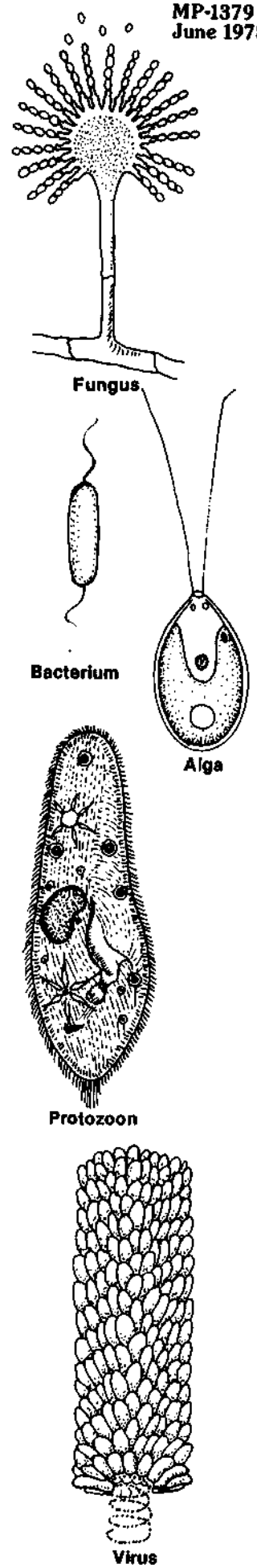
Item ID Number	03971	☐ **Not Scanned**
Author	Diaz-Colon, J.D.	
Corporate Author		
Report/Article Title	Selected Bibliography of the Phenoxy Herbicides: V. Interrelations with Microorganisms	
Journal/Book Title		
Year	1978	
Month/Day	June	
Color	☐	
Number of Images	92	
Description Notes		

MP-1379
June 1978



Selected Bibliography of the Phenoxy Herbicides

V. Interrelations with Microorganisms

The Texas Agricultural Experiment Station, Neville P. Clarke, Director,
The Texas A&M University System, College Station, Texas

In cooperation with Federal Research—Science
and Education Administration, U.S. Department of Agriculture

CONTENTS

Introduction.....1

List of Abbreviated Sources.....3

Language Abbreviation.....13

Subject Index (Part A - Herbicide Effects on Microorganisms).....14

Bibliography (Part A - Herbicide Effects on Microorganisms).....39

Subject Index (Part B - Effects of Microorganisms on Herbicides)....64

Bibliography (Part B - Effects of Microorganisms on Herbicides).....71

Keywords.....88

Acknowledgment.....Inside Back Cover

Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the Texas Agricultural Experiment Station or the U. S. Department of Agriculture and does not imply its approval to the exclusion of other products that also may be suitable.

All programs and information of the Texas Agricultural Experiment Station are available to everyone without regard to race, color, religion, sex, age, or national origin.

SELECTED BIBLIOGRAPHY OF THE PHENOXY HERBICIDES

V. Interrelations With Microorganisms

J. D. Diaz-Colon and R. W. Bovey*

Introduction

This is the fifth publication in the series of "Selected Bibliographies of the Phenoxy Herbicides." Four previous bibliographies regarding fate, dioxin, toxicology, and ecology were published during 1976, 1977, and 1978.

The extensive use of pesticides in modern agriculture makes it imperative to increase our knowledge regarding their activities in the environment. Since microorganisms are part of the ecological system, it is important to know their behavior when pesticides are present on different ecosystems. Therefore, this publication on the phenoxy herbicides deals with two important aspects: Part A - Herbicide Effects on Microorganisms and Part B - Effects of Microorganisms on Herbicides.

The two parts consist of references listed in alphabetical order according to senior author's name. A subject numerical index, consisting of three sections, is provided for each part. Each section is identified by a Roman numeral.

Section I contains research papers. Scientific names of microorganisms are listed alphabetically under their respective groups (Fungi, Bacteria, Algae, Protozoa, Viruses). Section II includes reviews dealing with the information from the preceding section. Section III deals with informative nontechnical papers.

* Respectively, agricultural research technician and research agronomist, Federal Research, Science and Education Administration, U.S. Department of Agriculture, and The Texas Agricultural Experiment Station (Department of Range Science).

Each Arabic numeral on the subject indexes identifies a reference in their respective author's alphabetical lists. For references published in languages other than English, the abbreviated form of the particular language is enclosed in parentheses after the title. A list of the abbreviated and complete names of languages and a list of the abbreviated and complete names of periodicals, together with their countries and cities of origin, are also provided. If English abstracts for the references are available, the abstract sources are included after the listed reference.

List of Abbreviated Sources

ACS Symp. Ser.	American Chemical Society, Symposium Series (Washington, D.C.)
Acta Agric. Scan.	Acta Agriculturae Scandinavica (Stockholm, Sweden)
Acta Microbiol. Acad. Sci. Hung.	Acta Microbiologica Academiae Scientiarum Hungaricae (Budapest, Hungary)
Acta Microbiol. Pol., Ser. B	Acta Microbiologica Polonica. Series B, Microbiologica Applicate (Warsaw, Poland)
Advan. Agron.	Advances in Agronomy (New York, N.Y.)
Advan. Appl. Microbiol.	Advances in Applied Microbiology (New York, N.Y.)
Advan. Chem. Ser.	Advances in Chemistry Series (Washington, D.C.)
Agrartud. Egy. Kozl.	Agrartudomanyi Egyetem Kozlemenyei Godollo (Budapest, Hungary)
Agrartud. Egy. Mezogazd. Karanak Kozl.	Agrartudomanyi Egyetem Mezögazdasagtudomanyi Karanak, Közlemenyei (Budapest, Hungary)
Agrartud. Kozl.	Agrartudomanyi Kozlemenyek (Budapest, Hungary)
Agric. Res. Rev.	Agricultural Research Review (Cairo, Egypt)
Agrochimica	Agrochimica (Pisa, Italy)
Agron. J.	Agronomy Journal (Madison, Wisc.)
Alexandria J. Agric. Res.	Alexandria Journal of Agricultural Research (Alexandria, Egypt)
Allionia	Allionia (Turin, Italy)
Am. Chem. Soc., Abstr. Pap., Nat. Meet., Pestic. Chem. Sec.	American Chemical Society, Abstracts of Papers of the National Meetings, Pesticides Chemistry Section (Washington, D.C.)
Am. Inst. Chem. Eng., Symp. Ser.	American Institute of Chemical Engineering, Symposium Series (New York, N.Y.)
Am. J. Bot.	American Journal of Botany (Lawrence, Kans.)
Am. Soc. Microbiol., Abstr., Meet.	American Society for Microbiology. Abstracts of the Annual Meeting (Washington, D.C.)

An. Inst. Cercet. Cult. Cartofului Sfeclei Zahar, Brazov	Anale Institutul de Cercetari pentru Cultura Cartofului si Sfeclei de Zahar, Brazov (Brazov, Rumania)
Ann. Appl. Biol.	Annals of Applied Biology (London, England)
Ann. Bot. (London)	Annals of Botany (London) (London, England)
Ann. N.Y. Acad. Sci.	Annals of the New York Academy of Science (New York, N.Y.)
Ann. Phytopathol. Soc. Jpn.	Annals of the Phytopathological Society of Japan (Tokyo, Japan)
Annu. Rev. Microbiol.	Annual Review of Microbiology (Palo Alto, Calif.)
Antonie van Leeuwenhoek	Antonie van Leeuwenhoek. Journal of Microbiology and Serology (Amsterdam, Netherlands)
Appl. Microbiol.	Applied Microbiology (Baltimore, Md.)
Arch. Environ. Contam. Toxicol.	Archives of Environmental Contamination and Toxicology (New York, N.Y.)
Arch. Microbiol.	Archives of Microbiology (New York, N.Y.)
Arch. Mikrobiol.	Archiv fuer Mikrobiologie (Berlin, Germany)
Arch. Phytopathol. Pflanzenschutz	Archiv fuer Phytopathologie und Pflanzenschutz (Berlin, Germany)
Arkansas Agric. Exp. Stn., South. Coop. Ser. Bull.	Arkansas Agricultural Experiment Station, Southern Cooperative Series Bulletin (Fayetteville, Ark.)
Bacteriol. Proc.	Bacteriological Proceedings (Ann Arbor, Mich.)
Bacteriol. Rev.	Bacteriological Reviews (Baltimore, Md.)
Biochem. J.	Biochemical Journal, The (London, England)
Biol. Nauki (Moscow)	Biologicheskie Nauki (Moscow) (Moscow, USSR)
Biologico	Biologico (Sao Paulo, Brazil)
Biol. Plant.	Biologia Plantarum (Prague, Czechoslovakia)
Biol. Sol.	Biologie du Sol (Paris, France)
Biol. Zentralbl.	Biologisches Zentralblatt (Leipzig, E. Germany)

Bitki Koruma Bul.	Bitki Koruma Bulteni (Ankara, Turkey)
Bol. R. Soc. Esp. Hist. Nat.	Boletin de la Real Sociedad Espanola de Historia Natural (Madrid, Spain)
Bot. Gaz.	Botanical Gazette (Chicago, Ill.)
Br. Ecol. Soc. Symp.	British Ecological Society Symposium (Sivansea, England)
Br. Phycol. J.	British Phycological Journal (London, England)
Bull. Coll. Agric. Utsunomiya Univ.	Bulletin of the College of Agriculture, Utsunomiya University (Utsunomiya, Japan)
Bull. Environ. Contam. Toxicol.	Bulletin of Environmental Contamination and Toxicology (New York, N.Y.)
Bull. Ga. Acad. Sci.	Bulletin of the Georgia Academy of Science (Athens, Ga.)
Bull. Nat. Inst. Agric. Sci., Ser. C.	Bulletin of the National Institute of Agricultural Sciences, Series C: Plant Pathology and Entomology (Tokyo, Japan)
Can. J. Microbiol.	Canadian Journal of Microbiology (Ottawa, Canada)
Can. J. Plant Sci.	Canadian Journal of Plant Science (Ottawa, Canada)
Cesk. Hyg.	Ceskoslovenska Hygiena (Prague, Czechoslovakia)
Chem. Abstr.	Chemical Abstracts (Columbus, Ohio)
Chem. Pharm. Bull.	Chemical and Pharmaceutical Bulletin (Tokyo, Japan)
Chem. Technol.	Chemical Technology (Washington, D.C.)
Chimia	Chimia (Aarau, Switzerland)
Citrus Grow.	Citrus Grower (Orlando, Fla.)
Contrib. Boyce Thompson Inst.	Contributions from Boyce Thompson Institute (Yonkers, New York, N.Y.)
Contrib. Ist. Rec. Agrar. Milan	Contributi, Istituto di Recerche Agrarie, Milan (Milan, Italy)
Crit. Rev. Microbiol.	Critical Reviews in Microbiology (Cleveland, Ohio)
Crop Sci.	Crop Science (Madison, Wisc.)

C. R. Seances Acad. Agric. Fr.	Comptes Rendus des Seances de l'Academie d'Agriculture de France (Paris, France)
Curr. Sci.	Current Science (Bangalore, India)
Diss. Abstr. Int.	Dissertation Abstracts International (Ann Arbor, Mich.)
Dokl. Akad. S-Kh. Nauk Bolg.	Doklady Akademii Sel'skokhozyaistvennykh Nauk v Bolgarii (Sofia, Bulgaria)
Dokl. Biol. Sci. - En. Transl.	Doklady Biological Sciences - English Translation (New York N.Y.)
Down Earth	Down to Earth (Midland, Mich.)
Environ. Chem.	Environmental Chemistry (London, England)
Environ. Entomol.	Environmental Entomology (College Park, Md.)
Environ. Qual. Saf.	Environmental Quality and Safety (Stuttgart, Germany)
Erwerbsobstbau	Erwerbsobstbau, Der (Berlin, Germany)
Health Aspects Pestic.	Health Aspects of Pesticides, Abstract Bulletin (Chamblee, Ga.)
Hyac. Control J.	Hyacinth Control Journal (Fort Lauderdale, Fla.)
Indian J. Agric. Sci.	Indian Journal of Agricultural Sciences (New Delhi, India)
Indian J. Exp. Biol.	Indian Journal of Experimental Biology (New Delhi, India)
Indian J. Hortic.	Indian Journal of Horticulture (New Delhi, India)
Indian J. Microbiol.	Indian Journal of Microbiology (Baroda, India)
Indian J. Mycol. Plant Pathol.	Indian Journal of Mycology and Plant Pathology (Udaipur, India)
Indian J. Weed Sci.	Indian Journal Weed Science (Hissar, India)
Indian Phytopathol.	Indian Phytopathology (New Delhi, India)
Ind. Veg. Manage.	Industrial Vegetation Management (Dow Chemical Co., Midland, Mich.)

Int. Rice Comm., Newsl.	International Rice Commission, Newsletter (Bankoy, Thailand)
Izv. Akad. Nauk SSSR, Ser. Biol.	Izvestiya Akademii Nauk SSSR, Seriya Biologicheskaya (Moscow, USSR)
Izv. Timiryazevsk. Skh. Akad.	Izvestiya Timiryazevskoi Sel'skokhozyaistvennoi Akademii (Moscow, USSR)
J. Agric. Food Chem.	Journal of Agriculture and Food Chemistry (Washington, D.C.)
J. Agric. Sci.	Journal of Agricultural Science (Cambridge, England)
J. Agric. Univ. P.R.	Journal of Agriculture of the University of Puerto Rico (Rio Piedras, Puerto Rico)
J. Am. Soc. Agron.	Journal of the American Society of Agronomy (Geneva, N.Y.)
J. Am. Water Works Assoc.	Journal of the American Water Works Association (New York, N.Y.)
J. Anim. Sci.	Journal of Animal Science (Champaign, Ill.)
J. Bacteriol.	Journal of Bacteriology (Baltimore, Md.)
J. Cell. Physiol.	Journal of Cellular Physiology (Philadelphia, Pa.)
J. Chem. Soc.	Journal of the Chemical Society (London, England)
J. Environ. Qual.	Journal of Environmental Quality (Madison, Wisc.)
J. Exp. Bot.	Journal of Experimental Botany (London, England)
J. For.	Journal of Forestry (Washington, D.C.)
J. Gen. Appl. Microbiol.	Journal of General and Applied Microbiology (Tokyo, Japan)
J. Gen. Microbiol.	Journal of General Microbiology (Elstree, England)
J. Indian Soc. Soil Sci.	Journal of the Indian Society of Soil Science (New Delhi, India)
J. Invertebr. Pathol.	Journal of Invertebrate Pathology (New York, N.Y.)
J. Phycol.	Journal of Phycology (New York, N.Y.)
Jpn. J. Bot.	Japanese Journal of Botany (Tokyo, Japan)

J. Range Manage.	Journal of Range Management (Denver, Colo.)
J. S. Afr. Chem. Inst.	Journal of the South African Chemical Institute (Johannesburg, South Africa)
J. Sci. Food Agric.	Journal of the Science of Food and Agriculture (London, England)
J. Water Pollut. Control Fed.	Journal of the Water Pollution Control Federation (Washington, D.C.)
Kagawa Kenritsu Noka Daigaku Gakujutsu Hokoku	Kagawa Kenritsu Noka Daigaku Gakujutsu Hokoku (Kagawa, Japan)
Kasetsart J.	Kasetsart Journal, The (Bangkok, Thailand)
Khim. Sel'sk. Khoz.	Khimiya v Selskom Khoziastive (Moscow, USSR)
K. Lantbruks-Hoegsk. Ann.	Kungliga Lantbruks-Hoegskolans Annaler (Uppsala, Sweden)
Landbouwkd. Tijdschr.	Landbouwkundig Tijdschrift (Wageningen, Netherlands)
Madras Agric. J.	Madras Agricultural Journal (Coimbatore, India)
Mar. Pollut. Bull.	Marine Pollution Bulletin (London, England)
Meded. Fac. Landbouwwet., Rijksuniv. Gent	Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent (Ghent, Belgium)
Mich. Agric. Exp. Stn., Q. Bull.	Michigan Agricultural Experiment Station, Quarterly Bulletin (East Lansing, Mich.)
Microbiol. Esp.	Microbiologia Espanola (Madrid, Spain)
Mikrobiologiia	Mikrobiologiia (Moscow, USSR)
Mikrobiologiya	Mikrobiologiya (Moscow, USSR)
Mikrobiol. Zh. (Kiev)	Mikrobiologichnii Zhurnal (Kiev) (Kiev, USSR)
Mitt. Biol. Bundesanst. Land Forstwirtsch., Berlin-Dahlem	Mitteilungen aus der Biologischen Bundesanstalt fuer Land- und Forstwirtschaft, Berlin-Dahlem (Berlin, Germany)
Mitt. Biol. Zentralanst. Land Forstwirtsch., Berlin-Dahlem	Mitteilungen aus der Biologischen Zentralanstalt fuer Land- und Forstwirtschaft, Berlin-Dahlem (Berlin-Dahlem, Germany)

Mutat. Res.	Mutation Research (Amsterdam, Netherlands)
Mycologia	Mycologia (Bronx, N.Y.)
Nature	Nature - London (London, England)
Naturwissenschaften	Naturwissenschaften, Die (Berlin, Germany)
N.Dak. Farm Res.	North Dakota Farm Research (Fargo, N. Dak.)
New Phytol.	New Phytologist (London, England)
New Sci.	New Scientist (London, England)
Pamiet. Pulawski	Pamietnik Pulawski (Warsaw, Poland)
Parasitica	Parasitica (Gembloux, Belgium)
Pestic. Abstr.	Pesticides Abstracts (Washington, D.C.)
Pestic. Biochem. Physiol.	Pesticide Biochemistry and Physiology (New York, N.Y.)
Pesticides	Pesticides (Bombay, India)
Pestic. Sci.	Pesticide Science (London, England)
Phyton-ØYTON	Phyton - ØYTON (Buenos Aires, Argentina)
Phytopathology	Phytopathology (St. Paul, Minn.)
Plant Cell Physiol.	Plant and Cell Physiology (Tokyo, Japan)
Plant Dis. Rep.	Plant Disease Reporter, The (Washington, D.C.)
Plant Physiol.	Plant Physiology (Kutztown, Pa.)
Plant Sci. Lett.	Plant Science Letters (Amsterdam, Netherlands)
Plant Soil	Plant and Soil (The Hague, Netherlands)
Pochvoved. Agrokhim.	Pochvovedenie i Agrokhimiya (Kharkov, USSR)
Pochvovedenie	Pochvovedenie (Moscow, USSR)
Pochvozn. Agrokhim.	Pochvoznanie i Agrokhimiya (Sofia, Bulgaria)
Proc. Am. Soc. Hortic. Sci.	Proceedings of the American Society for Horticultural Science (St. Joseph, Mich.)

Proc. Ark. Acad. Sci.	Proceedings of the Arkansas Academy of Science (Fayetteville, Ark.)
Proc. Br. Weed Control Conf.	Proceedings of the British Weed Control Conference (Droitwich, Worcestershire, England)
Proc. Eur. Weed Res. Counc., Symp. Herbic.-Soil	Proceedings of the European Weed Research Council, Symposium on Herbicides-Soil (Oxford, England)
Proc. Fla. State Hortic. Soc.	Proceedings of the Florida State Horticultural Society (Lake Alfred, Fla.)
Proc. Indian Acad. Sci.	Proceedings of the Indian Academy of Sciences (Bangalore, India)
Proc. Int. Congr. Biochem.	Proceedings of the International Congress of Biochemistry (Bethesda, Md.)
Proc. La. Acad. Sci.	Proceedings of the Louisiana Academy of Sciences (Monroe, La.)
Proc. North Cent. Weed Control Conf.	Proceedings of the North Central Weed Control Conference (Omaha, Nebr.)
Proc. Northeast. Weed Control Conf.	Proceedings of the Northeastern Weed Control Conference (Farmingdale, N.Y.)
Proc. Pa. Acad. Sci.	Proceedings of the Pennsylvania Academy of Science (Easton, Pa.)
Proc. R. Soc., Ser. B	Proceedings of the Royal Society, Series B (London, England)
Proc. S.D. Acad. Sci.	Proceedings of the South Dakota Academy of Science (Vermillion, S. Dak.)
Proc. Soc. Exp. Biol. Med.	Proceedings of the Society for Experimental Biology and Medicine (New York, N.Y.)
Proc. Soil Sci. Soc. Am.	Proceedings of the Soil Science Society of America (Madison, Wis.)
Purdue Univ. Water Resour. Res. Cent., Tech. Rep.	Purdue University Water Resources Research Center, Technical Report (W. Lafayette, Ind.)
Rep., Rothamsted Exp. Stn., Harpenden, Engl.	Report, Rothamsted Experimental Station, Harpenden, England (Harpenden, England)
Residue Rev.	Residue Reviews (New York, N.Y.)

Rev. Ind. Agric. Tucuman	Revista Industrial y Agricola de Tucuman (San Miguel de Tucuman, Argentina)
Rocz. Glebozn.	Roczniki Gleboznawcze (Warsaw, Poland)
Rocz. Nauk Roln., Ser. H	Roczniki Nauk Rolniczych, Seria H (Warsaw, Poland)
S. Afr. J. Agric. Sci.	South African Journal of Agricultural Science (Pretoria, South Africa)
Science	Science (Washington, D.C.)
Soc. Appl. Bacteriol. Symp. Ser.	Society for Applied Bacteriology Symposium Series (London, England)
Soil Biol. Biochem.	Soil Biology and Biochemistry (Oxford, England)
Soil Sci.	Soil Science (Baltimore, Md.)
Soil Sci. Plant Nutr.	Soil Science and Plant Nutrition (Tokyo, Japan)
Sugar Bull.	Sugar Bulletin (New Orleans, La.)
Sven. Bot. Tidskr.	Svensk Botanisk Tidskrift (Stockholm, Sweden)
Swed. J. Agric. Res.	Swedish Journal of Agricultural Research (Stockholm, Sweden)
Symp. Biol. Hung.	Symposia Biologica Hungarica (Budapest, Hungary)
Tea Q.	Tea Quarterly (Talawakele, Ceylon)
Tex. J. Sci.	Texas Journal of Science (Austin, Tex.)
Trans. Am. Fish. Soc.	Transactions of the American Fisheries Society (Washington, D.C.)
Trib. CEBEDEAU	Tribune du CEBEDEAU (Liege, Belgium)
Tr. Kamenets-Podol'sk. Skh. Inst.	Trudy Kamenets-Podol'skogo Sel'skokhozyaistvennogo Instituta (Kamenets-Podolskii, USSR)
Turf Sport	Turf for Sport (Berkshire, England)
Univ. Rural Pernambuco, Comun. Tec.	Universidade Rural de Pernambuco, Comunicado Tecnico (Recife, Brazil)
U.S. Dep. Agric., Agric. Res. Serv., ARS	U.S. Department of Agriculture, Agricultural Research Service, ARS (Washington, D.C.)

