since Uzel's compendium (Fig. 1). Moreover, 55% of the accepted genera were published since 1950. The question considered here is 'How did this explosion from 36 genera to 850 come about?'

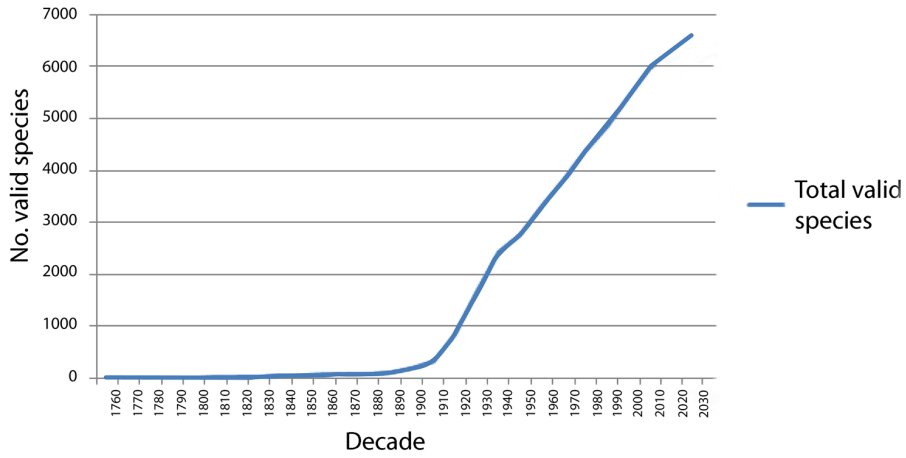

FIGURE 1. Number of Thysanoptera valid species by decade.

Historical review by decades

The first decade of the 20th century saw almost 10 workers publishing in thrips taxonomy. Trybom in Sweden was almost contemporary with Uzel, and between 1894 and 1900 published seven notes on the "Blåsfotingar (Physapoder)" of that country. As a result, he was asked to deal with the Thysanoptera specimens collected by Swedish expeditions to eastern Africa and to the Sudan. From these collections, Trybom produced seven extensive publications between 1908 and 1913, recognising seven new genera of which four remain valid, together with almost 40 new species.

During this decade, six further authors erected about 20 new genera between them: Buffa in Italy; Kirkaldy in Hawaii; Knechtel in Rumania; Schmutz in Austria, DL Crawford in California; and Hinds in Massachusetts. Of these authors, Schmutz in particular has left taxonomic problems for posterity, with several of his taxa of doubtful identity. After describing in 1909 three new monobasic genera from Brazil, he published in 1913 seven new genera and 24 new species from Sri Lanka. In contrast, another four authors who started work in the same decade erected during their careers about 300 new genera between them, and these authors were largely responsible for providing much of the shape to Thysanoptera systematics for the next 50 years. These authors were JD Hood in Illinois and New York, D Moulton in California, RS Bagnall in England, and H Karny in Austria (from 1920 in Indonesia). New genera proliferated, although taxonomic revisions over subsequent years have resulted in many of these now being placed as synonyms.

Bagnall erected about 100 genus-group names (Mound 1968) although only 62 of these continue to be accepted as representing valid genera. Similarly, Moulton erected 47 new thrips genera (Bailey 1949b) of which only 38 are now accepted. Also, Bailey (1949a) together with additions by O'Neill (1974) recorded that Hood erected 139 genus-group names, of which 100 are currently considered valid. In 1921, Karny produced an extensive key to world Thysanoptera. In this he distinguished 16 families, 20 subfamilies and 203 genera. Of the new Thysanoptera genera he erected 34 remain valid, and 227 species he described are still accepted. Most of these taxa were described from Indonesia and Indochina—areas for which, unfortunately, there have been few subsequent studies on thrips diversity. The rates of synonymy indicated above are not surprising considering the contemporaneous nature of the work of these scientists, and the low speed of communication between them. Also, in the years since they were writing there has been an increasing interest in systematic relationships based on far more extensive collections.

