

REFERENCES

- Adams, B. J., Bardgett, R. D., Ayres, E., Wall, D. H., Aislabie, J., Bamforth, S., Bargagli, R., Cary, C., Cavacini, P., Connell, L., Convey, P., Fell, J., Frati, F., Hogg, I., Newsham, N., O'Donnell, A., Russell, N., Seppelt, R. and Stevens, M. I. 2006. Diversity and Distribution of Victoria Land Biota. *Soil Biology and Biochemistry*. **38**: 3003–3018.
- Aguilar, A. 1996. Extremophile research in European Union: from fundamental aspects to industrial expectations. *FEMS Microbiology Reviews*. **18**: 89–92.
- Alias, S. A. and Azlina, A. 2004. Occurrence of soil fungi from Windmill Island. *Antarctica Proceeding of the 2nd Malaysian International Seminar on Antarctica*, Academy of Science Malaysia. **pp.** 1-4.
- Arenz, B., Held, B., Jurgens, J. and Blanchette, R. A. 2010. Fungal colonization of exotic substrates in Antarctica. *Fungal diversity*. DOI 10.1007/s13225-010-0079-4.
- Bargagli, R. 2008. Environmental contamination in Antarctic ecosystems. *Science of the Total Environment*. **4**: 212-226.
- Bendt, A., Hüller, H., Kammel, U., Helmke, E. and Schweder, T. 2001. Cloning, expression, and characterization of a chitinase gene from the Antarctic psychrotolerant bacterium *Vibrio* sp. strain Fi:7. *Extremophiles*. **5**: 119-126.
- Bergero, R., Girlanda, M., Varese, G., Intili, D. and Luppi, A. 1999. Psychrooligotrophic fungi from Arctic soils of Franz Joseph Land. *Polar Biology*. **21**: 361–368.
- Bhushan, B. and Hoondal, G.S. 1998. Isolation, purification and properties of a thermostable chitinase from an alkalophilic *Bacillus* sp. G-11. *Biotechnology Letter*. **20**: 157-159.

- Blume, H., Kuhn, D. and Bolter, M. 2002. Soils and soilscales. In Beyer, L. and Bölter, M. (Eds.). *Geoecology of Antarctic Ice-Free Coastal Landscapes. Ecological Studies*. Berlin: Springer-Verlag. **154**: 91–113.
- Bolter, M., Blume, H. and Erlenkeuser, H. 1994. Pedologic, isotopic and microbiological properties of Antarctic soils. *Polarforschung*. **64**: 1–7.
- Bradford, M. 1976. A rapid and sensitive method for the quantization of microgram quantities of protein utilizing the principle of protein-dye binding. *Analytical Biochemistry*. **72**: 248-254.
- Bradner J., Gillings, M. and Nevalainen, K. 1999. Qualitative assessment of hydrolytic activities in antractic microfungi grown at different temperature on soil media. *World Journal of Microbiology and Biotechnology*. **15**: 131-132.
- Bradner, R., Sidhu, K., Yee, B., Skotnicki, L., Selkirk, M. and Nevalainen, H. 2000. A new microfungal isolate, *Embellisia sp.*, associated with Antarctic moss *Bryum argenteum*. *Polar Biology*. **23**: 730-732.
- Brett, A., Benjamin, H., Joel, J., Roberta, F. and Robert, B. 2006. Fungal diversity in soils and historic wood from the Ross Sea Region of Antarctica. *Soil Biology and Biotechnology*. **38**: 3057-3046.
- Bridge, P. and Worland, M. 2004. First report of an entomophthoralean fungus on an arthropod host in Antarctica. *Polar Biology*. **27**: 190–192.
- Bridge, P. 2009. List of non-lichenized fungi from Antractic region. Cambridge, UK: British Antractic Survey Discovery Metadata Systems.
Retrieved January 25, 2010, from
http://www.antarctica.ac.uk/bas_research/data/access/fungi/Speciespublic2.html.
- Convey, P. 1996. The influence of environmental characteristics on the life history attributes of Antarctic terrestrial biota. *Biological Reviews*. **71**: 191–225.