U.S. Dep. Agric., Yearb. Agric.	U.S. Department of Agriculture, Yearbook of Agriculture (Washington, D.C.)
U.S. Fish Wildl. Serv., Bur. Sp. Fish. Wildl., Spec. Sci. Rep., Wildl.	U.S. Fish and Wildlife Service, Bureau of Sports Fisheries and Wildlife, Special Scientific Report, Wildlife (Washington, D.C.)
U.S. Fish Wildl. Serv., Cir.	U.S. Fish and Wildlife Service, Circular (Washington, D.C.)
U.S. For. Serv., Pac. Northwest For. Range Exp. Stn., Res. Notes	U.S. Forest Service, Pacific Northwest Forest and Range Experiment Station, Research Notes (Portland, Oreg.)
U.S.N.T.I.S., AD Rep. or PB Rep.	U.S. National Technical Information Service, AD Report or PB Report (Springfield, Va.)
Vestn. Skh. Nauki	Vestnik Sel'skokhozyaistvennoi Nauki (Moscow, USSR)
Vestn. Skh. Nauki Kaz.	Vestnik Sel'skokhozyaistvennoi Nauki Kazakhstana (Alma Ata, USSR)
Virology	Virology (New York, N.Y.)
Visn. Sil's'Kogospod. Nauki	Visnik Sil's'Kogospodars'koi Nauki (Kiev, USSR)
Wasserwirtsch.-Wassertech.	Wasserwirtschaft-Wassertechnik (Berlin, Germany)
Water Res.	Water Research (Oxford, England)
Water Resour. Bull.	Water Resources Bulletin (Urbana, Ill.)
Water Resour. Res. Inst., Clemson Univ., Rep.	Water Resources Research Institute, Clemson University, Report (Clemson, S.C.)
Weed Abstr.	Weed Abstracts (Oxford, England)
Weed Res.	Weed Research (Oxford, England)
Weeds	Weeds (Champaign, Ill.)
Weed Sci.	Weed Science (Champaign, Ill.)
Weed Sci. Soc. Am., Abstr., Meet.	Weed Science Society of America, Abstracts, Meetings (Champaign, Ill.)
Z. Allg. Mikrobiol.	Zeitschrift fuer Allgemeine Mikrobiologie. Morphologie, Physiologie, Genetik und Oekologie der Mikroorganismen (Berlin, Germany)

Zentralbl. Bakteriol. Parasitenkd. Infektionskr., Abt. 2	Zentralblatt fuer Bakteriologie, Parasitenkunde und Infektionskrankheiten, Abteilung 2 (Jena, E. Germany)
Zesz. Nauk. Akad. Roln. Szczecinie	Zeszyty Naukowe, Akademia Rolnicza w Szczecinie (Szczeien, Poland)
Z. Pflanzenkr. Pflanzenschutz	Zeitschrift fuer Pflanzenkrankheiten und Pflanzenschutz (Stuttgart, Germany)

Language Abbreviation

Bg - Bulgarian	Nl - Dutch
Cs - Czech	Pl - Polish
De - German	Pt - Portuguese
Es - Spanish	Ro - Romanian
Fr - French	Ru - Russian
Hu - Hungarian	Th - Thai
It - Italian	Tr - Turkish
Ja - Japanese	Uk - Ukrainian

Part A

Herbicide Effects on Microorganisms

Subject Index

I. Research Papers - Herbicide Effects on Microorganisms

A. 2,4-D (2,4-dichlorophenoxy)acetic acid

1. Effects on Fungi

Absidia cuneospora 259
Alternaria citri 67, 76
Alternaria humicola 308
Alternaria solani 170, 238
Alternaria sp. 216, 259, 262
Alternaria tenuissima 106
Arachnotheca albicans 259
Armillaria mellea 238
Ascochyta pisi 238
Ascochyta sp. 259
Aspergillus alliaceus 259
Aspergillus amstelodami 19, 259
Aspergillus awamori 265
Aspergillus candidus 192, 223, 267
Aspergillus flavipes 259
Aspergillus flavus 15, 106, 286
Aspergillus fumigatus 192, 265, 273, 286, 289
Aspergillus leoporis 19, 259
Aspergillus niger 15, 106, 192, 201, 238, 286, 289
Aspergillus oryzae 259, 286
Aspergillus paradoxus 286
Aspergillus puniceus 19, 259
Aspergillus sclerotorum 19, 259
Aspergillus sp. 16, 153, 266
Aspergillus sydowi 19, 106, 259
Aspergillus tamarii 15
Aspergillus terreus 106
Aspergillus ustus 259, 267, 286
Aspergillus versicolor 19, 259, 308
Beauvaria bassiana 259
Bipolaris sp. 106
Botrytis cinerea 76, 238
Candida albicans 238, 300
Candida parapsilosis 107
Candida pulcherrima 238
Cephalosporium acremonium 259
Cephalosporium coremioides 19, 259
Cercospora arachidicola 45
Chaetomium homopilatum 259
Chaetophoma sp. 259
Chrysosporium pannorum 19, 259
Chrysosporium sp. 259
Cladosporium cladosporioides 106
Cladosporium herbarum 259
Cladosporium hordei 259

2,4-D - Fungi (Cont'd)

Cochiliobolus miyabeanus 200
Colletotrichum phomoides 53
Corticium solani 238
Cryptococcus albidus 308
Cunninghamella sp. 201
Curvularia brachyospora 106
Curvularia sp. 47
Cylindrocarpon sp. 19, 259
Debaryomyces sp. 308
Diaporthe citri 76
Diplodia natalensis 76, 158
Fomes annosus 163
Fusarium aquaeductuum 267
Fusarium avenaceum 145, 267
Fusarium conglutinans 238
Fusarium culmorum 145
Fusarium equiseti 192
Fusarium graminearum 145
Fusarium lycopersicum 170
Fusarium moniliforme 180, 259
Fusarium nivale 238, 267, 302
Fusarium oxysporum 45, 47, 60, 192, 259
Fusarium oxysporum f. lycopersici 238
Fusarium solani 267
Fusarium sp. 16, 153, 201, 216, 261, 266, 267
Fusidium sp. 259
Geotrichum sp. 259
Gibberella saubinettii 273
Gibberella zeae 26, 238
Gliomastix sp. 259
Gloeosporium kaki 200
Gloeosporium olivarum 197, 198, 199, 200
Glomerella cingulata 53
Griphosphaeria nivalis 300
Helicobasidium mompa 273
Helminthosporium oryzae 236
Helminthosporium sativum 238
Helminthosporium sp. 16
Helminthosporium turcicum 53
Helminthosporium victoriae 26, 45
Heterosporium sp. 259
Hormodendrum sp. 267
Hyalodendron sp. 259
Hypochnus centrifugus 273
Lipomyces starkeyi 308
Malbranchea sp. 259
Melampsora citri 285
Microascus trigonosporus 19, 259
Microsporum canis 238
Mortierella sp. 259
Mucor griseocyanus 192

2,4-D - Fungi (Cont'd)

Mucor hiemalis 238
Mucor racemosus 192
Mucor ramannianus 308
Mucor sp. 153, 269, 308
Mycelia sterilia 106, 267
Neurospora crassa 232
Neurospora sitophila 238
Neurospora tetrasperma 223
Nigrospora sp. 267
Oïspora citriaurantii 76
Ophiobolus myabeanus 273
Paecilomyces varioti 15, 259
Penicillium canescens 19, 259
Penicillium chrysogenum 19, 106, 238, 259
Penicillium citrinum 106
Penicillium corylophilum 106
Penicillium cyaneo-fulvum 259
Penicillium cyclopium 19, 106, 259
Penicillium digitatum 76, 112, 113, 158
Penicillium expansum 53, 170
Penicillium frequentans 106, 192
Penicillium funiculosum 15, 267
Penicillium glaucum 289
Penicillium italicum 76
Penicillium martensii 259
Penicillium nalgiovensis 267
Penicillium nigricans 192
Penicillium notatum 106, 181, 238
Penicillium ochro-chloron 106, 308
Penicillium patulum 259
Penicillium piscarium 267
Penicillium purpurogenum 267
Penicillium simplicissimum 308
Penicillium sp. 16, 47, 53, 153, 261, 266, 267, 308
Penicillium urticae 106
Perisporium vulgare 192
Phoma sp. 259
Phomopsis citri 113
Phycomyces blakesleeanus 223
Phycomyces nitens 53
Phytophthora cactorum 53, 269
Phytophthora parasitica 45, 238
Piricularia oryzae 273
Pyrenophora avenae 238
Pyronema domesticum 191
Pythium debaryanum 26, 238
Pythium sp. 269
Rhizoctonia solani 216
Rhizopus arrhizus 106, 270, 271
Rhizopus nigricans 53, 192
Rhizopus oryzae 271
Rhizopus sp. 153

2,4-D - Fungi (Cont'd)

Rhizopus stolonifer 238, 271
Rhodotorula glutinis 208
Rhodotorula mucilaginosa 19, 259, 308
Saccharomyces acidifaciens 238
Saccharomyces cerevisiae 238, 305
Saccharomyces fragilis 238
Schizoblastosporion starkeyi-henricii 308
Schizophyllum commune 200, 223
Sclerotinia cinerea 53
Sclerotinia oryzaesativa 273
Sclerotinia sclerotiorum 53, 76, 170
Sclerotium delphinii 53
Sclerotium rolfsii 45, 53
Sporobolomyces sp. 259
Stachybotrys atra 267
Torulopsis aeria 308
Torulopsis glabrata 107
Torulopsis magnoliae 107
Trichoderma lignorum 76
Trichoderma sp. 47, 153, 201, 267, 269, 308
Trichoderma viride 180, 192, 238, 265
Trichophyton sulphureum 238
Trichothecium roseum 289
Ustilago maydis 206
Ustilago nuda 69
Verticillium albo-atrum 169
Verticillium candellabrum 267
Zygodesmus sp. 259
Zygorhynchus sp. 308
Zygosporium sp. 259

FUNGI (scientific names not given) 3, 14, 32, 64, 65, 130, 131, 132, 182, 184, 225, 249, 279, 304, 307

2. Effects on Bacteria

Achromobacter nephridii 120
Achromobacter parvulus 120
Achromobacter sp. 260
Actinomyces aureoverticillatus 308
Actinomyces chromogenes 273
Actinomyces fradiae 308
Actinomyces globisporus 308
Actinomyces griseus 273
Actinomyces lavendulae 308
Actinomyces scabies 187
Aerobacter aerogenes 53, 120, 164, 238
Agrobacterium radiobacter 136
Agrobacterium tumefaciens 238
Alcaligenes faecalis 53
Arizona sp. 105

2,4-D - Bacteria (Cont'd)

Arthrobacter globiformis 251
Arthrobacter oxydans 251
Azotobacter agile 141, 177, 178, 286
Azotobacter agilis 80
Azotobacter beijerinckii 136
Azotobacter chroococcum 66, 80, 103, 136, 141, 168, 177, 178, 180, 188, 237, 273, 286, 300
Azotobacter sp. 33, 47, 50, 66, 118, 119, 244, 249, 276, 277, 304
Azotobacter vinelandii 140, 141, 177, 178, 273
Bacillus brevis 170
Bacillus cereus 120, 138, 148, 308
Bacillus globigii 201
Bacillus megaterium 120, 308
Bacillus mesentericus 213, 308
Bacillus mycoides 53, 136, 213
Bacillus pasteurii 148
Bacillus subtilis 53, 120, 136, 148, 151, 170, 180, 201, 208, 213, 238, 239, 255, 261, 308
Bacterium aerogenes 136
Bacterium cadaveris 299
Bacterium coli 136
Bacterium lactis aerogenes 63
Bacterium prodigiosum 136
Brevibacterium linens 251
Cellvibrio sp. 136
Citrobacter sp. 105
Clostridium acetobutylicum 120, 156
Clostridium botulinum 300
Clostridium butyricum 156
Clostridium pasteurianum 156, 276, 277
Clostridium perfringens 120
Clostridium sporogenes 120
Clostridium tetani 300
Clostridium tetanomorphum 120, 164
Clostridium welchii 300
Corynebacterium fascians 120
Corynebacterium nephridii 120
Corynebacterium sp. 137, 238
Cytophaga sp. 136
Enterobacter aerogenes 105
Enterobacter cloacae 105
Enberobacter hafniae 105
Erwinia phytophthora 53
Escherichia coli 53, 105, 120, 151, 164, 170, 195, 213, 239, 292, 300, 308
Flavobacterium aquatile 137
Flavobacterium peregrinum 260
Flavobacterium sp. 35
Klebsiella pneumoniae 105
Microbacterium lacticum 308

2,4-D - Bacteria (Cont'd)

Micrococcus lysodeikticus 164
Micromonospora sp. 136
Mycobacterium mucosum 308
Mycobacterium phlei 136
Mycobacterium tuberculosis 71
Nitrobacter 280
Nitrosomanas europaea 136
Nitrosomonas sp. 136, 280
Nocardia blackwellii 100
Nocardia corallina 100, 136
Nocardia erytropolis 100
Nocardia globerula 231
Nocardia minima 100
Nocardia opaca 100
Nocardia rosea 100
Nocardia rubropertincta 100, 251
Nocardia salmonicolor 100
Nocardia sp. 99, 238, 259
Promicromonospora sp. 259
Proteus vulgaris 53, 213
Pseudomonas aeruginosa 53
Pseudomonas denitrificans 120
Pseudomonas fluorescens 121, 139, 164, 180, 238
Pseudomonas pyocyanea 136
Pseudomonas sp. 148, 278
Pseudomonas stutzeri 120
Rhizobium japonicum 43, 97, 147, 180, 300
Rhizobium leguminosarum 43, 94, 97, 136, 170
Rhizobium lupini 43, 136, 147, 301
Rhizobium meliloti 80, 97, 136, 140, 147, 205
Rhizobium phaseoli 43, 300
Rhizobium sp. 148
Rhizobium trifolii 43, 80, 83, 84, 85, 97, 136, 222, 300, 301
Salmonella typhimurium 5, 239, 305
Sarcina lutea 53, 238
Senatia liquefaciens 105
Serratia marcescens 53, 290, 308
Shigella paradysenteriae 71
Shigella sp. 105
Staphylococcus albus 300
Staphylococcus aureus 53, 120, 151, 164, 170
Streptococcus hemolyticus 71
Streptococcus salivarius 71
Streptomyces albus 259
Streptomyces aureus 19
Streptomyces azureus 259
Streptomyces diastatochromogenes 259
Streptomyces fasciculus 151
Streptomyces globisporus 151
Streptomyces griseus 136, 238

2,4-D Bacteria (Cont'd)

Streptomyces scabies 238
Streptomyces sp. 31, 238

BACTERIA (scientific names not given) 2, 3, 4, 14, 16, 17, 29, 32, 42, 48, 49, 58, 64, 65, 78, 130, 131, 132, 142, 144, 153, 155, 160, 181, 182, 184, 190, 211, 234, 243, 249, 255, 257, 268, 279, 291, 304, 307

3. Effects on Algae

Actinastrum sp. 39, 40
Anabaena cylindrica 288
Anabaena sp. 287, 288
Anabaena variabilis 125, 288
Anacystis marina 7, 303
Anacystis nidulans 287, 288, 290
Arthrospira brevis 7, 303
Aulosira fertilissima 287, 288
Calothrix parietina 7, 303
Carteria 40
Characium ambiguum 7, 303
Characium sp. 7, 303
Chlamydomonas eugametos 284
Chlamydomonas pyrenoidosa 7, 303
Chlamydomonas reinhardi 21
Chlamydomonas sp. 57, 73
Chlamydomonas typica 7, 303
Chlorella ellipsoidea 263
Chlorella fusca 154
Chlorella licheniforme 8
Chlorella pyrenoidosa 18, 22, 23, 24, 75, 125, 183, 264, 272, 284, 295, 296
Chlorella sp. 39, 40, 57, 73, 303
Chlorella vulgaris 7, 8, 9, 303
Chlorococcum diplobionticum 303
Chlorococcum ellipsoideum 7, 303
Chlorococcum sp. 7, 9, 57, 125, 293
Chroococcus sp. 73
Closteridium sp. 303
Coccochloris aeruginesa 7, 303
Coccochloris peniocystis 7, 303
Coccolithus sp. 73
Coelastrum microporum 290
Cylindrocystis brebisonii 7, 303
Cylindrospermum licheniforme 7, 8, 9
Cylindrospermum sp. 73, 173, 250
Dunaliella euchlora 41
Dunaliella tertiolecta 293
Euglena gracilis 218
Euglena sp. 7, 73, 303
Fischerella ambigua 7, 303
Golinkiniopsis sp. 39, 40

2,4-D - Algae (Cont'd)

Hantzschia sp. 57
Hormidium flaccidum 7, 303
Hormidium sp. 57
Hormidium subtilissimum 7, 303
Hydrodictyon sp. 73
Isochrisis galbana 293
Koliella sp. 39, 40
Laminaria hyperborea 133
Lyngbya sp. 57, 125
Merismopedia sp. 73
Microcoleus lyngbyaceus 7, 303
Microcoleus sp. 73
Microcoleus vaginatus 7, 303
Monoraphidium sp. 39, 40
Navicula sp. 73
Nitzschia sp. 38, 39, 40
Nodularia sp. 7, 303
Nostoc calcicola 288
Nostoc commune 7, 303
Nostoc ellipsosporum 7, 303
Nostoc fritschii 288
Nostoc muscorum 7, 173, 303
Nostoc punctiforme 173
Nostoc sp. 57, 73, 287, 288
Oscillatoria lutea 7, 303
Oscillatoria sp. 57, 73
Oscillatoria submembranaceae 7, 303
Palmella sp. 57
Pandorina sp. 73
Pediastrum sp. 73
Phytoconis sp. 57
Pithophora sp. 73
Platymonas sp. 41
Pleuorochrysis sp. 73
Porphyrosiphon notarisii 7, 303
Poteriochromonas stipitata 20, 231
Protococcus viridis 7, 303
Rivularia sp. 7, 303
Scenedesmus opoliensis 21
Scenedesmus quadricauda 281, 284
Scenedesmus quadricaudata 258
Scenedesmus sp. 21, 39, 40
Schizothrix arenaria 7, 303
Schizothrix calcicola 7, 303
Schizothrix friezii 7, 303
Scytonema sp. 57
Spirogyra sp. 73
Spongiochloris sp. 57
Spongiococcus bacillaris 303
Stichococcus bacillaris 7
Stichococcus sp. 57

2,4-D - Algae (Cont'd)

Tolypothrix sp. 57
Tolypothrix tenuis 117, 287, 288
Ulothrix sp. 57
Ulothrix tenerrima 7, 303
Volvox sp. 73
Zygnema sp. 73
Zygogonium ericetorum 7, 303

ALGAE (scientific names not given) 38, 58, 229

4. Effects on Protozoa

Acanthamoeba castellanii 220
Dasytricha sp. 1, 162
Diplodinium sp. 1, 162
Entodinium 1, 162
Epidinium sp. 162
Isotricha sp. 1, 162
Phytomonas fascians 53
Phytomonas phaseoli 53, 170
Phytomonas stewartii 53
Phytomonas tabaci 53
Phytomonas tumefaciens 53
Polyplastron sp. 162
Stylonychia mytilus 21

5. Effects on Viruses

Barley stripe mosaic virus (BSMV) 179
Chrysanthemum stunt virus (CSV) 189, 248
Exocortis virus 10
Potatoe virus x (PVX) 194
Tobacco mosaic virus (TMV) 46, 233, 245, 246, 247
Tobacco ringspot virus (TRSV) 68
Tristeza virus 10
Xyloporosis virus 10

6. Effects on unidentified Groups 25, 28, 54, 70, 74, 90, 101, 134, 135, 143, 152, 157, 166, 171, 172, 185, 186, 193, 219, 226, 228, 230, 242, 244, 252, 256, 282, 306

B. 3,4-D (3,4-dichlorophenoxy)acetic acid

1. Effects on Fungi

Cercospora arachidicola 45
Fusarium oxysporum 45
Helminthosporium victoriae 45
Phytophthora parasitica 45
Sclerotium rolfsii 45

3,4-D (Cont'd)

2. Effects on Bacteria

Salmonella typhimurium 5

C. 2,4-DB [4-(2,4-dichlorophenoxy)butyric acid]

1. Effects on Fungi

Absidia cylindrospora 174
Alternaria solani 238
Armillaria mellea 238
Ascochyta pisi 238
Aspergillus alliaceus 175
Aspergillus flavipes 175
Aspergillus fumigatus 175
Aspergillus niger 238
Aspergillus terreus 175
Aspergillus ustus 175
Botrytis cinerea 238
Candida albicans 238
Candida pulcherrima 238
Cladosporium cladosporioides 174
Clonostachys araucaria 174
Corticium solani 238
Fusarium conglutinans 238
Fusarium nivale 238
Fusarium oxysporum f. lycopersici 238
Gibberella zeae 238
Helminthosporium sativum 238
Microsporum canis 238
Mucor hiemalis 238
Mucor racemosus 174
Neurospora sitophila 238
Penicillium chrysogenum 175, 238
Penicillium citrinum 175
Penicillium cyclopium 175
Penicillium lilacinum 175
Penicillium notatum 175, 238
Penicillium variabile 175
Phytophthora parasitica 238
Pyrenophora avenae 238
Pythium debaryanum 238
Rhizoctonia sp. 13
Rhizopus stolonifer 238
Saccharomyces acidifaciens 238
Saccharomyces cerevisiae 238
Saccharomyces fragilis 238
Sclerotium bataticola 13
Sclerotium rolfsii 13
Trichoderma viride 174, 238
Trichophyton sulphureum 238

2,4-DB - Fungi (Cont'd)

Verticillium albo-atrum 169
Zygorhynchus molleri 174

FUNGI (scientific names not given) 44

2. Effects on Bacteria

Aerobacter aerogenes 238
Agrobacterium tumefaciens 238
Bacillus alvei 227
Bacillus brevis 227
Bacillus cereus 227
Bacillus circulans 227
Bacillus coagulans 227
Bacillus firmus 227
Bacillus laterosporus 227
Bacillus lentus 227
Bacillus licheniformis 227
Bacillus megaterium 227
Bacillus polymyxa 227
Bacillus pumilus 227
Bacillus sphaericus 227
Bacillus subtilis 227, 238
Corynebacterium sp. 238
Escherichia coli 227
Nocardia sp. 238
Proteus mirabilis 227
Proteus rettgeri 227
Proteus vulgaris 227
Pseudomonas aeruginosa 227
Pseudomonas fluorescens 238
Pseudomonas marginalis 227
Pseudomonas pisi 227
Pseudomonas tabaci 227
Rhizobium japonicum 147
Rhizobium lupini 147
Rhizobium meliloti 147
Rhizobium sp. 207
Rhizobium trifolii 83, 84, 85
Salmonella pullorum 227
Salmonella typhimurium 5, 227
Sarcina lutea 238
Staphylococcus aureus 227
Streptomyces griseus 238
Streptomyces scabies 238
Streptomyces sp. 44

BACTERIA (scientific names not given) 96

3. Effects on Algae

Chlamydomonas agloeformis 56

2,4-DB - Algae (Cont'd)

Chlamydomonas elipsoidea 56
Chlamydomonas terricola 56
Chlorella ellipsoidea 56
Chlorella pyrenoidosa 56
Chlorella vulgaris 56
Coccomyxa subellipsoidea 56
Haematococcus lacustris 56
Hormidium barlowii 56
Hormidium flaccidum 56
Hormidium stoechidium 56
Mesotaenium caldariorum 56
Scenedesmus quadricauda 56
Spongiochloris excentrica 56
Stichococcus bacillaris 56

4. Effects on unidentified Groups 95, 96, 143, 161

D. 3,4-DB [3,4-dichlorophenoxy)butyric acid]

1. Effects on Bacteria

Salmonella typhimurium 5

E. 2,4-DEP {*tris*[2-(2,4-dichlorophenoxy)ethyl]phosphite}

1. Effects on Fungi

FUNGI (scientific names not given) 165

2. Effects on Bacteria

Azotobacter sp. 165
Salmonella typhimurium 5

BACTERIA (scientific names not given) 165

F. 2,4-DES [2-(2,4-dichlorophenoxy)ethyl sodium sulfate]

1. Effects on Fungi

Cercospora arachidicola 45
Fusarium oxysporum 45
Helminthosporium victoriae 45
Phytophthora parasitica 45
Sclerotium rolfsii 45

