引 用 文 献

本書引用文献・参考文献の書誌情報は，朝倉書店ウェブサイト（https://www.asakura.co.jp/）よりダウンロードできます．検索の際にご活用ください．

第 1 章

太田寛行他：土壌生成プロセスにおける微生物の役割．土と微生物，**69**，80–83，2015.

大羽　裕・永塚鎮男：土壌生成分類学，養賢堂，1988.

藤村玲子他：初成土壌環境における微生物―三宅島土壌生態系再生のメカニズムを探る，日本生態学雑誌，**61**，211–218，2011.

Calvaruso, C. *et al.*：Influence of forest trees on the distribution of mineral weathering–associated bacterial communities of the *Scleroderma citrinum* mycorrhizosphere. *Appl. Environ. Microbiol.*, **76**, 4780–4787, 2010.

Chadwick, O. L. *et al.*：Changing sources of nutrients during four million years of ecosystem development. *Nature*, **397**, 491–497, 1999.

Conrad, R.：Soil microorganisms as controllers of atmospheric trace gases（H_2, CO, CH_4, OCS, N_2O, and NO）. *Microbiol. Rev.*, **60**, 609–640, 1996.

Frey, B. *et al.*：Weathering–associated bacteria from the Damma glacier forefield：physiological capabilities and impact on granite dissolution. *Appl. Environ. Microbiol.*, **76**, 4788–4796, 2010.

Fujimura, R. *et al.*：Unique pioneer microbial communities exposed to volcanic sulfur dioxide. *Sci. Rep.*, **6**, 19687, 2016. doi：10.1038/srep19687

Guo, Y. *et al.*：Characterization of early microbial communities on volcanic deposits along a vegetation gradient on the Island of Miyake, Japan. *Microbes Environ.*, **29**, 38–49, 2014.

Kelly, L. C. *et al.*：Pioneer microbial communities of the Fimmvörðuháls lava flow. Eyjafjallajökull, Iceland. *Microb. Ecol.*, **68**, 504–518, 2014.

King, G. M.：Contributions of atmospheric CO and hydrogen uptake to microbial dynamics on recent Hawaiian volcanic deposits. *Appl. Environ. Microbiol.*, **69**, 4067–4075, 2003.

Kurina, L. M. and P. M. Vitousek：Controls over the accumulation and decline of a nitrogen–fixed lichen, *Stereocaulon vulcani*, on young Hawaiian lava flows. *J. Ecol.*, **87**, 784–794, 1999.

Lepleux, C. *et al.*：Correlation of the abundance of *Betaproteobacteria* on mineral surfaces with mineral weathering in forest soils. *Appl. Environ. Microbiol.*, **78**, 7114–7119, 2012.

Nakai, S. *et al.*：Provenance of dust in the Pacific Ocean. *Earth Planet. Sci. Lett.*, **119**, 143–157, 1993.

Sato, Y. *et al.*：Nitrogenase activity（acetylene reduction）of an iron–oxidizing *Leptospirillum* strain cultured as a pioneer microbe from a recent volcanic deposit on Miyake–jima, Japan. *Microbes Envi-*

ron., **24**, 291–296, 2009.

第 2 章

犬伏和之・安西徹郎：土壌とはなにか．土壌学概論（犬伏和之・安西徹郎編），朝倉書店，p.4，2011.

服部　勉・宮下清貴：土の微生物学，養賢堂，p.37，p.86，p.89，1996.

Amundson, R.：The carbon budget in soils. *Annu. Rev. Earth Planet Sci*., **29**, 535–562, 2001.

Babikova, Z. *et al.*：Underground signals carried through common mycelial networks warn neighbouring plants of aphid attack. *Ecol. Lett*., **16**, 835–843, 2013.

Berendsen, R.L. *et al.*：The rhizosphere microbiome and plant health. *Trends. Plant. Sci*., **17**, 478–486, 2012.

Broeckling, C.D. *et al.*：Root exudates regulate soil fungal community composition and diversity. *Appl. Environ. Microbiol*., **74**, 738–744, 2008.

Drigo, B. *et al.*：Shifting carbon flow from roots into associated microbial communities in response to elevated atmospheric CO_2. *PNAS*, **107**, 10938–10942, 2010.

Ehlers, W. *et al.*：Penetration resistance and root growth of oats in tilled and untilled loess soil. *Soil Tillage Res*., **3**, 261–275, 1983.

Finlay, R.D. and B. Sodestrom：Mycorrhiza and carbon flow to the soil. In：Mycorrhizal functioning（Allen M.F. ed.), Chapman & Hall, pp.134–160, 1992.

Fitter, A.H. *et al.*：Biodiversity and ecosystem function in soil. *Funct. Ecol*., **19**, 369–377, 2005.

Jakobsen, I. and L. Rosendahl：Carbon flow into soil and external hypha from roots of mycorrhizal cucumber plants. *New Phytol*., **115**, 77–83, 1990.

Jobbágy, E.G. and R.B., Jackson：The vertical distribution of soil organic carbon and its relation to climate and vegetation. *Ecol. Appl*., **10**, 423–436, 2000.

Kautz, T.：Research on subsoil biopores and their functions in organically managed soils：A review. *Renew. Agr. Food Syst*., **30**, 318–327, 2014.

Kuzyakov, Y. and E. Blagodatskaya：Microbial hotspots and hot moments in soil：Concept & review. *Soil Biol. Biochem*., **83**, 184–199, 2015.