- Convey, P. 2001. Antarctica Ecosystems. In Levin, A. (Ed.). *Encyclopedia of Biodiversity*. San Diego: Academic Press. **1**: 171 – 184.
- Convey, P. 2010. Terrestrial biodiversity in Antarctica: Recent advances and future challenges. *Polar Science*. **20**: 1-13.
- Convey, P., Gibson, J., Hillenbrand, C., Hodgson, D., Pugh, P., Smellie, J. and Stevens, M. 2008. Antarctic terrestrial life: Challenging the history of the frozen continent? *Biology Reviews*. **83**: 103-117.
- Corte, A., Caretta, G. and Del Frate, G. 1993. Notes on *Thelebolus microspores* isolated in Antarctica. *Mycotaxon*. **48**: 34-58.
- Cotârleț, M., Negoit, T., Bahrim, G. and Stougaard, P. 2009. Cold adapted amylase and protease from new *Streptomyces* for alga Antarctic Strain. *Innovative Romanian Food Biotechnology*. **5**: 23- 30.
- Dahiya, N., Tewari, R., Tiwari, R. and Hoondal, G. 2005. Chitinase production in solid-state fermentation by *Enterobacter* sp. NRG4 using statistical experimental design. *Current Microbiology*. **51**: 222–228.
- Davey, M. and Rothery, P. 1993. Primary colonization by microalgae in relation to spatial variation in edaphic factors on Antarctic fellfield soils. *Journal of Ecology*. **81**: 335–343.
- Del Frate, G. and Caretta, G. 1990. Fungi isolated from Antarctic material. *Polar Biology*. **11**: 1–7.
- Duncan, S., Minasaki, R., Farrell, R., Thwaites, J., Held, B., Arenz, B., Jurgens, J. and Blanchette, R. 2008. Screening fungi isolated from historic Discovery Hut on Ross Island, Antarctica for cellulose degradation. *Antarctic Science*. **pp.** 1-8.
- Feller, G., Thiry, M., Arpigny, J., Mergeay, M. and Gerday, C. 1990. Lipases from psychrotrophic Antarctic bacteria. *FEMS Microbiology Letters*. **66**: 239-244.

- Feller, G., Narinx, E., Arpigny, L., Aittaleb, M., Baise, E., Genicot, S. and Gerday, C. 1996. Enzymes from Psychrophilic Organisms. *FEMS Microbiology Reviews*. **18**: 189–202.
- Felse, P. A. and Panda, T. 2000. Production of microbial chitinases – A Revisit. *Bioprocess Engineering*. **23**. 127-134.
- Fenice, M., Selbmann, L., Zucconi, L. and Onofri, S. 1997. Production of extracellular enzymes by Antarctic fungal strains. *Polar Biology*. **17**: 275–280.
- Fenice, M., Selbmann, L., Di Giambattista, R. and Federici, F. 1998. Chitinolytic activity at low temperature of an Antarctic strain (A3) of *Verticillium lecanii*. *Research Microbiology*. **149**: 289–300.
- Ferron, P. 1985. Fungal Control. In Kerkutand, G. A. and Gilbert, L. I. (Eds). *Comprehensive Insect Physiology. Biochemistry and Pharmacology*. Pergamon Press. pp. 313-346.
- Frändberg, E. and Schnürer, J. 1994. Chitinolytic properties of *Bacillus pabuli* K1. *Journal of Applied Bacteriology*. **76**. 361-367.
- Gerday, C., Aittaleb, M., Arpigny, J., Baise, E., Chessa, J., Garsoux, G., Petrescu, I. and Feller, G. 1997. Psychrophilic enzymes: a thermodynamic challenge. *Biochimica et Biophysica Acta*. **1342**: 119–131.
- Gerday, C., Aittaleb, M., Bentahir, M., Chessa, J.P., Claverie, P., Collins, T. D., Amico, S., Dumont, J., Garsoux, G., Georlette, D., Hoyoux, A., Lonhienne, T., Meuwis, M.A. and Feller, G. 2000. Cold-adapted enzymes: from fundamentals to biotechnology. *Trends Biotechnology*. **18**: 103–107.
- Gesheva, V. 2009. Distribution of psychrophilic microorganisms in soil of Terra Nova Bay and Edmonson Point, Victoria Land and their biosynthetic capabilities. *Polar Biology*. **32**: 1287-1291.
- Guan, X., Middlebrooks, B., Alesander, S. and Wasserman, S. 2006. Mutation of Tweedle D, a member of an unconventional cuticle protein family, alters body