2. Effects on unidentified Groups 116

G. 2,4-DP [2-(2,4-dichlorophenoxy)propionic acid]

1. Effects on Fungi

Cercosporella herpothricoides 204
Gaeumannomyces graminis 204
Verticillium albo-atrum 169

2. Effects on Bacteria

Azotobacter chroococcum 283

3. Effects on Algae

Chlamydomonas agloeformis 56
Chlamydomonas elipsoidea 56
Chlamydomonas terricola 56
Chlorella ellipsoidea 56
Chlorella pyrenoidosa 56
Chlorella vulgaris 56
Coccomyxa subellipsoidea 56
Haematococcus lacustris 56
Hormidium barlowii 56
Hormidium flaccidum 56
Hormidium stoechidium 56
Mesotaenium caldariorum 56
Scenedesmus quadricauda 56
Spongiochloris excentrica 56
Stichococcus bacillaris 56

4. Effects on unidentified Groups 111

H. MCPA [(4-chloro-*o*-tolyl)oxy]acetic acid, (2-methyl-4-chlorophenoxy-acetic acid)

1. Effects on Fungi

Alternaria solani 238
Armillaria mellea 6, 238
Ascochyta pisi 238
Aspergillus fumigatus 289
Aspergillus niger 87, 149, 238, 253, 289
Botrytis cinerea 238
Candida albicans 238
Candida pulcherrima 238
Cercospora arachidicola 45
Cercosporella herpothricoides 204
Corticium solani 238
Eurotium sp. 298
Fusarium avenaceum 145
Fusarium conglutinans 238
Fusarium culmorum 145, 298
Fusarium graminearum 145

MCPA - Fungi (Cont'd)

Fusarium nivale 238
Fusarium oxysporum 45
Fusarium oxysporum f. lycopersici 238
Gaeumannomyces graminis 204
Gibberella zeae 238
Helminthosporium oryzae 236
Helminthosporium sativum 238
Helminthosporium victoriae 45
Microsporum canis 238
Mucor hiemalis 238
Neurospora sitophila 238
Ophiobolus graminis 298
Penicillium chrysogenum 238
Penicillium glaucum 289
Penicillium notatum 238
Phytophthora parasitica 45, 238
Pyrenophora avenae 238
Pythium debaryanum 238
Rhizopus stolonifer 238, 298
Saccharomyces acidifaciens 238
Saccharomyces cerevisiae 238
Saccharomyces fragilis 238
Sclerotium rolfsii 45
Trichoderma viride 238, 298
Trichophyton sulphureum 238
Trichothecium roseum 289

FUNGI (scientific names not given) 6, 14, 212, 279, 307

2. Effects on Bacteria

Achromobacter 260
Aerobacter aerogenes 238
Agrobacterium radiobacter 136
Agrobacterium tumefaciens 238
Arthrobacter globiformis 251
Arthrobacter oxydans 251
Azotobacter sp. 212
Azotobacter beijerinckii 136
Azotobacter chroococcum 124, 136, 283
Bacillus mycoides 136
Bacillus subtilis 124, 136, 238
Bacterium aerogenes 136
Bacterium coli 136
Bacterium prodigiosum 136, 217
Brevibacterium linens 251
Cellvibrio sp. 136
Corynebacterium sp. 137, 238
Cytophaga sp. 136
Escherichia coli 217
Flavobacterium aquatile 137

MCPA - Bacteria (Cont'd)

Flavobacterium peregrinum 260
Micromonospora sp. 136
Mycobacterium phlei 136
Nitrobacter sp. 123, 274
Nitrosomonas europaea 136
Nitrosomonas sp. 123, 274
Nocardia corallina 136
Nocardia globerula 251
Nocardia rubropertincta 251
Nocardia sp. 238
Proteus vulgaris 217
Pseudomonas aeruginosa 124, 217
Pseudomonas fluorescens 87, 124, 238
Pseudomonas pyocyanea 136
Rhizobium japonicum 147
Rhizobium leguminosarum 104, 136, 275
Rhizobium lupini 136, 147
Rhizobium meliloti 104, 136, 147, 205, 275
Rhizobium phaseoli 275
Rhizobium sp. 207
Rhizobium trifolii 83, 84, 85, 104, 136, 275
Salmonella marcescens 37
Salmonella typhimurium 37
Sarcina lutea 238
Serratia marcescens 37
Streptomyces griseus 136, 238
Streptomyces scabies 238
Streptomyces sp. 238

BACTERIA (scientific names not given) 14, 62, 160, 279, 291, 307

3. Effects on Algae

Anabaena cylindrica 59
Aulosira sp. 59
Calothrix elenkinii 59
Chlamydomonas globosa 89, 150
Chlamydomonas sp. 57
Chlamydomonas subangulosa 238
Chlorella pyrenoidosa 89, 150
Chlorella sp. 57
Chlorococcum sp. 57
Chlorogloea fritschii 59
Cylindrospermum muscicola 59
Cylindrospermum sp. 173
Dictyococcus terrestris 238
Hantzschia sp. 57
Hormidium sp. 57
Laminaria hyperborea 133
Lyngbya sp. 57

MCPA - Algae (Cont'd)

Nostoc muscorum 59, 173
Nostoc punctiforme 173
Nostoc sp. 57, 59
Oscillatoria sp. 57
Palmella sp. 57
Phytoconis sp. 57
Scytonema sp. 57
Spongiochloris sp. 57
Stichococcus bacillaris 89, 150
Stichococcus sp. 57
Tolypothrix sp. 57
Tolypothrix tenuis 59
Ulothrix sp. 57
Westiellopsis 59

ALGAE (scientific names not given) 109, 124

4. Effects on unidentified Groups 25, 74, 110, 129, 256, 282

I. MCPB {4-[(4-chloro-*o*-tolyl)oxy]butyric acid, (4-(2-methyl-4-chlorophenoxy)butyric acid)}

1. Effects on Fungi

Absidia cylindrospora 174
Alternaria solani 238
Aphanomyces euteiches 122
Armillaria mellea 238
Ascochyta pisi 238
Aspergillus niger 87, 149, 238, 253
Botrytis cinerea 238
Candida albicans 238
Candida pulcherrima 238
Cladosporium cladosporioides 174
Clonostachys araucaria 174
Fusarium nivale 238
Fusarium oxysporum f. lycopersici 238
Gibberella zeae 238
Helminthosporium sativum 238
Microsporum canis 238
Mucor hiemalis 238
Mucor racemosus 174
Neurospora sitophila 238
Penicillium chrysogenum 238
Penicillium notatum 238
Phytophthora parasitica 238
Pyrenophora avenae 238
Pythium debaryanum 238
Rhizopus stolonifer 238
Saccharomyces acidifaciens 238

MCPB - Fungi (Cont'd)

Saccharomyces cerevisiae 238
Saccharomyces fragilis 238
Trichoderma viride 174, 238
Trichophyton sulphureum 238
Zygorhynchus molleri 174

FUNGI (scientific names not given) 146, 307

2. Effects on Bacteria

Aerobacter aerogenes 238
Agrobacterium tumefaciens 238
Bacillus subtilis 238, 239
Corynebacterium sp. 238
Escherichia coli 239
Flavobacterium sp. 146
Nocardia sp. 238
Pseudomonas fluorescens 87, 238
Rhizobium japonicum 147
Rhizobium lupini 147
Rhizobium meliloti 147
Rhizobium trifolii 83, 84, 85
Salmonella typhimurium 5, 36, 239
Sarcina lutea 238
Serratia marcescens 36
Streptomyces griseus 238
Streptomyces scabies 238
Streptomyces sp. 238

BACTERIA (scientific names not given) 307

3. Effects on Algae

Chlamydomonas globosa 89, 150
Chlamydomonas subangulosa 238
Chlorella pyrenoidosa 89, 150
Dictycoccus terrestris 238
Stichococcus bacillaris 89, 150

J. MCPP (Mecoprop) {2-(4-chloro-2-methylphenoxy)propionic acid, 2-[(4-chloro-*o*-tolyl)oxy]propionic acid}

1. Effects on Fungi

Aspergillus nidulans 12
Gaeumannomyces graminis 203
Saccharomyces cerevisiae 209, 210

2. Effects on Bacteria

Azotobacter chroococcum 283

MCPP - Bacteria (Cont'd)

Bacillus subtilis 239
Escherichia coli 239
Rhizobium japonicum 147
Rhizobium lupini 147
Rhizobium meliloti 147
Salmonella typhimurium 5, 239

3. Effects on unidentified Groups 27, 100, 102, 111

K. 2,4,5-T (2,4,5-trichlorophenoxy)acetic acid

1. Effects on Fungi

Absidia cuneospora 259
Alternaria citri 76
Alternaria solani 238
Alternaria sp. 259, 262
Arachnotheca albicans 259
Armillaria mellea 224, 238
Ascochyta pisi 238
Ascochyta sp. 259
Aspergillus alliaceus 259
Aspergillus amstelodami 19, 259
Aspergillus candidus 223
Aspergillus flavipes 259
Aspergillus fumigatus 108
Aspergillus leoporis 19, 259
Aspergillus niger 238
Aspergillus oryzae 259
Aspergillus punisceus 19, 259
Aspergillus sclerotiorum 19, 259
Aspergillus sydowi 19, 259
Aspergillus ustus 259
Aspergillus versicolor 19, 259
Aureobasidium sp. 108
Beauvaria bassiana 259
Botrytis cinerea 76, 238
Candida albicans 238
Candida pulcherrima 238
Cephalosporium acremonium 19, 259
Cephalosporium coremioides 259
Chaetomium homopilatum 259
Chaetomium spirale 108
Chaetophoma sp. 259
Chrysosporium pannorum 19, 259
Chrysosporium sp. 259
Cladosporium cladosporioides 108
Cladosporium herbarum 259
Cladosporium hordei 259
Corticium solani 238
Cylindrocarpon sp. 19, 259

2,4,5-T - Fungi (Cont'd)

Diaporthe citri 76
Diplodia natalensis 76
Fusarium conglutinans 238
Fusarium moniliforme 259
Fusarium nivale 238
Fusarium oxysporum 259
Fusarium oxysporum f. lycopersici 238
Fusidium sp. 259
Geotrichum sp. 259
Gibberella zeae 238
Gliomastix sp. 259
Helminthosporium sativum 238
Heterosporium sp. 259
Hyalodendron sp. 259
Malbranchea sp. 259
Microascus trigonosporus 19, 259
Microsporum canis 238
Mortierella sp. 259
Mucor hiemalis 238
Neurospora sitophila 238
Neurospora tetrasperma 223
Oöspora citriaurantii 76
Paecilomyces lilacinus 108
Paecilomyces varioti 259
Penicillium brevi-compactum 108
Penicillium canescens 19, 259
Penicillium chrysogenum 19, 238, 259
Penicillium cyaneo-fulvum 259
Penicillium cyclopium 19, 108, 259
Penicillium digitatum 76
Penicillium italicum 76
Penicillium martensii 259
Penicillium notatum 238
Penicillium patulum 259
Phoma sp. 259
Phycomyces blakesleeanus 223
Phytophthora parasitica 238
Pyrenophora avenae 238
Pythium debaryanum 238
Rhizopus arrhizus 269, 271
Rhizopus oryzae 271
Rhizopus stolonifer 238, 271
Rhodotorula mucilaginosa 19, 259
Saccharomyces acidifaciens 238
Saccharomyces cerevisiae 238
Saccharomyces fragilis 238
Schizophyllum commune 223
Sclerotinia sclerotiorum 76
Sporobolomyces sp. 259
Trichoderma lignorum 76
Trichoderma viride 238

2,4,5-T - Fungi (Cont'd)

Trichophyton sulphureum 238
Verticillium albo-atrum 169
Zygodesmus sp. 259
Zygosporium sp. 259

FUNGI (scientific names not given) 196, 225, 254

2. Effects on Bacteria

Aerobacter aerogenes 238
Agrobacterium tumefaciens 148, 238
Azotobacter agile 177
Azotobacter chroococcum 92, 177
Azotobacter vinelandii 176, 177
Bacillus megaterium 127, 128
Bacillus sp. 148
Bacillus subtilis 238
Corynebacterium sp. 238
Nitrobacter sp. 274
Nitrosomonas sp. 274
Nocardia sp. 238, 259
Promicromonospora sp. 259
Pseudomonas fluorescens 238
Pseudomonas sp. 148
Rhizobium alfalfa 91
Rhizobium japonicum 147
Rhizobium leguminosarum 92, 221
Rhizobium lupini 147
Rhizobium meliloti 147
Rhizobium phaseoli 221
Rhizobium sp. 148, 221
Rhizobium trifolii 83, 84, 221
Salmonella marcescens 37
Salmonella typhimurium 5, 36, 37
Sarcina lutea 238
Serratia marcescens 36, 37
Staphylococcus aureus 159
Streptomyces albus 259
Streptomyces aureus 19
Streptomyces azureus 259
Streptomyces diastatochromogenes 259
Streptomyces griseus 238
Streptomyces scabies 238
Streptomyces sp. 31, 192, 238

BACTERIA (scientific names not given) 78, 81, 82, 114, 115, 160

3. Effects on Algae

Anacystis marina 303
Arthrospira brevis 303

2,4,5-T - Algae (Cont'd)

Calothrix parietina 303
Characium ambiguum 303
Characium sp. 303
Chlamydomonas agloeformis 56
Chlamydomonas elipsoidea 56
Chlamydomonas eugametos 284
Chlamydomonas pyrenoidosa 303
Chlamydomonas terricola 56
Chlamydomonas typica 303
Chlorella ellipsoidea 56
Chlorella pyrenoidosa 56, 98, 284, 303
Chlorella sp. 303
Chlorella vulgaris 56, 303
Chlorococcum diplobionticum 303
Chlorococcum ellipsoideum 303
Chlorococcum sp. 293
Closteridium sp. 303
Coccochloris aeruginesa 303
Coccochloris peniocystis 303
Coccomyxa subellipsoidea 56
Cylindrocystis brebisonii 303
Dunaliella tertiolecta 293
Euglena gracilis 218
Euglena sp. 303
Fischerella ambigua 303
Haematococcus lacustris 56
Hormidium barlowii 56
Hormidium flaccidum 56, 303
Hormidium stoechidium 56
Hormidium subtillissimum 303
Isochrisis galbana 293
Mesotaenium caldariorum 56
Microcoleus lyngbyaccus 303
Microcoleus vaginatus 303
Nodularia sp. 303
Nostoc commune 303
Nostoc ellipsosporum 303
Nostoc muscorum 303
Oscillatoria lutea 303
Oscillatoria submembranaceae 303
Porphyrosiphon notarisii 303
Protococcus viridis 303
Rivularia sp. 303
Scenedesmus quadricauda 56, 284
Schizothrix arenaria 303
Schizothrix calcicola 303
Schizothrix friezii 303
Spongiochloris excentrica 56
Spongiococcus bacillaris 303
Stichococcus bacillaris 56
Ulothrix tenerrima 303

2,4,5-T - Algae (Cont'd)

Zygogonium ericetorum 303

ALGAE (scientific names not given) 229

4. Effects on Protozoa

Dasytricha sp. 162
Diplodinium 162
Entodinium 162
Epidinium sp. 162
Isotricha sp. 162
Polyplastron sp. 162
Tetrahymena pyriformis 240, 241

5. Effects on unidentified Groups 157, 172, 228, 282

L. 2,4,5-TB [4-(2,4,5-trichlorophenoxy)butyric acid

1. Effects on Fungi

Alternaria solani 238
Armillaria mellea 238
Ascochyta pisi 238
Aspergillus niger 238
Botrytis cinerea 238
Candida albicans 238
Candida pulcherrima 238
Corticium solani 238
Fusarium conglutinans 238
Fusarium nivale 238
Fusarium oxysporum f. lycopersici 238
Gibberella zeae 238
Helminthosporium sativum 238
Microsporum canis 238
Mucor hiemalis 238
Neurospora sitophila 238
Penicillium chrysogenum 238
Penicillium notatum 238
Phytophthora parasitica 238
Pyrenophora avenae 238
Pythium debaryanum 238
Rhizopus stolonifer 238
Saccharomyces acidifaciens 238
Saccharomyces cerevisiae 238
Saccharomyces fragilis 238
Trichoderma viride 238
Trichophyton sulphureum 238

2. Effects on Bacteria

Aerobacter aerogenes 238

2,4,5-TB - Bacteria (Cont'd)

Agrobacterium tumefaciens 238
Bacillus subtilis 238
Corynebacterium sp. 238
Nocardia sp. 238
Pseudomonas fluorescens 238
Salmonella typhimurium 5
Sarcina lutea 238
Streptomyces griseus 238
Streptomyces scabies 238
Streptomyces sp. 238

M. Erbon [2-(2,4,5-trichlorophenoxy)ethyl-2,2-dichloropropionate]

1. Effects on Bacteria

Salmonella typhimurium 5

N. Silvex (2,4,5-TP) [2-(2,4,5-trichlorophenoxy)propionic acid]

1. Effects on Fungi

Cercospora arachidicola 45
Fusarium oxysporum 45
Helminthosporium victoriae 45
Phytophthora parasitica 45
Sclerotium rolfsii 45

2. Effects on Bacteria

Azotobacter sp. 33
Salmonella typhimurium 5
Streptomyces sp. 31

3. Effects on Algae

Ankistrodesmus 167
Cladophora sp. 51, 52
Golenkinia sp. 167
Hydrodictyon sp. 51, 52
Micrasterias sp. 167
Navicula sp. 167
Pediastrum sp. 167
Scenedesmus sp. 167
Spirogyra sp. 51, 52
Zygnema sp. 52

4. Effects on unidentified Groups 116

II. Reviews 11, 30, 34, 55, 61, 72, 79, 86, 88, 93, 109, 111, 126, 214, 215, 235, 294, 297

III. Miscellaneous 202

Part A

Herbicide Effects on Microorganisms

A

1. Abou Akkada, A. R., M. A. Hassan, and M. A. Naga. 1973. Effect of some pesticides and herbicides on the rumen micro-organisms of sheep. J. Agric. Sci. 81(2):231-236. Pestic. Abstr. 7(3):150, 1974. Weed Abstr. 23(3):59, 1974.

2. Abueva, A. A. 1970. The effect of 2,4-D on the growth of micro-organisms and on nitrogen metabolism in a derno-podzolic soil. (Ru.) Khim. Sel'sk. Khoz. 8(8):601-604. Weed Abstr. 21(2):181, 1972.

3. Abueva, A. A. and V. B. Bagaev. 1975. The conversion of nitrogen in a derno-podzolic soil under the influence of 2,4-D. (Ru.) Izv. Timiryazevsk. Skh. Akad. 2:127-130. Weed Abstr. 25(1):38, 1976.

4. Akamine, E. K. 1951. Persistence of 2,4-D toxicity in Hawaiian soils. Bot. Gaz. 112:312-319.

5. Andersen, K. J., E. G. Leighty, and M. T. Takahashi. 1972. Evaluation of herbicides for possible mutagenic properties. J. Agric. Food Chem. 20(3):649-656. Weed Abstr. 22(5):97, 1973.

6. Andruszewska, A. 1973. Investigation of the influence of herbicides, used in forestry, on soil fungi especially on mycorrhizal fungi. (Pl.) Zesz. Nauk. Akad. Roln. Szczecinie 39:3-21. Weed Abstr. 24(5):129, 1975.

7. Arvik, J. H. 1969. Soil algae of the Eglin AFB defoliant test range and the response of selected species to military herbicides. Technical Report No. AFATL-TR-69-35. Air Force Armament Laboratory, Eglin Air Force Base, Fla. 32540. 22 p.

8. Arvik, J. H., D. L. Willson, and L. C. Darlington. 1969. Response of soil algae to Tordon 101 mixture. Weed Sci. Soc. Am., Abstr., 1969 Meet., p 141. Weed Abstr. 20(5):377, 1971.

9. Arvik, J. H., D. L. Willson, and L. C. Darlington. 1971. Response of soil algae to picloram-2,4-D mixtures. Weed Sci. 19(3):276-278. Weed Abstr. 21(4):338-339, 1972.

10. Atubra, O. K. and A. H. Krezdorn. 1973. Responses of healthy and virus-infected citrus to growth regulators. Proc. Fla. State Hortic. Soc. 86:24-29.

11. Audus, L. J. 1970. The action of herbicides on the microflora of the soil. Proc. Br. Weed Control Conf. 10:1036-1051. Weed Abstr. 20(5): 374, 1971.

12. Aulicino, F., M. Bignami, A. Carere, G. Conti, G. Morpurgo, and A. Velcich. 1976. Mutational studies with some pesticides in *Aspergillus nidulans*. Mutat. Res. 38(2):138. Pestic. Abstr. 9(9):630, 1976.

B

13. Bain, D. C. 1961. Effect of various herbicides on some soil fungi in culture. Plant Dis. Rep. 45(10):814-817.

14. Bakalivanov, D. and G. Nikolova. 1971. The effect of the herbicides 2,4-D and Dicotex on the microflora of alluvia soil. (Bg.) P 263-266. In Vtori Kongres po Mikrobiologiya. IV. Chast, Sofia. I. Pashev (Ed.). Sofia, Bulgaria, B"lgarskata Akademiya na Naukite. Weed Abstr. 22(10):259, 1973.

15. Bakalivanov, D. 1972. Biological activity of certain herbicides on microscopic soil fungi. Symp. Biol. Hung. 11:373-377. Pestic. Abstr. 7(5):323, 1974. Weed Abstr. 22(8):200-201, 1973.

16. Balasubramanian, A. and G. Rangaswami. 1973. Influence of foliar application of chemicals on the qualitative changes in bacterial and fungal populations in the rhizospheres of *Sorghum vulgare* and *Crotalaria juncea*. Madras Agric. J. 60(30):218-224.

17. Barber, T. A. 1972. Influence of pesticides on mule deer rumen bacteria. Diss. Abstr. Int. 32(8):4751B-4752B. Health Aspects Pestic. 5(11):560, 1972.

18. Barrentine, J. L. and R. E. Frans. 1973. Assessment of herbicide-induced growth inhibition of soybean. Weed Sci. 21(5):455-460.

19. Beck, S. P., W. H. Macklin, II, and E. L. Arnold. 1976. Degradation of chlorophenoxyalkanoic acid herbicides by purified cultures of soil microorganisms. Weed Sci. Soc. Am., Abstr., 1976 Meet., p 86.

20. Behm, E. and I. Schröder. 1969. A method for the determination of 2,4-dichlorophenoxyacetic acid (2,4-D) in algal culture media. (De.) Weed Res. 9(1):43-47.

21. Benijts-Claus, C. and G. Persoone. 1975. Toxicity of three herbicides in the aquatic ecosystem. (Fr.) Trib. CEBEDEAU 28(383):340-347. Pestic. Abstr. 9(7):526, 1976.

22. Bertagnolli, B. L. and M. J. Nadakavukaren. 1970. Effect of 2,4-dichlorophenoxyacetic acid on the fine structure of *Chlorella pyrenoidosa* Chick. J. Phycol. 6(1):98-100. Weed Abstr. 21(1):85-86, 1972.

23. Bertagnolli, B. L. 1972. Some physiological and ultrastructural responses of *Chlorella pyrenoidosa*, strain #211-8a, to 2,4-dichlorophenoxyacetic acid. Diss. Abstr. Int. 32(9):5054-B.