Morpho-taxonomy of Thysanoptera is based on the study of adult specimens. In the early part of the 20th century the studied specimens were pinned, dry mounts as used by Reuter, also by Bagnall in his first papers on exotic thrips. Very quickly it was realised that to study thrips it was essential to slide-mount the specimens, and Bagnall appears to have used technicians at the University of Oxford for this purpose (Berridge 2023). However, Hood was a perfectionist who, personally, developed an improved technique of clearly displaying whole thrips, one on each slide. He preferred not to fully clear specimens using weak solutions of sodium or potassium hydroxide, and in this preference, he was followed by many later workers including H Priesner, TN Ananthakrishnan and R zur Strassen. Curiously, Karny held the opinion that mouth parts would provide important character states. He thus preferred to slide-mount Phlaeothripidae ventral side uppermost, which has made subsequent critical study of his specimens particularly difficult. Karny, also some subsequent thrips workers, often mounted numerous specimens onto each single slide, usually poorly distended and inadequately cleared. More recent improvements in mounting techniques have facilitated access to additional details of thrips anatomy and enhanced the overall quality of taxon descriptions and character interpretation. Collections developed by each of the four authors cited above remain available for study, in California, Washington DC, London or Frankfurt. The development of these large collections, often with long series of some species, has facilitated a greater understanding of structural variation within and among many Thysanoptera species. This variation ranges from almost trivial differences in sculpture to remarkable sexual and alary dimorphisms and size-related polyphenisms.

Some further aspects of the work of the four authors mentioned above are of interest to more recent scientists. Bagnall was a businessman and amateur entomologist. He had no students and produced no extensive identification keys to help other workers. Similarly, despite being a university teacher for much of his life, Hood produced few keys and had no thrips students—he was considered an excellent university teacher, but his thrips work was focussed on publishing and developing his personal slide collection. When the Hood collection was accessioned by the US National Museum in 1965 it comprised 60,000 slides and included the 1038 species that Hood had described (Pitkin 1978). In contrast, both WE Hinds in Massachusetts and D Moulton in California were employed as economic entomologists to provide a service to other biologists. Thus, in 1902 Hinds produced a monograph of the information then available on North American Thysanoptera, and in 1911 Moulton published an extensive overview of North American Thysanoptera. Also, in 1948 Moulton produced a key to about 140 species that he recognised in the genus *Frankliniella*. The initial impetus for this increasing interest in Thysanoptera taxonomy in this first decade of the 20th century was the development by each author of a knowledge of their local insect diversity. Thus from 1908–1912 Hood's publications focussed largely on thrips collected in Illinois where he was employed for a time (Hoebeke 1993). Similarly, Moulton from 1905–1926 focussed on California where he lived, and Karny from 1908–1910 focussed on species found in Austria. In contrast, six of the first 15 publications by Bagnall were concerned with thrips specimens from Asia and South America. These he acquired from various European museums, initially in 1907 from the British Museum (Berridge 2023). Bagnall was an avid entomologist whose interests were concentrated on small arthropods, including Isopods, Psocoptera, Coniopterygid Neuroptera and rare beetles—but primarily thrips. All four of these authors, after their initial studies, transferred their interests to wider geographical areas.

Karny became entomologist at the botanic gardens in Bogor, Java, and from there he published many papers. Bagnall and Moulton both acquired thrips from many countries around the world. In contrast, Hood personally collected thrips in various parts of the USA, and twice in southeastern and northern Brazil as well as in some West Indian Islands. He published extensively on the previously unknown Neotropical fauna, and acquired many species from F Plaumann, an energetic collector who sold insect specimens to various taxonomists in other countries.

The next decade of the 20th century was seriously disrupted by the war in Europe, but JR Watson in Florida began studies on his local thrips, and CB Williams studied thrips in the West Indies, sometimes in collaboration with Hood. However, this decade is noted for the explosion onto the thrips world of Hermann Priesner in Linz, Austria. Initially, Priesner studied the thrips that were near his home, although in 1918 he was sent to Albania for a time on Malaria control, in company with Karny, his senior by five years (zur Strassen 1975). By 1925 he had published 40 papers on thrips, and 1926–28 saw the publication of the outstanding 750-page *Die Thysanopteren Europas*. In 1928, Priesner was appointed head of entomology to the Ministry of Agriculture in Cairo, and from that appointment came a flood of books and publications over the following years. Despite the interruption of the Second World War, he published in 1964 a 240-page taxonomic account of the Thysanoptera of Europe, and in 1965 was issued his much delayed 550-page monograph on Egyptian thrips. At Linz in 1966, Herman Priesner told Laurence Mound that this volume had been sent to press on 1st October 1951, and pointed out the incorrect dates on the front and rear covers. Priesner was author of 130 new genera of which 106 remain in use, and about 720 species. He was an outstanding zoologist with numerous publications on other groups of insects, particularly Hymenoptera. Despite being very helpful to many other workers, Priesner's publications are almost entirely under sole authorship. However, these publications largely determined the direction of Thysanoptera taxonomic studies for many years.

