

MANAGEMENT REPORT

Covering Period: April 1st, 2003-September 30st, 2003

Submitted to the U.S. Agency for International Development: Bureau for Global Programs, Field
Support and Research; Center for Economic Growth

**PRODUCTION OF ARACHIDONIC ACID (AA) FROM THE ALGA *PARIETOCHLORIS*
*INCISA***

Principal Investigator: Prof. Zvi Cohen

Grantee Institution: Ben Gurion University

Collaborator: Dr. Fergus Molloy

Institution: University of Namibia

Project Number: C20-013

Grant Number: TA-MOU-00-C20-013

Grant Project Officer: Lawrence J. Gumbiner

Project Duration: April 1st, 2002-March 31st, 2005

Scientific summary:

The fresh water green alga, *Parietochloris incisa*, is the richest plant source of the polyunsaturated fatty acid (PUFA) arachidonic acid (20:4 ω 6, AA). To elucidate the biosynthesis of AA in this alga we have labeled cultures of *P. incisa* with radioactive precursors. Pulse chase labeling with acetate resulted in its incorporation via the *de novo* biosynthesis pathway of fatty acids. However, labeled acetate was utilized also for the elongation of C₁₆ and C₁₈ PUFAs. Labeling with [1-¹⁴C]oleic acid has shown that the first steps of the lipid-linked fatty acid desaturations utilize cytoplasmic lipids. Phosphatidylcholine (PC) and diacylglyceryltrimethylhomoserine (DGTS) are the major lipids involved as acyl carriers for the Δ 12 and Δ 6 desaturations of oleic acid, leading sequentially to linoleic and γ -linolenic acid. The latter is released from its lipid carrier and elongated to 20:3 ω 6, which is reincorporated primarily into phosphatidylethanolamine (PE) and PC and finally desaturated to AA. Galactolipids, mostly monogalctosyl-diacylglycerol (MGDG), serve as substrates for the chloroplastic Δ 12 desaturase and apparently also the ω 3 desaturation, common to higher plants and many green algae. The predominant sequence desaturates the 18:1/16:0 molecular species of MGDG stepwise to the 18:3 ω 3/16:3 ω 3 molecular species in similar to the prokaryotic pathway of higher plants and green algae.

A) Managarial issues:

Unfortunately, the request of the Namibian coinvestigator Dr. Fergus Molloy for permanent residency was rejected by the Namibian authorities and as a result, Dr. Molloy had to leave Namibia and the project in a short notice. He was replaced by his colleague, Dr. Martha Kandawa-Schulz (enclosed please find her CV). Fortunately, she is a Namibian citizen.

B) Collaboration, Travel, Training and Publications:

A student from the Namibian laboratory is currently visiting the Principal investigator's laboratory for extended training. She will be leaving by the end of November 2003. She has already received all the training required to be able to conduct the required experiments in her own lab.

Prof. Mark Merzlyak from Moscow University was visiting the PI's lab to consult and develop a method for rapid assessment of arachidonic acid content in algae. The method requires the collection of spectral data of whole cells and could eliminate the need for extraction and lengthy tedious analysis. The results and significance of this breakthrough will be detailed in the next annual report.

Three scientists from the PI lab (Prof. Zvi Cohen, Prof. Sammy Boussiba and Prof. Avigad Vonshak) will visit the Namibian lab during next January for a short training course.

Publications:

C. Bigogno, I. Khozin-Goldberg, D. Adlerstein & Z. Cohen (2003) Biosynthesis of arachidonic acid in the oleaginous microalga *Parietochloris incisa* (Chloropyceae): Radiolabeling studies. *Lipids* 37, 209-16.