24. Bertagnolli, B. L. and M. J. Nadakavukaren. 1974. Some physiological responses of *Chlorella pyrenoidosa* to 2,4-dichlorophenoxyacetic acid. J. Exp. Bot. 25(84):180-188. Pestic. Abstr. 9(5):355, 1976.

25. Bertrand, D. and A. de Wolf. 1972. The influence of certain herbicides on the soil microflora and agronomic effects. (Fr.) C. R. Seances Acad. Agric. Fr. 58(17):1469-1473. Weed Abstr. 23(9):223, 1974.

26. Bever, W. M. and F. W. Slife. 1948. Effect of 2,4-D in culture medium on the growth of three pathogenic fungi. Phytopathology 38:1037-1038.

27. Bezuglov, V. G., A. K. Minenko, and E. P. Shelestov. 1973. The effect of dicamba, Tordon 22K and Lumeton on weeds and soil microflora. (Ru.) Khim. Sel'sk. Khoz. 11(11):854-856. Weed Abstr. 23(12):317, 1974.

28. Boika, V. S., M. G. Degtyareva, and I. P. Kazakova. 1969. The effect of 2,4-D and simazine on the microflora and nutrient status of grey forest soils. (Ru.) Khim. Sel'sk. Khoz. 7(3):233-234.

29. Bollag, J. M. and N. M. Henninger. 1976. Influence of pesticides on denitrification in soil and with an isolated bacterium. J. Environ. Qual. 5(1):15-23. Pestic. Abstr. 9(5):354-355, 1976.

30. Bollen, W. B. 1961. Interactions between pesticides and soil microorganisms. Annu. Rev. Microbiol. 15:69-92.

31. Bounds, H. C. and A. R. Colmer. 1964. Resistance of *Streptomyces* to herbicides. Sugar Bull. 42:274-276.

32. Breazeale, F. W. and N. D. Camper. 1970. Bacterial, fungal, and actinomycete populations in soils receiving repeated applications of 2,4-dichlorophenoxyacetic acid and trifluralin. Appl. Microbiol. 19(2): 379-380. Weed Abstr. 20(1):62, 1971.

33. Brenner, F. J. and S. D. W. Corson. 1974. The effect of insecticides and herbicides on *Azotobacter* in an old field community. Proc. Pa. Acad. Sci. 48:65-67. Pestic. Abstr. 8(4):259, 1975.

34. Buffington, J. D. 1974. Assessment of the ecological consequences of herbicide use along transmission line rights-of-way and recommendation for such use. U.S.N.T.I.S. Rep. Anl./Es-34; April 1974; 45 p.

35. Burger, K., I. C. MacRae, and M. Alexander. 1962. Decomposition of phenoxyalkyl carboxylic acids. Proc. Soil Sci. Soc. Am. 26:243-246.

36. Buselmaier, W., G. Roehrborn, and P. Propping. 1972. Mutagenicity studies with pesticides in the host-mediated assay and with the dominant lethal test in the mouse. (De.) Biol. Zentralbl. 91(3):311-325. Health Aspects Pestic. 6(4):195, 1973.

37. Buselmaier, W., G. Roehrborn, and P. Propping. 1973. Comparative investigations on the mutagenicity of pesticides in mammalian test systems. Mutat. Res. 21(1):25-26. Pestic. Abstr. 7(1):36, 1974.

38. Butler, G. L. 1975. Effects of five pesticides on twenty-one freshwater algae. Diss. Abstr. Int. 35(11):5245B. Pestic. Abstr. 8(8): 541, 1975.

39. Butler, G. L., T. R. Deason, and J. C. O'Kelley. 1975. Loss of five pesticides from cultures of twenty-one planktonic algae. Bull. Environ. Contam. Toxicol. 13(2):149-152. Pestic. Abstr. 8(6):359, 1975.

40. Butler, G. L., T. R. Deason, and J. C. O'Kelley. 1975. The effect of atrazine, 2,4-D, methoxychlor, carbaryl and diazinon on the growth of planktonic algae. Br. Phycol. J. 10(4):371-376.

41. Butler, P. A. 1963. Commercial fisheries investigations. P 11-25. In Pesticide-Wildlife Studies. A review of fish and wildlife service investigations during 1961 and 1962. U.S. Fish Wildl. Serv., Cir. No. 167.

C

42. Carlson, R. 1962. Surface waters and underground seas. P 39-83 and P 199-216. In Silent Spring. Houghton Mifflin Co.; Boston, Mass. 368 p.

43. Carlyle, R. E. and J. D. Thorpe. 1947. Some effects of ammonium and sodium 2,4-dichlorophenoxyacetates on legumes and the *Rhizobium* bacteria. J. Am. Soc. Agron. 39:929-936.

44. Chandra, P. 1964. Herbicidal effects on certain soil microbial activities in some brown soils of Saskatchewan. Weed Res. 4:54-63.

45. Chappell, W. E. and L. I. Miller. 1956. The effects of certain herbicides on plant pathogens. Plant Dis. Rep. 40(1):52-56.

46. Cheo, P. C. 1969. Effect of 2,4-dichlorophenoxyacetic acid on tobacco mosaic virus infection. Phytopathology 59:243-244.

47. Chulakov, Sh. A. and Sh. U. Zharasov. 1973. The biological activity of southern soils of Kazakhstan with the use of herbicides. (Ru.) Izv. Akad. Nauk Kaz. SSR, Ser. Biol. 11(2):7-13. Weed Abstr. 22(12): 322-323, 1973.

48. Chunderova, A. I. and T. P. Zubets. 1970. The effect of herbicides on nitrifying bacteria from dernopodzolic soils. (Ru.) Mikrobiologiya 39(5):887-891. Weed Abstr. 20(4):286, 1971.

49. Chunderova, A. I., T. P. Zubets, and A. M. Sofinskii. 1971. Effect of herbicides on soil microflora during their systematic use in crop rotation. (Ru.) Khim. Sel'sk. Khoz. 9(7):527-530.

50. Colmer, A. R. 1953. The action of 2,4-D upon the *Azotobacter* of some sugarcane soils. Appl. Microbiol. 1:184-187.

51. Cowell, B. C. 1965. The effects of silvex on aquatic vegetation and plankton in central New York farm ponds. Down Earth 21(1-2):19-20.

52. Cowell, B. C. 1965. The effects of sodium arsenite and silvex on the plankton populations in farm ponds. Trans. Am. Fish. Soc. 94:371-377.

53. Culler, D. M. 1946. The effect of 2,4-dichlorophenoxyacetate upon the morphological and physiological characteristics of certain microorganisms associated with food spoilage. M.S. Thesis, The Ohio State University. 34 p.

54. Cullimore, D. R. 1969. Initial studies on the effect of 2,4-D on the soil's microflora. Biol. Sol. 11:24-26.

55. Cullimore, D. R. 1971. Interaction between herbicides and soil microorganisms. Residue Rev. 35:65-80.

56. Cullimore, D. R. 1975. The in vitro sensitivity of some species of Chlorophyceae to a selected range of herbicides. Weed Res. 15(6): 401-406. Weed Abstr. 25(5):155, 1976.

57. Cullimore, D. R. and A. E. McCann. 1977. Influence of four herbicides on the algal flora of a prairie soil. Plant Soil 46:499-510.

D

58. Daly, R. W., Jr. 1972. Degradation of 2,4-DBEE in an aquatic environment. Diss. Abstr. Int. 32(7):3806B. Health Aspects Pestic. 5:494, 1972. Weed Abstr. 22(4):74-75, 1973.

59. DaSilva, E. J., L. E. Henriksson, and E. Henriksson. 1975. Effect of pesticides on blue-green algae and nitrogen-fixation. Arch. Environ. Contam. Toxicol. 3(2):193-204. Weed Abstr. 26(1):36, 1977.

60. Davis, D. and A. E. Dimond. 1953. Inducing disease resistance with plant growth-regulators. Phytopathology 43:137-140.

61. Davis, F. S. 1974. Toxicology, persistence, and mobility of phenoxy herbicides in the environment. P E3-E16. U.S.N.T.I.S., AD Rep. A002 568. 143 p.

62. De, B. K. and S. Mukhopadhyay. 1971. Effect of MCPA and Stam F-34 on the occurrence of some nutritional groups of bacteria in the rice fields of west Bengal. Int. Rice Comm., Newsl. 20(3):35-40. Weed Abstr. 23(2):43, 1974.

63. Dean, A. C. R. and H. S. Law. 1964. The action of 2,4-dichlorophenoxyacetic acid on *Bacterium lactis aerogenes (Aerobacter aerogenes)*. Ann. Bot. 38(112):703-710.

64. Deshmukh, V. A. and J. G. Shrikhande. 1974. Effect of pre- and post-emergence treatment of herbicides on soil microflora and two microbial processes. J. Indian Soc. Soil Sci. 22(1):36-42. Pestic. Abstr. 9(8):582, 1976. Weed Abstr. 24(10):276, 1975.

65. Deshmukh, V. A. and J. G. Shrikhande. 1974. Effect of some herbicides on soil microflora. J. Indian Soc. Soil Sci. 22(4):300-303. Pestic. Abstr. 9(8):583, 1976. Weed Abstr. 25(8):269, 1976.

66. Desi, I., Z. Pecho, L. Gönczi, A. Hollo, and M. Milassin. 1975. The effect of the herbicide 2,4-dichlorophenoxyacetic acid on soil bacteria. P 63-73. In 8th International Plant Protection Congress. Reports and Informations, Section 4. Plant protection in relation to human health and environmental pollution. Moscow. Weed Abstr. 25(11):388, 1976.

67. DeWolfe, T. A., L. C. Erickson, and B. L. Brannaman. 1959. Retardation of *Alternaria* rot in stored lemons with 2,4-D. Proc. Am. Soc. Hortic. Sci. 74:367-371.

68. DeZeeuw, D. J., J. G. Karas, and C. L. Hamner. 1961. Influence of 2,4-dichlorophenoxyacetic acid treatment of zinnia on the ability to recover tobacco ringspot virus. Mich. Agric. Exp. Stn., Q. Bull. 44(1):56-60.

69. Dobrev, D. and N. Mitov. 1971. Using 2,4-D herbicide for controlling barley loose smut *(Ustilago nuda)*. (Ru.) Dokl. Akad. S-Kh. Nauk Bolg. 4(2):189-192.

70. Doxtader, K. G. and N. Saleh-Rastine. 1975. The herbicide 2,4-D and its impact on microorganisms in soil. Colorado State University. 88th Annual Research Conference. P 46. Colorado Experiment Station Project 242.

71. Dubos, R. J. 1946. Inhibition of bacterial growth by auxins. Proc. Soc. Exp. Biol. Med. 63:317-319.

E

72. Edwards, C. A. 1964. Effects of pesticide residues on soil invertebrates and plants. Br. Ecol. Soc. Symp. 5:239-261.

73. Elder, J. H., C. A. Lembi, and D. J. Morre. 1970. Toxicity of 2,4-D and picloram to fresh and salt water algae. Proc. North Cent. Weed Control Conf. 25:96-98.

74. Elfadl, M. A. and M. Fahmy. 1958. Effect of sodium 2,4-D and MCPA on root nodulation of legumes and soil microorganisms. Agric. Res. Rev. 36:333-338.

75. Erickson, L. C., R. T. Wedding, and B. L. Brannaman. 1954. Influence of pH on 2,4-dichlorophenoxyacetic and acetic acid activity in *Chlorella*. Plant Physiol. 30(1):69-74.

76. Erickson, L. C., T. A. de Wolfe, and B. L. Brannaman. 1958. Growth of some citrus-fruit pathogens as affected by 2,4-D and 2,4,5-T. Bot. Gaz. 120(1):31-36.

77. Evans, W. C., B. S. W. Smith, P. Moss, and H. N. Fernley. 1971. Bacterial metabolism of 4-chlorophenoxyacetate. Biochem. J. 122(4): 509-519.

78. Evans, W. F. 1971. A facility for the biological treatment of a complex chlorophenolic waste. Proc. Ark. Acad. Sci. 25:38-40. Pestic. Abstr. 7(1):5, 1974. Weed Abstr. 24(3):54, 1975.

79. Executive Office of the President. 1971. Report on 2,4,5-T. A report of the Panel on herbicides of the President's Science Advisory Committee. Executive Office of the President, Office of Science and Technology. Washington, D.C. 69 p. Weed Abstr. 22(4):74, 1973.

F

80. Fawaz, K. M. 1974. Effect of certain herbicides on the growth of *Azotobacter* and *Rhizobia*. Alexandria J. Agric. Res. 22(2):331-338. Weed Abstr. 26(3):98, 1977.

81. Ferebee, R. N. 1973. The effects of selected herbicides on bacterial populations in an aquatic environment. Diss. Abstr. Int. 34(2):779B. Weed Abstr. 23(9):222, 1974.

82. Ferebee, R. N. and R. K. Guthrie. 1973. The effects of selected herbicides on bacterial populations in an aquatic environment. Water Resour. Bull. 9(6):1125-1135. Pestic. Abstr. 7(10):693, 1974.

83. Fletcher, W. W. 1956. Effect of hormone herbicides on the growth of *Rhizobium trifolii*. Nature 177:1244-1245.

84. Fletcher, W. W., P. B. Dickenson, and J. C. Raymond. 1956. The effect of certain hormone herbicides on the growth and nodulation of *Trifolium repens sylvestre* in aseptic culture. Phyton-ØYTON 7(2):121-130.

85. Fletcher, W. W., P. B. Dickenson, J. D. Forrest, and J. C. Raymond. 1957. The effect of soil-applications of certain substituted phenoxyacetic and phenoxybutyric acids on the growth and nodulation of *Trifolium repens sylvestre*. Phyton-ØYTON 9(1):41-46.

86. Fletcher, W. W. 1960. The effect of herbicides on soil microorganisms. P 20-62. In Herbicides and the Soil. Woodford, E. K. and G. R. Sagar (Eds.). Blackwell Scientific Publications; Oxford, England.

87. Fletcher, W. W. and J. E. Smith. 1964. Herbicides and soil microbes. New Sci. 24:527-528.

88. Fletcher, W. W. 1966. Herbicides and the bio-activity of the soil. Landbouwkd. Tijdschr. 78(8):274-281.

89. Fletcher, W. W., R. C. Kirkwood, and D. Smith. 1970. Investigations on the effect of certain herbicides on the growth of selected species of micro-algae. Colloque International sur l'Action des Pesticides et Herbicides sur la Microflore et la Faunule du Sol. Biodegradation Tellurique de leurs Molecules, Gand [in Mededelingen Faculteit Landbouwwetenschappen Gent 35(2):855-867]. Weed Abstr. 21(1):85, 1972.

90. Flieg, O. 1952. The persistence of 2,4-D in the soil with reference to microbial activity. (De.) Mitt. Biol. Zentralanst. Land Forstwirtsch., Berlin-Dahlem 74:133-135.

91. Flores, M. 1969. Partial inhibition of *Rhizobium* growth by certain herbicides. (Es.) Bol. R. Soc. Esp. Hist. Nat. 67:61-69. Weed Abstr. 20(5):375, 1971.

92. Foldesy, R. G., L. Mineo, and S. K. Majumdar. 1972. The effect of 2,4,5-trichlorophenoxyacetic acid on two nitrogen fixing bacteria. Proc. Pa. Acad. Sci. 46:23-24. Health Aspects Pestic. 6(11):617, 1973. Weed Abstr. 23(7):154, 1974.

93. Frans, R. E., D. E. Davis, and J. B. Weber. 1972. Behavior of specific herbicides in plants and soils. A summary of regional research accomplishments in the southern United States. Ark. Agric. Exp. Stn., South. Coop. Ser. Bull. No. 167. 26 p.

94. Fults, J. L. and M. G. Payne. 1947. Some effects of 2,4-D, DDT, and Colorado 9 on the bacteria *Rhizobium leguminosarum* Frank in the root nodules of the common bean. Am. J. Bot. 33(5):245-248.

G

95. Garcia, M. and D. C. Jordan. 1967. Effect of herbicides on nodulation and N-fixation in birdsfoot trefoil. Bacteriol. Proc., Abstr. A47, p 8.

96. Garcia, M. M. and D. C. Jordan. 1969. Action of 2,4-DB and dalapon on the symbiotic properties of *Lotus corniculatus* (birdsfoot trefoil). Plant Soil 30(2):317-334.

97. Gaur, A. C. and K. C. Misra. 1972. Effect of 2,4-dichlorophenoxyacetic acid on the growth of *Rhizobium* spp. in vitro. Indian J. Microbiol. 12(1):45-46. Weed Abstr. 22(5):99, 1973.

98. Geike, F. 1972. Effect of 2,4,5-trichlorophenoxyacetic acid on the chlorophyll content of *Chlorella pyrenoidosa*. (De.) Z. Pflanzenkr. Pflanzenschutz 79(11-12):677-685.

99. Gergely, Z. 1970. Studies on the effect of heterocyclic compounds and herbicides on *Nocardia* strains. (De.) Tag Ber. dtsch. Akad. Landw. Wiss. Berl., 1970, 109: Beitraege zur Erforschung der Aufnahme, der Weiterleitung und des Metabolismus der wichtigsten neuen Herbizide in the Pflanzen; Vortraege eines internationalen Symposiums, 26-31 May 1968. p 165-169. Weed Abstr. 21(1):85, 1972.

100. Gergely, Z. 1973. Investigations into the effect of herbicides on some *Nocardia* strains. (Hu.) Agrartud. Egy. Kozl. 1973:165-172.

101. Geshtovt, Yu. N., Sh. U. Zharasov, and N. Adekenov. 1970. The effect of herbicides on the microflora of dark chestnut soils under maize crops in the Karagandiskaya Province. (Ru.) Vestn. Skh. Nauki Kaz. 13(11):35-38. Weed Abstr. 21(4):338, 1972.

102. Geshtovt, Yu. N., Sh. U. Zharasov, Kh. T. Bainazarova, E. Kostutinov, and M. F. Baranovskii. 1973. Herbicides in a fallow/cereals/row crop rotation. (Ru.) Vestn. Skh. Nauki Kaz. 16(12):30-34.

103. Gil, I., J. Morales, A. Martin, C. Ruano, and F. Aragones. 1970. Influence of some pesticides on *Azotobacter*. Microbiol. Esp. 23(6): 271-277. Weed Abstr. 22(12):323, 1973.

104. Gillberg, B. O. 1971. On the effects of some pesticides on *Rhizobium* and isolation of pesticide-resistant mutants. Arch. Mikrobiol. 75(3):203-208. Weed Abstr. 21(1):82, 1972.

105. Gilliam, M. and H. L. Morton. 1974. Enterobacteriaceae isolated from honey bees, *Apis mellifera*, treated with 2,4-D and antibiotics. J. Invertebr. Pathol. 23:42-45.

106. Gilliam, M., D. B. Prest, and H. L. Morton. 1974. Fungi isolated from honey bees, *Apis mellifera*, fed 2,4-D and antibiotics. J. Invertebr. Pathol. 24(2):213-217. Pestic. Abstr. 8(12):836-837, 1976.

107. Gilliam, M., L. J. Wickerham, H. L. Morton, and R. D. Martin. 1974. Yeasts isolated from honey bees, *Apis mellifera*, fed 2,4-D and antibiotics. J. Invertebr. Pathol. 24(3):349-356. Pestic. Abstr. 8 (12):837, 1976.

108. Gilliam, M., H. L. Morton, D. B. Prest, R. D. Martin, and L. J. Wickerham. 1977. The mycoflora of adult worker honeybees, *Apis mellifera:* Effects of 2,4,5-T and caging of bee colonies. J. Invertebr. Pathol. 30(1):50-54.

109. Greaves, M. P., H. A. Davies, J. A. P. Marsh, and G. I. Wingfield. 1976. Herbicides and soil microorganisms. Crit. Rev. Microbiol. 5(1):1-38. Pestic. Abstr. 10(2):92, 1977.

110. Grossbard, E. 1971. The effect of repeated field applications of four herbicides on the evolution of carbon dioxide and mineralization of nitrogen in soil. Weed Res. 11(4):263-275. Weed Abstr. 21(4):338, 1972.

111. Grossbard, E. 1976. Effects on the soil microflora. P 99-146. In Vol. 2. Herbicides - Physiology, Biochemistry, Ecology. L. J. Audus (Ed.). Academic Press; New York, N.Y. 564 p.

112. Guiscafre-Arrillaga, J. 1948. Sensitivity of *Penicillium digitatum* to 2,4-dichlorophenoxyacetic acid. Plant Dis. Rep. 32:248-250.

113. Guiscafre-Arrillaga, J. 1949. Inhibitory action of 2,4-dichlorophenoxyacetic acid on *Penicillium digitatum* and *Phomopsis citri*. Phytopathology 39:8-9.

114. Guthrie, R. K., R. N. Ferebee, and D. S. Cherry. 1974. Biologic detection and control of water pollution. Water Resour. Res. Inst., Clemson Univ., Rep. No. 40. 39 p.

115. Guthrie, R. K., R. N. Ferebee, and D. S. Cherry. 1974. Biologic detection of water pollution. U.S.N.T.I.S., PB Rep. 239 412. 46 p. Pestic. Abstr. 8(9):595, 1976.

H

116. Hale, M. G., F. H. Hulcher, and W. E. Chappell. 1957. The effects of several herbicides on nitrification in a field soil under laboratory conditions. Weeds 5:331-334.

117. Hamdi, Y. A., A. S. El Nawawy, and M. S. Tewfik. 1970. Effect of herbicides on growth and nitrogen-fixation of alga, *Tolypothrix tenuis*. Acta Microbiol. Pol. 2(1):53-56. Weed Abstr. 20(5):375, 1971.

118. Hammouda, M. H. M. 1974. Biochemical activity of free-living nitrogen-fixing bacteria resistant to herbicides. (Ru.) Vestn. Skh. Nauki Kaz. 17(8):109-112. Pestic. Abstr. 9(9):646, 1976.

119. Hammouda, M. H. M. 1974. Effect of herbicides on free nitrogen-fixing bacteria. (Ru.) Vestn. Skh. Nauki Kaz. 17(4):104-107. Pestic. Abstr. 9(9):646, 1976.

120. Hart, L. T. and A. D. Larson. 1966. Effect of 2,4-dichlorophenoxyacetic acid on different metabolic types of bacteria. Bull. Environ. Contam. Toxicol. 1(3):108-120.

121. Hart, L. T. and A. D. Larson. 1967. Inhibition of fumarase of *Pseudomonas fluorescens* by 2,4-D in the presence of AMP. Bacteriol. Proc., Abstr. A44, p 8.

122. Harvey, R. G., D. J. Hagedorn, and R. L. DeLoughery. 1975. Influence of herbicides on root rot in processing peas. Crop Sci. 15(1):67-71.

123. Hauke-Pacewiczowa, T. and M. Krolowa. 1968. Influence of MCPA and ioxynil on the soil microflora of the oat rhizosphere. (Pl.) Pamiet. Pulawski 31:17-23.

124. Hauke-Pacewiczowa, T. 1971. Influence of herbicides on the activity of soil microflora. (Pl.) Pamiet. Pulawski 46:5-48. Weed Abstr. 22(6):128, 1973.

125. Hawxby, K., B. Tubea, J. Ownby, and E. Basler. 1977. Effects of various classes of herbicides on four species of algae. Pestic. Biochem. Physiol. 7(3):203-209.

126. Helling, C. S., P. C. Kearney, and M. Alexander. 1971. Behavior of pesticides in soils. Advan. Agron. 23:147-240.

127. Hicks, G. F., Jr. and T. R. Corner. 1975. Distribution and effects of 2,4,5-trichlorophenoxyacetic acid in cells of *Bacillus megaterium*. Appl. Microbiol. 30(6):959-963. Pestic. Abstr. 10(2):75, 1977.