Morris, P. *et al.*：Chemotropic and contact responses of *Phytophthora sojae* hyphae to soybean isoflavonoids and artificial substrates. *Plant Physiol*., **117**, 1171–1178, 1998.

Nakamoto, T.：The distribution of maize roots as influenced by artificial vertical macropores. *Jpn. J. Crop Sci*., **66**, 331–332, 1997.

Pankhurst, C.E. *et al.*：Microbiological and chemical properties of soil associated with macropores at different depths in a red-duplex soil in NSW Australia. *Plant Soil*, **238**, 11–20, 2002.

Pérez-Montaño, F. *et al.*：Nodulation-gene-inducing flavonoids increase overall production of autoinducers and expression of N-acyl homoserine lactone synthesis genes in rhizobia. *Res. Microbiol*., **162**, 715–723, 2011.

Philippot, L. *et al.*：Going back to the roots：the microbial ecology of the rhizosphere. *Nat. Rev. Microbiol*., **11**, 789–799, 2013.

Rodríguez, H. and R. Fraga：Phosphate solubilizing bacteria and their role in plant growth promotion. *Biotechnol. Adv.*, **17**, 319–339, 1999.

第 3 章

Adl, S. M. *et al.*：The revised classification of eukaryotes. *J. Eukaryot. Microbiol.*, **59**, 429–493, 2012.

Brochier–Armanet, C. *et al.*：Mesophilic Crenarchaeota：proposal for a third archaeal phylum, the *Thaumarchaeota*. *Nat. Rev. Microbiol.*, **6**, 245–252, 2008.

Money, N. P.：*Microbiology, A Very Short Introduction*. Oxford University Press, 2014.

Ward, N. L. *et al.*：Three genomes from the phylum *Acidobacteria* provide insight into the lifestyles of these microorganisms in soils. *Appl. Environ. Microbiol.*, **75**, 2046–2056, 2009.

Youssef, N. H. and M. S. Elshahed：Diversity rankings among bacterial lineages in soil. *ISME J.*, **3**, 305–313, 2009.

Zhang, H.：*Gemmatimonas aurantiaca* gen. nov., sp. nov., a Gram–negative, aerobic, polyphosphate– accumulating micro–organism, the first cultured representative of the new bacterial phylum Gemmatimonadetes phyl. nov. *Int. J. Syst. Evol. Microbiol.*, **53**, 1155–1163, 2003.

第 4 章

荒尾知人他：土壌リン脂質と微生物バイオマス・群集構造．土と微生物，**51**，49–58，1998.

星野（高田）裕子：土壌 RNA を用いた微生物群集構造解析．日本微生物生態学会誌，**22**，51–58，2007.

星野（高田）裕子・長谷部亮：土壌からの DNA 抽出法．*J. Environ. Biotech.*，**5**，43–53，2005.

村瀬　潤：安定同位体プロービング（SIP）法で探る水田土壌の炭素動態と微生物．土と微生物，**67**，39–46，2013.

Fujie, K. *et al.*：Analysis of respiratory quinones in soil for characterization of microbiota. *Soil Sci. Plant Nutr.*, **44**, 393–404, 1998.

Ikenaga, M. and M. Sakai：Application of locked nucleic acid（LNA）oligonucleotide–PCR clamping technique to selectively PCR amplify the SSU rRNA genes of bacteria in investigating the plant–associated community structures. *Microbes Environ.*, **29**，286–295，2014.

Metzker, M. L.：Sequencing technologies—the next generation. *Nat. Rev. Genet.*, **11**, 31–46, 2010.

第 5 章

Bertagnolli, A. D. *et al.*：Agricultural land usage transforms nitrifier population ecology. *Environ. Microbiol.*, **18**, 1918–1929, 2016.

Daims, H. *et al.*：Complete nitrification by *Nitrospira* bacteria. *Nature*, **528**, 504–509, 2015.

Leininger, S. *et al.*：Archaea predominate among ammonia–oxidizing prokaryotes in soils. *Nature*, **442**, 806–809, 2006.

Onodera, Y. *et al.*：Seasonal change in vertical distribution of ammonia–oxidizing archaea and bacteria and their nitrification in temperate forest soil. *Microbes Environ.*, **25**, 28–35, 2010.

Zeglin, L. H. *et al.*：Bacterial and archaeal *amoA* gene distribution covaries with soil nitrification proper-

ties across a range of land uses. *Environ. Microbiol. Rep.*, **3**, 717–726, 2011.

Zhu, T. *et al.*：Fungi-dominant heterotrophic nitrification in a subtropical forest soil of China. *J. Soils Sediments*, **15**, 705–709, 2015.

第6章

板倉　学他：ダイズ根粒根圏からの亜酸化窒素発生機構とその低減化．化学と生物，**49**，560–565，2011.

植田　徹・松口龍彦：窒素の循環．土壌生化学（仁王以智夫他），朝倉書店，pp.111–131，1994.

川口正代司：マメ科植物における共生と器官形成の全身的制御システム．蛋白質 核酸 酵素，**48**，1808–1815，2003.

九町健一：共生窒素固定放線菌フランキア．生物工学，**91**，24–27，2013.

九町健一・椿健太郎：窒素固定を行う放線菌．土と微生物，**70**，17–22，2016.

坂本一憲：植物–微生物共生における共通性と多様性：根粒菌と菌根菌．土と微生物，**69**，25–29，2015.