The decade of the 1920s saw the start of work on thrips by five authors with diverse backgrounds. These were JC Faure in South Africa, TV Ramakrishna in India, GD Morison in Scotland, E Titschack in Germany, and AA Girault in Australia. Faure erected 13 new genera of Thysanoptera and described 87 new species from Africa. His most influential contributions to entomological science were about locust biology, but he produced no overview of the interesting biology and diversity of the South African thrips fauna. Ramakrishna was essentially an economic entomologist, although he has been considered one of the best systematists that India has produced (Raman & Sharma 2013). In 1928 he published a 100-page account of the Thysanoptera of India. Morison was a university teacher of economic entomology at Aberdeen, but he collected thrips widely across Britain for many years. His major contribution to taxonomy was in emphasising species biological differences by carefully recording the plants on which each species breeds. His emphasis on distinguishing the difference between "finding place" and "host plant" had a considerable influence on many subsequent workers. His "*Thrips of the London Area*" was the first attempt since Haliday to provide an overview of the British thrips fauna (Morison 1947–1949), and his extensive British collections provided the basis for more comprehensive studies by later authors (Mound *et al*. 2018). From 1924, Titschack was head of entomology at the Hamburg Museum, but in 1944 when that was destroyed, he was employed at two other museums until he retired in 1957. Of the thrips genera described in various taxonomic publications by these four authors only the seven genera erected by Ramakrishna remain in use. Girault was an American economic entomologist who took a three-year contract in Queensland, Australia, to study sugar cane pests. He decided to stay and specialised on the taxonomy of Chalcidoid wasps, but in a series of four-line descriptions (mainly self-published), he issued 133 species-group names on Thysanoptera from Australia. Not only were the descriptions remarkably trivial but his slide mounts of specimens are of exceptionally low quality and more than 50% of his species names are now placed into synonymy.

In contrast, the next two decades, the 1930s and 1940s, involved the start of the taxonomic careers of four major contributors to our knowledge of thrips diversity. In Hawaii, and based mainly at the pineapple research centre, K Sakimura published almost 60 papers on thrips between 1932 and 1986. His primary interest was in thrips as pests, particularly as virus vectors, but 30 species and two genera he described remain as valid, including *Neurisothrips*, the dominant, and only endemic, thripine genus of the Hawaiian Islands.

In Argentina, L de Santis published over 30 papers on Thysanoptera between 1943 and 1995. These involved 24 new species and two new genera, and in 1980 he published a 70-page synopsis of the thrips of Argentina. In 1961 he published a catalogue introducing to the world the private publications of Girault in Australia. Unfortunately, these four-line "descriptions" might more appropriately have been referred to the Zoological Commission for consideration as invalid.

J Pelikán of Czechoslovakia published over 70 papers on Thysanoptera between 1945 and 2004. These originally concerned his local fauna, but progressively he described taxa from various Asian countries. Pelikán, despite being subject to serious political constraints in his country that required him to work on small mammals, was a wonderfully extrovert character. His thrips publications were a model of accuracy with outstanding line drawings; 71 species and six genera that he erected remain in use.

The most prolific thrips author who began work in the 1940s was TN Ananthakrishnan, who between 1947 and 1994 produced about 220 papers and books concerning thrips, mainly from India (Bhatti 2004a). In these, he erected 260 species-group names and 60 genus-group names, of which 46 genera remain in use (Bhatti 2004b).

Unfortunately, many of his taxa cannot be recognised from their descriptions, and the illustrations provided were often far from perfect. Much work is needed in India on leaf-feeding Phlaeothripinae in order to understand the complexities of that fauna and the many available names. The type specimens of these species are apparently deposited in the Institute of Agricultural Research, Delhi. However, the bulk of Ananthakrishnan's slide collection, comprising about 1050 nominal species on 3250 slides, was sold to the University of Minnesota a few years prior to his death in 2004.

