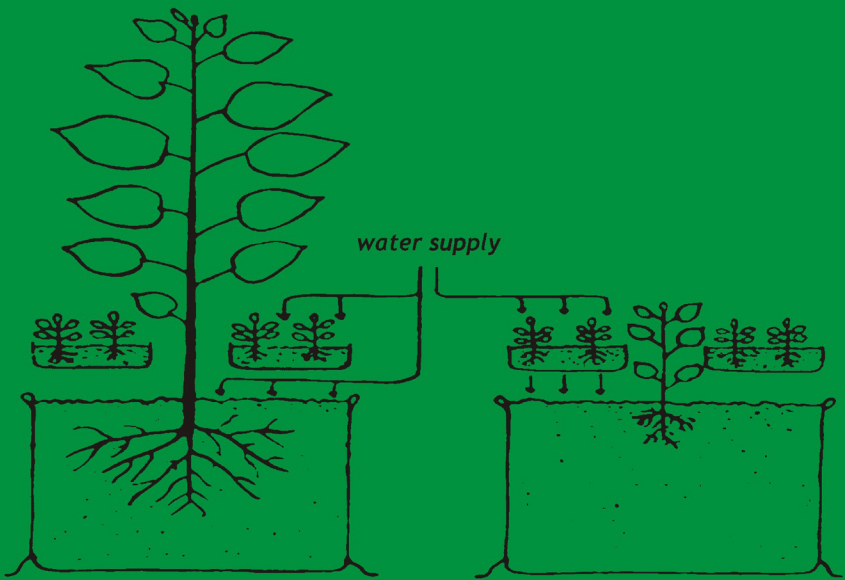


The Mutual Interaction of Higher Plants Allelopathy

Gerhard Grümmer



Translation and Notes by
R. J. Willis

The Mutual Interaction of Higher Plants - Allelopathy

Gerhard Grümmer

GERHARD GRÜMMER

Die gegenseitige Beeinflussung
höherer Pflanzen
– Allelopathie –

Mit 52 Abbildungen im Text



VEB GUSTAV FISCHER VERLAG · JENA

1955

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Gerhard Grümmer

Translation and Notes by

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About the Translator



Dr Rick Willis is a Senior Lecturer in the Botany School, University of Melbourne. He has published widely on allelopathy, and is noted for his research on events and issues that have shaped the science of allelopathy. His most recent book, titled simply *The History of Allelopathy* explores allelopathy as known from antiquity until the mid 1950's, and a continuing volume is planned to be published in 2009.

Acknowledgements

The English translation of *Die gegenseitige Beeinflussung höherer Pflanzen – Allelopathie* by the late Prof. Gerhard Grümmer is published with the kind permission of the Grümmer family. In particular, I wish to thank Frau Gertraud Grümmer and Dr. Harald Grümmer for their generosity in allowing Prof. Grümmer's seminal text on allelopathy to become available to English readers.

The Work of Gerhard Grümmer

R. J. Willis

Botany School, University of Melbourne, Parkville, Australia

Introduction

During the twentieth century, there have been several surges of interest in allelopathy. The first of these was during the opening two decades, from about 1900-1920, during which research, led by Spencer Pickering in England, and by Milton Whitney, Oswald Schreiner and their co-workers at the Bureau of Soils, United States Department of Agriculture, commanded great interest. However, their work was plagued by both scepticism and controversy, and by 1920 was largely forgotten, or regarded with disfavour¹.

The second episode occurred during the late 1930's, largely due to workers such as Gerhard Madaus, Hans Molisch, and Friedrich Boas in Germany. It was, of course, Molisch who coined the term "allelopathy" in 1937; however, his work was concerned primarily with the effects of ethylene, now more usually regarded as a plant hormone. The advent of the Second World War dimmed almost all interest in these matters, and the subject of allelopathy remained largely ignored until the 1950's.

The resumption in interest in allelopathy, which has continued more or less unabated since the mid 1950's, is due in great part to the seminal work of the German, Gerhard Grümmer. While it is seldom acknowledged in the literature, it was chiefly Grümmer who revitalised interest in allelopathy, and who wrote the first real textbook on allelopathy. Given the limitations of earlier works, such as that of Molisch, and some related reviews by Loehwing (1937), Evenari (1949), Bonner (1950) and others, Grümmer's book is remarkable both in its scope and perspicacity.