鮫島（斎藤）玲子・南澤　究：土壌生態圏はいかに窒素を獲得したか：共生窒素固定系の進化．化学と生物，**42**，346–351，2004.

下田宜司他：マメ科植物と共生微生物の感染初期過程を制御する宿主植物遺伝子研究の現況：植物の成長調節，**46**，94–102，2011.

林　誠他：共生シグナルの受容と共通シグナル伝達経路の分子遺伝学的解明．蛋白質 核酸 酵素，**51**，1030–1037，2006.

山中高史・岡部宏秋：わが国に生息する放線菌根性植物とフランキア菌．森林総合研究所研究報告，**7**，67–80，2008.

横山　正：植物の根と微生物の相互作用．土壌微生物生態学（堀越孝雄・二井一禎編），朝倉書店，pp.37–96，2003.

渡辺　巌：日本でのアゾラ利用の現状と将来―アゾラ外来種が侵略的植物として法規制の対象に．雑草研究，**51**，178–184，2006.

Adhikari, D. *et al.*：Genetic diversity of soybean-nodulating rhizobia in Nepal in relation to climate and soil properties. *Plant Soil*, **357**, 131–145, 2012.

Fowler, D. *et al.*：The global nitrogen cycle in the twenty-first century. *Phil. Trans. R. Soc. B.*, **368**, 2013. doi：10.1098/rstb.2013.0165

Franche, C. *et al.*：Nitrogen-fixing bacteria associated with leguminous and non-leguminous plants. *Plant Soil*, **321**, 35–59, 2009.

Galloway, J. N.：The Global Nitrogen Cycle. In：*Treatise on Geochemistry* vol.8 Biogeochemistry（Holland H. D. and Turekian K. K. eds.）Elsevier, pp.557–583, 2003.

Itakura, M. *et al.*：Mitigation of nitrous oxide emission from soils by *Bradyrhizobium japonicum* inoculation. *Nat. Clim. Chang.*, **3**, 208–212, 2013.

Kennedy, I. R. *et al.*：Non-symbiotic bacterial diazotrophs in crop-farming systems：can their potential for plant growth promotion be better exploited?. *Soil Biol. Biochem.*, **36**, 1229–1244, 2004.

Li, Q. Q. *et al.*：Diversity and biogeography of rhizobia isolated from root nodules of *Glycine max* grown in Hebei Province, China. *Microb. Ecol.*, **61**, 917–931, 2011.

Okazaki, S. *et al.*：Hijacking of leguminous nodulation signaling by the rhizobial type III secretion system, *PNAS*, **110**, 17131–17136, 2013.

People, M. B. *et al.*：Biological nitrogen fixation：An efficient source of nitrogen for sustainable agricultural production?. *Plant Soil*, **174**, 3–28, 1995.

Risal, C. P. *et al.*：Genetic diversity of native soybean bradyrhizobia from different topographical regions along the southern slopes of the Himalayan mountains in Nepal. *Syst. Appl. Microbiol.*, **33**, 416–425, 2010.

Saeki, Y. *et al.*：Mathematical ecology analysis of geopraphical distribution of soybean-nodulating bradyrhizobia in Japan. *Microbes Environ.*, **28**, 470–478, 2013.

Saeki, Y. *et al.*：Effect of flooding and the *nosZ* gene in bradyrhizobia on bradyrhizobial community structure in the soil. *Microbes Environ.*, **32**, 154–163, 2017.

Sameshima-Saito, R. *et al.*：Symbiotic *Bradyrhizobium japonicum* reduces N_2O surrounding the soybean root system via nitrous oxide reductase. *Appl. Environ. Microbiol.*, **72**, 2526–2532, 2006.

Shiro, S. *et al.*：Genetic diversity and geographical distribution of indigenous soybean-nodulating bradyrhizobia in the United States. *Appl. Environ. Microbiol.*, **79**, 3610–3618, 2013.

Suzuki, K. *et al.*：Diversity and distribution of indigenous soybean-nodulating rhizobia in the Okinawa islands, Japan. *Soil Sci. Plant Nutr.*, **54**, 237–246, 2008.

Watanabe, I. and C. C. Liu：Improving nitrogen-fixing systems and integrating them into sustainable rice farming. *Plant Soil*, **141**, 57–67, 1992.

第 7 章

大場広輔・小島知子：アーバスキュラー菌根実験法（1）アーバスキュラー菌根共生研究へのいざない．土と微生物，**60**，53–56，2006.

大場広輔・大和政秀：アーバスキュラー菌根実験法（8）アーバスキュラー菌根菌の分子生物学的多様性解析．土と微生物，**61**，83–89，2007.

唐澤敏彦：輪作におけるアーバスキュラー菌根菌の動態と作物の生育に関する研究. 北海道農研研報, **179**, 1–71，2004.

小島知子他：日本各地の草地におけるアーバスキュラー菌根菌相．日草誌，**55**，148–155，2009.

斎藤雅典：草地生態系における菌根共生．日本生態学会誌，**49**，139–144，1999.

齋藤雅典：アーバスキュラー菌根菌接種技術の可能性．日草誌，**59**，274–276，2014.

西尾道徳・木村龍介：リン溶解菌とその農業利用の可能性．土と微生物，**28**，31–40，1986.

堀江直樹他：耐酸性菌根菌（*Rhizophagus clarus* RF1）資材を用いた酸性土壌法面の緑化工．日緑工誌，**42**，156–159，2016.

