

Executive Summary

Cladophora glomerata ("Draadalg") is a worldwide nuisance alga of natural and man made water bodies. In the summer rainfall region of South Africa it causes blockages of structures such as weirs and grates in irrigation canals leading to water loss, a serious problem in a dry land .

Present control methods of *C. glomerata* in irrigation canals in South Africa include mechanical removal or dosing with copper sulphate in reaction to large blooms of the alga. Both are expensive options with high labour or material costs. Neither option leads to long term control. Because of these problems, two different biological control options are in the process of being investigated, namely the use of sterile triploid Grass Carp, and use of pathogens. The latter is reported on here.

A previous project surveyed for indigenous pathogens of *C. glomerata* in irrigation canals in the summer rainfall of South Africa. Two Chytridiomycete species were commonly observed. Also a number of *Pythium* species were commonly isolated from *C. glomerata* during this survey. At least three species of *Pythium* are known to be pathogenic to a number of fresh-water green algae, especially *Spirogyra* species. The marine red alga *Porphyra* is also attacked by *Pythium* species, which can cause a serious disease during mariculture. As *Pythium* species are also well known pathogens of plants, including in hydroponic (soilless) plant growing systems, it was suggested that their potential as biological control agents needed to be investigated, and this project was therefore initiated to achieve this goal.

The aims of the project were:

1. Investigate the efficacy of selected organisms to control *Cladophora glomerata* under laboratory and field conditions.
2. Investigate the mass production, viable and practical formulations for application of, and the optimal dosage rates of the selected organisms.
3. Determine the host range of the selected organisms to ensure crop safety.

The first and third aim were achieved, however as no *Pythium* isolate proved to be highly pathogenic in laboratory conditions, testing under field conditions was not investigated. The second aim was therefore also not pursued.

Further studies on the effect of temperature, pH and copper on the growth, zoospore production and zoospore mobility of *Pythium* isolates was investigated. Lastly, preliminary studies on the use of *Acacia mearnsii* (black wattle) bark for control of algal growth were carried out. Factors influencing the integration of the use of *Pythium* with other existing or potential control methods were also investigated.

Conclusions reached were:

1. The *Pythium* isolates tested are adapted to the conditions from which they were isolated.
2. Copper treatment at 0.5 mg/l Cu⁺ is unlikely to kill all the *Pythium* mycelium present in a system, but it will reduce the potential inoculum and in particular all zoospores will be eliminated.

3. The *Pythium* species tested proved to be incapable of penetrating healthy algal cells, and therefore can't be considered as pathogens with the potential to be developed as a bioherbicide. These fungi are therefore not the causal organism of diseased *C. glomerata* observed previously, and the use of *Pythium* species as biocontrol agents against *C. glomerata* will not be pursued further.
4. A few isolates of *Pythium* proved to have a high potential pathogenicity against certain of the crop plants tested.
5. *Acacia mearnsii* bark proved to be algicidal (at high concentrations) or to inhibit growth (at low concentrations) of *C. glomerata*.
6. Fungal pathogens other than *Pythium* are present in the irrigation schemes, and may yet prove to be valuable biocontrol agents against *C. glomerata*.

Integration with copper treatment would be problematical due to the general toxicity of the chemical to organisms. However the indirect use of pathogens present in the irrigation schemes, after treatments such as water level fluctuation or dosing with low concentrations of *A. mearnsii* bark, or possibly even low concentrations of copper (<0.2 mg/l), may still prove to be valuable within an integrated management programme.

Recommendations made were:

1. The role of organisms (insects and fungi) in reducing algal biomass after a stress treatment such as fluctuating the water level or a low dose of an algicide needs to be determined.
2. The short and long term effects of copper treatment on organisms capable of attacking *Cladophora glomerata* need to be assessed, and their recruitment rates after copper treatment determined.
3. The potential of *Acacia mearnsii* bark to control algal blooms needs to be assessed, as well as possible toxicological effects.
4. Further efforts to isolate the observed pathogen of *Cladophora glomerata* present in at least some irrigation schemes need to be carried out, and its potential as a biological control agent tested.

Acknowledgements

The Water Research Commission is thanked for financial assistance. The steering committee, and in particular Dr. S.A. Mitchell, are thanked for their interest shown in this project and their important input of suggestions and fruitful discussions. The technical assistance of Ms G. Samuels and Mrs JL Uys are gratefully acknowledged.