

Floating fern, duckweed to fight arsenic

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DR ABDUL AZIZ

A floating fern (*Azolla pinnata* strain Dh113) and duckweed (*Spirodela polyrhiza* Dh116) have been found to suck up arsenic from water (Aziz 2000, Asiatic Society Bangladesh, Sci. 26(2): 271-276). Large-scale production system for both these plants are known and could be used as cheap and safe way of cleaning up arsenic from contaminated groundwater. The plants double every three days in freshwater ponds and could yield on an average 1000kg per hectare per day if fertilisers are applied everyday. The production cost is about Tk 0.50 per kg. Only two labours can manage (harvesting and fertilising) a hectare pond.

Laboratory tests showed that the amount of arsenic a plant absorbs is quick, i.e. in about 24 hours. The duckweed was found to accumulate about 0.035 per cent on dry wt. basis while the floating fern accumulated about 0.007 per cent. In other words, the duckweed and the fern can suck up 0.0180g and 0.0035g arsenic per square metre (= about one kg fresh plants) per day from 1000 and 200 parts per billion (ppb) arsenic respectively.

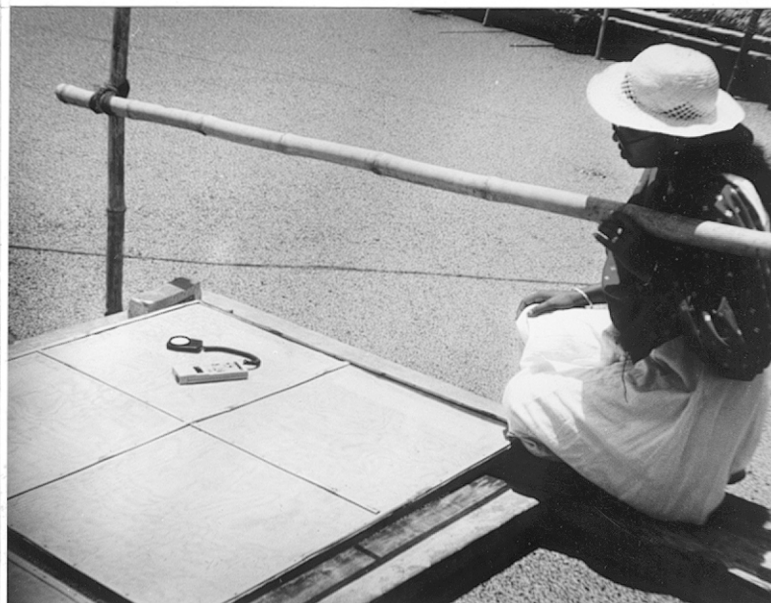
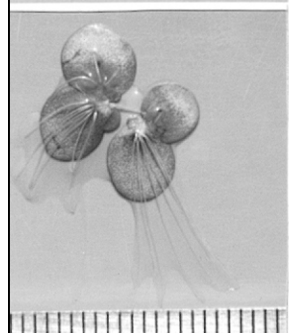
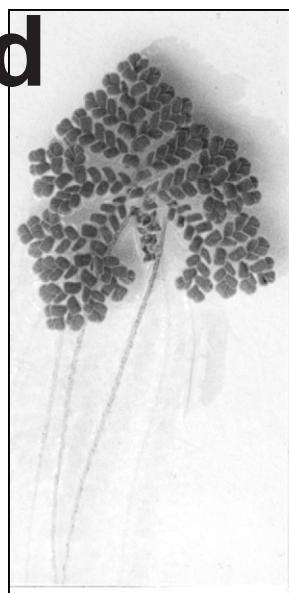
The fern is active in water with 100 to 200ppb, while the duckweed is active 500 to 1000ppb arsenic (the concentration usually found in many shallow tube-well water used for irrigation). Conceptually, the arsenic contaminated water for irrigating *boro* crop (January to May) may be collected in a reservoir and treated with the floating plants to filter out the arsenic. After every 24 hours the arsenic absorbed plants should be harvested and fresh plants should be added. The rate of evaporation of reservoir water is low because of a complete cover by the plants. The complete cover of plants also reduces chances of the reservoir becoming a breeding ground for mosquito. To bring down 500ppb arsenic to