森　崇他：自然栽培が作物根へのアーバスキュラー菌根菌感染と土壌微生物バイオマスリンに及ぼす影響．中部土壌肥料研究，**105**，46–47，2016.

Smith, S. E. and D. J. Read：*Mycorrhizal Symbiosis*. 3rd ed. Academic Press, 2008.

van Tuinen, D. *et al.*：Charcterization of root colonization profiles by a microcosm community of arbuscular mycorrhizal fungi using 25S rDNA-targeted nested PCR. *Mol. Ecol.*, **7**, 879–887, 1998.

第8章

Ahmed, A. and S. Hasnain：Auxin-producing *Bacillus* sp.：Auxin quantification and effect on the growth of *Solanum tuberosum*. *Pure Appl. Chem*., **82**, 313–319, 2010.

Ahmad, M. *et al.*：Efficacy of *Rhizobium* and *Pseudomonas* strains to improve physiology, ionic balance and quality of mung bean under salt-affected conditions on farmer's fields. *Plant Physiolol. Biochem*., **63**, 170–176, 2013.

Davies, P. J.：*Plant Hormones*：*Physiology, Biochemistry, and Molecular Biology*, Kluwer Academic, 1995.

Flores-Félix, J. D. *et al.*：Plants probiotics as a tool to produce highly functional fruits：The case of *Phyllobacterium* and vitamin C in strawberries. *PLoS One*, **10**, 2015. e0122281

Glick, B. R.：Plant growth-promoting bacteria：Mechanisms and applications. *Scientifica*, 2012. 963401, doi：10.6064/2012/963401

Glick, B. R.：Bacteria with ACC deaminase can promote plant growth and help to feed the world. *Microbiol. Res*., **169**, 30–39, 2014.

Jourdan, E. *et al.*：Insights into the defense-related events occurring in plant cells following perception of surfactin-type lipopeptide from *Bacillus subtilis*. *Mol. Plant Microbe Interact*., **22**, 456–468, 2009.

Khan, A. L. *et al.*：Bacterial endophyte *Sphingomonas* sp. LK11 produces gibberellins and IAA and promotes tomato plant growth. *J. Microbiol*., **52**, 689–695, 2014.

Kloepper, J. W. and M. N. Schroth：Plant growth-promoting rhizobacteria and plant growth under gnotobiotic conditions. *Phytopathology*, **71**, 642–644, 1981.

Lambrecht, M. *et al.*：Indole-3-acetic acid：a reciprocal signalling molecule in bacteria-plant interactions. *Trends. Microbiol*., **8**, 298–300, 2000.

Liu, F. *et al.*：Cytokinin-producing, plant growth-promoting rhizobacteria that confer resistance to drought stress in *Platycladus orientalis* container seedlings. *Appl. Microbiol. Biotechnol*., **97**, 9155–9164, 2013.

Marulanda, A. *et al.*：Regulation of plasma membrane aquaporins by inoculation with a *Bacillus megaterium* strain in maize (*Zea mays* L.) plants under unstressed and salt-stressed conditions. *Planta*, **232**, 533–543, 2010.

Naveed, M. *et al.*：Drought stress amelioration in wheat through inoculation with *Burkholderia phytofirmans* strain PsJN. *Plant Growth Regul*., **73**, 121–131, 2014.

Pishchik, V. N. *et al.*：Experimental and mathematical simulation of plant growth promoting rhizobacteria and plant interaction under cadmium stress. *Plant Soil*, **243**, 173–186, 2002.

Puga-Freitas, R., and M. Blouin：A review of the effects of soil organisms on plant hormone signaling pathways. *Environ. Exp. Bot*., **114**, 104–116, 2015.

Ryu, C. *et al.*：Bacterial volatiles promote growth in *Arabidopsis*. *Proc. Natl. Acad. Sci. U.S.A*., **100**, 4927–4932, 2003.

Ryu, C. *et al.*：Bacterial volatiles induce systemic resistance in *Arabidopsis*. *Plant Physiol*., **134**, 1017–1026, 2004.

Sarma, R. K. and R. Saikia：Alleviation of drought stress in mung bean by strain *Pseudomonas aeruginosa* GGRJ21. *Plant Soil*, **377**, 111–126, 2014.

Stein, T.：*Bacillus subtilis* antibiotics：structures, syntheses and specific functions. *Mol. Microbiol.*, **56**, 845–857, 2005.

Yokota, K. and H. Hayakawa：Impact of antimicrobial lipopeptides from *Bacillus* sp. on suppression of *Fusarium* yellows of tatsoi. *Microbes Environ.*, **30**, 281–283, 2015.

第 9 章

荒川征夫：リゾクトニア．土壌微生物実験法 第 3 版（土壌微生物学会編），養賢堂，pp.171–175，2013.

有江　力他：フザリウム．土壌微生物実験法 第 3 版（土壌微生物学会編），養賢堂，pp.175–189，2013.

土壌伝染病談話会編：土壌伝染病談話会レポート，日本植物病理学会，1992.

内藤繁雄：病気の予防と防除．最新植物病理学（奥田誠一他編），朝倉書店，p.147，2004.

日本土壌協会：土壌診断と対策，曙光印刷，2016.

農林水産省：農業経営統計調査 品目別経営統計．http://www.maff.go.jp/j/tokei/kouhyou/noukei/hinmoku/index.html

平成 28 年度全国農業システム化研究会：野菜の土壌病害虫対策に関する情報交換会資料（東北関東甲信越東海近畿北陸ブロック 26 府県）.