Grümmer first presented an overview of the realm of allelopathy in a seldom cited review (Grümmer 1953), but his enduring contribution was his comprehensive and compact text entitled *Die gegenseitige Beeinflussung höherer Pflanzen – Allelopathie*, published in 1955. It is just over fifty years since this work was first published, and while an English translation arrives undeniably late, it seems as fitting a time as ever to offer the English reader access to Grümmer's important text.

¹ These aspects and Grümmer's work in context are discussed in *The History of Allelopathy* by Willis (2007).

Gerhard Grümmer – A Brief Biography

Gerhard Grümmer was born on 20 August 1926 in Görlitz, a German city on the Nysa (Neisse) River, on the southeastern border with Poland. He was the only son of a secondary school teacher, Dr. Richard Grümmer and his wife Erna (née Heitzsch) Grümmer. Gerhard attended school in Görlitz, and from a relatively early age he had a strong interest in the natural sciences, especially biology, which he thought would lead him to a career in medicine. However, he was required to leave secondary school in autumn 1943 to join the RDA² program as part of the German war effort. In early 1944 Gerhard Grümmer was recruited into the German navy, where he learned of submarining, which was to serve him later in life as a novelist. Due to his expressed interest in medicine, he received initial training as a medical officer. In August 1944 Grümmer was captured by British forces at St. Malo, France, on the English Channel, where he was stationed. He remained a prisoner of war and was released from detention in England in 1945, but he chose to stay in England and take advantage of the educational opportunities there. He subsequently studied the International Red Cross two-year course in natural science offered through a Red Cross Academy of Medicine, which allowed him to complete his pre-medical examinations in 1947.

Grümmer returned to Germany in February 1948 and was discharged from the Armed Services. Because of his advanced status, he was able within just a few months to complete his German secondary school matriculation at Gera, south of Leipzig. Following a brief period of work in a laboratory, he was recommended to begin tertiary studies in biology and chemistry, and not medicine, at the Friedrich-Schiller-Universität at Jena in October 1948. He completed his Diploma in Biology in December 1950. His tertiary studies at Jena culminated with a doctorate, with first class honours, in 1951. Grümmer's doctoral thesis examined the relationship between the constituents of *Papaver somniferum*, and its susceptibility to infection by the hyphomycete *Helminthosporium papaveris*.

In June 1954 Gerhard Grümmer married Gertraud Ranis, a lecturer in sports at the University of Greifswald. They had two sons, Gerald (born 1960), and Harald (born 1961).

In 1951 Grümmer was appointed as a teaching assistant in Botany at the University of Jena. From 1952-1954 he was an assistant at the Institute of Agrobiology, Ernst-Moritz-Arndt-Universität (University of Greifswald). In 1955 Grümmer was appointed as a Lecturer (Dozent) of phytopathology at the University of Greifswald, and in 1958, he was confirmed as a professor. From 1963-1970 Grümmer served as the Director, Institute of Phytopathology, University of Greifswald, until the closure of the Institute in 1970 due to the controversial Third Higher Education Reform of the Deutsche Demokratische Republik (DDR; East Germany) government. In 1971, he moved to Rostock, where he served as a Professor of Chemistry at the University of Rostock until his premature retirement in 1974.

² The RAD or Reichsarbeitsdienst was the German National Work Service.

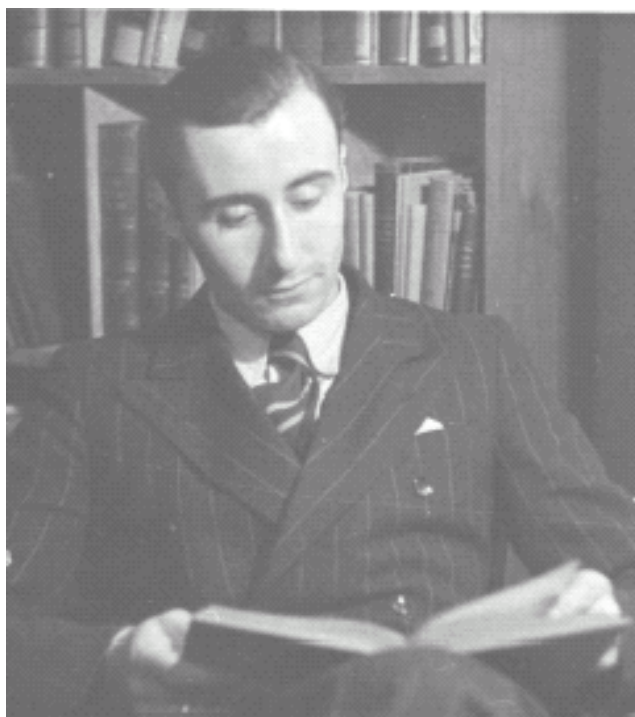


*Gerhard and Gertraud Grümmer on their wedding day in June 1954
(photograph courtesy of Dr Harald Grümmer).*

Contributions to Allelopathy

Gerhard Grümmer's interest in allelopathy arose while he was studying at the University of Jena. Early in his studies, an old farmer brought him a poppy plant which was infested with disease. Grümmer knew that his studies on *Papaver* could assist the farmer, and he then realised that the story of the chemical powers of plants needed to be told. One of his greatest pleasures was seeing the publication of his monograph on allelopathy in 1955.

