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The Science Observer

GENETICALLY MODIFIED (GM) CROPS: AN INCESSANT DEBATE

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Introduction

In the pitched debate over genetically modified (GM) foods and crops, it can be hard to see where scientific evidence ends and dogma and speculation begin. In the nearly 20 years since they were first commercialized, GM crop technologies have seen dramatic uptake. There has been intense debate in the columns of *EMBO reports* and elsewhere about the rationality of the public's attitude towards genetically modified (GM) crops. The world population has topped 6 billion people and is predicted to double in the next 50 years. So GM Crops were developed to improve crop varieties, pest resistance, herbicide tolerance, cold tolerance, Drought tolerance, nutrition etc but actually is it happening there are many controversial case studies show how blame shifts, myths are spread and cultural insensitivities can debate.

What is a GM crop

Genetic modification is the newest scientific tool for developing improved crop varieties. Such crops can help to enhance agricultural productivity, boost food production, reduce the use of farm chemicals, and make our food healthier. Genetically modified (GM; also called transgenic, genetically engineered or bioengineered) crops represent the fastest-adopted technology in the history of agriculture, yet they are not universally accepted because of perceived concerns about their safety. Skeptics believe that such crops may pose unrecognized risks to human and animal health and could damage the environment.

The debate

There are many Environmental activists, religious organizations public interest groups, professional associations and other scientists and government officials who have all raised concerns about GM foods, and criticized agribusiness for pursuing profit without concern for potential hazards, and the government for failing to exercise adequate regulatory oversight. Most concerns about GM foods fall into three categories: **Environmental hazards** like Unintended harm to other organisms, reduced effectiveness of pesticides, and gene transfer to non-target species. **Human health risk like** Allergy and unknown effect on human health may also develop. **Economic concerns** like GM crops is costly process, the major economic fears are the risk of patent enforcement which may oblige farmers to depend on giant engineering companies such as Monsanto for strains when their crops are cross pollinated.

Reasons for the debate

Consumer advocates are equally worried that patenting these new plant varieties will raise the price of seeds so high that small farmers and third world countries will not be able to afford seeds for GM crops, thus widening the gap between the wealthy and the poor. Due to these problems protest were going on all over the world. The "March Against Monsanto" movement began, when Canal created a Facebook page on 28 February calling for a rally against the company's practices. Organizers said "March Against Monsanto" protests were held in 52 countries and 436 cities, including Los Angeles where demonstrators waved signs that read "Real Food 4 Real People" and "Label GMOs, It's Our Right to Know." The Biotechnology Industry Organization, a lobbying group that represents Monsanto, DuPont & Co and other makers of genetically modified seeds, has said that it supports voluntary labeling for people who seek out such products. But it says that mandatory labeling would only mislead or confuse consumers into thinking products weren't safe, even though the FDA has said there is no difference between GMO and organic, non-GMO foods. But people were seen still many problem like Harm to other organisms. For example genes and their effect included in a crop may turn out to be poisonous to insects (monarch butterfly poisoned by GM corns), Taste of GM Crops are not as good or "natural", Cross -pollination with traditional, organic plants. Cross pollination can occur at quite large distances. New genes may also be included in the offspring of the traditional, organic crops miles away. This makes it difficult to distinguish which crop field is organic, and which is not, posing a problem to the proper labelling of non-GM food products, Spread of new, more resistant "super weeds, Spread of new, more resistant "super pests", Major trading countries that obtain most of the benefit from the production and trade of genetically modified crops. This might cause more geopolitical conflicts, Critics say GM Crops may cause health problems, As the USA is the biggest producer of GM crops, their exports may rouse more anti-American feeling, due to “Americanization” worldwide, Possible damages to the environment, Possible greed of GM manufacturing firms, Un-harmonized tests, and safety standards around the world, GM Crops are made because it is possible to make them, not because consumers feel their need, Possible creation of new kinds of weapons; genetic food and beverage weapons.

Conclusions

There is no scientific evidence still available which support that GM Crops are intrinsically safe for health or the environment so GM Crops should be banned till they solve all the problem which they have but in our view the production of GM Crops as it may helps in minimizing our dependence on naturally growing crops which can easily effected by climatic change and seasonal variation. But in case of GM Crops the effect of seasonal variation is less or can use other farming technologies which are more successful for feeding.