堀江博道編著：カラー図説 植物病原菌類の見分け方 第 1 編 植物病原菌類の所属と形態的特徴，大誠社，2014.

村上圭一・後藤逸男：土壌のリン酸過剰が土壌病害の発病を助長する．農及園，**82**，1290–1294，2007.

持田秀之：連作障害．環境保全型農業事典（石井龍一編），丸善出版，pp.344–350，2005.

米山伸吾他：図説 野菜の病気と害虫―伝染環・生活環と防除法，農山漁村文化協会，2005.

和田さと子：殺線虫剤が土壌中の線虫及び微生物群集に及ぼす影響．東京農工大学大学院生物システム応用科学府　博士論文，2009.

Banno, S. *et al.*：Quantitative nested real-time PCR detection of *Verticillium longisporum* and *V. dahliae* in the soil of cabbage. *J. Gen. Plant Pathol.*, **77**, 282–291, 2011.

Bonanomi, G. *et al.*：Identifying the characteristics of organic soil amendments that suppress soilborne plant diseases. *Soil Biol. Biochem.*, **42**, 136–144, 2010.

Min, Y. Y. *et al.*：A novel nematode diagnostic method by the direct quantification of plant-parasitic nematodes in soil with real-time PCR. *Nematology*, **14**, 265–276, 2012.

Oerke, E. C.：Crop losses to pests. *J. Agric. Sci.*, **144**, 31–43, 2006.

Oerke, E. C. and H. W. Dehne：Safeguarding production-losses in major crops and the role of crop protection. *Crop Prot.*, **23**, 275–285, 2004.

Sato, E. *et al.*：Effects of the density of root-lesion nematode（*Pratylenchus penetrans*）, soil chemical and microbial properties on the damage to Japanese radish. *Nematology*, **15**, 931–938, 2013.

Wada, S. *et al.*：Effects of the nematicide imicyafos on soil nematode community structure and damage to radish caused by *Pratylenchus penetrans*. *J. Nematol.*, **43**, 1–6, 2011.

第 10 章

石沢修一・豊田広三：本邦土壌の微生物フロラに関する研究．農技研報 B，**14**，204–284，1964.

塩田悠賀里他：長期にわたる四要素および堆肥の欠除が水田土壌の微生物性に及ぼす影響．土と微生物，**29**，3–8，1987.

妹尾啓史：温室効果ガスと土壌微生物．土と微生物，**69**，10–15，2015.

高井康雄：湛水下の土壌中における酸化還元過程．水田土壌学（川口桂三郎編），講談社，pp.23–55，1978.

若月利之：水田土壌．最新土壌学（久馬一剛編），朝倉書店，pp.157–178，1997.

和田秀徳：水田土壌における物質変化と微生物．土の微生物（土壌微生物研究会編），博友社，pp.127–171，1981.

FAOSTAT 2014　http://www.fao.org/faostat/en/#home

Kimura, M.：Anaerobic microbiology in waterlogged rice fields. In：*Soil Biochemistry Vol. 10*（J. Bollag and G. Stotzky eds.），Marcel Dekker, pp.35–138, 2000.

Kimura, M. *et al.*：Carbon cycling in rice field ecosystems in the context of input, decomposition and translocation of organic materials and the fates of their end products（CO_2 and CH_4）. *Soil Biol. Biochem.*, **36**, 1399–1416, 2004.

Kirk, G.：*The biogeochemistry of submerged soils*, John Wiley & Sons, 2004.

Minamisawa, K. *et al.*：Are symbiotic methanotrophs key microbes for N acquisition in paddy rice root?. *Microbes Environ.*, **31**, 4–10, 2016.

Murase, J. *et al.*：Impact of long-term fertilizer treatment on the microeukaryotic community structure of a rice field soil. *Soil Biol. Biochem.*, **80**, 237–243, 2015.

Noll, M. *et al.*：Succession of bacterial community structure and diversity in a paddy soil oxygen gradient. *Environ. Microbiol.*, **7**, 382–395, 2005.

Usui, Y. and T. Kasubuchi：Effects of herbicide application on carbon dioxide, dissolved oxygen, pH, and RpH in paddy-field ponded water. *Soil Sci. Plant Nutr.*, **57**, 1–6, 2011.

Watanabe, I. and C. Furusaka：Microbial ecology of flooded rice soils. In：*Advances in Microbial Ecology Volume 4*（M. Alexander ed.），Plenum Press, pp.125–168, 1980.

Ye, R. *et al.*：Homoacetogenesis：A potentially underappreciated carbon pathway in peatlands. *Soil Biol. Biochem.*, **68**, 385–391, 2014.

第 11 章

赤司和隆：土壌と根圏 IV．農業技術体系 土壌施肥編第 1 巻，農村漁村文化協会，118–124，1975.

石沢修一・豊田広三：本邦土壌の微生物フロラに関する研究．農技研報 B 土壌肥料，203–284，1964.

駒田　亘・門間敏幸：連作障害総合防除システム開発の手引き．総合農業研究叢書，**16**，13–32，1989.

西尾道徳：連作障害の発生について．土肥誌，**54**，64–73，1983.

松口龍彦・新田恒雄：きゅう肥，作物残渣の施用が畑作物の根群発達および根の糸状菌フロラに及ぼす影響．土肥誌，**58**，661–670，1987.