These two decades also saw a further expansion of thrips studies in South Africa. CF Jacot-Guillarmod was employed by the Department of Agriculture, and between 1937 and 1942 he published six taxonomic papers involving two new genera and 29 new species of Thysanoptera. In 1958 he joined the staff of the Albany Museum, working on Hymenoptera and in 1962 he took leave to visit Cornell University for further work on Scoliidae. During this visit he became associated with Hood, who gave him a very large collection of thrips literature and slides (Scott 1980). From 1972 to his death in 1979 he concentrated on producing a series of volumes of a citation index to all Thysanoptera taxonomic publications. EK Hartwig also produced six papers on South African thrips between 1948 and 1978, including, in 1952, his extensive doctorate thesis. These publications introduced 20 new species and one new genus. These various descriptive studies suggest that the Thysanoptera fauna of South Africa is either curiously depauperate or inadequately investigated. A catalogue of the known species by zur Strassen (1960) indicates a fauna that is remarkable for the lack of leaf-feeding Phlaeothripinae. This is in sharp contrast to those parts of Australia that have rather similar semi-arid habitats—although a very different flora.

In the 1950s two influential thrips taxonomists began publishing. LJ Stannard in Illinois produced almost 50 books and papers on Thysanoptera between 1950 and 1982. A total of 69 species and 15 genera that he erected remain in use, but his most important contribution to Thysanoptera (1957) was his revision of systematic relationships within the largest family, Phlaeothripidae. Interestingly, he produced this seminal work despite being refused access to the extensive collections of Hood. Stannard's phylogenetic system opened up the possibility for subsequent authors to re-examine Priesner's (1961) systematic opinions. A student in Stannard's laboratory, TH Wilson, produced as a doctoral thesis an important review of the Thripidae subfamily Panchaetothripinae.

The other major thrips worker of this decade, zur Strassen, was the son of the Director of the Senckenberg Museum, Frankfurt. Following his doctorate thesis on a staphylinid beetle, zur Strassen went to Pretoria for three years to work on a thrips project and published his first paper on these insects in 1957. He returned to Germany in 1963 to a position at the Senckenberg in charge of the Coleoptera and Thysanoptera collections, and he remained in that position until he retired in 1991 (Vierbergen 2015). However, he continued to work on thrips until shortly before his death in 2013, building up an extensive worldwide collection of thrips on slides, together with massive card catalogues and a magnificently comprehensive reprint collection. Between 1957 and 2008 zur Strassen produced 153 publications on thrips; 140 species and 23 genera that he described remain in use (including 7 genera of fossils in Lebanon Amber). His most important contribution to our understanding of Thysanoptera was the 270-page manual to the Terebrantia of Europe (2003), with its clear line drawings that facilitate use of the many identification keys.

The 1960s involved the period when three further major contributors to thrips taxonomy began publishing on these insects. The first publication by JS Bhatti, in India, was in 1960 on a new species from the Punjab, and during the succeeding 60 years he published over 130 papers. Of these publications 54 were in one or other of the three journals that he created and issued under the titles *Zoology*, *Thrips* and *Thysanoptera*. From his studies, 135 species and 59 genera remain in use, and these provide a basis for understanding the diversity of the Indian Terebrantia fauna. In addition, Bhatti generated various interesting ideas on the higher classification of Thysanoptera, although few of these have been adopted. He produced several careful revisionary studies of particular taxa, including the *Tryphactothrips* group, the *Sericothrips* group, and the genus *Thrips*. However, his most important contributions to our knowledge of thrips were probably his detailed studies on thrips comparative morphology together with his many meticulous line drawings of structural details in various species. These illustrations and descriptions set new and very high standards for students of thrips worldwide, but particularly on the Indian subcontinent.

In 1961 G Schliephake, working under the rather constrained conditions at that time of Eastern Germany, published his first paper on thrips—on the biology of species associated with Lucerne. Between then and 2005 he produced 57 publications on thrips, the most important being in 1979, a 480-page book on the Thysanoptera of Germany with his student K Klimt. Later in his life he came to specialise in the study of fossil thrips. Of living thrips, he published only two new genera and two new species, but of fossil thrips he described 15 new genera and 63 species.