128. Hicks, G. F., Jr. 1976. Distribution and effects of DDT and 2,4,5-T in *Bacillus megaterium*. Diss. Abstr. Int. 36(9):4313B. Pestic. Abstr. 10(2):85-86, 1977.

129. Hoffman-Kakol, I. and H. Kwarta. 1972. Studies on the influence of MCPA on weeds, yield of summer barley and soil microflora. (Pl.) Zesz. Nauk. Akad. Roln. Szczecinie 9(38):105-116.

130. Hoover, M. E. 1952. The action of some herbicides upon the microflora of the soil. M.S. Thesis, Louisiana State University. 51 p.

131. Hoover, M. E. and A. R. Colmer. 1953. The action of some herbicides on the microflora of a sugarcane soil. Proc. La. Acad. Sci. 16: 21-27.

132. Hoover, M. E. and A. R. Colmer. 1953. The action of 2,4-D, TCA and sodium chlorate on the microflora of sharkey clay. Sugar Bull. 31:416-418.

133. Hopkins, R. and J. M. Kain. 1971. The effect of marine pollutants on *Laminaria hyperborea*. Mar. Pollut. Bull. 2(5):75-77. Weed Abstr. 21(1):71, 1972.

I

134. Il'in, A. M. 1962. Concerning the effect of the herbicide 2,4-D on soil microorganisms. Microbiology 30:1050-1051.

135. Iurkevich, I. V. and N. Z. Tolkachev. 1972. Effect of various dosages of 2,4-D and simazine on microflora of ordinary chernozem. (Ru.) Khim. Sel'sk. Khoz. 10(9):56-58.

J

136. Jensen, H. L. and H. I. Petersen. 1952. Decomposition of hormone herbicides by bacteria. Acta Agric. Scand. 2:215-231.

137. Jensen, H. L. and H. I. Petersen. 1952. Detoxication of hormone herbicides by soil bacteria. Nature 170(4314):39-40.

138. Johnson, E. J. and A. R. Colmer. 1955. The effect of herbicides on soil microorganisms. I. The effect of 2,4-dichlorophenoxyacetic acid on some phases of the nitrogen metabolism of *Bacillus cereus*. Appl. Microbiol. 3:123-126.

139. Johnson, E. J. and A. R. Colmer. 1955. The effect of herbicides on soil microorganisms. II. The effect of 2,4-dichlorophenoxyacetic acid on some phases of the nitrogen metabolism of *Pseudomonas fluorescens* and the microorganisms of a soil suspension. Appl. Microbiol. 3(2):126-128.

140. Johnson, E. J. and A. R. Colmer. 1957. Relationship between magnesium and the physiological effects of 2,4-dichlorophenoxyacetic acid on *Azotobacter vinelandii* and *Rhizobium meliloti*. J. Bacteriol. 73: 139-143.

141. Johnson, M. K., L. A. Magee, and A. R. Colmer. 1956. Some factors affecting the respiratory response of *Azotobacter* to 2,4-D and related compounds. Appl. Microbiol. 4:109-113.

142. Jones, H. E. 1948. The influence of 2,4-dichlorophenoxyacetic acid on nitrate formation in a prairie soil. J. Am. Soc. Agron. 40:522-526.

143. Jones, L. S., O. E. Anderson, and C. Dowler. 1974. Effects of herbicides in a crop-herbicide rotation on sulfur oxidation in Tifton soil. Agron. J. 66(6):744-747. Pestic. Abstr. 9(1):32, 1976.

144. Jordan, D. C. and M. M. Garcia. 1969. Interactions between 2,4-DB and the root-nodule bacteria of *Lotus corniculatus*. Plant Soil 30(3):360-372.

K

145. Kachalova, Z. P. and N. D. Yatsenko. 1974. The effect of herbicides on the infection of winter wheat by cereal root rots. (Ru.) Vestn. Skh. Nauki 19(6):29-32.

146. Kaszubiak, H. 1970. Effect of herbicides on microorganisms in the rhizosphere of seradella. Meded. Fac. Landbouwwet., Rijksuniv. Gent 35(2):543-550. Weed Abstr. 21(5):424, 1972.

147. Kecskes, M. 1972. A survey of herbicide sensitivity and resistance of *Rhizobia*. Symp. Biol. Hung. 11:405-415. Pestic. Abstr. 7(5): 323, 1974.

148. Kecskes, M., E. Balazs, and K. Schmidt. 1975. The change of the microbial ecosystem in a chernozem affected by phenoxyaceticacid derivatives. Rocz. Glebozn. 26(2):185-190. Weed Abstr. 25(6):203, 1976.

149. Kirkwood, R. C., M. M. Robertson, and J. E. Smith. 1966. Differential absorption as a factor influencing the selective toxicity of MCPA and MCPB. P 47-57. In GAO-IAEA Symposium on the Use of Isotopes in Weed Research. Vienna, Austria.

150. Kirkwood, R. C. and W. W. Fletcher. 1970. Factors influencing the herbidical efficiency of MCPA and MCPB in three species of microalgae. Weed Res. 10(1):3-10.

151. Kiss, M. 1966. Investigating the genotypic effects of herbicides on individual species of Streptomyces. (Hu.) Agrartud. Egy. Kozl., p 100-114.

152. Klein, D. A., T. C. Loh, and R. L. Goulding. 1971. A rapid procedure to evaluate the dehydrogenase activity of soils low in organic matter. Soil Biol. Biochem. 3(4):385-387. Weed Abstr. 21(5):425, 1972.

153. Kliuchnikov, L. J. and A. M. Petrova. 1960. The effect of frequent use of herbicides upon soil microflora. (Ru.) Mikrobiologiya 29 (2):238-241.

154. Klotz, F. K. 1974. Light controlled growth and metabolic responses of *Chlorella* to 2,4-dichlorophenoxyacetic acid. Diss. Abstr. Int. 34(12):5837B-5838B.

155. Koike, H. and P. L. Gainey. 1952. Effects of 2,4-D and CADE, singly and in combination, upon nitrate and bacterial content of soils. Soil Sci. 74:165-172.

156. Kozyrev, M. A. and A. A. Laptev. 1972. The effect of herbicides used in the crop rotation on the microflora of a derno-podzolic soil. (Ru.) Khim. Sel'sk. Khoz. 10(8):614-617. Weed Abstr. 22(8):200, 1973.

157. Kratochvil, D. E. 1951. Determinations of the effect of several herbicides on soil microorganisms. Weeds 1:25-31.

158. Kriel, H. T. and F. C. Loest. 1953. Citrus wastage studies. Citrus Grow. 232:7-9.

159. Kucera, L. S., H. S. Goldberg, and R. N. Goodman. 1965. Influence of 2,4,5-trichlorophenoxyacetic acid on staphylococcal penicillinase. J. Bacteriol. 89(6):1621-1622.

160. Kulinska, D. 1967. Effect of herbicides on oxygen uptake by soil. (Pl.) Rocz. Nauk Roln., Ser. H 93A:125-130.

161. Kunelius, H. T. 1974. Influence of weed control and N fertilization at establishment on growth and nodulation of birdsfoot trefoil. Can. J. Plant Sci. 54:259-264.

162. Kutches, A. J., D. C. Church, and F. L. Duryee. 1970. Toxicological effects of pesticides on rumen function *in vitro*. J. Agric. Food Chem. 18(3):430-433. Weed Abstr. 20(6):437, 1971.

L

163. Laird, P. P. and M. Newton. 1973. Contrasting effects of two herbicides on invasion by *Fomes annosus* in tree-injector wounds on western hemlock. Plant Dis. Rep. 57(1):94-96.

164. Lamartiniere, C. A., L. T. Hart, and A. D. Larson. 1969. Delayed lethal effect of 2,4-dichlorophenoxyacetic acid on bacteria. Bull. Environ. Contam. Toxicol. 4(2):113-119. Weed Abstr. 19(2):133, 1970.

165. Lazareva, N. V. and V. G. Blokhin. 1969. The effect of prometryne, Falone and Alipur on the soil microflora. (Ru.) Khim. Sel'sk. Khoz. 7(8):609-611. Weed Abstr. 21(1):81, 1972.

166. Leiderman, J., J. J. Hinojo, and F. A. Fogliata. 1971. Influence of different herbicides applied in sugar cane on the nitrification of urea. First part. (Es.) Rev. Ind. Agric. Tucuman 48(2):7-14.

167. Lembi, C. A. and S. E. Coleridge. 1975. Selective toxicity of detergents and herbicides to phytoplankton. Purdue Univ. Water Resour. Res. Cent., Tech. Rep. No. 71. 71 p.

168. Lenhard, G. 1959. The effects of 2,4-D on certain physiological aspects of soil microorganisms. S. Afr. J. Agric. Sci. 2(4):487-497.

169. LeTourneau, D. and L. Buer. 1961. The toxicity of some chlorinated phenols and aryloxyalkanecarboxylic acids to *Verticillium alboatrum*. Phytopathology 51:128-129.

170. Lewis, R. W. and C. L. Hamner. 1946. The effect of 2,4-D on some microorganisms. Mich. Agric. Exp. Stn., Q. Bull. 29:112-114.

171. Liu, L. C. and H. R. Cibes-Viade. 1972. Effect of various herbicides on the respiration of soil microorganisms. J. Agric. Univ. P.R. 56(4):417-425. Health Aspects Pestic. 6(7):388, 1973. Weed Abstr. 22(8):200, 1973.

172. Lozano-Calle, J. M. 1970. Effects of 2,4-D and 2,4,5-T ethyl esters on the microflora of a sand and clay soil. (Fr.) Meded. Fac. Landbouwwet., Rijksuniv. Gent 35(2):599-614. Weed Abstr. 21(1): 81, 1972.

173. Lundkvist, I. 1970. Effect of two herbicides on nitrogen fixation by blue-green algae. Sven. Bot. Tidskr. 64:460-461. Weed Abstr. 21(1):86, 1972.

174. Luppi Mosca, A. M. and C. Foa Mortarino. 1969. Action *in vitro* of some herbicides on typical soil fungi. (It.) Allionia 15:85-98. Weed Abstr. 21(1):84, 1972.

175. Luppi Mosca, A. M. and M. Polimeno. 1970. *In vitro* effects of some herbicides on soil *Aspergilli* and *Penicillia*. (It.) Allionia 16: 25-32. Health Aspects Pestic. 6(1):21, 1973.

M

176. Mackenzie, K. A. and I. C. MacRae. 1972. Tolerance of the nitrogen-fixing system of *Azotobacter vinelandii* for four commonly used pesticides. Antonie van Leeuwenhoek 38(4):529-535. Pestic. Abstr. 7(1):23, 1974.

177. Magee, L. A. and A. R. Colmer. 1955. The effect of herbicides on soil microorganisms. III. The effect of some herbicides on the respiration of *Azotobacter*. Appl. Microbiol. 3:288-292.

178. Magee, L. A. and A. R. Colmer. 1956. Some effects of 2,4-dichlorophenoxyacetic acid upon *Azotobacter* as measured by respiration inhibition. Weeds 4:124-130.

179. Makovcova, O., L. Sindelar, and Z. Polak. 1976. Changes in respiration and BSMV concentration of infected wheat plants after treatment with 2,4-D. Biol. Plant. 18(3):190-194.

180. Marathe, G. V. and G. Rangaswami. 1973. Influence of foliar chemical sprays on microorganisms in rhizosphere of three crop plants. Indian J. Exp. Biol. 11(5):468-469.

181. Marth, P. C. 1947. Effect of 2,4-D applications to the soil. U.S. Dep. Agric., Yearb. Agric., p 47-49.

182. Mashtakov, S. M., E. S. Gurinouvitch, T. I. Zimenko, and I. V. Kabailova. 1962. Effect of herbicides on the soil microflora. (Ru.) Mikrobiologiya 31:85-89.

183. Matorin, D., P. S. Venediktov, and M. G. Makevnina. 1975. The use of the method of recording the afterglow of green algae for determining water and soil pollution by phytotoxic substances. (Ru.) Biol. Nauki (Moscow) 18(12):122-125. Weed Abstr. 26(6):194, 1977.

184. McCurdy, E. V. and E. S. Molberg. 1974. Effects of the continuous use of 2,4-D and MCPA on spring wheat production and weed populations. Can. J. Plant Sci. 54(2):241-245.

185. Medvedev, A. N. and V. F. Burmistrov. 1972. The effect of some herbicide mixtures on the biological activity, the dynamics of nutrients, and on the water content in soil. (Ru.) Vestn. Skh. Nauki Kaz. 15(2):88-93. Health Aspects Pestic. 6(4):213, 1973. Weed Abstr. 23(3):61, 1974.

186. Mereshko, M. Ya. 1969. The effect of herbicides on the biological activity of the microflora of chernozem soils. (Uk.) Mikrobiol. Zh. (Kiev) 31(5):525-529. Weed Abstr. 20(1):61, 1971.

187. Michaelson, M. E., L. A. Schaal, and J. L. Fults. 1948. Some effects of 2,4-dichlorophenoxyacetic acid, its salts, and esters on several physiologic strains of the potato scab organism *Actinomyces scabies* (Thaxt.) Guss. Proc. Soil Sci. Soc. Am. 13:267-270.

188. Misra, K. C. and A. C. Gaur. 1971. Tolerance of *Azotobacter* to some herbicides. Indian J. Weed Sci. 3(2):99-103. Weed Abstr. 22(6): 128, 1973.

189. Misra, A. K. and B. P. Singh. 1975. Influence of chemicals on metabolism of chrysanthemum stunt virus infected chrysanthemum leaves. Indian J. Exp. Biol. 13(1):34-38.

190. Mohammed Hammouda, H. M. 1974. The biochemical activity of free-living nitrogen-fixing bacteria, resistant to herbicides. (Ru.) Vestn. Skh. Nauki Kaz. 17(8):109-112. Weed Abstr. 24(11):316, 1975.

191. Moore-Landecker, E. 1972. Abnormalities in the morphology of *Pyronema domesticum* induced by 2,4-D. Mycologia 64(2):276-287.

192. Mueller, G. and B. Hickisch. 1974. Effects of herbicides on soil microorganisms. (Hu.) Agrartud. Kozl. 33(1):17-24. Pestic. Abstr. 9(6):406, 1976.

193. Mullison, W. R. 1972. Ecological effects of herbicides. Down Earth 28(2):21-24. Health Aspects Pestic. 6(1):8, 1973.

N

194. Nagaich, B. B., I. P. Chaubey, S. J. Singh, G. C. Upreti, and D. M. Kaley. 1972. Effect of herbicides on infection, concentration and spread of potato virus X. Indian J. Hortic. 29(1):105-108. Weed Abstr. 24(9):243, 1975.

195. Nagy, Zs., I. Mile, and F. Antoni. 1975. The mutagenic effect of pesticides on *Escherichia coli* WP2 try$^-$. Acta Microbiol. Acad. Sci. Hung. 22(3):309-314. Pestic. Abstr. 9(2):96, 1976.

196. Naidu, S. M. 1972. Pesticide residues and their effects on microbial activities following massive disposal of pesticides in the soil. Diss. Abstr. Int. 33(7):2894B. Health Aspects Pestic. 6(7):351, 1973. Weed Abstr. 22(12):322, 1973.

197. Naito, N. and T. Tani. 1951. Effect of 2,4-D in culture medium on the mycelial growth of *Gloeosporium olivarum* Alm. (Ja.) Kagawa Kenritsu Noka Daigaku Gakujutsu Hokoku 3:80-90.

198. Naito, N. and T. Tani. 1955. On a fungistatic substance produced in culture filtrates of *Gloeosporium olivarum* on media containing 2,4-D. (Ja.) Ann. Phytopathol. Soc. Jpn. 19:129.

199. Naito, N. and T. Tani. 1956. An antibiotic isolated from culture filtrates of *Gloeosporium olivarum* grown on media containing 2,4-D. Jpn. J. Bot. 15:152-163.

200. Naito, N. and Y. Kojima. 1957. Morphological characteristics of the colonies of several fungi on agar media containing 2,4-D and its related phenoxy compounds. Ann. Phytopathol. Soc. Jpn. 22:193-196.

201. Newman, A. S. 1947. The effect of certain plant growth-regulators on soil microorganisms and microbial processes. Proc. Soil Sci. Soc. Am. 12:217-221.

202. Newman, A. S. and C. R. Downing. 1958. Herbicides and the soil. J. Agric. Food Chem. 6:352-353.

203. Nilsson, H. E. 1973. Influence of the herbicide mecoprop on *Gaeumannomyces graminis* and take-all disease of spring wheat. Swed. J. Agric. Res. 3(3):105-113.

204. Nilsson, H. E. 1973. Influence of herbicides on take-all and eyespot disease of winter wheat in a field trial. Swed. J. Agric. Res. 3(3):115-118.

205. Nilsson, P. E. 1957. The influence of antibiotics and antagonists on symbiotic nitrogen fixation in legume cultures. K. Lantbruks-Hoegsk. Ann. 23:219-253.

O

206. Oka, I. N. and D. Pimentel. 1974. Corn susceptibility to corn leaf aphids, *Rhopalosiphum maidis*, and common corn smut, *Ustilago maydis*, after herbicide 2,4-dichlorophenoxyacetic acid treatment. Environ. Entomol. 3(6):911-915.

P

207. Pacewiczowa, T. 1969. Influence of herbicide treatments on the symbiosis of leguminous plants with *Rhizobium*. (Pl.) Pamiet. Pulawski 37:241-259. Weed Abstr. 20(1):62, 1971.

208. Paris, D. F., D. L. Lewis, J. T. Barnett, and G. L. Baughman. 1975. Microbial degradation and accumulation of pesticides in aquatic systems. U.S.N.T.I.S., PB Rep. 241 293. 45 p. Weed Abstr. 25(6): 199, 1976.

209. Parry, J. M. 1973. The induction of gene conversion in yeast by herbicide preparations. Mutat. Res. 21(2):83-91. Health Aspects Pestic. 6(9):496, 1973. Weed Abstr. 23(8):181, 1974.

210. Parry, J. M. 1974. The selective effects of herbicides upon the growth of yeast cultures. Arch. Microbiol. 98:331-338.

211. Payne, M. G. and J. L. Fults. 1947. Some effects of 2,4-D, DDT, and Colorado 9 on root nodulation in the common bean. J. Am. Soc. Agron. 39:52-55.

212. Peshakov, G., E. Raikov, and D. Tsvetanov. 1969. Investigating the effect of various herbicides on the soil microflora and on ammonification and nitrification in the soil. (Bg.) Pochvoved. Agrokhim. 4(6):89-94. Weed Abstr. 20(4):286, 1971.

213. Petruk, G. F. 1964. Effect of herbicides on heterotrophic microorganisms of ponds. Mikrobiologiya 33:1018-1021. Weed Abstr. 14 (6):330, 1965.

214. Pfister, R. M. 1972. Interactions of halogenated pesticides and microorganisms: A review. Crit. Rev. Microbiol. 2(1):1-33.

215. Pimentel, D. 1971. Ecological effects of pesticides on non-target species. Executive Office of the President, Office of Science and Technology. June 1971. 220 p.

216. Plamadeala, B. 1972. Effects of certain herbicides on the fungi *Rhizoctonia solani* Kühn, *Alternaria* sp. and *Fusarium* sp. (Ro.) An. Inst. Cercet. Cult. Cartofului Sfeclei Zahar, Brazov 3:365-372. Weed Abstr. 24(4):87, 1975.

217. Pokorny, J. 1971. The estimation of inhibiting concentrations of several pesticides. (Cs.) Cesk. Hyg. 16(4/5):141-145. Health Aspects Pestic. 5:125, 1972.

218. Poorman, A. E. 1973. Effects of pesticides on *Euglena gracilis*. I. Growth studies. Bull. Environ. Contam. Toxicol. 10(1):25-28. Health Aspects Pestic. 6(11):604, 1973. Weed Abstr. 23(4):77, 1974.

219. Pranaitene, E. V. 1970. The effect of different cultivation treatments and herbicides on the soil microflora. (Ru.) Materialy 7-go Pribaltiiskogo Soveshchaniya po Zashchite Rastenii, Elgava 8-12. Weed Abstr. 21(5):423, 1972.

220. Prescott, L. M. and D. L. Olson. 1972. The effect of pesticides on the soil amoeba *Acanthamoeba castellanii* (Neff). Proc. S.D. Acad. Sci. 51:136-141. Pestic. Abstr. 7(12):802, 1974.

R

221. Ranga Rao, V., N. S. Subba Rao, and K. G. Mukerji. 1973. *In vitro* effects of some growth regulators on *Rhizobium*. J. Gen. Appl. Microbiol. 19(1):55-58. Weed Abstr. 24(1):22, 1975.

222. Ranga Rao, V. 1976. Nitrogenase activity in *Rhizobium* associated with leguminous and non-leguminous tissue cultures. Plant Sci. Lett. 6:77-83.

223. Richards, R. R. 1949. Responses of representative fungi to certain growth-regulating substances. Bot. Gaz. 110:523-550.

224. Rishbeth, J. 1976. Chemical treatment and inoculation of hardwood stumps for control of *Armillaria mellea*. Ann. Appl. Biol. 82(1): 57-70.

225. Roberts, J. E. and W. B. Bollen. 1955. A microplating method for soil molds and its use to detect some effects of certain insecticides and herbicides. Appl. Microbiol. 3(3):190-194.

226. Rogoff, M. and J. J. Reid. 1952. Persistence of weed control agents and effect on nitrification in field and garden soil. Bacteriol. Proc., Abstr. A2, p 13.

227. Roman, M., C. Gonzalez, and D. Rodriguez. 1970. Effect of 4-(2,4-dichlorophenoxy)butyric acid on cultures of *Bacillus* and other gram-positive and gram-negative bacteria. (Fr.) Zentralbl. Bakteriol. Parasitenkd. Infektionskr., Abt. 2, 124(2):119-128.

228. Ruffin, J. 1974. The effects of various pesticides on oxygen uptake by soil microbes. Bull. Ga. Acad. Sci. 32(3-4):76-82. Pestic. Abstr. 9(3):168, 1976.

S

229. Salk, M. S. 1976. The effects of selected pesticides on ten isolates of terrestrial algae. Diss. Abstr. Int. 36(8):3749B. Pestic. Abstr. 9(5):345, 1976.

230. Samoladas, T. Kh. 1971. The effects of repeated and combination herbicide treatments on the soil. (Ru.) Pochvovedenie 7:148-149. Weed Abstr. 22(11):288, 1973.

231. Schröder, I. 1970. Morphological alterations of the single cell alga *Poteriochromonas stipitata* after action of 2,4-dichlorophenoxyacetic acid. (De.) Z. Allg. Mikrobiol. 10(4):299-302.

232. Schröder, I., M. Meyer, and D. Mücke. 1970. Effects of the herbicides 2,4-D, aminotriazole, atrazine, chlorpropham and chlorflurenol on nucleic acid biosynthesis in the ascomycete *Neurospora crassa*. (De.) Weed Res. 10(2):172-177. Weed Abstr. 20(3):212, 1971.

233. Schuster, G. 1975. The effect of several auxins and auxin herbicides on the development of local lesions of tobacco mosaic virus. (De.) Arch. Phytopathol. Pflanzenschutz 11(1):9-17.

234. Schwartz, C. C., J. G. Nagy, and C. L. Streeter. 1973. Pesticide effect on rumen microbial function. J. Anim. Sci. 37(3):821-826. Pestic. Abstr. 7(2):87, 1974.

235. Scrivani, P. and F. Volga Gera. 1970. Information and considerations on the degree of danger from herbicides. (It.) Contrib. Ist. Rec. Agrar. Milan. p 41-45. Weed Abstr. 20(6):436, 1971.