- shape in *Drosophila*. *Proceedings of the National Academy Science U. S. A.* **103**: 16794-16799.
- Gushterova, A., Vasileva-Tonkova, E., Dimova, E., Nedkov, P. and Haertle, T. 2005. Keratinase production by newly isolated antarctica actinomycetes strains. *World Journal of Microbiology and Biotechnology.* **21**: 831-834.
- Hadwiger, L. and Beckman, J. 1980. Chitosan as a component of pea - *Fusarium saloni* interactions. *Plant Physiology.* **66**: 203-211.
- Huang, I.H., Chen, C.J. and Su, Y.C. 1996. Production of chitinolytic enzymes from a novel species of *Aeromonas*. *Journal of Industrial and Microbiology.* **17**. 89-95.
- Huston, A. 2008. Biotechnological aspects of cold-adapted enzymes. In Margesin, R., Schinner, F., Max, J. C., Gerday, C. (Eds.). *Psychrophiles: From Biodiversity to Biotechnology*. Berlin Heidelberg: Springer. **pp.** 347–363.
- Jackman, D., Bartlett, F. and Patel, T. 1983. Heat-Stable Proteases from Psychrotrophic Pseudomonads: Comparison of Immunological Properties. *Applied Environment Microbiology.* **46**: 6–12.
- Jumpponen, A., Newsham, K. and Neises, D. 2003. Filamentous ascomycetes inhabiting the rhizoid environment of the liverwort *Cephaloziella varians* in Antarctica are assessed by direct PCR and cloning. *Mycologia.* **95**: 457–466.
- Kelly, S., Grimm, L., Hengstler, J., Schultheis, E., Krull, R. and Hempel, D. 2004. Agitation effects on submerged growth and product formation of *Aspergillus niger*. *Bioprocess and Biosystems Engineering.* **26**: 315-323.
- Kostadinova, N., Krumova, E., Tosi, S., Pashova and Angelova, M. 2009. Isolation and identification of filamentous fungi from Island Livingston, Antarctica. *Biotechnology & Biotechnological.* EQ. **23**: 267-270.
- Leotta, G., Pare, J., Sigler, L., Montalti, D., Vigo, G., Petruccelli, M. and Reinoso, E. 2002. *Thelebolus microsporus* mycelial mats in the trachea of wild brown skua

- (*Catharacta antarctica lonnbergi*) and South Polar skua (*C. maccormicki*) carcasses. *Journal of Wildlife Disease*. **38**(2): 443–447.
- Lopes, M., Gomes, D., Bello, K., Maria, G., Priminho, C., Ce'zar De Mattos, C., Goesneto, A. and Micheli, F. 2008. Use of response surface methodology to examine chitinas regulation in the basidiomycete *Moniliophthora perniciosa*. *Mycological Research*. **112**: 399–406.
- Magan, N. 2007. Fungi in extreme environments. In: Kubicek, C.P. and Druzhinina, I.S. (Eds.). *The Mycota IV. Environmental and Microbial Relationships*. Berlin: Springer-Verlag. **pp.** 85-103.
- Margesin, R., Neuner, G. and Storey, K. 2007. Cold-loving microbes, plants, and animals - fundamental and applied aspects. *Naturwissenschaften*. **94**: 77-99.
- Marshall, W. 1998. Aerial transport of keratinaceous substrate and distribution of the fungus *Geomyces pannorum* in Antarctic soils. *Microbial Ecology*. **36**: 212–219.
- Mendonsa, E. S., Vartak, P. H., Rao, J. V. and Deshpande, M. V. 1996. An enzyme from *Myrothecium verrucaria* that degrades insect cuticles for biocontrol of *Aedes aegypti* mosquito. *Biotechnology Letters*. **18**: 373-376.
- Miller, G. 1959. Use of Dinitrosalicylic acid reagent for determination of reducing sugar. *Analytical Chemistry*. **31**: 426-428.
- Morita, Y. 1975. Psychrophilic bacteria. *Bacteriological Reviews*. **39**: 144–167.
- Morita, Y., Nakamura, T., Hasanb, Q., Murakamia, Y., Yokoyama, K. and Tamiyaa, T. 1997. Cold active enzymes from cold-adapted bacteria. *Journal of American Oil Chemist's Society*. **74**: 441-443.
- Muzzarelli, R. 1973. (Ed.). *Natural Chelating Polymers*. New York: Pergamon Press. **pp.** 83.
- Muzzarelli, R. 1989. Chitinase, widely occurring enzyme.. *Products Chemical*. **30**: 6-8.