The third author who started in the 1960s was LA Mound who after graduation worked for six years in tropical countries on whitefly—the Hemiptera—Aleyrodidae. In 1964 he was appointed to the Natural History Museum in London to develop the collections of whitefly and thrips, and his first thrips paper was on a British species in 1965. His field work over the next 30 years was mainly in eastern Asia and the Americas, resulting in a large slide collection at the Museum. He retired from the NHM in 1994 with a 2-year grant to produce a monograph on the thrips of Central and South America. This was published in 1996 with R Marullo from Italy, and he was then invited to Australia to work on thrips. At the date of his retirement, Mound had published about 100 papers on thrips, several being in co-authorship with his two outstanding assistants, Brian Pitkin and Jenny Palmer, plus a catalogue of world Aleyrodidae with Sheila Halsey. By 2024 his publications had risen to 500 books and papers, involving 105 new genera and 940 new species. Two factors contributed to this output—the opportunity to explore the continent of Australia and its almost unknown thrips fauna, plus the opportunity to collaborate with a wide range of other biologists and taxonomists. The remarkable diversity of the Australian fauna was stimulating, resulting in the increase in number of valid thrips species known from Australia from about 200 in 1965 to almost 1100 in 2024 (Fig. 2), and the number of genera from less than 100 to 250 (AFD 2024). Equally stimulating was the collaboration with a diversity of other entomologists. Particularly important was a project with Bernard Crespi from Canada that funded multiple trips across Australia. This resulted, in addition to many other publications, in a 330-page book on the Phlaeothripinae species that breed only on *Acacia* foliage in Australia (Crespi *et al*. 2004). The project was targeted at the remarkable eusociality exhibited by some gall thrips species in the genus *Kladothrips*, but it also involved exploring the complex relationships amongst the many other thrips species found only on these trees. Collaboration also generated funding, including quarantine projects with Alice Wells on Norfolk Island, Timor Leste, and New Caledonia, various highly successful studies with the bio-control specialist, Mark Hoddle of California, also invited thrips tutorials in California, West Malaysia and China, all of which yielded further thrips taxa for the collections in Canberra.

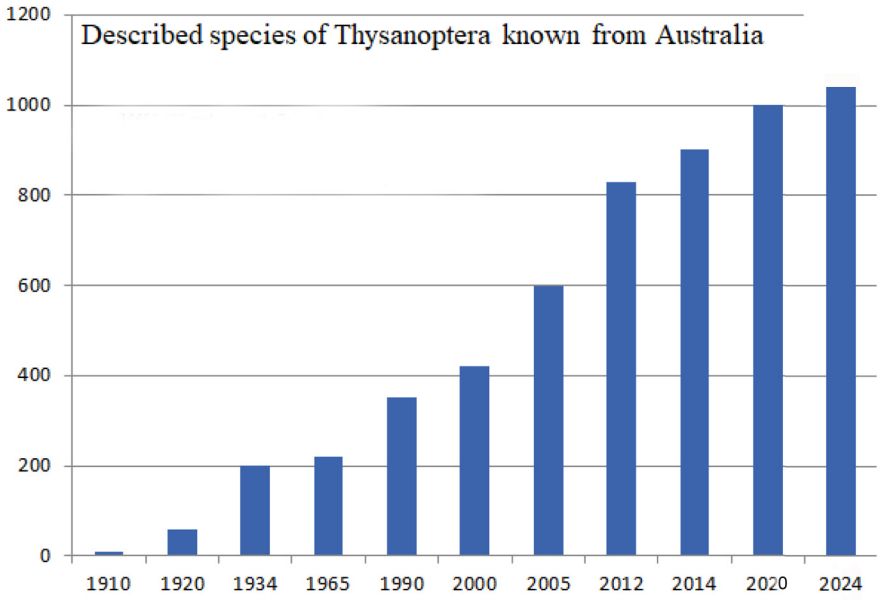

FIGURE 2. Number of valid described Thysanoptera species from Australia.

These expanding thrips collections and research programs in Canberra attracted many visitors and students, and the resultant collaborations generated much new information and new ideas. These working visitors included at various times S Okajima and M Masumoto from Japan, as well as A Cavalleri and E Lima from Brazil, also A Goldarazena from Spain, R. Marullo from Italy, Ng YF and Azidah AA from Malaysia, Zhang ZH and Dang LH from China, together with multiple visits by Desley Tree from Queensland Department of Agriculture. One of the most important outputs in these years was the web site ThripsWiki, making readily available worldwide a huge quantity of thrips taxonomic information. In October 2023 this site became unavailable due to cyber criminals attacking the computer server in Berlin—but the data has not been lost and access is expected to be regained in due course. The

other major output, particularly through the encouragement of Gerald Moritz of Halle, was the development of web-based identification and information systems to Thysanoptera taxa from Australia, Brazil, Britain, California, China, New Zealand and Timor Leste (Watson & Mound 2020).