Grümmer's contributions to allelopathy were not numerous, but it was he who largely revitalised interest in allelopathy. As had occurred about twenty years earlier with works by Molisch, Madaus, Boas and Loehwing, there was a major resurgence of interest in allelopathic phenomena with near simultaneous publication of books by Knapp (1954), Chernobrivenko (1956), Martin (1957) and Grümmer (1955); however, it was the latter which really led the way. Recognition of allelopathy had clearly languished since 1937, both because of the death of Molisch in 1937 and the occurrence of the Second World War, and indeed the word "allelopathy" rarely appears in any of the scientific literature until after 1955.

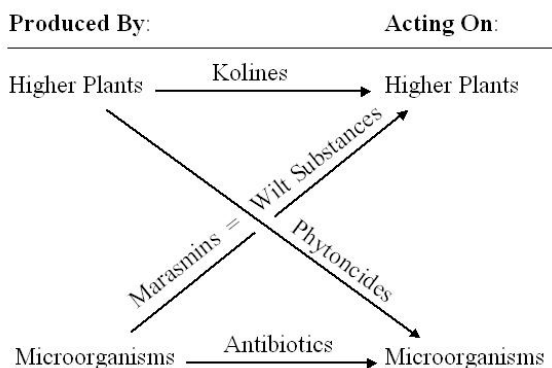


Gerhard Grümmer

Dr Gerhard Grümmer c. 1955 (photograph courtesy of Dr Harald Grümmer)

Grümmer was the first to consolidate allelopathy as a phenomenon in plant ecology (Grümmer 1953). In 1955, his book, *Die gegenseitige Beeinflussung höherer Pflanzen - Allelopathie*, was published by VEB Gustav Fischer Verlag, the same publisher that had published much of the work of Molisch. Grümmer's proficiency in many languages helped him to compile and understand a remarkable overview of the world literature of a previously little described topic. Grümmer's monograph was soon translated into Russian (Grümmer 1957), but lack of editions in other languages has proved a barrier to accessibility.

One of the underrated attributes of Grümmer's monograph is its organisation of an unwieldy wealth of information into a coherent framework. In achieving this, Grümmer introduced a novel scheme of allelopathic interactions, and introduced the term choline (or koline), which is still used today by some ecologists.



Grümmer's scheme of allelopathic interactions (Grümmer 1955)

Grümmer published a brief update in 1956 (Grümmer 1956a), as new data on allelopathy were rapidly emerging, especially in Germany. Grümmer's continued interest in allelopathy focussed on the performance of weeds in flax cultivation. He was particularly impressed by the concept that weeds could affect the yield of crop plants through the release of toxic substances (Grümmer and Natbo 1958, Grümmer 1960, 1964a). He found that the flax-like weed *Camelina* had a detrimental effect on the growth of flax through the production of root exudates and leaf leachates (Grümmer 1956b, 1958), although the identity of the principal inhibitor, so-called "camelinine" remained elusive (Grümmer 1961). He was the first scientist to implicate the phenolic acids in allelopathic interactions (Grümmer 1955, Grümmer and Beyer 1960).

Grümmer travelled and lectured widely on allelopathy in several countries. He visited France in 1954, Bulgaria in 1956, and following publication of the Russian edition of his book on allelopathy, he visited the Soviet Union to collect royalty payment which could not be sent out of the Soviet Union. The Grümmer's received generous payment in roubles, and consequently travelled extensively in the Soviet Union. In 1959 Grümmer was an invited speaker at the First Symposium on Biology of Weeds, at Oxford, organised by the British Ecological Society. Grümmer there presented his work on the allelopathic effects of *Camelina* (Grümmer and Beyer 1960), which generated a memorable and heated debate on the nature of competition. Subsequently, in September 1960, Grümmer was invited to speak at the XIV Symposium of the Society for Experimental Biology on the subject of competition. In the resulting paper, Grümmer (1961) reviewed the status of allelopathy in the plants *Agropyron repens*, *Encelia farinosa*, *Artemisia absinthium*, *Camelina alyssum* and *Juglans* spp., and drew early attention to the hazards of drawing ecological inference from laboratory bioassay results. As with his monograph, this paper also appeared in Russian (Grümmer 1964b). During 1964-1965 he visited Romania, India and the United Arab Republic (Egypt). In 1970 Grümmer travelled to Vietnam, where he was irrevocably moved by the senseless destruction caused by the war there. His last international visit was to Norway in 1971.