- Nawani, N. and Kapadnis, B. 2005. Optimization of chitinase production using statistics based experimental designs. *Process Biochemistry*. **40**: 651–666.
- Onofri, S., Pagano, S., Zucconi, L., Cicalini, A., Selbmann L. and Fenice, M. 1999. Microfungi in Antarctic extreme environments. Extracellular enzyme activities. *IBC's World Congress on Enzyme Technologies*. San Francisco March. **pp.** 10-12.
- Onofri, S., Fenice, M., Cicalini, A., Tosi, S., Magrino, A., Pagano, S., Selbmann, L., Zucconi, L., Vishniac, H., Ocampo-Friedmann, R. and Friedmann, E. 2000. Ecology and biology of microfungi from Antarctic rocks and soil. *Italian Journal Zoology*. **67**(4): 163-168.
- Onofri, S., Selbmann, L., Zucconi, L. and Pagano, S. 2004a. Antarctic microfungi as models for exobiology. *Planet Space Science*. **52**: 229–237.
- Onofri, S., Zucconi, L., Selbmann, L., Tosi, S., Barreca, D., Ruisi, S. and Fenice, M. 2004b. Studies on Antarctic fungi. *Polarnet Technical Report*. **1**: 49-52.
- Onofri, S., Zucconi, L., Selbmann, L., Hoog, S., Rios, A., Ruisi, S. and Grube, M. 2007. Fungal association at the cold edge of life. In: Seckbach, J. (Ed.). *Algae and Cyanobacteria in Extreme Environments: Cellular Origin, Life in Extreme Habitats and Astrology*. Berlin: Springer-Verlag. **pp.** 735-757.
- Ozerskaya, S., Kochkina, G., Ivanushkina, N., Knyazeva, E. and Gilichinskii, D. 2008. The structure of micromycete complexes in permafrost and cryopegs of the Arctic. *Microbiology*. **77**: 482–489.
- Park, H., Kim, D., Kim, H., Lee, C., Kim, I., Kim, J., Lee, H. and Yim, J. 2009. Characteristics of cold-adaptive endochitinase from Antarctic bacterium *Sanguibacter antarcticus* KOPRI 21702. *Enzyme and Microbial Technology*. **45** (5): 391 – 396.
- Park, H., Han, S., Lee, S., Lee, H. and Yim, J. 2010. Optimization of cold-active chitinase production from the Antarctic bacterium, *Sanguibacter antarcticus*

KOPRI 21702. *Applied Microbiology Biotechnology*. DOI 10.1007/s00253-010-2890-y.

Po-Min, K., Chih-I, C., Shu-Chen, H., Kai-Min, L., Yung-Chi, C. and Yung-Chuan, L. 2009. Preparation of fermentation-processed chitin and its application in chitinase affinity adsorption. *Process Biochemistry*. **44**: 343–348.

Prashanth, K. and Tharanathan, R. 2007. Chitin/chitosan: modifications and their unlimited application potential and an overview. *Trends in Food Science & Technology*. **18**: 117-131.

Ray, M., Uma, D., Seshu, K. and Shivaji, S. 1992. Extracellular Protease from Antarctica Yeast *Candida humicola*. *Applied and Environment Microbiology*. **58**: 1918-1923.

Raza, S., Fransson, L. and Hult, K. 2000. Enantioselectivity in *Candida antarctica* lipase B: A molecular dynamics study. *Protein Science*. **10**: 329-338.

Revah-Moiseev, S. and Carrod, P. 1981. Conversion of the enzymatic hydrolysate of shellfish waste chitin to single cell protein. *Biotechnology Bioengineering*. **23**: 1067–1078.

Roberts, W. and Selitrennikoff, C. 1988. Plant and bacterial chitinases differ in antifungal activity. *Journal of General Microbiology*. **134**: 169–176.

Rodriguez-Kabana, R., Godoy, G., Morgan-Jones, G. and Shelby, R. 1983. The determination of soil chitinase activity: conditions for assay and ecological studies. *Plant Soil*. **75**: 95-106.

Rojas-Avelizapa, L., Cruz-Camarillo, R., Guerrero, M., Rodríguez-Vázquez, R. and Ibarra, J. 1999. Selection and characterization of a proteo-chitinolytic strain of *Bacillus thuringiensis*, able to grow in shrimp waste media. *World Journal of Microbiology and Biotechnology*. **15**: 299-308.