CURRICULUM VITAE

Personal details:

Name: Martha Annery Kandawa-Schulz
Date of birth: 11.08.1965
Place of birth: Iikokola, Namibia
Marital status: Married
Nationality: Namibian

Educational qualifications:

1972-1976: Primary School at Iikokola, Namibia
1977-1979: Secondary School at Nehale Secondary School, Namibia
1979-1980: English Course in Lusaka, Zambia
1980-1984: Secondary School in Freetown, Sierra Leone. I obtained my O'Level in Biology, Chemistry, Physics, Mathematics, Additional Mathematics, English and English Literature
1984-1985: Taught Mathematics, biology and Chemistry in Kwanza-Sul, Angola
1985-1986: German Language in Leipzig, Germany
1986-1987: A'Level in Freiberg, Germany and the subjects studied were: Biology, Chemistry, Physics, Mathematics, German and Civics.

Education at the University level:

1987-1989: I started my MSc at the University of Rostock.
June 1992: I completed my MSc at the University of Rostock.
 The subjects studied are:
 Botany, Zoology, Taxonomy of Plants and Animals, Plant Physiology, Animal Physiology, Cytology, Ecology, Evolution and Genetics, Biochemistry, Parasitology, Histochemistry, Anthropology, Phytopathology, Paedagogic of Biology and that of Chemistry, Microbiology, Molecular Biology, Organic Chemistry I and II, Inorganic Chemistry I and II, Technical Chemical Technology and Physical Chemistry I and II.

I did the scientific work on characterisation of the progenies between wild and cultivated barley using isozymes and markerenzymes.

November 1992: Started with my Doctorate thesis (Characterization of the selfed progenies of a F₂-Hybrid using biochemical and molecular markers) at the University of Rostock and successfully completed this in **October 1996**

Languages spoken and written: Oshindonga, English and German

Professional Experience:

- 1984-1985:** Teacher at the Namibian Education Centre in Zambia
Subjects taught were: Chemistry, Biology and Mathematics
- June - September 1989:** An Educator at the School of Friendship at Staßfurt, Germany
- January to April 1990:** Teaching practice at the Deutsche Höhere Privatschule (DHPS) in Windhoek, Namibia
- May to October 1990:** Science Co-ordinator at the Namibian Teachers Training Programme (NTTP) Windhoek, Namibia
- January to May 1992:** Taught Biology and Chemistry (Grade 11 and 12) at Güstrow, Germany
- Since November 1996:** Lecturing and conducting practical Biochemistry (3rd Year) and Agricultural Chemistry (1st Year), now Chemistry for Life Sciences, University of Namibia.
- Since March 1998:**
- Chairperson of the Namibian Biotechnology Alliance (NABA), a group dealing with the issues of biotechnology and biosafety and Coordinator of a UNEP/GEF pilot project on developing a National Biosafety Framework
 - A member of the National Biodiversity Task Force
- Since August 2001:** Head of the Department of Chemistry, University of Namibia

Publications:

Kandawa, M.A.; Proeseler, G.; Habekuss, A. and Michel, M. (1995) Use of genetic markers to characterise selfed progenies of a *Hordeum bulbosum* x *Hordeum vulgare* Hybrid. Intern. Symp. 75 Years of Phytopathological and Resistance Research at Aschersleben 12-16 June, 1995, 1(2), 339-342.

Pickering, R.A., Hill, A.M.; Timmerman-Vaughan; Gilpin, M.J.; Gromej, M.G. and Fobes, E.M. in New Zealand; Kandawa, M.A. Gross Lüsewitz, Germany; Kynast, R.G. Merseburg, Germany; Proeseler, G. Aschersleben, Germany; Steffenson, B.J. USA and Szigat, G. Gülzow, Germany
The introgression of genes from *Hordeum bulbosum* L. into barley (*H. vulgare* L.). Barley Genetic Symposium, 1996 Canada.

Kandawa-Schulz, M.A. Characterisation of hybrids for the introgression of resistance traits from wild (*H. bulbosum*) into cultivated barley (*H. vulgare*). Dissertation, University of Rostock. (1996) pp 124.

