ISCDRA

Wolffiella gladiata

International Steering Committee on Duckweed Research and Application 2013-2015

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Happy New Year!

Letter no. 3
January, 2014

Dear Duckweed Friends,

The year of the first International Steering Committee election has drawn to an end. I think that after only 4 months we can say that we had a good start. Please, help us in the next year to make our work fruitful. We have the joy and the responsibility to make the potential of duckweed visible for researchers and people in application. Yes, we can – together.

In this year 2013 Elias Landolt passed away and we dedicated the 2nd Meeting "Duckweed Research and Application" at the Rutgers University in New Brunswick, NJ to him. We wrote an obituary which is now published in "Aquatic Botany". With permission we attach it to this letter number 3.

On behalf of the International Steering committee on Duckweed Research and Application I wish you a happy and successful New Year 2014.

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Klaus-J. Appenroth
Head of the International Steering Committee
Germany

Important News

On the home page of Rutgers University there is now the opportunity to register your clones (cf. DRA-ISC Letter No. 1): www.ruduckweed.org

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Rediscovery of *Wolffia microscopica* (Griff.) Kurz

By Dr. K. Sowjanya Sree[1] and Dr. Klaus-J Appenroth[2]

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The only clone of *Wolffia microscopica* (Griff.) Kurz which existed in different clonal collections around the world was shouting, “Rescue me!” The duckweed community heard its plea in 2009 but by then it was too late.

W. microscopica was lost in all the duckweed stock collections, Zurich (Dr. Elias Landolt); Jena (Dr. Klaus-J Appenroth) and Rutgers (Dr. Eric Lam).

W. microscopica is endemic to the Indian subcontinent and is reported from India, Pakistan and Bangladesh. Its unique morphological and physiological features make it all the more interesting. The presence of a ventral projection, a “pseudoroot”, makes it distinct from other *Wolffia* species. This species flowers very often and sets seeds with which it survives the harsh seasons of the year. Renowned scientists, Dr. F. Hegelmaier from Germany during the 1800s and Dr. S.C. Maheshwari and his group from India during the middle to late 1900s worked with this unique duckweed species but it was later neglected over the years.

Having realised that we lost this species in the clonal collections, late 2009, we, K. Sowjanya Sree and Klaus-J Appenroth) went on a mission to hunt this species back from nature. Initially it looked like a simple task; we opened the monograph of Landolt and located all the places where this species was collected in the past. This was easily done. We then wanted to go to these places contact the scientists who collected it earlier and simply collect it again. We contacted Dr. J. P. Khurana from Delhi, India, a student and co-worker of Dr. S. C. Maheshwari and arranged a few

field trips in 2010 together with him.Unfortunately, huge buildings cropped up at the place where once upon a time a lake full of *W. microscopica* existed. Dr. E. Landolt wrote to his contacts in India if they could send him a live sample of this species again but there was no positive response.

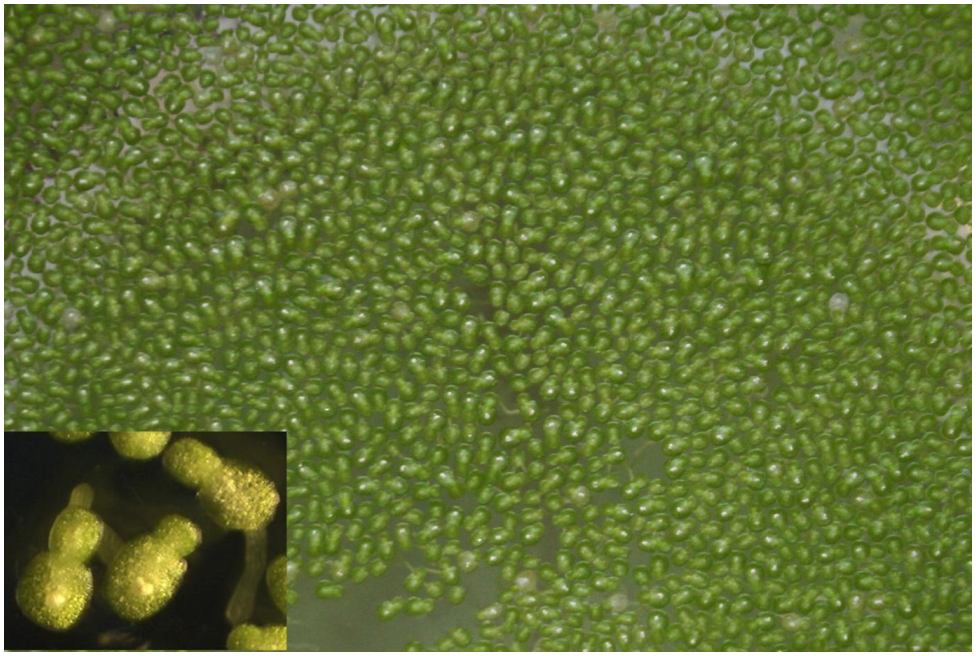

Figure: Flowering fronds of *W. microscopica.* Inset: A closer view of the flowers on the dorsal surface and the ventral “pseudoroot”. (Photo: K.-J. Appenroth; Inset: K. Sowjanya Sree)

We then travelled to Sohna, Haryana, India and Kadi, Gujarat, India and went around hiring two bicycles going from one lake to the other. We had to return also this time without *W. microscopica* although it was fun watching plenty of lakes full of duckweed and also collecting a few samples from them. India, to us, looked like a duckweed nation. We also came in contact with Dr. Yogi from Kadi, Gujarat. We then visited the lake in Sirajganj, Bangladesh from where W. microscopia was collected earlier together with Dr. Aziz, again unsuccessful. So, this was not an easy task as we thought! The man-made changes in environmental conditions apparently disturbed the ecosystem of the lakes where *W. microscopica* was growing earlier and we were close to concluding the extinction of this endemic species.