Holland, J. E. *et al.*：Liming impacts on soils, crops and biodiversity in the UK：A review. *Sci. Total Environ.*, **610–611**, 316–332. 2018.

コラム 2

Cahyani, V. R. *et al.*：Succession of microbiota estimated by phospholipids fatty acid analysis and changes in organic constituents during the composting process of rice straw. *Soil Sci. Plant Nutr.*, **48**, 735–743, 2002.

Cahyani, V. R. *et al.*：Succession and phylogenetic composition of bacterial communities responsible for the composting process of rice straw estimated by PCR–DGGE analysis. *Soil Sci. Plant Nutr.*, **49**, 619–630, 2003.

Cahyani, V. R. *et al.*：Succession and phylogenetic profile of eukaryotic communities in the composting process of rice straw estimated by PCR–DGGE analysis. *Biol. Fertil. Soils*, **40**, 334–344, 2004.

第 12 章

大園享司：冷温帯林における落葉の分解過程と菌類群集．日本生態学会誌，**57**，304–318，2007.

片山義博他編：〈木材科学講座 11〉バイオテクノロジー，海青社，2002.

深沢　遊・大園享司：植物リター分解菌とブナ林の土壌生態系．微生物の生態学（日本生態学会編），共立出版，pp.169–185，2011.

藤井一至：大地の五億年―せめぎあう土と生き物たち，山と渓谷社，2015.

二井一禎・肘井直樹：森林微生物生態学，朝倉書店，2000.

Buée, M. *et al.*：454 Pyrosequencing analyses of forest soils reveal an unexpectedly high fungal diversity. *New Phytol.*, **184**, 449–456, 2009.

Deng S. P. and M. A. Tabatabai：Cellulase activity of soils. *Soil Biol. Biochem.*, **26**, 1347–1354, 1994.

Floudas, D. *et al.*：The Paleozoic origin of enzymatic lignin decomposition reconstructed from 31 fungal genomes. *Science*, **336**, 1715–1719, 2012.

Foissner, W.：Biogeography and dispersal of micro-organisms：a review emphasizing protists. *Acta Protozool.*, **45**, 111–136, 2006.

Fujii, K. *et al.*：Environmental control of lignin peroxidase, manganese peroxidase, and laccase activities in forest floor layers in humid Asia. *Soil Biol. Biochem.*, **57**, 109–115, 2013.

Gams, W.：Biodiversity of soil-inhabiting fungi. *Biodivers. conserv.*, **16**, 69–72, 2007.

Hofrichter, M.：Lignin conversion by manganese peroxidase（MnP）. *Enzyme Microb. Technol.*, **30**, 454–466, 2002.

Jongmans, A. G. *et al.*：Rock-eating fungi. *Nature*, **389**, 682, 1997.

Kemmitt, S. J. *et al.*：pH regulation of carbon and nitrogen dynamics in two agricultural soils. *Soil Biol. Biochem.*, **38**, 898–911, 2006.

Lal, R.：Carbon sequestration. *Philos. Trans. R. Soc. B：Biol. Sci.*, **363**, 815–830, 2008.

von Lützow, M. and I. Kögel-Knabner：Temperature sensitivity of soil organic matter decomposition―what do we know?. *Biol. Fertil. Soils*, **46**, 1–15, 2009.

Poll, C. *et al.*：Dynamics of litter carbon turnover and microbial abundance in a rye detritusphere. *Soil Biol. Biochem.*, **40**, 1306–1321, 2008.

Schimel, J. P. and M. N. Weintraub：The implications of exoenzyme activity on microbial carbon and

nitrogen limitation in soil：a theoretical model. *Soil Biol. Biochem.*, **35**, 549–563, 2003.

Toju, H. *et al.*：Networks depicting the fine-scale co-occurrences of fungi in soil horizons. *PloS one*, **11**, e0165987. 2016.

Wallander, H. *et al.*：Estimation of the biomass and seasonal growth of external mycelium of ectomycorrhizal fungi in the field. *New Phytol.*, **151**, 753–760, 2001.

第 13 章

中央環境審議会土壌農薬部会土壌汚染技術基準等専門委員会：油汚染対策ガイドライン―鉱油類を含む土壌に起因する油臭・油膜問題への土地所有者等による対応の考え方，2006.

永田裕二・津田雅孝：有機塩素系殺虫剤分解菌の出現―代謝系の構築と酵素の機能．蛋白質 核酸 酵素，**50**，1511–1518，2005.

Dick, R. E. and J. P. Quinn：Glyphosate-degrading isolates from environmental samples：occurrence and pathways of degradation. *Appl. Microbiol. Biotechnol.*, **43**, 545–550, 1995.

Jitsumori, K. *et al.*：X-Ray crystallographic and mutational studies of fluoroacetate dehalogenase from *Burkholderia* sp. strain FA1. *J. Bacteriol.*, **191**(8), 2630–2637, 2009.

Kamei, I. *et al.*：Bioconversion of dieldrin by wood-rotting fungi and metabolite detection. *Pest Manag. Sci.*, **66**, 888–891, 2010.

Kataoka, R. *et al.*：Biodegradation of dieldrin by a soil fungus isolated from a soil with annual endosulfan applications. *Environ. Sci. Technol.*, **44**, 6343–6349, 2010.

Liu, C. M. *et al.*：Degradation of the herbicide glyphosate by members of the family *Rhizobiaceae*. *Appl. Environ. Microbiol.*, **57**, 1799–1804, 1991.

