



DEPARTMENT OF GENETICS

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PROFESSOR ANNA-MARIA BOTHA-OSBERHOLSTER

Biography

Anna-Maria Botha-Oberholster (*née* Botha) completed her Ph.D. in 1991. Where after she received training in Plant Genetics at the Weizmann Institute of Science, Rehovot, Israel and the Salk Institute of Biological Science, La Jolla, CA, USA. In 1994, she accepted a lecturing position at the University of the Free State, Bloemfontein. In 1998, she relocated to the University of Pretoria as an Associate Professor and in 2004, she was promoted to Full Professor in the Department of Genetics, University of Pretoria. In 2008, she accepted a position as an Affiliate Professor in the Department of Soils and Crop Sciences, Colorado State University, Fort Collins, CO, USA. Late 2009, she accepted a position as Professor in the Department of Genetics, AgriSciences, Stellenbosch University. In 2008, she represented South Africa in the field of Plant Biotechnology at the India-Brazil-South Africa (IBSA) II Academic Seminar of IBSA Education in Florianopolis, State of Santa Catarina. She serves on the editorial board of several journals and is a steering committee member of the International Plant Resistance to Insects Society, USA since 2008. Her research outputs over a span of 20 years include more than 90 peer-reviewed papers in accredited international journals, 5 book chapters, numerous peer-reviewed conference proceedings, technical reports and popular articles. She has acted as an invited guest speaker, and chair, on numerous occasions at several international conferences. She has been an NRF rated scientist since 1993.

Research Group

Our mission statement

The Genomics research group at Stellenbosch, headed by Prof. Anna-Maria Botha-Oberholster aims to be at the forefront of research on the understanding of wheat resistance to *Diuraphis noxia*, although other important plant stressors like drought tolerance are also under investigation. Our research is hypothesis driven and fundamental in nature but aims to address current problems relevant to the agricultural community.

Research focus

Russian wheat aphid resistance

Research in the Cereal Genome program is motivated by the need to deliver improved crop varieties to farmers, and focuses on biotic and abiotic stressors. Firstly, we work on the premise that understanding the ongoing evolutionary arms race between crop plants and their pests will enable us to deliver on our biotic stress targets. For this purpose we use bread wheat (*Triticum aestivum* L.) and its specialist aphid pest, *Diuraphis noxia* (Kurdj., Hemiptera: Aphididae) as model system making use of genomic tools. Key areas of interest are resistance genes in the host, effector proteins in the pest, and novel strategies to provide breeders





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with improved varieties. Recent accomplishments include sequencing the genome of *Diuraphia noxia* (Kurdj., Hemiptera: Aphididae) in collaboration with international partners, as well as the ditelosomic wheat chromosomes 7DS and 7DL from Chinese Spring. Secondly, we are developing drought tolerant crop varieties using chemical mutagenesis and transgenic approaches. Recent accomplishments include the production of several lines with confirmed drought tolerance.

Water quality and food security

Since South Africa is a water scarce country, conservation of our water resources are of the utmost importance, thus motivating our involvement in research on drought tolerance in plants, as well as other issues related to water quality and plant health. Specific interests include the effects of heavy and trace metal pollutants on plant stress, associated production of reactive oxygen species and resultant genotoxicity. This initiative is strongly supported through our collaboration with the research team of Dr. Paul J. Oberholster at the CSIR: Natural Resources and the Environment, South Africa.

Current postdoctoral fellows, students and staff

Dr. Anandi Bierman, N. Francois V. Burger, Shirmon Botha, Kelly Breeds, Arno de Klerk, Liesl Hill, Marlon Le Roux, Nadia M. Smith (*née* Fisher), Louis Steyn, Maronel Steyn, Ilze Visser.

Selected publications

- SCHULTZ T., L. VAN ECK & **A-M. BOTHA** (2014) Phi-class glutathione-S-transferase is involved in *Dn1*-mediated aphid resistance. *Physiologia Plantarum*. (DOI: 10.1111/ppl.12284) (**Impact factor = 3.067**)
- **BOTHA A-M.**, L. VAN ECK, N.F.V. BURGER & Z.H. SWANEVELDER (2014) Near-isogenic lines of *Triticum aestivum* with distinct modes of resistance exhibit dissimilar transcriptional regulation during *Diuraphis noxia* feeding. *Biology Open* 3: 1116-1126. (DOI: 10.1242/bio.201410280). (**Impact factor = 3.625**).
- **BOTHA A-M.**, N.F.V. BURGER & L. VAN ECK (2014) Hypervirulent *Diuraphis noxia* (Hemiptera: Aphididae) Biotype SAM Avoids Triggering Defenses in Its Host (*Triticum aestivum*) (Poales: Poaceae) During Feeding. *Environmental Entomology* 43(3):672-681 (DOI: 10.1603/EN13331).
- **BOTHA A-M.** (2013) A coevolutionary conundrum: The arms race between *Diuraphis noxia* (Kurdjumov) a specialist pest and its host *Triticum aestivum* (L.). *Arthropod-Plant Interactions* 7:359-372 (DOI: 10.1007/s11829-013-9262-3).
- OBERHOLSTER P.J., P-H. CHENG, **A-M. BOTHA** & B. GENTHE (2014) The potential of selected macroalgal species for treatment of AMD at different pH ranges in temperate regions. *Water Research* 60(1):82-92 (DOI: 10.1016/j.watres.2014.04.031). (**Impact factor = 6.092**).
- VAN ECK L., R.M. DAVIDSON, S. WU, B.Y. ZHAO, **A-M. BOTHA**, J.E. LEACH & N.L.V. LAPITAN (2014) The transcriptional network of WRKY53 in cereals links oxidative responses to biotic and abiotic stress inputs. *Functional and Integrative Genomics* 14:351-362 (DOI: 10.1007/s10142-014-0374-3). (**Impact factor = 2.691**).
- DE JAGER L-E., N.F.V. BURGER & **A-M. BOTHA** (2014) Complete mitochondrial genome of *Diuraphis noxia* (Hemiptera: Aphididae) from nine populations, SNP variation between populations, and comparison with other Aphididae species. *African Entomology* 22:847-862 (DOI: 0.4001/003.022.0409).
- VAN ECK L., T. SCHULTZ, J.E. LEACH, S.R. SCOFIELD, F.B. PEAIRS, **A-M. BOTHA** & N.L.V. LAPITAN (2010) Virus-induced gene silencing of *WRKY53* and an inducible *phenylalanine ammonia-lyase* in wheat reduces aphid resistance. *Plant Biotechnology*