Yanka Nieuwoudt; Martha Kandawa-Schulz; Marius von Moltke Adaptability of German Barley (*Hordeum vulgare*) in Namibia – AgriViews Second Quarter (1998)

Kandawa-Schulz, Martha The use of DNA techniques in fingerprinting the marama bean (*Tylosema esculentum* L). A paper prepared for the first Commonwealth Scientific Forum, 23-25 September 1999, Goa, India

Kandawa-Schulz, Martha (1999); Objectives of the National Biosafety Framework. Proceedings of the first National Biosafety workshop; 3-4 February 1999; Windhoek, Namibia

Martha, Kandawa-Schulz (2000); Biosafety Regulations, releases and research activities in selected African countries; Proceedings of the 6th International Symposium on the Biosafety of genetically modified organisms; July 2000, Saskatoon, Canada

Kandawa-Schulz, M (2000) Nutritional Evaluation of different varieties of bambara groundnut *Vigna subterranea* in Namibia; a study commissioned by the Food and Agriculture Organization of the United Nations; December 2000; Windhoek, Namibia

Kandawa-Schulz, M (2002); Capacity building on Biosafety in Namibia: Proceedings of a workshop on biosafety capacity building in Eastern and Southern Africa; SEI, Stockholm, Sweden

Nyarku, SK and Kandawa-Schulz MA (2003); Aspartame – an artificial sweetener. Namibian Scientific Society, Windhoek, Namibia (in press)

Müseler D L, Schönfeldt H C, Kandawa-Schulz M A, Rothauge A (2003) The effect of season, stocking rate and cattle frame size on the dietary selection of the marama plant (*T esculentum*) by cattle from the Eastern part of Namibia; Agri Review, Windhoek, Namibia (in press)

Naomab E, Masare F, Kandawa-Schulz M (2003) Assessment of genetic variation in natural populations of Marama (*Tylosema esculentum*) using molecular genetic screening techniques (in preparation)

Workshops, Courses and Conferences/meetings attended:

- Southern and East Africa **Regional Biosafety Workshop** from 5-10 April 1997 in Harare, Zimbabwe
- Organised by UNESCO/BAC Biotechnology Education and Training Centre (BETCEN) for Africa:
Course on **Plant Molecular Markers** from 9-23 August 1997 at ARC-Roodeplaat, Pretoria, South Africa
- 7th Annual **Congress Agricultural Scientific Society of Namibia** from 4-6 November 1997 at Neudam Agricultural College, Windhoek, Namibia
- Fourth Meeting of the Open – Ended Ad Hoc Working Group on **Biosafety** from 5-13 February 1998 in Montreal, Canada
- **(H)IGCSE workshop** from 25-27 February 1998 at Rössing Education Centre, Windhoek, Namibia
- **Clearing - House - Mechanism workshop** for Africa from 5-7 March 1998 in Nairobi, Kenya
- Regional African Meeting on **Biological Diversity** from 9-11 March 1998 in Nairobi, Kenya
- **Gender Training** Course from 6 –24 April 1998 at the University of Namibia, Windhoek, Namibia
- 4th Meeting of the Conference of the Parties to the **Convention on Biological Diversity** from 4-15 May 1998 in Bratislava; Slovak Republic
- **Workshop on Agriculture and WTO** from 16-17.1998in Geneva
- **WTO Ministerial Conference** from 18-20 May 1998 in Geneva: Switzerland
- Fifth Meeting of the Open – Ended Ad Hoc Working Group on **Biosafety** from 17-28 August 1998 in Montreal, Canada
- Study tour of **commercial field settings of transgenic crops in the USA** for the national focal points or representatives of the 18 countries participating in the national component of the biosafety pilot project 29 August - 6 September 1998 organised by the industry and UNEP
- Fifth International Symposium **“The Biosafety Results of Field Tests of Genetically Modified Plants and Microorganisms** 7-10 September 1998 in Braunschweig, Germany