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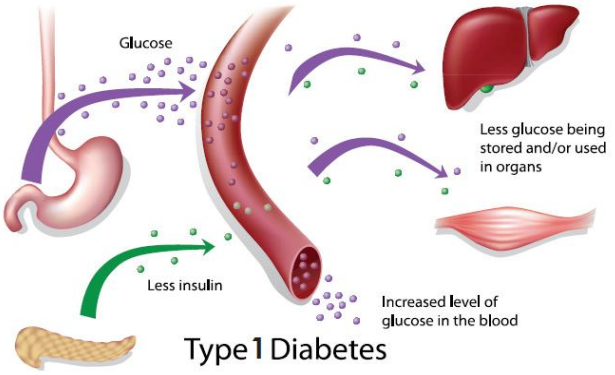

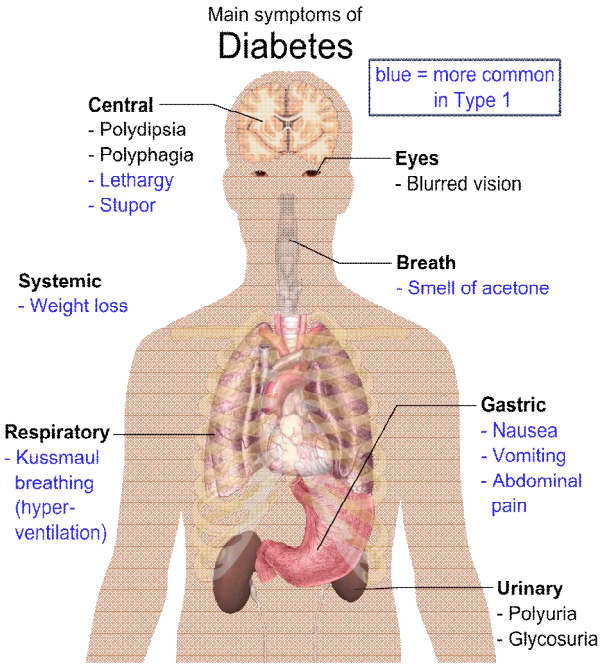

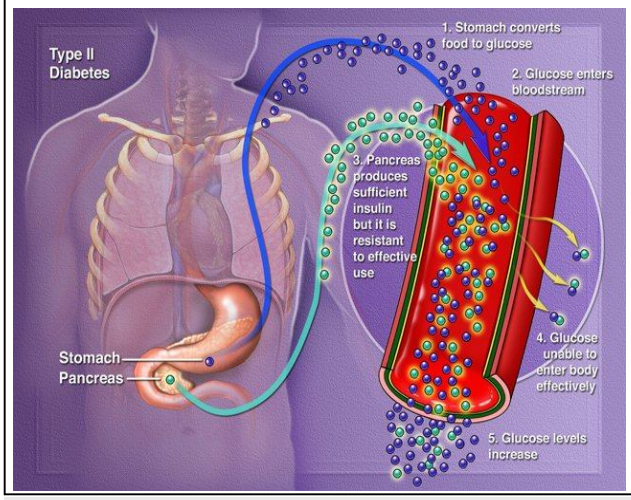

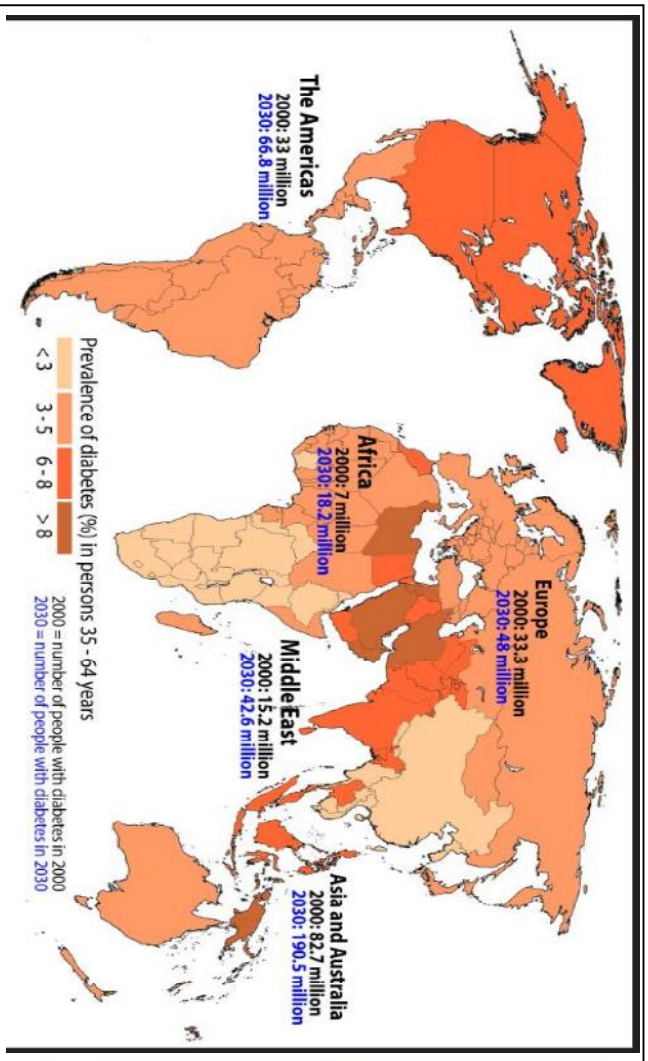

[Courtesy: Google and Wikipedia]

CAN WE DUMP THE NUCLEAR WASTE PROBLEM?

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Introduction

Since the institution of the nuclear age, the concern over the dilemma of disposal of nuclear waste is becoming a major concern in the 21st Century. Nuclear waste includes a range of material that entails diverse type of management to shield general population and the surroundings. One of the issues in managing nuclear wastes is the time that they are likely to continue hazardous. This depends on the type of radioactive isotopes present in them, and chiefly the half lives (The half-life is the time it takes for a given radioactive isotope to lose half of its radioactivity. After four half lives the level of radioactivity is 1/16th of the original and after eight half-lives 1/256th) attribute of each of those isotopes. (IAEA, 2012) The rate of decay of an isotope is inversely proportional to its half-life; a short half-life means that it decays rapidly. Hence, for each kind of radiation, the higher the intensity of radioactivity in a given amount of material, the shorter the half-lives involved.

What is nuclear waste?

Nuclear waste or the radioactive wastes are wastes that have radioactive matter. Nuclear wastes are usually the by-products of nuclear power generation and other applications that utilize the nuclear fission technology, such as wide scale applications in research, medicine, industry and in the generation of electricity by nuclear fission. The wastes may be in the form of gases, liquids, sludge or solids, and their nature, physical and chemical form, volume and activity are all closely related to the original nuclear process (IAEA, 2012).

Types of nuclear wastes