236. Sen, C. and S. A. K. M. Kaiser. 1972. The role of herbicides in the control of brown spot of paddy caused by *Helminthosporium oryzae*. Indian J. Mycol. Plant Pathol. 2(2):152-154.

237. Sharma, L. N. and S. N. Saxena. 1974. Influence of 2,4-D on soil microorganisms with special reference to *Azotobacter*. J. Indian Soc. Soil Sci. 22(2):168-171. Pestic. Abstr. 8(10):697, 1976. Weed Abstr. 24(10):276, 1975.

238. Shennan, J. L. and W. W. Fletcher. 1965. The growth *in vitro* of microorganisms in the presence of substituted phenoxyacetic and phenoxybutyric acids. Weed Res. 5:266-274.

239. Shirasu, Y., M. Moriya, K. Kato, A. Furuhashi, and T. Kada. 1976. Mutagenicity screening of pesticides in the microbial system. Mutat. Res. 40(1):19-30. Pestic. Abstr. 9(9):630, 1976.

240. Silberstein, G. B. 1973. A study of the effects of the herbicide 2,4,5-trichlorophenoxyacetic acid on the protozoan *Tetrahymena pyriformis* strain ST. Diss. Abstr. Int. 34(5):1889B-1890B. Pestic. Abstr. 7(2):85-86, 1974.

241. Silberstein, G. B. and A. B. Hooper. 1975. The effect of the herbicide 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) on the growth and metabolism of *Tetrahymena pyriformis*. J. Cell. Physiol. 85(2):331-338. Pestic. Abstr. 8(7):471-472, 1975.

242. Silva Fernandes, C. 1957. Observations upon the action of 2,4-D and TCA in the process of ammonia nitrification. (Pt.) Univ. Rural Pernambuco, Comun. Tec. IV, 14 p.

243. Silva Fernandes, C. 1959. Action of 2,4-D and TCA on nitrification of ammonia. Chem. Abstr. 53:19283c.

244. Simon-Sylvestre, G. 1974. Complexity of the effects of pesticides on the soil biological equilibrium, and repercussion on cultures. (Fr.) Agrochimica 18(4):334-343. Pestic. Abstr. 8(8):524, 1975.

245. Simons, T. J. and A. F. Ross. 1965. Effect of 2,4-dichlorophenoxyacetic acid on size of tobacco mosaic virus lesions in hypersensitive tobacco. Phytopathology 55:1076-1077.

246. Simons, T. J., H. W. Israel, and A. F. Ross. 1972. Effect of 2,4-dichlorophenoxyacetic acid on tobacco mosaic virus lesions in tobacco and on the fine structure of adjacent cells. Virology 48(2): 502-515.

247. Sindelar, L. and O. Makovcova. 1975. Influence of some herbicides on the reproduction of tobacco mosaic virus in *Nicotiana tabacum* cv. 'Samsun'. Biol. Plant. 17(5):371-373.

248. Singh, B. P. and A. K. Misra. 1974. Effect of chemicals on flowering of chrysanthemum stunt virus-infected plants. Proc. Indian Acad. Sci. B 80(6):267-274.

249. Singh, K. 1971. Effect of 2,4-D and simazine on total bacteria, fungi, *Azotobacter*, ammonification and nitrification under field conditions. Pesticides 5(6):14-17.

250. Singh, P. K. 1974. Algicidal effect of 2,4-dichlorophenoxyacetic acid on blue-green alga *Cylindrospermum* sp. Arch. Microbiol. 97(1): 69-72.

251. Skryabin, G. K., L. A. Golovleva, and T. F. Solov'eva. 1974. Co-oxidation of phenoxyalkanic acids by microbial cultures. Dokl. Biol. Sci. - En. Transl. 215(1-6):160-161. Pestic. Abstr. 9(8):571-572, 1976. Weed Abstr. 24(9):241, 1975.

252. Smith, A. E. 1973. Influence of 2,4-D and 2,4,5-T on in vitro digestion of forage samples. J. Range Manage. 26(4):272-274. Pestic. Abstr. 7(1):35, 1974. Weed Abstr. 23(8):181, 1974.

253. Smith, J. E. and J. L. Shennan. 1966. The effect of substituted phenoxyacetic and phenoxybutyric acids on the growth and respiration of *Aspergillus niger*. J. Gen. Microbiol. 42:293-300.

254. Smith, J. R. 1973. The effect of herbicides on the ectotrophic mycorrhizal fungi of pine. Ph.D. Thesis, University of London. 198 p. Weed Abstr. 24(5):129, 1975.

255. Smith, N. R., V. T. Dawson, and M. E. Wenzel. 1945. The effect of certain herbicides on soil microorganisms. Proc. Soil Sci. Soc. Am. 10:197-201.

256. Sokolov, M. S., L. L. Knyr, B. P. Strekozov, and V. D. Agarkov. 1975. Behavioral characteristics of Propanid, Yalan, MCPA and 2,4-D in rice irrigation systems in the Kuban. (Ru.) Khim. Sel'sk. Khoz. 13(3):224-234. Weed Abstr. 24(12):345, 1975.

257. Soontornpundha, S. and N. Singhabootra. 1975. Effects of insecticide dieldrin and herbicide 2,4-D on soil microorganism activities. (Th.) Kasetsart J. 9(1):45-54.

258. Stadnyk, L., R. S. Campbell, and B. T. Johnson. 1971. Pesticide effect on growth and ^{14}C assimilation in a freshwater alga. Bull. Environ. Contam. Toxicol. 6(1):1-8. Weed Abstr. 21(1):71, 1972.

259. Stark, H. E., J. K. McBride, and G. F. Orr. 1975. Soil incorporation/biodegradation of herbicide Orange: I. Microbial and baseline ecological study of the U.S. Air Force Logistics Command Test Range, Hill Air Force Base, Utah. Final Report. TECOM Project No. 5-CO-213-000-015. U.S. Army Dugway Proving Ground; Dugway, Utah. 73 p.

260. Steenson, T. I. and N. Walker. 1958. Adaptive patterns in the bacterial oxidation of 2,4-dichloro- and 4-chloro-2-methyl-phenoxyacetic acid. J. Gen. Microbiol. 18:692-697.

261. Stevenson, E. C. and J. W. Mitchell. 1945. Bacteriostatic and bactericidal properties of 2,4-dichlorophenoxyacetic acid. Science 101 (2634):642-644.

262. Stewart, W. S., J. E. Palmer, and H. Z. Hield. 1952. Packing-house experiments on the use of 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid to increase storage life of lemons. Proc. Am. Soc. Hortic. Sci. 59:327-334.

263. Sumida, S. and M. Ueda. 1973. Studies of pesticide effects on *Chlorella* metabolism I. Effect of herbicides on complex lipid biosynthesis. Plant Cell Physiol. 14:781-785.

264. Swets, W. A. and R. T. Wedding. 1964. The effect of dinitrophenol and other inhibitors on the uptake and metabolism of 2,4-dichlorophenoxyacetic acid by *Chlorella*. New Phytol. 63(1):55-72.

265. Szabo, M., P. V. Scarpino, and C. Rogers. 1975. Effect of auxins and herbicides on enhancement of protein synthesis in fungi. J. Agric. Food Chem. 23(2):212-216.

266. Szegi, J. 1970. Effect of some herbicides on the growth of cellulose decomposing microscopic fungi. Meded. Fac. Landbouwwet., Rijksuniv. Gent 35(2):559-561. Weed Abstr. 21(1):84, 1972.

267. Szegi, J. 1972. Effect of a few herbicides on the decomposition of cellulose. Symp. Biol. Hung. 11:349-354. Weed Abstr. 22(9):231, 1973.

268. Szegi, J., F. Gulyas, and K. M. Fawzi. 1976. The effect of herbicides on microbiological processes in certain soil types in Hungary. (Bg.) Pochvozn. Agrokhim. 11(1):135-139. Weed Abstr. 26(4):132, 1977.

T

269. Teuteberg, A. 1970. A further report on the effect of herbicides on the soil microflora in orchards. (De.) Erwerbsobstbau 12(4):69-71. Weed Abstr. 21(2):180, 1972.

270. Thakur, D. P. and V. V. Chenulu. 1974. Chemical control of soft rot of potato tubers caused by *Rhizopus arrhizus*. Indian Phytopathol. 27(3):375-378.

271. Thakur, D. P., V. V. Chenulu, Z. S. Kanwar, and R. B. S. Kherata. 1974. Growth regulators in control of post-harvest fungal diseases of fruits and vegetables. Indian Phytopathol. 27(4):532-536.

272. Tomisek, A., M. R. Reid, W. A. Short, and H. E. Skipper. 1957. Studies on the photosynthetic reaction. III. The effects of various inhibitors upon growth and carbonate-fixation in *Chlorella pyrenoidosa*. Plant Physiol. 32(1):7-10.

273. Tomizawa, C. and H. Koike. 1954. Studies on herbicides. Bull. Nat. Inst. Agric. Sci., Ser. C 4:70-73.

274. Torstensson, L. 1974. Effects of MCPA, 2,4,5-T, linuron and simazine on some functional groups of soil microorganisms. Swed. J. Agric. Res. 4:151-160. Weed Abstr. 24(8):222-223, 1975.

275. Torstensson, L. 1975. Effects of bentazon and dinoseb on soil microorganisms and on the *Rhizobium-Leguminosae* symbiosis. Swed. J. Agric. Res. 5:177-183. Pestic. Abstr. 10(4):229, 1977. Weed Abstr. 25(8):269, 1976.

276. Tyagni-Ryadno, M. G. 1967. Effect of herbicides on the microflora and agrochemical properties of soil. (Ru.) Tr. Kamenets-Podol'sk. Skh. Inst. 9:43-48.

277. Tyagni-Ryadno, M. G., et al. 1969. The effect of herbicides on soil microflora. (Ru.) Visn. Sil's'Kogospod. Nauki 12(9):59-65. Weed Abstr. 20(4):286, 1971.

278. Tyler, J. E. and R. K. Finn. 1974. Growth rates of a pseudomonad on 2,4-dichlorophenoxyacetic acid and 2,4-dichlorophenol. Appl. Microbiol. 28(2):181-184.

U

279. Uziak, S. and K. Leoniak-Steinbrich. 1974. The influence of herbicides on some biological and chemical properties of sandy and loess soils. P 185-192. In Transactions of the 10th International Congress of Soil Science, Moscow. Weed Abstr. 25(6):202, 1976.

280. Uziak, S. and K. Leoniak-Steinbrich. 1977. The influence of some herbicides on selected groups of microorganisms in loess and sandy soils. II. The effect on nitrification. Acta Microbiol. Pol. 26(1):105-111.

V

281. Valentine, J. P. and S. W. Bingham. 1974. Influence of several algae on 2,4-D residues in water. Weed Sci. 22(4):358-363. Pestic. Abstr. 7(10):694, 1974. Weed Abstr. 24(4):85, 1975.

282. Van Himme, M. 1974. Environmental consequences of herbicide use. (Nl.) Parasitica 30(3):87-99. Pestic. Abstr. 8(12):808-809, 1976.

283. Van Schreven, D. A., D. J. Lindenbergh, and A. Koridon. 1970. Effects of several herbicides on bacterial populations and activity and the persistence of these herbicides in the soil. Plant Soil 33(3):513-532. Weed Abstr. 20(6):444, 1971.

284. Vance, B. D. and D. L. Smith. 1969. Effects of five herbicides on three green algae. Tex. J. Sci. 20(4):329-337.

285. Vasil'ev, O. A., V. I. Saplina, and N. E. Chertova. 1974. Effect of aerial chemical care of young stands with 2,4-dichlorophenoxyacetic acid on the incidence of pine trees infected with trunk rust, *Melampsora lini* (A. Br.) Rostr.). Sb. Nauchn. Tr. Leningr. Nauchno-Issled Inst. Lesn. Khoz. 18:77-83.

286. Venkataraman, G. S. and B. Rajyalakshmi. 1971. Interactions between pesticides and soil microorganisms. Indian J. Exp. Biol. 9(4):521-522. Health Aspects Pestic. 6(1):30, 1973. Weed Abstr. 22(6):128, 1973.

287. Venkataraman, G. S. and B. Rajyalakshmi. 1971. Tolerance of blue-green algae to pesticides. Curr. Sci. 40(6):143-144. Weed Abstr. 21(2):181, 1972.

288. Venkataraman, G. S. and B. Rajyalakshmi. 1972. Relative tolerance of nitrogen-fixing blue-green algae to pesticides. Indian J. Agric. Sci. 42(2):119-121. Weed Abstr. 22(6):126-127, 1973.

289. Virag, A. 1958. The effect of chemical weedkillers on some microscopic fungi. (Hu.) Agrartud. Egy. Mezogazd. Karanak Kozl., p 343-356. Soils Fert. 22:452, 1959.

290. Voight, R. A. and D. L. Lynch. 1974. Effects of 2,4-D and DMSO on procaryotic and eucaryotic cells. Bull. Environ. Contam. Toxicol. 12(4):400-405. Pestic. Abstr. 8(3):145, 1975.

W

291. Walker, N. 1957. The persistence in soil of bacteria adapted to the decomposition of hormone herbicides. Turf Sport 3:3-4.

292. Walsh, F. and R. Mitchell. 1974. Inhibition of inter-microbial predation by chlorinated hydrocarbons. Nature 249(5458):673-674. Pestic. Abstr. 8(5):321-322, 1975.

293. Walsh, G. E. 1972. Effects of herbicides on photosynthesis and growth of marine unicellular algae. Hyac. Control J. 10:45-48. Weed Abstr. 22(12):320, 1973.

294. Way, J. M. 1969. Toxicity and hazards to man, domestic animals, and wildlife from some commonly used auxin herbicides. Residue Rev. 26:37-62.

295. Wedding, R. T., L. C. Erickson, and M. K. Black. 1959. Influence of 2,4-dichlorophenoxyacetic acid on solute uptake by *Chlorella*. Plant Physiol. 34(1):3-10.

296. Wedding, R. T. and M. K. Black. 1961. Uncoupling of phosphorylation in *Chlorella* by 2,4-dichlorophenoxyacetic acid. Plant Soil 14(3): 242-248.

297. Wettasinghe, D. T. 1971. The effect of the use of herbicides for the control of weeds on the environment. Tea Q. 42(4):201-205. Weed Abstr. 22(4):73, 1973.

298. Wilkinson, V. and R. L. Lucas. 1969. Effects of herbicides on the growth of soil fungi. New Phytol. 68:709-719.

299. Williams, V. R. 1960. Aspartate transport in *Bacterium cadaveris* with special reference to the phosphate aging effect. J. Bacteriol. 79:125-131.

300. Worth, W. A., Jr. and A. M. McCabe. 1948. Differential effects of 2,4-D on aerobic, anaerobic, and facultative anaerobic microorganisms. Science 108(2792):16-18.

301. Wrobel, T. 1952. The influence of 2,4-D on *Rhizobium*. (Pl.) Acta Microbiol. Pol., Ser. B 1(1):39-41.

Y

302. Yegen, O. and S. Iren. 1974. Side effects of the growth substances 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid esters on the cereal snow mold. (Tr.) Bitki Koruma Bull. 14(2):69-82.

303. Young, A. L. 1974. Ecological Studies on a Herbicide-Equipment Test Area (TAC-52A), Eglin AFB Reservation, Florida. Technical Report AFATL-TR-74-12. Environics and Flame Munitions Branch; Flame Incendiary and Explosives Division, Air Force Armament Laboratory, Eglin Air Force Base, Fla. 32540. 141 p.

304. Yurkevich, I. V. and N. Z. Tolkachev. 1972. Effect of different rates of 2,4-D and simazine on the microflora of a normal chernozem soil. (Ru.) Khim. Sel'sk. Khoz. 10(9):696-698. Health Aspects Pestic. 6(11):614, 1973. Weed Abstr. 22(8):201, 1973.

Z

305. Zetterberg, G., L. Busk, R. Elovson, I. Starec-Nordenhammar, and H. Ryttman. 1977. The influence of pH on the effects of 2,4-D (2,4-dichlorophenoxyacetic acid, Na salt) on *Saccharomyces cerevisiae* and *Salmonella typhimurium*. Mutat. Res. 42:3-18. Pestic. Abstr. 10(5):269, 1977.

306. Zinchenko, V. A., T. V. Osinskaya, and N. A. Prokudina. 1969. The effect of herbicides on the biological activity of the soil. (Ru.) Khim. Sel'sk. Khoz. 7(11):850-853. Weed Abstr. 20(5):374-375, 1971.

307. Zubets, T. P. 1973. Microbiological and biochemical activities of soil as an indication of the presence of herbicides or their metabolites. (Ru.) P 82-88. In The Behaviour, Conversion and Analysis of Pesticides and their Metabolites in Soil. Proceedings of the 1st All-Union Conference, Pushchino-na-Oke, USSR, Akademiya Nauk. Weed Abstr. 24(4):86-87, 1975.

308. Zwiagincew, D. G. and I. W. Asiejewa. 1975. Application of herbicide 2,4-D butyl ether for the improvement of hilly meadows. Rocz. Glebozn. 26(2):151-157. Weed Abstr. 25(9):307, 1976.

Part B

Effects of Microorganisms on Herbicides

Subject Index

I. Research Papers - Effects of Microorganisms on Herbicides

A. 2,4-D (2,4-dichlorophenoxy)acetic acid

1. Effects of Fungi

Alternaria tenuis 191
Aspergillus leoporis 18
Aspergillus niger 28, 54, 55
Gloeosporium kaki 132
Gloeosporium olivarum 132
Hendersonula toruloidea 199, 200
Penicillium megasporum 184
Penicillium sp. 184, 191
Rhodotorula glutinis 143
Schizophyllum commune 132
Stachybotrys atra 200
Trichoderma viridis 191

FUNGI (scientific names not given) 32, 161

2. Effects of Bacteria

Achromobacter sp. 20, 21, 114, 154, 172, 173, 174
Achromobacterium sp. 176
Agrobacterium sp. 95
Alcaligenes sp. 114, 154
Arthrobacter globiformis 160
Arthrobacter oxydans 160
Arthrobacter sp. 25, 26, 27, 45, 108, 109, 110, 116, 154, 156, 157
Azotobacter sp. 32, 179, 180, 181, 182, 183, 184
Bacillus cereus var. *mycoides* 95
Bacillus pasteurii 95
Bacillus sp. 95, 171, 184
Bacillus subtilis 95, 143
Bacterium globiforme 12, 14, 15, 46, 191
Bacterium sp. 83
Brevibacterium linens 160
Cellulomonas sp. 191
Corynebacterium sp. 46, 84, 148, 151, 152
Flavobacterium aquatile 46, 83, 84
Flavobacterium peregrinum 169, 170, 172, 173, 174, 190
Flavobacterium sp. 33, 83, 117, 176
Micrococcus sp. 176
Mycoplana bullata 191
Mycoplana dimorpha 191
Mycoplana sp. 191
Nocardia coeliaca 176
Nocardia globerula 160
Nocardia rubropertincta 160

2,4-D - Bacteria (Cont'd)

Pseudomonas fluorescens 195
Pseudomonas sp. 49, 51, 57, 80, 95, 171, 176, 184
Rhizobium japonicum 86
Rhizobium meliloti 86
Sarcina lutea 184
Streptomyces aureus 18

BACTERIA (scientific names not given) 32, 42, 44, 85, 161, 189, 192, 197

3. Effects of Algae

Actinastrum sp. 34
Asterionella formosa 30
Chlorella pyrenoidosa 175, 194
Chlorella sp. 34
Cosmarium sp. 129
Desmidium sp. 126
Euglena sp. 129
Golinkiniopsis sp. 34
Koliella sp. 34
Monoraphidium sp. 34
Navicula sp. 129
Nitzschia actinastroides 30
Nitzschia sp. 34
Scenedesmus acutus 30, 31
Scenedesmus quadricauda 185, 186
Scenedesmus sp. 34
Trachelomonas sp. 129

4. Effects of unidentified Groups 2, 5, 10, 11, 19, 22, 43, 52, 58, 59, 66, 71, 72, 73, 75, 81, 82, 101, 104, 105, 134, 135, 137, 138, 139, 141, 147, 149, 150, 155, 161, 163, 164, 165, 168, 178, 196, 202

B. 2,4-DB [4-(2,4-dichlorophenoxy)butyric acid]

1. Effects of Fungi

Aspergillus niger 56
Phytophthora megasperma 166

2. Effects of Bacteria

Achromobacterium sp. 176
Flavobacterium sp. 117, 118, 119, 120, 176
Micrococcus sp. 176
Nocardia coeliaca 176
Nocardia opaca 193
Nocardia sp. 193
Pseudomonas sp. 176

2,4-DB - Bacteria (Cont'd)

3. Effects of unidentified Groups 2, 5, 6, 66, 196

C. 2,4-DP [2-(2,4-dichlorophenoxy)propionic acid

1. Effects of unidentified Groups 98, 196

D. 3-(2,4-DP) [3-(2,4-dichlorophenoxy)propionic acid

1. Effects of Bacteria

Flavobacterium sp. 117

2. Effects of unidentified Groups 2

E. MCPA [(4-chloro-*o*-tolyl)oxy]acetic acid, (2-methyl-4-chlorophenoxy-acetic acid)

1. Effects of Fungi

Aspergillus niger 28, 99
Fusarium culmorum 184
Gloeosporium kaki 132
Gloeosporium olivarum 132
Mucor sp. 184
Penicillium sp. 184
Schizophyllum commune 132
Verticillium sp. 184
Zygorhynchus molleri 184

2. Effects of Bacteria

Achromobacter sp. 172, 173, 174
Arthrobacter globiformis 160
Arthrobacter oxydans 160
Arthrobacter sp. 24, 25, 108
Azotobacter sp. 184
Bacterium globiforme 14
Bacterium sp. 83
Brevibacterium linens 160
Corynebacterium sp. 84, 184
Flavobacterium aquatile 83, 84
Flavobacterium peregrinum 24, 172, 173, 174, 190
Nocardia globerula 160
Nocardia rubropertincta 160
Pseudomonas sp. 49, 62, 64, 65, 184

BACTERIA (scientific names not given) 189

3. Effects of Algae

Chlamydomonas globosa 100

MCPA - Algae (Cont'd)

Chlorella pyrenoidosa 100
Stichococcus bacillaris 100

4. Effects of unidentified Groups 2, 32, 43, 59, 63, 71, 72, 98, 114, 120, 167, 168, 178

F. MCPB {4-[(4-chloro-*o*-tolyl)oxy]butyric acid, (4-(2-methyl-4-chlorophenoxy)butyric acid)}

1. Effects of Fungi

Aspergillus niger 56

2. Effects of Bacteria

Flavobacterium sp. 33
Nocardia opaca 193
Nocardia sp. 193

3. Effects of Algae

Chlamydomonas globosa 100
Chlorella pyrenoidosa 100
Stichococcus bacillaris 100

4. Effects of unidentified Groups 2, 98, 99

G. MCPP (Mecoprop) {2-(4-chloro-2-methylphenoxy)propionic acid, 2-[(4-chloro-*o*-tolyl)oxy]propionic acid}

1. Effects of unidentified Groups 2, 98

H. 2,4,5-T [(2,4,5-trichlorophenoxy)acetic acid]

1. Effects of Fungi

Aspergillus leoporis 18
Gloeosporium kaki 132
Gloeosporium olivarum 132
Schizophyllum commune 132

2. Effects of Bacteria

Agrobacterium sp. 95
Bacillus sp. 95, 171
Brevibacterium sp. 77
Pseudomonas sp. 80, 95, 171

BACTERIA (scientific names not given) 44, 197

2,4,5-T (Cont'd)

3. Effects of Algae

Asterionella formosa 30
Nitzschia actinastroides 30
Scenedesmus acutus 30, 31

4. Effects of unidentified Groups 14, 22, 32, 35, 41, 43, 52, 59, 71, 72, 100, 102, 120, 135, 137, 139, 141, 147, 196

I. 2,4,5-TB [4-(2,4,5-trichlorophenoxy)butyric acid]

1. Effects of Fungi

Aspergillus niger 56

2. Effects of unidentified Groups 22, 196

J. Sesone [2-(2,4-dichlorophenoxy)ethyl sodium sulfate]

1. Effects of Bacteria

Bacillus cereus var. *mycoides* 187, 188

K. Silvex (2,4,5-TP) [2-(2,4,5-trichlorophenoxy)propionic acid]

1. Effects of Bacteria

Achromobacter sp. 159
Pseudomonas sp. 80, 159

BACTERIA (scientific names not given) 44

2. Effects of unidentified Groups 2, 71, 72, 98, 196

L. CPA (4-chlorophenoxyacetic acid, ρ-chlorophenoxyacetic acid)

1. Effects of Fungi

Aspergillus niger 23, 38, 53, 56

2. Effects of Bacteria

Arthrobacter sp. 68
Pseudomonas sp. 50

3. Effects of unidentified Groups 47, 48, 50

M. 4-CPB [4-(4-chlorophenoxy)butyric acid]

1. Effects of Fungi

Aspergillus niger 56

II. Reviews 1, 3, 4, 6, 7, 8, 9, 13, 16, 17, 29, 37, 39, 40, 41, 60, 61, 67, 69, 70, 74, 76, 78, 79, 87, 88, 89, 90, 91, 92, 93, 96, 97, 103, 106, 107, 111, 112, 113, 115, 121, 122, 123, 124, 126, 127, 128, 130, 133, 140, 142, 144, 145, 146, 153, 158, 162, 177, 201, 202

III. Miscellaneous 36, 94, 125, 131, 136, 198

Part B

Effects of Microorganisms on Herbicides

A

1. Advisory Committee on 2,4,5-T. 1971. Report of the Advisory Committee on 2,4,5-T to the Administrator of the Environmental Protection Agency. 76 p. Weed Abstr. 21(5):417, 1972.