Dr. Gerhard Grümmer in his laboratory at the University of Greifswald, c. 1960 (photograph courtesy of Dr Harald Grümmer).

In 1963 A. M. Grodzinskii, the emerging Soviet doyen on allelopathy, visited Greifswald to attend the International Symposium on the Physiology, Ecology and Biochemistry of Germination. Grümmer was subsequently invited to prepare a paper on flax soil sickness which appeared in the first volume of Grodzinskii's important series *Fiziologo-biokhimicheskie Osnovy Vzaimodeistvie Rastanii v Fitotsenozakh* (Grümmer 1969).

Other Scientific Works

Grümmer's botanical contributions were in several disciplines other than allelopathy. He had longstanding interests in phytopathology, plant growth regulation, and crop science. Apart from numerous scientific papers, he published monographs on poppies: a general work, *Der Mohn* (1955), and one on the diseases of poppies, *Krankheitserreges und Schädlinge an Mohn* (1966). He became an expert in rice cultivation and published a text, *Rice* (1970). In 1981 he wrote, in conjunction with A. Krummsdorf, a text on land restoration, *Landschaft vom Reissbrett: die Zukunft unserer Kippen, Halden und Restlöcher*. As discussed below, he became increasingly concerned about the use of defoliants such as "agent orange" by the American armed forces in the escalating Vietnam War. Grümmer, who was skilled in languages, early in his career translated some

scientific works, such as *Sowjetische Genetik* (1954) and *Tiefseebiologie* (1957), and this skill was to serve him well in retired life.

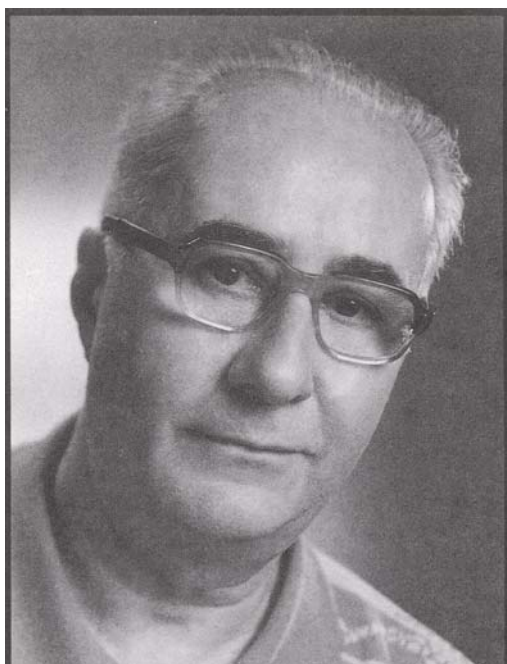
Vietnam

It might be argued that lack of proper recognition of Grümmer's achievements in allelopathic research, particularly in the United States, may have been a legacy of anti-German sentiment following the Second World War. Further to this, Grümmer was resident in the DDR (East Germany), which in 1955 became a member of the Warsaw Pact, in opposition to the U.S.-dominated North Atlantic Treaty Organisation (NATO). This, and what follows, may explain why Grümmer never visited, or perhaps was never allowed to visit, the United States. Grümmer avoided connections to the Communist Party, but he was an ardent humanitarian, and in the 1960's he became outraged by the American use of chemical herbicides in the Vietnam War. Grümmer did become a member of the Vietnam Commission of the Afro-Asian Solidarity Committee of the German Democratic Republic, and in 1969 he authored a booklet entitled *Herbizide in Vietnam*. In 1970 he was invited by the Democratic Republic of Vietnam (DRV; North Vietnam) to visit Vietnam. Following his visit there in late 1970, two scathing reports by Grümmer were released: one on the American use of herbicides in regard to both their ecological and medical effects (*Genocide with Herbicides*, 1971), and the second, on similar issues, as well as the inhumanity of the use of various anti-personnel bombs and mutilating chemical agents such as napalm (*Accusation from the Jungle*, 1972).