The term 'radioactive waste' covers a wide variety of material, ranging from wastes that can be put safely into a dustbin to items that need remote handling, heavy shielding and cooling to be managed safely. To be clear, radioactive waste is considered in different categories (SEPA, 2007). These are:

High-level waste (HLW)

Radioactive waste that is radioactive enough for the decay heat to significantly increase its temperature and the temperature of its surroundings. This means that heat generation has to be taken into account when designing storage and disposal facilities. This category of waste includes:
The liquid residue that contains most of the radioactivity from the reprocessing of spent nuclear fuel;
his material following solidification;
Spent fuel (if it is declared a waste); or
Any other waste with similar radiological characteristics.

Intermediate-level waste (ILW)

Intermediate-level waste has radioactivity levels that are higher than low-level waste but which do not generate enough heat to require special storage or disposal facilities. However, like other radioactive waste it still needs to be contained to protect workers from the radiation. ILW arises mainly from the reprocessing of spent fuel and from general operations and maintenance at nuclear sites, and can include metal items such as fuel cladding and reactor components, graphite from reactor cores, and sludge from the treatment of radioactive liquid effluents.

Low-level waste (LLW)

Most LLW today arises from the operation of nuclear power stations and nuclear fuel reprocessing facilities, as well as the decommissioning and clean up of nuclear sites. Operational LLW is principally lightly contaminated miscellaneous waste arising from maintenance and monitoring, such as plastic, paper and metal. LLW from decommissioning is mainly soil, building materials and metal plant and equipment. Most LLW from nuclear licensed sites is currently disposed of at the Low-Level Waste Repository (LLWR) near Drigg in Cumbria.