50ppb (the safe level), it has been estimated that a reservoir of 1000 square metres with one metre deep water (= about one million litre water), about 40 days would be needed. About 1000kg plants would be needed to cover the reservoir and a one-hectare pond is enough to provide the said amount of inoculum. This time period will be needed by the duckweed that has been isolated from Dhaka, having the capacity of absorbing 0.01g arsenic per square metre per day from water containing 500ppb arsenic. Searching is being done to find out strains from arsenic affected area of Bangladesh that would absorb ten times than the present one. In that case it would be possible to clean the arsenic to the safe level in only a week time. Arsenic contaminated underground water (from hand tube-wells) may also be purified in cemented tanks for drinking during the lean period. Field tests would thus be needed to check out these concepts.

The arsenic absorbed fresh plants (e.g. 0.2mg arsenic per kg) could be used as feed at the rate of one kg per cow. Low arsenic containing plants may be used as fish or poultry feed. In case of very high arsenic (e.g. 20 or more mg per kg plants) concentration, plants may be composted and the compost may be made into bricks. Research is needed to see environmental hazards if any by using the contaminated plants for the various purposes.

The production and treatment reservoirs may be used for the rest of the year (June to November) in the production of the fern and duckweed using rainwater. The crops could be used as feed for fish, poultry and cattle. The fern may be used as bio-fertiliser. Thus the set up, in addition to arsenic mitigation, may be a constant source of income and help in poverty alleviation.

Dr Aziz is a professor of botany at Dhaka University



Fern (*Azolla pinnata* Dh113) three times enlarged (top left); the fern in a large-scale production pond; duckweed (*Spirodela polyrhiza* Dh116) in top and bottom views (middle and bottom left; scale in mm); duckweed production pond in the background and cemented tanks for treating contaminated water in the foreground (bottom right).

ENVIRONMENT WATCH

Dam or destruction?

Planned dams would displace 10 million people, warns WWF

AFP, GLAND, Switzerland

Dams under construction risk destroying a third of the world's still-wild rivers in the next 10 years, displacing up to 10 million people, said the World Wildlife Foundation.

About 10,000 dams are to be built in coming years, principally in India, China and Turkey, the foundation said. "These projects will mean up to 10 million people being displaced, thousands of small farmers losing their jobs, a widening economic gap favouring the rich, increasing social conflict over water and more species going extinct," said the published statement.

The WWF pointed to Senegal, where dams over the Senegal River have cut the fishing catch by 11,000 tonnes a year.

The WWF statement precedes a World Commission on Dams meeting from February 25 to 27 in Cape Town, South Africa. The 68-member WCD, which includes government agencies, multilateral organisations like the World Bank, utility companies and non-governmental organisations, will discuss ways to stop harmful dam construction.

Dr Biksham Gujja, the director of WWF's Water Department, asked the Commission to "commit to specific actions."

The WWF recommends a moratorium on mega-dams more than 100-metres (330 feet) high and establishing a "code of good conduct" that would keep blocked projects from being proposed again.

Super-trout fails to make a splash

Common sense vs. genetic engineering

AFP, Paris

Attempts to genetically engineer fast-growing "super-fish" that can be put on your dinner plate within a year of being hatched have been questioned by scientists on the grounds of common sense.

Such fish may not grow any faster than ordinary strains commonly used in fish-farming and also appear vulnerable to deformity and premature death, say Canadian scientists.

Researchers at Fisheries and Oceans Canada at Vancouver, British Columbia added a gene to promote growth in two varieties of rainbow trout -- the sleek "wild" type caught in streams and rivers, and the chubby "domesticated" type grown in pens by fish farmers.

The gene-altered wild type grew much faster than its unaltered counterpart. After 14 months, it was more than 17 times heavier, they report in Thursday's issue of *Nature*, the British science weekly.

The normal wild trout was a skinny 9.7 grams, whereas the lab version was a whopping 167 grams.

But the growth rate of the modified domesticated trout was no better than the fish-farm model. They both weighed in at around 2.7 kilos.

In addition, both strains of modified trout had high rates of skull abnormality, and all the transgenic domesticated fish perished before they reached sexual maturity.