- Fourth Annual World Congress on **Zero Emissions** 14-17 October 1998 in Windhoek, Namibia
- A UNEP/GEF Regional workshop on **biosafety** for Africa Region 23-27 November 1998 in Nairobi, Kenya
- The African Regional Workshop on Understanding **Biodiversity related International Instruments** 11-15 January in Lusaka, Zambia
- AMCEN Special Expert Consultation Meeting on the **Biosafety Protocol** 28-29 January 1999 at the UN Headquarters in Nairobi, Kenya
- Sixth Meeting of the Open – Ended Ad Hoc Working Group on **Biosafety** from 14-19 February 1999 in Cartagena, Colombia
- The **extra ordinary Conference of Parties to the Convention on Biological Diversity** from 22-23 February 1999 in Cartagena, Colombia. This COP was postponed, as Parties could not come to a consensus.
- **MIRCEN Yeast Biotechnology Course** 19-23 April 1999, B;oemfontein, South Africa
- Sub-sectoral specialist working group on **biotechnology impact on water** 10-11 June 1999, Harare, Zimbabwe
- Informal consultations on **biosafety protocol** September 1999, Vienna, Austria
- **Bioprospecting, IPR, etc and DNA Fingerprinting** and the Commonwealth September 1999, Goa, India
- Informal consultations on the **biosafety protocol** and the 1st Extraordinary Meeting of the Conference of Parties to the Convention on Biological Diversity (Resumed Session), 20-28 January 2000
- **Subsidiary Body on Scientific, Technical and Technological Advice** (5th Meeting), 31 January – 4 February 2000
- **Knowledge Based Value-Added Production and Interpreneuership Seminar**, 6-8 March 2000, Windhoek, Namibia
- **SADC Tree Seed Centre Network Technical Meeting on Indigenous Fruit Trees**, 13-14 March 2000, Windhoek, Namibia
- 5th Meeting of the Conference of the Parties to the **Convention on Biological Diversity** from 15-26 May 2000 in Nairobi: Kenya

- The 6th International Symposium on the **Biosafety of Genetically Modified Organisms**. 8-13 July 2000; Saskatoon; Canada
- Workshop on Food and Agricultural Biotechnology for Decision Makers in the SADC Region; 1st – 2nd August 2000; Gallagher estates, Midrand, South Africa
- Workshop on Biotechnology Communication; 21-23 May 2001; ARC – Pretoria, South Africa
- Workshop on the Strategic Plan of the Convention on Biological Diversity; 28-30 May 2001; Mahè, Seychelles
- Open-ended Expert meeting on the implementation of Capacity Building Provisions of the Cartagena Protocol on Biosafety; 11-13 July 2001; Havana, Cuba
- Risk Assessment Training Workshop, August 2001, Poland
- Compliance of the Cartagena Protocol on Biosafety and the ICCP 2; 26 September – 5 October 2001
- Developing a National Biosafety Framework UNEP/GEF, UNEP Nairobi, Kenya 16-19 January 2002.
- 6th Meeting of the Conference of the Parties (COP-6), The Hague, Netherlands. 7-19 April 2002
- 3rd Meeting of the Intergovernmental Committee for the Cartagena Protocol on Biosafety (ICCP-3), The Hague, Netherlands, 22-26 April 2002

Projects coordinated:

- Screening of Bambara groundnut produced by one of our local breeders in the North of the country
- FAO co-funded project on finalisation of screening bambara groundnut *Vigna subterranea* using RAPD-PCR. Report submitted to the FAO, Windhoek
- EU funded project on Characterisation of Marama Beans *Tylosema esculentum* using isozymes and RAPD-PCR and nutritional value of marama beans – on going
- Developing a National Biosafety Framework (A country Study, National Technical Guidelines, National Policy and a draft Legislation have been completed) – a UNEP GEF funded pilot project
- Implementation of the National Biosafety Framework – UNEP GEF funded project – on going

Post graduate students

2 MSc Students working under the EU funded project on Marama beans *Tylosema esculentum*

1 MSc student under the USAID funded project on the production of Arachidonic Acid (AA) from the alga *Parietochloris incisa* in collaboration with Ben Gurion University (BGU)