2. Alexander, M. and M. I. H. Aleem. 1961. Effect of chemical structure on microbial decomposition of aromatic herbicides. J. Agric. Food Chem. 9(1):44-47.

3. Alexander, M. 1964. Microbiology of pesticides and related hydrocarbons. P 15-42. In Principles and Applications in Aquatic Microbiology. H. Henkelekiass and N. C. Dondero (Eds.). John Wiley & Sons, Inc., New York, N.Y. 520 p.

4. Alexander, M. 1965. Biodegradation: Problems of molecular recalcitrance and microbial fallibility. Advan. Appl. Microbiol. 7:35-80.

5. Alexander, M. 1965. Persistence and biological reactions of pesticides in soils. Proc. Soil Sci. Soc. Am. 29(1):1-7.

6. Alexander, M. 1968. Degradation of pesticides by soil bacteria. P 270-289. In The Ecology of Soil Bacteria. T. R. G. Gray and D. Parkinson (Eds.). Liverpool University Press; Liverpool, England.

7. Alexander, M. 1969. Microbial degradation and biological effects of pesticides in soil. P 209-240. In Soil Biology: Review of Research. United Nations Educational Scientific and Cultural Organization; Paris, France. 240 p.

8. Alexander, M. 1971. Biochemical ecology of microorganisms. Annu. Rev. Microbiol. 25:361-392. Health Aspects Pestic. 6(1):1, 1973.

9. Allebone, J. E., R. J. Hamilton, and B. Ravenscroft. 1975. Environmental organic chemistry of 2,4-dichlorophenoxyacetic acid. Environ. Chem. 1:60-90. Weed Abstr. 25(10):350, 1976.

10. Aly, O. M. and S. D. Faust. 1964. Studies on the fate of 2,4-D and ester derivatives in natural surface waters. J. Agric. Food Chem. 12(6):541-546.

11. Audus, L. J. 1949. The biological detoxication of 2,4-dichlorophenoxyacetic acid in soil. Plant Soil 2(1):31-36.

12. Audus, L. J. 1950. Biological detoxication of 2,4-dichlorophenoxyacetic acid in soils: Isolation of an effective organism. Nature 166:356.

13. Audus, L. J. 1951. The biological detoxication of hormone herbicides in soil. Plant Soil 3(3):170-192.

14. Audus, L. J. 1952. The decomposition of 2,4-dichlorophenoxyacetic acid and 2-methyl-4-chlorophenoxyacetic acid in the soil. J. Sci. Food Agric. 3:268-274.

15. Audus, L. J. and K. V. Symonds. 1955. Further studies on the breakdown of 2,4-dichlorophenoxyacetic acid by a soil bacterium. Ann. Appl. Biol. 42:174-182.

16. Audus, L. J. 1960. Microbiological breakdown of herbicides in soils. P 1-19. In Herbicides and the Soil. E. K. Woodford and G. R. Sagar (Eds.). Blackwell Scientific Publications; Oxford, England.

17. Audus, L. J. 1964. Herbicide behavior in the soil. II. Interactions with soil microorganisms. P 163-206. In The Physiology and Biochemistry of Herbicides. L. J. Audus (Ed.). Academic Press; New York, N.Y. 555 p.

B

18. Beck, S. P., W. H. Macklin, II, and E. L. Arnold. 1976. Degradation of chlorophenoxyalkanoic acid herbicides by purified cultures of soil microorganisms. Weed Sci. Soc. Am., Abstr., 1976 Meet., p 86.

19. Behm, E. and I. Schröder. 1969. A method for the determination of 2,4-dichlorophenoxyacetic acid (2,4-D) in algal culture media. (De.) Weed Res. 9:43-47.

20. Bell, G. R. 1957. Some morphological and biochemical characteristics of a soil Bacterium which decomposes 2,4-dichlorophenoxyacetic acid. Can. J. Microbiol. 3:821-840.

21. Bell, G. R. 1960. Studies on a soil Achromobacter which degrades 2,4-dichlorophenoxyacetic acid. Can. J. Microbiol. 6:325-337.

22. Blackman, G. E., J. D. Fryer, A. Lang, and M. Newton. 1974. The effects of herbicides in South Vietnam. Part B. Working Papers. National Academy of Sciences - National Research Council; Washington, D.C. 59 p.

23. Bocks, S. M., J. R. L. Smith, and R. O. C. Norman. 1964. Hydroxylation of phenoxyacetic acid and anisole by *Aspergillus niger* (van Tiegh). Nature 201:308.

24. Bollag, J. M., C. S. Helling, and M. Alexander. 1967. Metabolism of 4-chloro-2-methylphenoxyacetic acid by soil bacteria. Appl. Microbiol. 15(6):1393-1398.

25. Bollag, J. M., M. A. Loos, and M. Alexander. 1967. Enzymatic degradation of phenoxyalkanoate herbicides. Bacteriol. Proc., Abstr. A-42, p 8.

26. Bollag, J. M., G. G. Briggs, J. E. Dawson, and M. Alexander. 1968. 2,4-D metabolism - enzymatic degradation of chlorocatechols. J. Agric. Food Chem. 16(5):829-833.

27. Bollag, J. M., C. S. Helling, and M. Alexander. 1968. 2,4-D metabolism - enzymatic hydroxylation of chlorinated phenols. J. Agric. Food Chem. 16(5):826-828.

28. Bollag, J. M. 1972. Biochemical transformation of pesticides by soil fungi. Crit. Rev. Microbiol. 2(1):35-37.

29. Bollag, J. M. 1974. Biochemical transformation of pesticides by soil fungi. P 34-56. In Microbial Ecology. A. I. Laskin and H. Lechevalier (Eds.). CRC Press; Cleveland, Ohio. 191 p.

30. Böhm, H. H. 1975. Accumulation of herbicides in planktonic fresh water algae. (De.) Mitt. Biol. Bundesanst. Land Forstwirtsch., Berlin-Dahlem, 165:205. Weed Abstr. 25(9):301, 1976.

31. Böhm, H. H. and H. Müller. 1976. Model studies on the accumulation of herbicides by microalgae. Naturwissenschaften 63(6):296. Weed Abstr. 26(6):196, 1977.

32. Buffington, J. D. 1974. Assessment of the ecological consequences of herbicide use along transmission line rights-of-way and recommendation for such use. U.S.N.T.I.S. Rep. Anl./Es-34; April 1974. 45 p.

33. Burger, K., I. C. MacRae, and M. Alexander. 1962. Decomposition of phenoxyalkyl carboxylic acids. Proc. Soil Sci. Soc. Am. 26:243-246.

34. Butler, G. L., T. R. Deason, and J. C. O'Kelley. 1975. Loss of five pesticides from cultures of twenty-one planktonic algae. Bull. Environ. Contam. Toxicol. 13(2):149-152. Pestic. Abstr. 8(6): 359, 1975.

35. Byast, T. H. and R. J. Hance. 1975. Degradation of 2,4,5-T by South Vietnamese soils incubated in the laboratory. Bull. Environ. Contam. Toxicol. 14(1):71-76.

C

36. CAST. 1975. The phenoxy herbicides. Weed Sci. 23(3):253-263. Pestic. Abstr. 9(9):599, 1976.

37. Catroux, G., J. C. Fournier, and G. Soulas. 1973. Introduction to the biodegradation of herbicides. (Fr.) Proc. Eur. Weed Res. Counc., Symp. Herbic.-Soil. p 141-150. Weed Abstr. 23(9):219, 1974.

38. Clifford, D. R. and D. Woodcock. 1964. Metabolism of phenoxyacetic acid by *Aspergillus niger* van Tiegh. Nature 203(4946):763.

39. Cullimore, D. R. 1971. Interaction between herbicides and soil microorganisms. Residue Rev. 35:65-80.

D

40. Davis, F. S. 1973. 2,4,5-T. Am. Inst. Chem. Eng., Symp. Ser. 69 (129):269-278. Weed Abstr. 23(8):181, 1974.

41. Davis, F. S. 1974. Toxicology, persistence and mobility of phenoxy herbicides in the environment. P E3-E16. U.S.N.T.I.S., AD Rep. A002 568. 143 p.

42. DeMarco, J., J. M. Symons, and G. G. Robeck. 1967. Behavior of synthetic organics in stratified impoundments. J. Am. Water Works Assoc. 59:965-976.

43. DeRose, H. R. and A. S. Newman. 1947. The comparison of the persistence of certain plant growth-regulators when applied to soil. Proc. Soil Sci. Soc. Am. 12:222-226.

44. Dimock, C. W. and C. W. Houston. 1975. Effect of soluble organic matter on the microbial degradation of recalcitrant herbicides. Am. Soc. Microbiol., Abstr., 1975 Meet., p 212. Weed Abstr. 25 (1):36, 1976.

45. Duxbury, J. M., J. M. Tiedje, M. Alexander, and J. E. Dawson. 1970. 2,4-D metabolism: Enzymatic conversion of chloromaleylacetic acid to succinic acid. J. Agric. Food Chem. 18(2):199-201. Weed Abstr. 20(1):62, 1971.

E

46. Evans, W. C. and B. S. W. Smith. 1954. The photochemical inactivation and microbial metabolism of the chlorophenoxyacetic acid herbicides. Biochem. J. 57:xxx.

47. Evans, W. C. and P. Moss. 1957. The metabolism of the herbicide ρ-chlorophenoxyacetic acid by a soil microorganism - the formation of a β-chloromuconic acid on ring fission. Biochem. J. 65: 8P.

48. Evans, W. C. 1958. Metabolism of aromatic compounds by lower plants. Vol. 10. P 474-476. In Encyclopedia of Plant Physiology. W. Ruhland (Ed.). Springer-Verlag; Berlin, Germany.

49. Evans, W. C., J. K. Gaunt, and J. I. Davies. 1961. The metabolism of the chlorophenoxyacetic acid herbicides by soil microorganism. Proc. Int. Congr. Biochem. 9:364-365.

50. Evans, W. C., B. S. W. Smith, P. Moss, and H. N. Fernley. 1971. Bacterial metabolism of 4-chlorophenoxyacetate. Biochem. J. 122: 509-517.

51. Evans, W. C., B. S. W. Smith, H. N. Fernley, and J. I. Davies. 1971. Bacterial metabolism of 2,4-dichlorophenoxyacetate. Biochem. J. 122:543-551.

52. Evans, W. F. 1971. A facility for the biological treatment of a complex chlorophenolic waste. Proc. Ark. Acad. Sci. 25:38-40. Pestic. Abstr. 7(1):5, 1974. Weed Abstr. 24(3):54, 1975.

F

53. Faulkner, J. K. and D. Woodcock. 1961. Fungal detoxication. Part V. Metabolism of *o*- and p-chlorophenoxyacetic acids by *Aspergillus niger*. J. Chem. Soc., p 5397-5400.

54. Faulkner, J. K. and D. Woodcock. 1964. Metabolism of 2,4-dichlorophenoxyacetic acid (2,4-D) by *Aspergillus niger* van Tiegh. Nature 203(4947):865.

55. Faulkner, J. K. and D. Woodcock. 1965. Fungal detoxication. Part VII. Metabolism of 2,4-dichlorophenoxyacetic acid and 4-chloro-2-methylphenoxyacetic acids by *Aspergillus niger*. J. Chem. Soc., p 1187-1191.

56. Faulkner, J. K. and D. Woodcock. 1966. Fungal detoxication. Part VIII. Metabolism of substituted 4-phenoxybutyric acids by *Aspergillus niger*. J. Chem. Soc., Sec. C, p 884-887.

57. Fernley, H. N. and W. C. Evans. 1959. Metabolism of 2,4-dichlorophenoxyacetic acid by soil *Pseudomonas*: Isolation of α-chloromuconic acid as an intermediate. Biochem. J. 73:22.

58. Flieg, O. 1952. The persistence of 2,4-D in the soil with reference of microbial activity. (De.) Mitt. Biol. Zentralanst. Land Forstwirtsch., Berlin-Dahlem 74:133-135.

59. Foster, R. K. and R. B. McKercher. 1973. Laboratory incubation studies of chlorophenoxyacetic acids in chernozemic soils. Soil Biol. Biochem. 5(3):333-337. Health Aspects Pestic. 6(9):505, 1973. Weed Abstr. 23(3):60, 1974.

60. Foy, C. L. 1969. The chlorinated aliphatic acids. P 207-253. In Degradation of Herbicides. P. C. Kearney and D. D. Kaufman (Eds.). Marcel Dekker, Inc., New York, N.Y. 394 p.

61. Freed, V. H. and M. L. Montgomery. 1969. Metabolism of herbicides. Ann. N.Y. Acad. Sci. 160(1):133-139.

G

62. Gamar, Y. and J. K. Gaunt. 1971. Bacterial metabolism of 4-chloro-2-methylphenoxyacetate. Formation of glyoxylate by side-chain cleavage. Biochem. J. 122:527-531.

63. Gaunt, J. K. and W. C. Evans. 1961. Metabolism of 4-chloro-2-methylphenoxyacetic acid by a soil microorganism. Biochem. J. 79:25-26.

64. Gaunt, J. K. and W. C. Evans. 1971. Metabolism of 4-chloro-2-methylphenoxyacetate by a soil *Pseudomonad*. Preliminary evidence for the metabolic pathway. Biochem. J. 122:519-526.

65. Gaunt, J. K. and W. C. Evans. 1971. Metabolism of 4-chloro-2-methylphenoxyacetate by a soil *Pseudomonad*. Ring-fission, lactonizing and delactonizing enzymes. Biochem. J. 122:533-542.

66. Gutenmann, W. H., M. A. Loos, M. Alexander, and D. J. Lisk. 1964. Beta oxidation of phenoxyalkanoic acids in soil. Proc. Soil Sci. Soc. Am. 28:205-207.

H

67. Haider, K. 1976. Microbial synthesis of humic materials. ACS Symp. Ser. 29:244-257.

68. Helling, C. S., J. M. Bollag, and J. E. Dawson. 1968. Cleavage of ether-oxygen bond in phenoxyacetic acid by an *Arthrobacter* species. J. Agric. Food Chem. 16:538-539.

69. Helling, C. S., P. C. Kearney, and M. Alexander. 1971. Behavior of pesticides in soils. Advan. Agron. 23:147-240.

70. Hemmett, R. B., Jr. and S. D. Faust. 1969. Biodegradation kinetics of 2,4-dichlorophenoxyacetic acid by aquatic microorganisms. Residue Rev. 29:191-207.

71. Hemmett, R. B., Jr. 1972. The biodegradation kinetics of selected phenoxyacetic acid herbicides and phenols by aquatic microorganisms. Diss. Abstr. Int. 32(12):7097B. Health Aspects Pestic. 6(5):254, 1973.

72. Hemmett, R. B., Jr. and S. D. Faust. 1972. Biodegradation kinetics of selected phenoxyacetic acid herbicides by aquatic microorganisms. Am. Chem. Soc., Abstr. Pap., 163rd Nat. Meet., Pestic. Chem. Sec., Abstr. No. 37.

73. Hernandez, T. P. and G. F. Warren. 1950. Some factors affecting the rate of inactivation and leaching of 2,4-D in different soils. Proc. Am. Soc. Hortic. Sci. 56:287-293.

74. Hertwig, K., L. Leiderman, C. A. Lobato dos Santos, and N. Grassi. 1974. Dissipation of herbicides in the soil. (Pt.) Biologico 40(1):11-21. Pestic. Abstr. 9(8):544, 1976.

75. Hirsch, P. and M. Alexander. 1960. Microbial decomposition of halogenated propionic and acetic acids. Can. J. Microbiol. 6(3): 241-249.

76. Horowitz, M. 1971. Ecology of herbicides under irrigated subtropical conditions. P 101-115. In Fate of Pesticides in Environment. A. S. Tahori (Ed.). Gordon & Breach Science Publishers; London, England.

77. Horvath, R. S. 1971. Microbial cometabolism of 2,4,5-trichlorophenoxyacetic acid. Bull. Environ. Contam. Toxicol. 5(6):537-541. Weed Abstr. 20(5):375, 1971.

78. Horvath, R. S. 1972. Microbial cometabolism and the degradation of organic compounds in nature. Bacteriol. Rev. 36(2):146-155. Health Aspects Pestic. 6(4):193, 1973.

79. House, W. B., L. H. Goodson, H. M. Gadberry, and K. W. Dockter. 1976. Assessment of ecological effects of extensive or repeated use of herbicides. Final Report. Processed for Defense Documentation, Defense Supply Agency. AD 824-314. U.S. Department of Commerce, National Bureau of Standards. 369 p.

80. Houston, C. W. 1975. Biodegradation of aquatic pollutants. U.S. N.T.I.S., PB Rep. 246 273/76A. 37 p.

81. Hurle, K. and B. Rademacher. 1970. The effect of long-term treatment with DNOC and 2,4-D on their breakdown in soil. (De.) Weed Res. 10:159-164. Health Aspects Pestic. 4:131, 1971.

82. Hurle, K. 1973. Lag-phase studies with DNOC and 2,4-D in the soil. (De.) Proc. Eur. Weed Res. Counc., Symp. Herbic.-Soil, p 151-162. Weed Abstr. 23(9):219, 1974.

J

83. Jensen, H. L. and H. I. Petersen. 1952. Decomposition of hormone herbicides by bacteria. Acta Agric. Scand. 2:215-231.

84. Jensen, H. L. and H. I. Petersen. 1952. Detoxication of hormone herbicides by soil bacteria. Nature 170(4314):39-40.

85. Jensen, H. L. 1956. Decomposition of chloro-substituted aliphatic acids by soil bacteria. Can. J. Microbiol. 3:151-164.

86. Jordan, D. C. and M. M. Garcia. 1969. Interactions between 2,4-DB and the root-nodule bacteria of *Lotus corniculatus*. Plant Soil 30(3):360-372.

K

87. Kaufman, D. D. 1970. Pesticide metabolism. P 73-86. In International Symposium on Pesticides in the Soil: Ecology, Degradation and Movement. Michigan State University; East Lansing, Mich. Weed Abstr. 21(3):256, 1972.

88. Kaufman, D. D. 1971. Degradation of pesticide combinations. P 175-204. In Fate of Pesticides in Environment. A. S. Tahori (Ed.). Gordon & Breach Science Publishers; London, England.

89. Kaufman, D. D. and P. C. Kearney. 1976. Microbial transformation in the soil. P 29-64. In Vol. 2. Herbicides - Physiology, Biochemistry, Ecology. L. J. Audus (Ed.). Academic Press; New York, N.Y. 564 p.

90. Kearney, P. C. 1960. Metabolism of herbicides in soils. Advan. Chem. Ser. 60:250-262.

91. Kearney, P. C., D. D. Kaufman, and M. Alexander. 1967. Biochemistry of herbicide decomposition in soils. P 318-342. In Soil Biochemistry. A. D. McLaren and G. H. Peterson (Eds.). Marcel Dekker, Inc., New York, N.Y.

92. Kearney, P. C. 1970. Herbicides in the environment. P 1-15. In FAO International Conference on Weed Control. Weed Science Society of America Special Committee (Eds.). University of California, Davis. Weed Abstr. 20(6):436, 1971.

93. Kearney, P. C. and D. D. Kaufman. 1972. Microbial degradation of some chlorinated pesticides. P 166-189. In Degradation of Synthetic Organic Molecules in the Biosphere. ISBN 0-309-02046-8; National Academy of Science; Washington, D.C.

94. Kearney, P. C. 1974. Adaptation of soil microorganisms to herbicides. P 165. In Abstract Book 3rd International Congress of Pesticide Chemistry ... Sponsored by IUPAC; Helsinki, Finland. Weed Abstr. 24(5):126-127, 1975.

95. Kecskes, M., L. Szucs, and E. Balazs. 1976. Bactericidal activity and degradation of phenoxy derivatives in various soil ecosystems. (Hu.) Agrartud. Kozl. 35(1-3):305-315.

96. Kenaga, E. E. 1975. The evaluation of the safety of 2,4,5-T to birds in areas treated for vegetation control. Residue Rev. 59:1-19. Pestic. Abstr. 9(3):188, 1976. Weed Abstr. 25(11):386, 1976.

97. Khan, M., M. Gassman, and R. Haque. 1976. Biodegradation of pesticides. Chem. Technol. 6(1):62-69. Pestic. Abstr. 9(4):272, 1976.

98. Kirkland, K. and J. D. Fryer. 1972. Degradation of several herbicides in a soil previously treated with MCPA. Weed Res. 12(1):90-95.

99. Kirkwood, R. C., M. M. Robertson, and J. E. Smith. 1966. Differential absorption as a factor influencing the selective toxicity of MCPA and MCPB. P 47-54. In FAO-IAEA Symposium on the Use of Isotopes in Weed Research. Vienna, Austria.

100. Kirkwood, R. C. and W. W. Fletcher. 1970. Factors influencing the herbicidal efficiency of MCPA and MCPB in three species of micro-algae. Weed Res. 10:3-10.

101. Klein, S. A., D. Jenkins, R. J. Wagenet, J. W. Biggar, and M. S. Yang. 1974. An evaluation of the accumulation, translocation, and degradation of pesticides at land wastewater disposal sites. U.S.N.T.I.S., AD Rep. A-006 551. 21 p.