- Ruisi, S., Donatella, B., Laura, Z. and Onofri, S. 2007. Fungi in Antarctica. *Reviews in Environmental Science and Biotechnology*. **6**: 127-141.
- Russell, N. 2006. Antarctica micro-organisms: Coming in from the cold. *Culture*. **27**(2): 1-4.
- Sahai, A. and Manocha, M. 1993. Chitinases of fungi and plants their involvement in morphogenesis and host parasite interaction. *FEMS Microbiology Reviews*. **4**: 317-338.
- Shaikh, S. and Desphande, M. 1993. Chitinolytic enzymes their contribution to basic and applied research. *World Journal Microbiology Biotechnology*. **9**: 468-475.
- Singh, S., Puja, G. and Bhat, D. 2006. Psychrophilic fungi from Schimacher Oasis, East Antarctica. *Current Science*. **90**: 1388-1392.
- Skujins, J., Potgieter, H. and Alexander, M. 1965. Dissolution of fungal cell walls by a streptomycete chitinase and beta- (1-3) glucanase. *Arch Biochemistry Biophysics*. **111**: 358-364.
- Souza, R.F., Gomes, R.C., Coelho, R.R.R., Alviano, C.S. and Soares, R.M.A. 2003. Purification and characterization of an endochitinase produced by *Colletotrichum gloeosporioides*. *FEMS Microbiology Letters*. **222**: 45-50.
- Suzuki, K., Suzuki, M., Taiyoji, M., Nikaidou, N. and Watanabe, T. 1998. Chitin binding protein (CBP21) in the culture supernatant of *Serratia marcescens* 2170. *Bioscience Biotechnology Biochemistry*. **62**: 128-135.
- Thamthiankul, S., Moar, W., Miller, M. and Panbangred, W. 2004. Improving the insecticidal activity of *Bacillus thuringiensis* subsp. *aizawai* against *Spodoptera exigua* by chromosomal expression of a chitinase gene. *Applied Microbiology and Biotechnology*. **65**: 183-192.

- Tin, T., Fleming, Z., Hughes, K., Ainley, D., Convey, P., Moreno, C., Pfeiffer, S., Scott, J. and Snape, I. 2009. Impact of local human activities on the Antarctica environment: a review. *Antarctic Science*. **21**: 3-33.
- Tosi, S., Begon, C., Gerdol, R. and Caretta, G. 2002. Fungi isolated from Antarctic mosses. *Polar Biology*. **25**: 262–268.
- Tosi, S., Onofri, S., Brusoni, M., Zucconi, L. and Vishniac, H. 2005. Response of Antarctic soil fungal assemblages to experimental warming and reduction of UV radiation. *Polar Biology*. **28**: 470–482.
- Vishniac, H.S. 1996. Biodiversity of yeasts and filamentous fungi in terrestrial Antarctic ecosystems. *Biodiversity and Conservation*. **5**: 1365–1378.
- Vyas, P., and Deshpande, M. 1991. Enzymatic hydrolysis of chitin by *Myrothecium verrucaria* chitinase complex and its utilization to produce SCP. *Journal of General Applied Microbiology*. **37**: 267–275.
- Wiwat, C., Siwayaprahm, P. and Bhumiratana, A. 1999. Purification and Characterization of Chitinase from *Bacillus circulans* No.4.1. *Current Microbiology*. **39**: 134-140.
- Wynn-Williams, D. 1990. Ecological aspects of Antarctic microbiology. *Advanced Microbial Ecology*. **11**: 71–146.
- Wynn-Williams, D. 1996. Antarctic microbial diversity: the basis of polar ecosystem processes. *Biodiversity Conservation*. **5**: 1271–1293.
- Xia, J., Xiong, J., Xu, T., Zhang, C., Zhang, R., Zhang, Q., Wu, S. and Qiu, G. 2009. Purification and characterization of extracellular chitinase from a novel strain *Aspergillus fumigatus*. *Journal of Central South University of Technology*. **16**: 552-557.

- Yalpani, M., F. Johnson and L.E. Robinson. 1992. Antimicrobial Activity of Some Chitosan Derivatives. In Brine, C. J., Sandford, P.A. and Zikakis, J.P. (Eds.). *Advances in Chitin and Chitosan*. London: Elsevier Applied Science. **pp.** 543.
- Yamamoto, H., Ohtani, S., Tatsuyama, K. and Akiyama, M. 1991. Preliminary report on cellulolytic activity in the Antarctic region (extended abstract). *Symposium Polar Biology*. **4**: 179–182.
- Yergeau, E., Bokhorst, S., Huiskes, A., Boschker, H., Aerts, R. and Kowalchuk, G. 2006. Size and Structure of bacterial, fungal nematode communities along an antarctica environmental gradient. *FEMS Microbiology Ecology*. **59**: 436-451.
- Yu, Y., Li, H., Zeng, Y. and Chen, B. 2009. Extracellular enzymes of cold-adapted bacteria from Arctic sea ice, Canada Basin. *Polar Biology*. **32**: 1539–1547.
- Zucconi, L., Pagano, S., Fenice, M., Selbmann, L., Tosi, S. and Onofri, S. 1996. Growth temperature preferences of fungal strains from Victoria Land, Antarctica. *Polar Biology*. **16**: 53–61.