Lu, T. Q. *et al.*：Regulation of hydroxylation and nitroreduction pathways during metabolism of the neonicotinoid insecticide imidacloprid by *Pseudomonas putida*. *J. Agric. Food Chem.*, **64**, 4866–4875, 2016.

Sadowsky, M. J.：Diversity and evolution of micro-organisms and pathways for the degradation of environmental contaminants：a case study with the s-triazine herbicides. In：*Ecology of industrial pollution*（L. C. Batty and K. B. Hallberg eds.）. Cambridge University Press, 205–225, 2010.

Sakakibara, F. *et al.*：Isolation and identification of dieldrin-degrading *Pseudonocardia* sp. strain KSF27 using a soil-charcoal perfusion method with aldrin trans-diol as a structural analog of dieldrin. *Biochem. Biophys. Res. Commun.*, **411**, 76–81, 2011.

Van Beilen, J. B. *et al.*：Diversity of alkane hydroxylase systems in the environment. *Oil Gas Sci. Tech.*, **58**, 427–440, 2003.

コラム 4

野口勝憲：病害制御を目指した微生物資材の評価と展開．微生物の資材化：研究の最前線（鈴井孝仁他編），ソフトサイエンス社，pp.157–167，2000.

福井　糧：拮抗微生物利用による生物防除の将来展望．拮抗微生物による作物病害の生物防除―我が国における研究事例・実用化事例―（百町満朗監修），クミアイ化学工業株式会社，pp.225–237，2003.

吉田重信・對馬誠也：植物病害に対する微生物農薬の研究開発における課題と展望．化学と生物，**51**，

pp.541–547, 2013.

Hyakumachi, M. *et al.* : Recent studies on biological control of plant diseases in Japan. *J. Gen. Plant Pathol.*, **80**, 287–302, 2014.

参 考 文 献

第 1 章

フェンチェル, T. 他著, 太田寛行他訳：微生物の地球化学―元素循環をめぐる微生物学, 東海大学出版部, 2015.

Johnson, D. L. and R. J. Schaetzl：Differing views of soil and pedogenesis by two masters：Darwin and Dokuchaev. *Geoderma*, **237–238**, 176–189, 2015.

King, G. M.：Chemolithotrophic bacteria：distributions, functions and significance in volcanic environment. *Microbes Environ.*, **22**, 309–319, 2007.

第 2 章

堀越孝雄・二井一禎編著：土壌微生物生態学, 朝倉書店, 2003.

松中照夫：土壌学の基礎, 農文協, 2014.

Callaway, R. M. *et al.*：Novel weapons：invasive plant suppresses fungal mutualists in America but not in its native Europe. *Ecology*, **89**, 1043–1055, 2008.

Eldor, P. A. ed.：*Soil Microbiology, Ecology, and Biochemistry* 4th ed., Academic Press, 2015.

Guo, Z.-Y. *et al.*：Rhizosphere isoflavones (daidzein and genistein) levels and their relation to the microbial community structure of mono-cropped soybean soil in field and controlled conditions. *Soil Biol. Biochem.*, **43**, 2257–2264, 2011.

Hassan, S. and U. Mathesius：The role of flavonoids in root–rhizosphere signalling：opportunities and challenges for improving plant–microbe interactions. *J. Exp. Bot.*, **63**, 3429–3444, 2012.

Hensen, V.：Die Wurzeln in den tieferen Bodenschichten. *Jahrbuch der Deutschen Landwirtschafts-Gesellschaft.* **7**, 84–96, 1892.

Köpke, U.：A comparison of methods for measuring root growth of field crops [oats, *Avena sativa* L.]. *Zeitschrift fuer Acker und Pflanzenbau*, **150**, 39–49, 1981.

Maier, M. R. *et al.*, eds.：*Environmental Microbiology* 4th ed., Academic Press, 2000.

Mathesius, U. *et al.*：Extensive and specific responses of a eukaryote to bacterial quorum-sensing signals. *PNAS*, **100**, 1444–1449, 2003.

第 3 章

日本土壌微生物学会編：〈新・土の微生物 (5)〉系統分類からみた土の細菌, 博友社, 2000.

細矢　剛他：カビ図鑑―野外で探す微生物の不思議, 全国農村教育協会, 2010.

宮道慎二他編：微生物の世界, 筑波出版会, 2006.

第 4 章

菅野純夫・鈴木　穣：細胞工学別冊 次世代シークエンサー：目的別アドバンストメソッド，秀潤社，2012.
鈴木健一朗他：微生物の分類・同定実験法 分子遺伝学・分子生物学的手法を中心に，シュプリンガー・ジャパン，2001.
妹尾啓史：分子生物学と土壌生化学．〈実践土壌学シリーズ〉土壌生化学（犬伏和之編），朝倉書店，印刷中.
中村和憲・関口勇地：微生物相解析技術 目に見えない微生物を遺伝子で解析する，米田出版，2009.
二階堂愛：実験医学別冊 次世代シークエンス解析スタンダード NGS のポテンシャルを活かしきる WET & DRY，羊土社，2014.
日本土壌微生物学会：土壌微生物実験法 第 3 版，養賢堂，2013.