102. Konnai, M., Y. Takeuchi, and T. Takematsu. 1974. Fundamental studies on residues and movement of forestry herbicides in soil. (Ja.) Bull. Coll. Agric., Utsunomiya Univ. 9(1):95-112. Weed Abstr. 23(12):316, 1974. Pestic. Abstr. 8(7):450-451, 1975.

103. Kramer, D. and G. Schmaland. 1974. Herbicide residues in water bodies: Problems of water economy as a consequence of the application of pesticides. (De.) Wasserwirtsch.-Wassertech. 24(5): 161-167. Pestic. Abstr. 7(11):714, 1974.

104. Kries, O. H. 1947. Persistence of 2,4-dichlorophenoxyacetic acid in soil in relation to content of water, organic matter, and lime. Bot. Gaz. 108:510-525.

L

105. Lavy, T. L., F. W. Roeth, and C. R. Fenster. 1973. Degradation of 2,4-D and atrazine at three soil depths in the field. J. Environ. Qual. 2(1):132-137. Health Aspects Pestic. 6(10):535, 1973. Weed Abstr. 23(1):22, 1974.

106. Leiderman, J. 1970. Biodegradation of herbicides. (Es.) P 39-41. In Primer Coloquio Sobre Herbicidas en Cana de Azucar. Publicacion Miscelanea No. 17. Estacion Experimental Agricola de Tucuman. San Miguel de Tucuman, Argentina. Weed Abstr. 21(5): 420, 1972.

107. Lingens, F. 1973. Breakdown of herbicides and fungicides by soil microorganisms. (De.) Chimia 27(12):628-635. Pestic. Abstr. 7(5):306, 1974.

108. Loos, M. A., J. M. Bollag, and M. Alexander. 1967. Phenoxyacetate herbicide detoxication by bacterial enzymes. J. Agric. Food Chem. 15:858-860.

109. Loos, M. A., R. N. Roberts, and M. Alexander. 1967. Formation of 2,4-dichlorophenol and 2,4-dichloroanisole from 2,4-dichlorophenoxyacetate by *Arthrobacter* sp. Can. J. Microbiol. 13:691-699.

110. Loos, M. A., R. N. Roberts, and M. Alexander. 1967. Phenols as intermediates in the decomposition of phenoxyacetates by an *Arthrobacter* species. Can. J. Microbiol. 13:679-690.

111. Loos, M. A. 1969. Degradation of phenoxyalkanoic acid herbicides by soil microorganisms. J. S. Afr. Chem. Inst. 22:S71-S78. Weed Abstr. 20(6):440, 1971.

112. Loos, M. A. 1969. Phenoxyalkanoic acids. P 1-49. In Degradation of Herbicides. P. C. Kearney and D. D. Kaufman (Eds.). Marcel Dekker, Inc., New York, N.Y. 394 p.

113. Loos, M. A. 1971. Metabolism of phenoxy herbicides by plants and soil microorganisms. P 291-304. In Pesticide Terminal Residues. Papers from the International Symposium of Pesticide Terminal Residues, Tel-Aviv, Israel. A. S. Tahori (Ed.). Butterworth's Scientific Publications; London, England. 365 p. Weed Abstr. 22(12): 321, 1973.

114. Loos, M. A. 1975. Indicator media for microorganisms degrading chlorinated pesticides. Can. J. Microbiol. 21(1):104-107. Pestic. Abstr. 8(5):308, 1975.

115. Loos, M. A. 1975. Phenoxyalkanoic acids. P 1-128. In Herbicides - Chemistry, Degradation and Mode of Action. P. C. Kearney and D. D. Kaufman (Eds.). Marcel Dekker, Inc., New York, N.Y. 500 p.

116. Luscombe, B. M. and D. Pramer. 1974. The dynamics of the biodegradation of 2,4-D. Am. Soc. Microbiol., Abstr., 1974 Meet., p 183. Weed Abstr. 25(10):351, 1976.

M

117. MacRae, I. C. and M. Alexander. 1963. Metabolism of phenoxyalkyl carboxylic acids by a *Flavobacterium* species. J. Bacteriol. 86:1231-1235.

118. MacRae, I. C., M. Alexander, and A. D. Rovira. 1963. The decomposition of 4-(2,4-dichlorophenoxy)butyric acid by *Flavobacterium* sp. J. Gen. Microbiol. 32:69-76.

119. MacRae, I. C. and M. Alexander. 1964. Use of gas chromatography for the demonstration of a pathway of phenoxy herbicide degradation. Agron. J. 56:91-92.

120. MacRae, I. C. and M. Alexander. 1965. Microbial degradation of selected herbicides in soil. J. Agric. Food Chem. 13(1):72-76.

121. Marth, P. C. 1947. Effect of 2,4-D applications to the soil. U.S. Dep. Agric., Yearb. Agric. p 47-49.

122. Matsumura, F. 1972. Biological effects of toxic pesticidal contaminants and terminal residues. P 525-548. In Environmental Toxicology of Pesticides. F. Matsumura, G. M. Boush, and T. Misato (Eds.). Academic Press; New York, N.Y. 637 p. Pestic. Abstr. 7(10):657, 1974.

123. Matsumura, F. 1973. Degradation of pesticide residues in the environment. P 494-512. In Environmental Pollution by Pesticides. Plenum Press; London, England. Pestic. Abstr. 7(10):652, 1974.

124. Matsumura, F. 1975. Microbial degradation of pesticides with particular reference to the formation of terminal residues. Environ. Qual. Saf. 4:160-174.

125. McNew, G. L. 1972. Interrelationships between agricultural chemicals and environmental quality in perspective. J. Environ. Qual. 1(1): 18-22.

126. Menzie, C. M. 1969. 2,4-D and related compounds. P 109-122. In Metabolism of Pesticides. U.S. Fish. Wildl. Serv., Bur. Sp. Fish. Wildl., Spec. Sci. Rep., Wildl. No. 127. 487 p.

127. Montgomery, M. L. and L. A. Norris. 1970. A preliminary evaluation of the hazards of 2,4,5-T in the forest environment. U.S. For. Serv., Pac. Northwest For. Range Exp. Stn., Res. Note, PNW-116. 10 p. Weed Abstr. 20(6):438, 1971.

128. Montgomery, M. L., D. Klein, R. Goulding, and V. H. Freed. 1971. Biological degradation of pesticide wastes. P 117-125. In Fate of Pesticides in Environment. A. S. Tahori (Ed.). Gordon & Breach Science Publishers; London, England. 302 p. Health Aspects Pestic. 6(9):467, 1973.

129. Morre, D. J. 1974. Brush control along agricultural drainage ditches: Environmental safety and efficacy of herbicide formulations. Purdue Univ. Water Resour. Res. Cent., Tech. Rep. No. 49. 108 p.

130. Mullison, W. R. 1970. The significance of herbicides to non-target organisms. Proc. Northeast. Weed Control Conf. 24:111-147.

131. Mullison, W. R. 1972. Ecological effects of herbicides. Down Earth 28(2):21-24. Health Aspects Pestic. 6(1):8, 1973.

N

132. Nakajima, S., N. Naito, and T. Tani. 1973. Microbial transformation of 2,4-D and its analogues. Chem. Pharm. Bull. 21(3):671-673. Health Aspects Pestic. 6(9):487, 1973. Weed Abstr. 23(4):78, 1974.

133. Nalewaja, J. D., L. W. Mitich, and A. Dexter. 1971. Herbicides in North Dakota's environment. N.Dak. Farm Res. 28(4):25-28. Weed Abstr. 20(6):436, 1971.

134. Newman, A. S. and J. R. Thomas. 1949. Decomposition of 2,4-dichlorophenoxyacetic acid in soil and liquid media. Proc. Soil Sci. Soc. Am. 14:160-164.

135. Newman, A. S., J. R. Thomas, and R. L. Walker. 1952. Disappearance of 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid from soil. Proc. Soil Sci. Soc. Am. 16(1):21-24.

136. Newman, A. S. and C. R. Downing. 1958. Herbicides and the soil. J. Agric. Food Chem. 6(5):352-353.

137. Norris, L. A. 1966. Degradation of 2,4-D and 2,4,5-T in forest litter. J. For. 64(7):475-476.

138. Norris, L. A. and D. Greiner. 1967. The degradation of 2,4-D in forest litter. Bull. Environ. Contam. Toxicol. 2(2):65-74.

139. Norris, L. A. 1970. Degradation of herbicides in the forest floor. P 397-411. In Tree Growth and Forest Soils. C. T. Youngberg and C. B. Davey (Eds.). Oregon State University Press; Corvallis, Oreg.

140. Norris, L. A. and D. G. Moore. 1970. The entry and fate of forest chemicals in streams. P 138-158. In Proceedings of a Symposium. Forest Land Uses and Stream Environment. A Continuing Education Book; Corvallis, Oreg.

O

141. Okey, R. W. and R. H. Bogan. 1965. Apparent involvement of electronic mechanisms in limiting the microbial metabolism of pesticides. J. Water Pollut. Control Fed. 37(5):692-712.

P

142. Paris, D. F. and D. L. Lewis. 1973. Chemical and microbial degradation of ten selected pesticides in aquatic systems. Residue Rev. 45:95-124. Health Aspects Pestic. 6(11):590, 1973. Weed Abstr. 23 (3):60, 1974.

143. Paris, D. F., D. L. Lewis, J. T. Barnett, and G. L. Baughman. 1975. Microbial degradation and accumulation of pesticides in aquatic systems. U.S.N.T.I.S., PB Rep. 241 293. 45 p. Weed Abstr. 25(6):199, 1976.

144. Pfister, R. M. 1972. Interactions of halogenated pesticides and microorganisms: A review. Crit. Rev. Microbiol. 2(1):1-33.

145. Pfister, R. M. 1974. Interactions of halogenated pesticides and microorganisms: A review. P 1-33. In Microbial Ecology. A. I. Laskin and H. Lechevalier (Eds.). CRC Press; Cleveland, Ohio. 191 p.

146. Pimentel, D. 1971. Ecological effects of pesticides on non-target species. Executive Office of the President, Office of Science and Technology. June 1971. 220 p.

147. Plumb, T. R., L. A. Norris, and M. L. Montgomery. 1977. Persistence of 2,4-D and 2,4,5-T in chaparral soil and vegetation. Bull. Environ. Contam. Toxicol. 17(1):1-8.

R

148. Reid, J. J. 1960. Bacterial decomposition of herbicides. Proc. Northeast. Weed Control Conf. 14:19-30.

149. Robson, T. O. 1966. Some studies of the persistence of 2,4-D in natural surface waters in Britain. Proc. Br. Weed Control Conf. 16 (1478):594-597.

150. Rogoff, M. H. and J. J. Reid. 1952. Persistence of weed control agents and effect on nitrification in field and garden soil. Bacteriol. Proc., Abstr. A2, p 13.

151. Rogoff, M. H. and J. J. Reid. 1954. Biological decomposition of 2,4-dichlorophenoxyacetic acid. Bacteriol. Proc., Abstr. A16, p 21.

152. Rogoff, M. H. and J. J. Reid. 1956. Bacterial decomposition of 2,4-dichlorophenoxyacetic acid. J. Bacteriol. 71:303-307.

153. Rogoff, M. H. 1961. Oxidation of aromatic compounds by bacteria. Advan. Appl. Microbiol. 3:193-221.

S

154. Sandmann, E. R. I. C. 1974. Aromatic metabolism by phenoxy herbicide-degrading soil bacteria. M.S. Thesis, University of Natal. 190 p. Weed Abstr. 25(1):36, 1976.

155. Schwartz, H. G., Jr. 1967. Microbial degradation of pesticides in aqueous solutions. J. Water Pollut. Control Fed. 39(10):1701-1714.

156. Sharpee, K. W. 1973. Microbial degradation of phenoxy herbicides in culture, soil, and aquatic ecosystems. Diss. Abstr. Int. 34(3): 954B. Weed Abstr. 23(10):257, 1974.

157. Sharpee, K. W., J. M. Duxbury, and M. Alexander. 1973. 2,4-Dichlorophenoxyacetate metabolism by *Arthrobacter* sp.: Accumulation of a chlorobutenolide. Appl. Microbiol. 26(3):445-447. Pestic. Abstr. 7(1):23, 1974. Weed Abstr. 23(7):153, 1974.

158. Sheets, T. J. and L. L. Danielson. 1960. Herbicides in soil. P 170-181. In The Nature and Fate of Chemicals Applied to Soils, Plants and Animals. U.S. Dep. Agric., Agric. Res. Serv., ARS 20-9.

159. Sikka, H. C. and L. T. Ou. 1975. Extensive degradation of silvex by synergistic action of aquatic microorganisms. P 101-105. In Proceedings, Research Planning Conference on the Aquatic Plant Control Program, 22-24 October 1975, Charleston, S.C.; Corps of Engineers, Miscellaneous Paper A-76-1.

160. Skryabin, G. K., L. A. Golovleva, and T. F. Solov'eva. 1974. Co-oxidation of phenoxyalkanic acids by microbial cultures. Dokl. Biol. Sci. - En. Transl. 215(1-6):160-161. Pestic. Abstr. 9(8):571-572, 1976. Weed Abstr. 24(9):241, 1975.

161. Skryabin, G. K., L. A. Golovleva, B. P. Strekozov, and N. V. Pribud'ko. 1974. Microbiological transformation of herbicides under cooxidation conditions. (Ru.) Izv. Akad. Nauk SSSR, Ser. Biol. 3:353-360. Pestic. Abstr. 8(1):38, 1975.

162. Skryabin, G. K. and L. A. Golovleva. 1975. Microbiological transformation and degradation of pesticides. (Ru.) Izv. Akad. Nauk SSSR, Ser. Biol. 6:805-819. Pestic. Abstr. 9(11):782, 1976.

163. Smith, A. E. 1972. Influence of calcium hydroxide and sulfur on 2,4-D degradation in soil. Soil Sci. 113(1):36-41.

164. Smith, A. E. 1972. The hydrolysis of 2,4-dichlorophenoxyacetate esters to 2,4-dichlorophenoxyacetic acid in Saskatchewan soils. Weed Res. 12:364-372. Health Aspects Pestic. 6(6):304, 1973. Weed Abstr. 22(10):258, 1973.

165. Smith, A. E. 1973. Influence of 2,4-D and 2,4,5-T on in vitro digestion of forage samples. J. Range Manage. 26(4):272-274. Pestic. Abstr. 7(1):35, 1974. Weed Abstr. 23(8):181, 1974.

166. Smith, A. E. and D. V. Phillips. 1976. Degradation of 4-(2,4-dichlorophenoxy)butyric acid (2,4-DB) by *Phytophthora megasperma*. J. Agric. Food Chem. 24(2):294-295. Pestic. Abstr. 9(5):351-352, 1976. Weed Abstr. 25(10):351, 1976.

167. Soderquist, C. J. and D. G. Crosby. 1975. Dissipation of 4-chloro-2-methylphenoxyacetic acid (MCPA) in a rice field. Pestic. Sci. 6(1): 17-33. Pestic. Abstr. 8(9):571, 1976.

168. Sokolov, M. S., L. L. Knyr, B. P. Strekozov, and V. D. Agarkov. 1975. Behavioral characteristics of Propanid, Yalan, MCPA and 2,4-D in rice irrigation systems in the Kuban. (Ru.) Khim. Sel'sk. Khoz. 13(3): 224-234. Weed Abstr. 24(12):345, 1975.

169. Spicher, G. 1954. Contributions for the knowledge of the efficiency of 2,4-D decomposition by *Flavobacterium peregrinum* St. et Sp. (De.) Zentralbl. Bakteriol. Parasitenkd. Infektionskr., Abt. 2, 108(8/12): 225-231.

170. Stapp, C. and G. Spicher. 1954. Examination about the effect of 2,4-D in soil. IV. *Flavobacterium peregrinum n. sp.* and its ability for the reduction of hormones. (De.) Zentralbl. Bakteriol. Parasitenkd. Infektionskr., Abt. 2, 108(4/7):113-126.

171. Stark, H. E., J. K. McBride, and G. F. Orr. 1975. Soil incorporation/biodegradation of herbicide Orange. I. Microbial and baseline ecological study of the U.S. Air Force Logistics Command Test Range, Hill Air Force Base, Utah. Final Report. TECOM Project No. 5-CO-213-000-015. U.S. Army Dugway Proving Ground; Dugway, Utah. 73 p.

172. Steenson, T. I. and N. Walker. 1956. Observations on the bacterial oxidation of chlorophenoxyacetic acids. Plant Soil 8(1):17-32.

173. Steenson, T. I. and N. Walker. 1957. The pathway of breakdown of 2,4-dichloro- and 4-chloro-2-methyl-phenoxyacetic acid by bacteria. J. Gen. Microbiol. 16:146-155.

174. Steenson, T. I. and N. Walker. 1958. Adaptive patterns in the bacterial oxidation of 2,4-dichloro- and 4-chloro-2-methyl-phenoxyacetic acid. J. Gen. Microbiol. 18:692-697.

175. Swets, W. A. and R. T. Wedding. 1964. The effect of dinitrophenol and other inhibitors on the uptake and metabolism of 2,4-dichlorophenoxyacetic acid by *Chlorella*. New Phytol. 63(1):55-72.

T

176. Taylor, H. F. and R. L. Wain. 1962. Side-chain degradation of certain *w*-phenoxyalkanecarboxylic acids by *Nocardia coeliaca* and other microorganisms isolated from soil. Proc. R. Soc., Ser. B 156:172-186.

177. Thiegs, B. J. 1962. Microbial decomposition of herbicides. Down Earth, Fall 1962. p 7-10.

178. Thornton, H. G. 1955. Decomposition of chlorophenoxyacetic acids in soil. Rep., Rothamsted Exp. Stn., Harpenden, Engl., p 66-67.

179. Tiedje, J. M. 1968. Metabolism of 2,4-dichlorophenoxyacetic acid by enzymes of an *Arthrobacter* sp. Ph.D. Thesis, Cornell Univ. 116 p.

180. Tiedje, J. M., G. G. Briggs, and M. Alexander. 1968. Phenoxyacetate detoxication by *Arthrobacter* sp. Bacteriol. Proc., Abstr. A32, p 6.

181. Tiedje, J. M. and M. Alexander. 1969. Enzymatic cleavage of the ether bond of 2,4-dichlorophenoxyacetate. J. Agric. Food Chem. 17(5): 1080-1084.

182. Tiedje, J. M., J. M. Duxbury, M. Alexander, and J. E. Dawson. 1969. 2,4-D metabolism: Pathway of degradation of chlorocatechols by *Arthrobacter* sp. J. Agric. Food Chem. 17(5):1021-1026.

183. Tomati, U., D. Lippi, and W. Pietrosanti. 1970. An enzymatic complex, capable of degrading 2,4-D. (Fr.) Meded. Fac. Landbouwwet., Rijksuniv. Gent 35(2):829-838. Weed Abstr. 21(1):75, 1972.

184. Torstensson, N. T. L., J. Stark, and B. Göransson. 1975. The effect of repeated applications of 2,4-D and MCPA on their breakdown in soil. Weed Res. 15:159-164.

V

185. Valentine, J. P. 1973. The influence of four algae on herbicide residues in water. Diss. Abstr. Int. 34(3):1251B-1252B. Weed Abstr. 23(9):219, 1974.

186. Valentine, J. P. and S. W. Bingham. 1974. Influence of several algae on 2,4-D residues in water. Weed Sci. 22(4):358-363. Pestic. Abstr. 7(10):694, 1974. Weed Abstr. 24(4):85, 1975.

187. Vlitos, A. J. 1952. Biological activation of sodium 2-(2,4-dichlorophenoxy)ethyl sulfate by *Bacillus cereus* var. *mycoides*. Contrib. Boyce Thompson Inst. 16:435-438.

188. Vlitos, A. J. 1953. Biological activation of sodium 2-(2,4-dichlorophenoxy)ethyl sulfate. Contrib. Boyce Thompson Inst. 17(2):127-149.

W

189. Walker, N. 1957. The persistence in soil of bacteria adapted to the decomposition of hormone herbicides. Turf Sport 3:3-4.

190. Walker, N. and T. I. Steenson. 1957. Bacterial decomposition of herbicides. Rep., Rothamsted Exp. Stn., Harpenden, Engl., p 81.

191. Walker, R. L. and A. S. Newman. 1956. Microbial decomposition of 2,4-dichlorophenoxyacetic acid. Appl. Microbiol. 4:201-206.

192. Watson, J. R. 1977. Seasonal variation in the biodegradation of 2,4-D in river water. Water Res. 11:153-157.

193. Webley, D. M., R. B. Duff, and V. C. Farmer. 1958. The influence of chemical structure on β-oxidation by soil *Nocardias*. J. Gen. Microbiol. 18:733-746.

194. Wedding, R. T. and G. E. Blackman. 1961. The uptake of growth substances. III. Influence of indoleacetic acid and other auxins on the uptake of 2,4-dichlorophenoxyacetic acid by *Chlorella*. J. Exp. Bot. 12(36):378-389.

195. Wedemeyer, G. 1966. Uptake of 2,4-dichlorophenoxyacetic acid by *Pseudomonas fluorescens*. Appl. Microbiol. 14(4):486-491.

196. Whiteside, J. S. and M. Alexander. 1960. Measurement of microbiological effects of herbicides. Weeds 8:204-213.

197. Winston, A. W., Jr. and P. M. Ritty. 1961. What happens to phenoxy herbicides when applied to a watershed area. Proc. Northeast. Weed Sci. Soc. 15:396-400.

198. Winston, A. W., Jr. and P. M. Ritty. 1972. What happens to phenoxy herbicides when applied to a watershed area. Ind. Veg. Manage. 4(1):12-14.

199. Wolf, D. C. 1974. Degradation of bromacil, terbacil, 2,4-D and atrazine in soil and pure culture and their effect on microbial activity. Diss. Abstr. Int. 34(10):4783B-4784B. Pestic. Abstr. 7(8):525, 1974.

200. Wolf, D. C. and J. P. Martin. 1976. Decomposition of fungal mycelia and humic-type polymers containing carbon-^{14} from ring and side-chain labeled 2,4-D and chlorpropham. Soil Sci. Soc. Am. J. 40 (5):700-704. Pestic. Abstr. 10(4):228, 1977.

201. Wright, S. J. L. 1971. Degradation of herbicides by soil micro-organisms. Soc. Appl. Bacteriol. Symp. Ser. 1:233-254. Health Aspects Pestic. 6(9):503-504, 1973. Weed Abstr. 23(8):182, 1974.

Y

202. Yoshida, T. and T. F. Castro. 1975. Degradation of 2,4-D, 2,4,5-T, and picloram in two Philippine soils. Soil Sci. Plant Nutr. 21(4): 397-404.

Keywords: Algae/bacteria/fungi/protozoa/viruses/ammonification/antibiotic/biodegradation/colonies/culture media/ecosystem/enzymes/genetic/growth/herbicide effects/nitrification/oxidation/physiology/plankton/population/root nodulation/soil/toxicity/2,4-D/3,4-D/2,4-DB/3,4-DB/2,4-DEP /2,4-DES/2,4-DP/dichlorprop/MCPA/MCPB/MCPP/mecoprop/2,4,5-T/ 2,4,5-TB/erbon/2,4,5-TP/silvex/CPA/4-CPB

ACKNOWLEDGMENT

We wish to acknowledge Mrs. Erne Glenn, secretary in the U.S. Department of Agriculture, Texas A&M University, for her typing assistance, and Miss Kara Lisa Easterling, undergraduate student in the Department of Range Science, Texas A&M University, for miscellaneous functions involved in producing this publication.

The Texas Agricultural Experiment Station, Neville P. Clarke, Director, College Station, Texas
2M—6-78