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- Journal 8(9):1023-1032 (DOI: 10.1111/j.1467-7652.2010.00539.x). (**Impact factor = 4.732**).
- OBERHOLSTER P.J., C. BLAISE & **A-M. BOTHA** (2010) Phytobenthos and phytoplankton community changes upon exposure to a sunflower oil spill in a South African protected freshwater wetland. *Ecotoxicology* 19:1426-1439 (DOI: 10.1007/s10646-010-0528-6). (**Impact factor = 3.051**).
 - ZAAYMAN D., N.L.V. LAPITAN & **A-M. BOTHA** (2009) Dissimilar molecular defense responses are elicited in *Triticum aestivum* L. after infestation by different *Diuraphis noxia* (Kurdjumov) biotypes. *Physiologia Plantarum* 136(2):209-222 (DOI: 10.1111/j.1399-3054.2009.01232.x) (**Impact factor = 3.067**).
 - LAPITAN N.L.V., A. HESS, **A-M. BOTHA**, B. COOPER, D. BADILLO, H. IYER, J. MENERT, T. CLOSE, L. WRIGHT, M. TAHIR, G. HANNING & C. LAWRENCE (2009) Differentially expressed genes during malting and correlation with malting quality phenotypes in barley (*Hordeum vulgare* L.). *Theoretical and Applied Genetics* 118(5):937-52 (DOI: 10.1007/s00122-008-0951-8). (**Impact factor = 3.785**).
 - **BOTHA, A-M.**, L. LACOCK, C. VAN NIEKERK, M.T. MATSILOKO, F.B. DU PREEZ, S. LOOTS, E. VENTER, K.J. KUNERT & C.A. CULLIS (2006) Is Photosynthetic Transcriptional regulation in *Triticum aestivum* L. cv. 'TugelaDN' a contributing factor for tolerance to *Diuraphis noxia* (Homoptera: Aphididae)? *Plant Cell Reports* 25(1): 41-54. (**Impact factor = 2.613**).
 - GILL, B.S., R. APPELS, **A-M. BOTHA-OBERHOLSTER**, C.R. BUELL, J.L. BENNETZEN, B. CHALHOUB, F. CHUMLEY, J. DVORAK, M. IWANAGA, B. KELLER, W. LI, W.R. McCOMBIE, Y. OGIHARA, F. QUETIER and T. SASAKI (2004) Workshop Report: A Workshop Report on Wheat Genome Sequencing: International Genome Research on Wheat Consortium. *Genetics* 168:1087-1096. (**Impact factor = 4.311**).
 - VAN DER WESTHUIZEN, A.J., X-M. QIAN & **A-M. BOTHA** (1998) β -1,3-glucanases in wheat and resistance to the Russian wheat aphid. *Physiologia Plantarum* 103:125-131 (DOI: 10.1034/j.1399-3054.1998.1030115.x). (**Impact factor = 3.067**).
 - VAN DER WESTHUIZEN, A.J., X-M. QIAN & **A-M. BOTHA** (1998) Differential induction of apoplastic peroxidase and chitinase activities in susceptible and resistant wheat cultivars by Russian wheat aphid induction. *Plant Cell Reports* 8:132-137. (**Impact factor = 2.613**).
 - MYBURG, A.A., M. CAWOOD, B.D. WINGFIELD & **A-M. BOTHA** (1998) Development of RAPD and SCAR markers linked to the Russian wheat aphid resistance gene *Dn2* in wheat. *Theoretical and Applied Genetics* 96:1162-1169. (**Impact factor = 3.785**).
 - **BOTHA, A-M.** & F.C. BOTHA (1993) Induction of pyrophosphate dependent phosphofructokinase in water melon (*Citrullus lanatus*) cotyledons coincides with insufficient cytosolic D-fructose-1,6-bisphosphate 1-phosphohydrolase to sustain gluconeogenesis. *Plant Physiology* 101:1385-1390 (DOI: <http://dx.doi.org/10.1104/pp.101.4.1385>). (**Impact factor = 7.016**).
 - **BOTHA, A-M.** & F.C. BOTHA (1991) The pyrophosphate dependent phosphofructokinase of *Citrullus lanatus*: molecular forms and expression of subunits. *Plant Physiology* 96: 1185-1192 (DOI: <http://dx.doi.org/10.1104/pp.96.4.1185>). (**Impact factor = 7.016**).
 - **BOTHA, A-M.** & F.C. BOTHA (1991) Effect of anoxia on the expression and molecular form of the pyrophosphate dependent phosphofructokinase. *Plant Cell Physiology* 32(8):1299-1302. (**Impact factor = 3.941**).
 - **BOTHA, A-M.** & F.C. BOTHA (1990) Control of pyrophosphate:D-fructose-6-phosphate 1-phosphotransferase activity in the cotyledons of *Citrullus lanatus*. *Plant Physiology* 93:683-688 (**Impact factor = 7.016**).