Later Life

Grümmer's interests in allelopathy were largely overtaken by his duties at the Institute of Phytopathology at the University of Greifswald, and he worked and published increasingly on plant diseases and growth problems in crops. While Grümmer remained active in academic life until late 1974, his interest in botany and phytopathology had waned with the forced closure of his institute in Greifswald.

Due to poor health, Grümmer retired from the University of Rostock in late 1974, and he more or less severed his ties with academia. He bravely embarked upon a new career, initially as a self-employed translator and editor, and later as an author and publisher. His best-known work is the novel *Irrfahrt* ("Odyssey"), which drew on his wartime experiences and knowledge of the perils of life in a submarine, and has enjoyed ten successive editions since 1977. He also authored a series of shorter military works for the *Tatsachen* series, such as *Der Atem des Todes* (1987), and including some under the pseudonym Gerhard Meer, such as *Das gestohlene Radargerät* (1976), *Gift über Seveso* (1977), *Giftige Wolken* (1980), *Der Giftküche der IG Farben* (1984). In 1985 he wrote a book on chemical warfare entitled *Giftküchen des Teufel*. Ironically, it is these books of military interest for which Grümmer is best known in Germany.



Photograph of Gerhard Grümmer taken in 1993 (courtesy of Gertraud Grümmer).

Grümmer authored an incredibly wide range of works including popular science: *Pflanzen und Tieren tropischer Gebiete* (1967, second edition 1969), *Im Ringem um die Natur* (1970), *Kurzweil durch Biologie* (1988). He translated several works on exploration, including: Ross' *Zum Magnetpol in der Arktis* (1983), Irving's *Leben und Reisen des Christoph Columbus* (1984), Robert E. Peary: *Schlittenreise zum Nordpol* (1985), Franklin's *Vorstoss in die kanadische Arktis* (1986), and Mandeville's *Von seltsamen Ländern und wunderlichen Völkern* (1986). He prepared a collection of German explorations entitled *Nordlich von Europa* (1989).

Grümmer had a love of words and language and was endowed with a gentle sense of humour, which is apparent in many of the books he wrote in his declining years: *Spielformen der Poesie* (1985), *Ponape im Aufstand* (1991) for which he did the drawings, *Marschall Vorwärts* (1992), *Travestien über Fuchs und Rabe* (1993), *De Kauh is dod* (1995). In 1990 Grümmer began his own publishing firm, Warnow-Verlag, which published his own work and that of local Rostock authors: *Palindrome* (1990), *Limericks und Schlimmericks* (1990), *Pirat in Pazifik: Die Abenteuer des Bully Hayes* (1990), *Rostocker Anekdoten* (1990), *Herzhaft und Scherzhaft* (1990), *Rostocker Stammbücher* (1990), *Deutsch für Angeber* (1993; co-authored with G. Drews), *Fachchinesisch für Angeber* (1994; co-authored with G. Drews), *Neue Schüttelreihe* (1994), and *Auf grosser Fahrt* (1995, co-authored with A. Sitte).

In 1995, Gerhard Grümmer was required to undergo a hip operation, but sadly, he died on 19 September 1995, at the age of 69.

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Acknowledgements

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Translator's Note

The full text of *Die gegenseitige Beeinflussung höheren Pflanzen – Allelopathie* written by Gerhard Grümmer and published by VEB Gustav Fischer Verlag, Jena, in 1955, is provided here in English for the first time.

Where possible, the figures from the original German edition have been modified with English text. Where Grümmer has provided German translation of text originally in English, I have endeavoured to use the original English passage. Small errors, found in the original edition, have been amended. In a few instances, I have added editorial footnotes to correct inaccuracies or clarify points for the English reader. Throughout the work, including the index, I have tried to retain most of the stylistic elements of the original edition.

In the References section, for the sake of clarity, the authors have been listed in a more conventional form than that used by Grümmer, and for some references, more information has been added. Notably, the Russian edition, *Vzaimnoe Vliyaniye Vysshikh Rastenii – Allelopatiya* (Gryummer 1957), which itself has had the Russian references corrected by the editor, has been consulted to amend the Russian references cited by Grümmer in the German edition. Reference titles, apart from those in Russian, have been left in the original language. Grümmer did not discriminate reference citations with the same author and date, and this problem remains in the translation.

The Mutual Interaction of Higher Plants — Allelopathy —

by

Dr. rer. nat. **Gerhard Grümmer**

Dozent in the Mathematics-Natural Sciences Faculty
of Ernst-Moritz-Arndt University, Greifswald
With 52 Illustrations in the Text

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