Nevertheless, we did not lose hope and planned further excursions during the 2013 monsoon season.

HURRAY! WE HAVE THE LITTLE ONES IN OUR HANDS!

We rediscovered the species, *W. microscopica* in North Gujarat, India. We acknowledge the support of Dr. Ajay S Gor (Principal, Kadi Science College, Gujarat, India),Dr. Patel and their other colleagues from Gujarat in arranging the field trip. Also with the support of Dr. Aziz, it was rediscovered in Jessore, Bangladesh. These were unforgettable moments of pleasure, having been able to restore this unique,

endemic species of duckweed to the stock collections. We were gleaming with joy at seeing these unique fronds once again.

Rediscovery of *W. microscopica* - We pay this as a tribute to Late Prof. Elias Landolt, who was closely associated with all our *W. microscopica* hunting sessions up until the week before he came closer to God.

From the Database

Common Duckweed (*Lemna minor*) Is a Versatile High-Throughput Infection Model For *the Burkholderia cepacia* Complex and Other Pathogenic Bacteria

Thomson, ELS, Dennis, JJ

PLOS ONE 8 (11) Article Number: e80102 DOI: 10.1371/journal.pone.0080102 NOV 6 2013

Members of the Burkholderia cepacia complex (Bcc) have emerged in recent decades as problematic pulmonary pathogens of cystic fibrosis (CF) patients, with severe infections progressing to acute necrotizing pneumonia and sepsis. This study presents evidence that Lemna minor (Common duckweed) is useful as a plant model for the Bcc infectious process, and has potential as a model system for bacterial pathogenesis in general. To investigate the relationship between Bcc virulence in duckweed and Galleria mellonella (Greater wax moth) larvae, a previously established Bcc infection model, a duckweed survival assay was developed and used to determine LD50 values. A strong correlation (R-2 = 0.81) was found between the strains' virulence ranks in the two infection models, suggesting conserved pathways in these vastly different hosts. To broaden the application of the duckweed model, enteropathogenic Escherichia coli (EPEC) and five isogenic mutants with previously established LD50 values in the larval model were tested against duckweed, and a strong correlation (R-2 = 0.93) was found between their raw LD50 values. Potential virulence factors in B. cenocepacia K56-2 were identified using a high-throughput screen against single duckweed plants. In addition to the previously characterized antifungal compound (AFC) cluster genes, several uncharacterized genes were discovered including a novel lysR regulator, a histidine biosynthesis gene hisG, and a gene located near the gene encoding the recently characterized virulence factor SuhB(Bc). Finally, to demonstrate the utility of this model in therapeutic applications, duckweed was rescued from Bcc infection by treating with bacteriophage at 6-h intervals. It was observed that phage application became ineffective at a timepoint that coincided with a sharp increase in bacterial invasion of plant tissue. These results indicate that common duckweed can serve as an effective infection model for the investigation of bacterial virulence factors and therapeutic strategies to combat them.

Effect of cutting interval of Taiwan grass (Pennisetum purpureum) and partial substitution with duckweed (*Lemna sp* and *Spirodela sp*.) on intake, digestibility and ruminal fermentation of Pelibuey lambs

Zetina-Cordoba, P; Ortega-Cerrilla, ME ; Ortega-Jimenez, E; Herrera-Haro, JG; Sanchez-Torres-Esqueda, MT; Reta-Mendiola, JL; Vilaboa-Arroniz, J; Munguia-Ameca, G

LIVESTOCK SCIENCE (2013); 157 (2-3), 471-477

The effects of Taiwan grass (TW) cutting interval and partial substitution with duckweed on dry matter intake (DMI), in vivo DM digestibility (DMD), and digestibility of organic matter (OMD), crude protein (CPD), neutral (NDFD) and acid detergent fiber (ADFD), as well as on nitrogen balance, ruminal pH, production of volatile fatty acids (VFA) and ammonia nitrogen (NH3-N), was evaluated. For each experimental period (P) of 30 (P1), 45 (P2), and 60 (P3) days of TW grass cutting interval, twelve Pelibuey lambs were randomly assigned to three groups of four lambs each in a completely random design. Average weights of lambs were 25.1 +/- 1.5, 27.6 +/- 1.9 and 28.6 +/- 1.8 kg. Lambs were housed in individual metabolic cages, and assigned to three treatments (n=4): (T1) 100% TW (T2)80% TW+20% DW, and (T3)70% TW+30% DW. Each experimental period lasted 16 days: 8 days for adaptation to the diet and 8 days for total feces collection and rumen liquor sampling; urine was collected the last two days. Data were analyzed with MIXED procedure and means compared with the Tukey test Inclusion of DW decreased DMI ($P < 0.01$), whereas DMD, OMD, CPD, and NDFD increased ($P < 0.05$) as the age of the TW increased; besides, ADFD showed differences ($P < 0.05$) among treatments only in P3. Nitrogen retention improved by DW ($P < 0.05$) in the three periods, and pH was affected by periods ($P > 0.05$) only in P3 ($P < 0.05$). In the three periods, 20 and 30% DW increased NH3-N concentration and the acetate: propionate ratio ($P < 0.05$), but the VFA proportion did not change.

From time to time we intend to send information to the duckweed community. Please feel free to disseminate this letter to colleagues who might be interested.

In case you are not interested to obtain letters from this committee in the future, please write to any of the addresses mentioned on the cover page.