コラム 1

Thompson L. R. *et al.*：A communal catalogue reveals Earth's multiscale microbial diversity. *Nature*, **551**, 457–463, 2017. doi.10.1038/nature24621

第 5 章

植田　徹・松口龍彦：窒素の循環．土壌生化学（仁王以智夫他），朝倉書店，pp.109–103，1994.
カーチマン，D. L. 著，永田　俊訳：微生物生態学―ゲノム解析からエコシステムまで，京都大学学術出版会，2016.
鮫島玲子：最近の脱窒糸状菌研究の動向と今後の展望．土と微生物，**68**，15–20，2014.
妹尾啓史：温室効果ガスと土壌微生物．土と微生物，**69**，10–15，2015.
早野恒一：植物の窒素，リン栄養と微生物．〈新・土の微生物（2）〉植物の生育と微生物（土壌微生物研究会編），博友社，pp.133–165，1997.
丸本卓哉：微生物バイオマス．土壌生化学（仁王以智夫他），朝倉書店，pp.34–51，1994.
渡辺克二・早野恒一：土壌中のプロテアーゼ生産微生物．土と微生物，**47**，9–22，1996.
Itakura, M. *et al.*：Mitigation of nitrous oxide emissions from soils by *Bradyrhizobium japonicum* inoculation. *Nature Clim. Change*, **3**, 208–212, 2013.
Lawton, T. *et al.*：Characterization of a nitrite reductase involved in nitrifier denitrification. *J. Biol. Chem.*, **288**, 25575–25583, 2013.
Qu, Z. *et al.*：Transcriptional and metabolic regulation of denitrification in *Paracoccus denitrificans* allows low but significant activity of nitrous oxide reductase under oxic conditions. *Environ. Microbiol.*, **18**, 2951–2963, 2016.
Wei, W. *et al.*：Higher diversity and abundance of denitrifying microorganisms in environments than considered previously. *ISME J.*, 1–12, 2015.
Zhu, B. *et al.*：Rhizosphere priming effects on soil carbon and nitrogen mineralization. *Soil Biol. Biochem.*, **76**, 183–192, 2014.

第 6 章

渡辺　巖：植物の根に共生する微生物，〈新・植物の微生物（2）〉植物の生育と微生物（土壌微生物研究会編），博友社，pp.41–74，1997.

Shiina, Y. *et al.*：Relationship between soil type and N_2O reductase genotype（*nosZ*）of indigenous soybean bradyrhizobia：*nosZ*–minus populations are dominant in Andosols. *Microbes Environ.*, **29**, 420–426, 2014.

Shiro, S. *et al.*：Temperature–dependent expression of nodC and community structure of soybean–nodulating bradyrhizobia. *Microbes Environ.*, **31**, 27–32, 2016.

Suzuki, Y. *et al.*：Effects of temperature on competition and relative dominance of *Bradyrhizobium japonicum* and *Bradyrhizobium* elkanii in the process of soybean nodulation. *Plant Soil*, **374**, 915–924, 2014.

第 7 章

梅谷献二・加藤　肇：農業有用微生物―その利用と展望―．養賢堂，1990.

大竹久夫：リン資源枯渇危機とはなにか―リンはいのちの元素―，大阪大学出版会，2011.

小川　眞：〈自然と科学技術シリーズ〉作物と土をつなぐ共生微生物―菌根の生態学，農村漁村文化協会，1987.

第 8 章

鈴井孝仁他編：微生物の資材化：研究の最前線，ソフトサイエンス社，2000.

第 9 章

大畑貫一他編：作物病原菌研究技法の基礎―分離・培養・接種―，日本植物防疫協会，1995.

田部井英夫他編：作物の細菌病―診断と防除―，日本植物防疫協会，1991.

Agrios, G. E. eds.：*Plant Pathology*, Elsevier Academic Press, 2004.

第 10 章

川口圭三郎編：水田土壌学，講談社，1978.

丸本卓哉：微生物バイオマス，土壌生化学（仁王以智夫他），朝倉書店，pp.34–51，1994.

Conrad, R. and P. Frenzel：Flooded soils. In：*Encyclopedia of Environmental Microbiology*（G. Britton ed.）, John Wiley & Sons, pp.1316–1333, 2002.

第 11 章

犬伏和之・安西徹郎編：土壌学概論，朝倉書店，2001.

土壌微生物研究会編：〈新・土の微生物（1）〉耕地・草地・林地の微生物，博友社，1996.

土壌微生物研究会編：〈新・土の微生物（2）〉植物の生育と微生物，博友社，1997.

服部　勉他：改訂版 土の微生物，養賢堂，2008.

堀越孝雄・二井一禎編：土壌微生物生態学，朝倉書店，2003.

第 12 章

柴田英昭編：森林と土壌，共立出版，2018.

Berg, B. and C. McClaughcrty 著，大園享司訳：森林生態系の落葉分解と腐植形成，シュプリンガー・ジャパン，2004.

第 13 章

鍬塚昭三・山本廣基：土と農薬―環境中における農薬のゆくえ，日本植物防疫協会，1999.

安原昭夫・小田淳子：地球の環境と化学物質，三共出版，2007.

Alexander, M. ed.：*Biodegradation and Bioremediation* 2nd ed., Academic Press, 1999.

Fritsche, W. and M. Hofrichter：Aerobic degradation by microorganisms. In：*Biotechnology*：*Environmental Processes II*（H.-J. Rehm and G. Reed eds.）, pp.144–167, 2008.

Maier, R. M.：Microorganisms and organic pollutants. In：*Environmental Microbiology*（R. M. Maier *et al*. eds.）, Academic Press, pp.363–402, 2000.