These results suggest that genetic alteration may somehow affect pathways unconnected with merely putting on weight -- there could be some side effects on the fish's shape and life-span, the researchers warn.

They urge bio-technologists should consider whether they can improve on domesticated strains before attempting to alter the fish's genetic make-up.

The study did not address environment consequences from transgenic fish.

Ecologists are deeply opposed to genetic alteration, pointing to preliminary research, which suggests that if just a handful of these fish escape into the wild, they could decimate local populations of the species.

North American researchers have experimented with inserting growth hormone genes into salmon, as well as a gene from a flounder that controls a so-called anti-freeze protein.

The protein protects the fish in very cold temperatures by inhibiting ice crystals from forming in its blood, thus enabling fish to be farmed in very low latitudes.

Rallying for the Reef



PHOTO: AFP

A World Wildlife Fund for Nature (WWF) supporter dressed as a panda displays rapidly melting ice sculptures of whales by Japan's Kenji Ogawa in Sydney to raise awareness about the plight of Australia's Great Barrier Reef. A collection of 20 scientific studies has found that the reef, which covers over 350,000 square kilometres, is being seriously threatened by land clearing, pesticides, heavy metal pollution and mass tourism.

Flicker of hopes for climate changes talks

QUAMRUL ISLAM CHOWDHURY

EFFORTS have been intensified to break the ongoing deadlock in climate change negotiations. On February 12, Dutch Environment Minister Jan Pronk, who is president of the climate change talks, announced at United Nations headquarters that the negotiations would resume for two weeks between mid-June and late July.

Pronk, widely regarded as a guru in climate change negotiations, was extremely unhappy when the talks failed in The Hague last November. Some environmentalists blamed an extremely rigid position taken by Frank Loy, the chief negotiator for the United States, for the failure. Frank also came under fire for a tougher position at a press briefing at The Hague. However, Pronk intervened to help stem the tide.

The date and the venue for the talks would be decided on soon based on availability of suitable conference facilities, Pronk announced. His announcement came following wide-ranging consultations with the Bureau of the Conference and with governments who wanted sufficient time to prepare adequately for the conference. It reflects his conviction that the members of the UN Climate Change Convention remain strongly committed to advancing the Convention's work and to making the 1997 Kyoto Protocol completely operational.

"Our immediate challenge is to maintain political engagement and to safeguard the many substantive advances achieved at The Hague, I hope that the shock of our inability to reach agreement last November will spur all governments to further efforts to find the middle ground of compromise and consensus," said Pronk.

The decision to continue pursuing a political consensus comes shortly after the release of a major report by the Intergovernmental Panel on Climate Change (IPCC) confirming the scientific consensus that the evidence for humanity's influence on the global climate is now stronger than ever before. A companion report detailing how global warming will impact humanity and the natural environment in the different regions of the world released by the IPCC on February 19, 2001 in Geneva. More flooding, droughts and forest fires, decreases in agricultural and aqua-culture productivity, displacement of tens of millions of coastal dwellers by sea level rise and intense tropical cyclones, and the degradation of mangroves and coral reef ecosystems are some of the likely consequences of climate change in Asia.

The projections are contained in the second volume of a major climate change report produced by the Intergovernmental Panel on Climate Change and released on February 19 in Geneva.

One hundred and forty government delegates from more than 100 countries accepted the new IPCC report "Climate Change 2001: Impacts, Adaptation, and Vulnerability" and approved its Summary for Policymakers.

The UNEP, which established the IPCC along with the World Meteorological Organisation, said the report -- produced by more than 400 scientific experts -- provided further evidence of the scale and seriousness of the global warming problem and need to act quickly and decisively.

"We must restart the stalled climate change negotiations as a first step towards the deep cuts in emissions from factories, power stations, cars and homes, needed to curb damaging climate change," said Klaus Toepfer, Executive Director of UNEP. "And we also need to help vulnerable people to adapt to the impacts and that action needs to be taken now."