The more recent decades

With his first publication in 1973, R Johansen was a prolific thrips taxonomist from Mexico. Of the many taxa he erected, 10 genera and 242 species remain in use, although a further 30 species he described are now placed as synonyms. His species concepts have been particularly disputed in the genera *Leptothrips* (Mound & O'Donnell 2017) and *Scirtothrips* (Hoddle *et al*. 2008; Mound & Hoddle 2016). The criteria he used to distinguish 78 new species in the genera *Elaphrothrips* and *Frankliniella* seem to have involved limited appreciation of intraspecific structural variation. These species need further assessment based on new collections and field work.

The most significant contributor to our understanding of thrips diversity since the early 1970s has been Shuji Okajima in Japan. His work has demonstrated the art of balancing the three essentials of thrips morpho-taxonomy: extensive and time-consuming field work to acquire specimens and biological information; long hours of specimen preparation and slide mounting to develop an extensive collection that demonstrates structural diversity; microscope study and comparisons based on these long series of specimens. Over 110 publications between 1974 and 2024 have been produced by Okajima, of which 18 were with Masami Masumoto. These publications involved 23 new genera and about 470 new species that were collected widely in southeast Asian countries. He has also published two important books on the thrips fauna of Japan. The 700-page monograph on the Tubulifera of Japan (2003) is essential for anyone trying to understand Phlaeothripidae diversity. And a 620-page book in Japanese with Masumoto (2020) describes, illustrates, and leads workers through keys to the 450 species of Thysanoptera known from Japan. This volume includes a total of 3500 monochrome photomicrographs, together with 300 colour photos of living adult thrips. These photographic images emphasise one of Okajima's most important contributions to world thrips taxonomy—the preparation onto slides of beautifully cleared and undistorted specimens.

The present century is seeing the development of many other productive contributors to the taxonomy and systematics of Thysanoptera, particularly from warmer areas where thrips diversity is largely unexplored. These workers include Dang LH and Zhang HR in China, M Masumoto in Japan, Ng YF in Malaysia, R Rachana and K Tyagi in India, J Alavi, K Minaei and M Mirab-balou in Iran, A Goldarazena in Spain, I Rasool in Saudi Arabia, and A Cavalleri and E Lima in Brazil. Particularly impressive have been the contributions to studies on fossil thrips in Burmese Amber from M Ulitzka of Germany. His work has involved cutting and polishing each amber fragment into a very thin piece that can be examined under high magnification. His techniques have revolutionised the study of such fossil thrips (Ulitzka 2022), and the macro-images of thrips that he has provided on his web site Thrips-id.com are superbly detailed. In addition to their publications, each of these workers is developing a well-organised slide collection on which future studies can be based. Such specimens, collected personally together with biological and behavioural observations, are often of greater use for taxonomic and systematic studies than specimens with uncertain data in museum collections. Extensive personal collections, derived from repetitive and time-consuming field work, need to be the model for future taxonomic studies.

Thus, the answer to the question posed at the start of this article is that the explosion in the number of recognised genera is due to those authors who have had the opportunity to collect and to prepare large reference collections of carefully slide-mounted specimens. Workers without access to such extensive resources often have the habit of erecting new monotypic genera for individual species that exhibit some unusual characteristic. More recently, taxonomists have been re-evaluating and updating such genera using new evidence and a broader concept of variation and evolution, such that one third of available generic names are now placed into synonymy. The rate at which new thrips species have been discovered and described over the past 50 years (Fig. 1) is particularly impressive. However, given the general lack of interest at universities in morphotaxonomy, it is difficult to predict if this will continue, despite the lack of knowledge of the thrips fauna of Africa and South America. The author of these notes, when a student, was told by Professor OW Richards "Do not just collect those insects; watch them and discover something about how they live". Such observations are not only of biological and ecological interest but have the potential to provide further ideas for character states to think about when considering evolutionary relationships and diversification. The biological attributes observed and recorded during taxonomic field work are as much expressions of the genome of a thrips as are the number of antennal segments or the shape of the genitalia.

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The statistics on numbers of taxa quoted here are extracted from Catalogue of Life, although the Thysanoptera data in that system were derived from ThripsWiki prior to the loss of that system in October 2023.

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