For the Asia region, the Summary for Policymakers states that:

Key issues that must still be resolved at the resumed talks include a package of financial support and technology transfer to help developing countries contribute to global action on climate change, including measures for adapting to climate change impacts; the establishment of an international emissions trading system and a "clean development mechanism"; the rules for counting emissions reductions from carbon "sinks" such as forests; and a compliance regime. All these are very important for Bangladesh. That's why this is so important for Bangladesh because it will be one of the most vulnerable countries in any degree of climate change.

- λ Extreme events have increased in temperate and tropical Asia, including floods, droughts, forest fires and tropical cyclones.
- λ Decreases in agricultural productivity and aqua-culture due to thermal and water stress, sea-level rise, floods and droughts, and tropical cyclones would diminish food security in many countries of arid, tropical, and temperate Asia; agriculture would expand and increase in productivity in northern areas.
- λ Runoff and water availability may decrease in arid and semi-arid Asia but increase in northern Asia.
- λ Human health would be threatened by possible increased exposure to vector-borne infectious diseases and heat stress in parts of Asia.
- λ Sea-level rise and an increase in the intensity of tropical cyclones would displace tens of millions of people in low-lying coastal areas of temperate and tropical Asia; increased intensity of rainfall would increase flood risks in temperate and tropical Asia.
- λ Climate change would increase energy demand, decrease tourist attraction, and influence transportation in some regions of Asia.
- λ Climate change would exacerbate threats to bio-diversity due to land-use and land-cover change and population pressure in Asia. Sea-level rise would put ecological security at risk, including mangroves and coral reefs.
- λ Poleward movement of the southern boundary of the permafrost zones of Asia would result in a change of thermokarst and thermal erosion with negative impacts on social infrastructure and industries.
- λ Adaptive capacity of human systems is low and vulnerability is high in the developing countries of Asia; the developed countries of Asia are more able to adapt and less vulnerable.

Last year, prior to the failed climate change convention meeting at The Hague in November, UNEP and the Asian Development Bank facilitated a series of national workshops throughout Asia to build understanding of the Kyoto Protocol's Clean Development Mechanism (CDM). The CDM is of special interest to developing countries, as it could provide for investments in projects for sustainable development, including clean energy projects. However, several important aspects of the mechanism are yet to be negotiated.

Toepfer urged all sectors of society including governments, aid agencies, non governmental agencies and the United Nations family of agencies to urgently work together to help vulnerable people and countries prepare for the impacts of climate change.

"There are no winners, only losers, in the climate change scenario. Now is time to act collectively and decisively," he said.

The first volume of the IPCC's report, released last month in Shanghai, confirmed the increasingly strong evidence for humanity's influence on the global climate. It also projected that the globally-averaged temperature of the air above the Earth's surface would rise by 1.4-5.8 degrees Celsius over the next 100 years.

The third working group report, assessing options for limiting greenhouse gas emissions and otherwise mitigating climate change will be finalised in Accra, Ghana from February 28 to March 3.

"As the scientific understanding of the risks we are creating for the coming decades becomes increasingly solid, the urgency of controlling greenhouse emissions becomes ever more real," said Michael Zammit Cutajar, the Convention's Executive Secretary.

"With the Kyoto Protocol's initial emissions targets set to kick in by 2008, it is time for political leaders to respond to the warnings of the scientists by putting into place policies that will lead to early and cost-effective reductions in greenhouse gas emissions," he said.

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All these are very important for Bangladesh. That's why this is so important for Bangladesh because it will be one of the most vulnerable countries in any degree of climate change. The IPCC Report forecasts a more severe weather changes raising the sea-levels and temperatures, reducing the agricultural productivity and straining already scarce water resources. "Flooding could displace tens of thousands of people in Bangladesh, China and India because of the climate changes," warned IPCC Chairman Professor Robert Watson.

How Bangladesh is looking at the forthcoming climate change negotiations? Are our officials ready for the talks? Do they have done their homework? Or are they going to start it now? Or do they care for it? Some of our leaders of the civil society can also play a role in this on-going negotiation process. They are leading the process globally. But, for a better deal, both civil society and officials should work together. Bangladesh has to face climate change. The government alone can't face it. The civil society can't alone help stem the tide. No single country can face it alone. Collaboration, consultation, co-operation and consensus are required. We can't wait for a tomorrow. We might not have a tomorrow. Please help prepare a Bangladesh country position. Do it before Pronk announces the exact date and venue of talks.

Turtles in troubled waters



PHOTO: AFP

Local villagers remove the carcasses of endangered olive ridley sea turtles strewn at Gahirmatha Beach on the Orissa coast, some 60 kilometres east of Bhubaneswar, India. Frequent movement of fishing trawlers and other ships are seemingly the cause of such casualties, much to the concern of environmentalists and wild life lovers.

One law for Arctic nature

IN 1920, the Norwegian government signed a treaty that gave it sovereignty over the 63,000 square kilometres that make up the Svalbard archipelago, a group of high Arctic islands otherwise known as Spitsbergen. It is one of the wildest and most unspoiled regions in the world, a unique landscape offering almost unrivalled opportunities for protection so that a great variety of wildlife can be observed at close quarters, and scientists can study intact natural phenomena and processes.

Today a little more than half of the land area -- most of which is permanently covered by ice and snow -- is protected by law, as are some 31,000km of Svalbard's territorial waters. But the system of protection covers three separate national parks, two larger nature reserves, fifteen bird sanctuaries, one special reserve for seabirds and walrus, one flora conservation area and two areas for plant species protection.

In 1995, the Norwegian parliament committed itself to making Svalbard "one of the best managed wilderness areas in the world." Yet at present each type of protected zone has a different set of goals and regulations, which makes it difficult to understand and follow all the rules. Now, proposals for a new Svalbard environmental law present an opportunity to make the parliament's commitment a reality -- by protecting the whole archipelago under a single management regime.

The Norwegian Polar Institute published two years ago a report concluding that "the national parks and the large nature reserves together do not safeguard a representative cross-section of Svalbard's natural and cultural environment. The most productive and species-rich land areas of the island group are least represented within the protected areas." There have already been threats to Svalbard, such as the proposal of the coal company Store Norske Spitsbergen to build the first major road in the area, cutting an 80km swathe across the rich tundra valley of Reindalen. A parliamentary committee

In 1995 the government of Norway set itself the goal of making the archipelago of Svalbard (Spitsbergen) the best-managed wilderness area in the world. Now, as new proposals for protecting the area arouse opposition from commercial interests, a campaign has begun to make the government live up to its commitment by creating a single national park, writes Peter Prokosch from Oslo, Norway

reached a majority decision that "development plans of this type in this area will be in the opinion of the majority harmful for the environment and can lead to further inappropriate activities. Such construction would be in clear conflict with the goal to preserve the wilderness nature of Svalbard."

In response to commercial pressures, the governor of Svalbard has now proposed the creation of nine new protected areas, including two national parks, three nature reserves, three nature sanctuaries and a plant preservation area. But the conservation organisation WWF, which has both an affiliate in Norway and an Arctic Programme, believes the best solution is to design a national park that covers the whole archipelago.

Already the governor's proposals have provoked opposition. Both Store Norske Spitsbergen and a Russian coal company, Trust Arktikugol, are opposing the creation of a new national park covering Reindalen. With the Norwegian firm having won permission to build a 10km road from the settlement at Svea to a nearby mining site, the Russian company claims a similar right to build a road from Barentsburg to the abandoned mining site at Colesbukta. Trust Arktikugol plans to reopen coal mines shut down in the 1970s, despite proposals

to establish a plant reserve nearby. Oil deposits have also been found in Svalbard.

The 1920 Treaty gives all signatory nations equal rights to exploit natural resources in the archipelago. By adopting WWF's idea of a single national park, Norway could require potential users to demonstrate why areas should be excluded instead of having to defend protection in certain areas. A greater area could be protected than at present and still -- by excluding inhabited and heavily used areas -- current activities could continue and even expand. Areas round the settlements could function as buffer zones with a higher degree of protection, like today's nature reserves.

WWF is working to build support for the realisation of the Norwegian parliament's aim of making Svalbard one of the world's best managed wilderness areas and is urging people to write to the Prime Minister, Jens Stoltenberg, advocating a single national park for the archipelago as the best way of fulfilling the commitment.

Peter Prokosch is Co-ordinator of the WWF Arctic Programme