Very low-level waste (VLLW)

VLLW is a subset of LLW and falls into two distinct categories:
Low-volume VLLW ('dustbin disposal'): Radioactive waste that can be safely disposed of to an unspecified destination with municipal, commercial or industrial waste. The radioactive risk from such material is low enough that controls on disposal of this material, after removal from the premises where the wastes arose, are not necessary.
High-volume VLLW ('bulk disposal'): Radioactive waste that can be disposed of to specified landfill sites. After the waste is removed from its site of origin, it will be subject to controls on its disposal, which will be specified by the environmental regulators.

The primary concerns

The objective of radioactive waste management is to deal with radioactive waste in a manner that protects human health and the environment now and in the future without imposing undue burdens on future generations. The World Nuclear Agency, (2012) has listed the some views and concerns that include the following:

- The nuclear industry till date has no solution to the 'waste problem', so cannot anticipate support for construction of new plants until this is remedied.
- The transportation of this waste poses an unacceptable risk to people and the environment.
- Plutonium is the most dangerous material in the world.
- There is a potential terrorist threat to the large volumes of radioactive wastes currently being stored and the risk that this waste could leak or be dispersed as a result of terrorist action.
- Nuclear wastes are hazardous for tens of thousands of years. This clearly is unprecedented and poses a huge threat to our future generations.
- Even if put into a geological repository, the waste might emerge and threaten future generations.
- Man-made radiation differs from natural radiation.
- Nobody knows the true costs of waste management. The costs are so high that nuclear power can never be economic.
- The waste should be disposed of into space.

Nuclear waste should be transmuted into harmless materials.

Possible solutions

Three general principles are employed in the management of radioactive wastes:

concentrate-and-contain
dilute-and-disperse
delay-and-decay.

The first two are also used in the management of non-radioactive wastes. The waste is either concentrated or then

isolated, or it is diluted to acceptable levels and then discharged to the environment. Delay-and-decay however is unique to radioactive waste management; it means that the waste is stored and its radioactivity is allowed to decrease naturally through decay of the radioisotopes in it. (Plendl, 2001) Specific long-term management methods include:

Geological disposal: The process of geological disposal centers on burrowing nuclear waste into the ground to the point where it is out of human reach. There are a number of issues that can arise as a result of placing waste in the ground. The waste needs to be properly protected to stop any material from leaking out. Seepage from the waste could contaminate the water table if the burial location is above or below the water level. Furthermore, the waste needs to be properly fastened to the burial site and also structurally supported in the event of a major seismic event, which could result in immediate contamination. (Murray & Manke, 2003)

Transmutation: Transmutation also poses a solution for long term disposal. It specifically involves converting a chemical element into another less harmful one. Common conversions include going from Chlorine to Argon or from Potassium to Argon. The driving force behind transmutation is chemical reactions that are caused from an outside stimulus, such as a proton hitting the reaction materials. Natural transmutation can also occur over a long period of time. Natural transmutation also serves as the principle force behind geological storage on the assumption that giving the waste enough isolated time will allow it to become a non-fissionable material that poses little or no risk. (Charalambus, 1971).

Waste re-use: As the name implies, the process involves taking waste and separating the useful components from those that aren't as useful. Specifically, it involves taking the fissionable material out from the irradiated nuclear fuel. Concerns regarding re-processing have largely focused around nuclear proliferation and how much easier re-processing would allow fissionable material to spread. (Andrews, 2008)

Space disposal: Space disposal has emerged as an option, but not as a very viable one. Specifically, space disposal centers on putting nuclear waste on a space shuttle and launching the shuttle into space. This becomes a problem from both a practicality and economic standpoint as the amount of nuclear waste that could be shipped on a single shuttle would be extremely small compared to the total amount of waste that would need to be dealt with. Furthermore, the possibility of the shuttle exploding en route to space could only make the matter worse as such an explosion would only cause the nuclear waste to spread out far beyond any reasonable measure of control. The upside would center on the fact that launching the material into space would subvert any of the other issues associated with the other disposal methods as the decay of the material would occur outside of our atmosphere regardless of the half-life. (Coopersmith, 2005)

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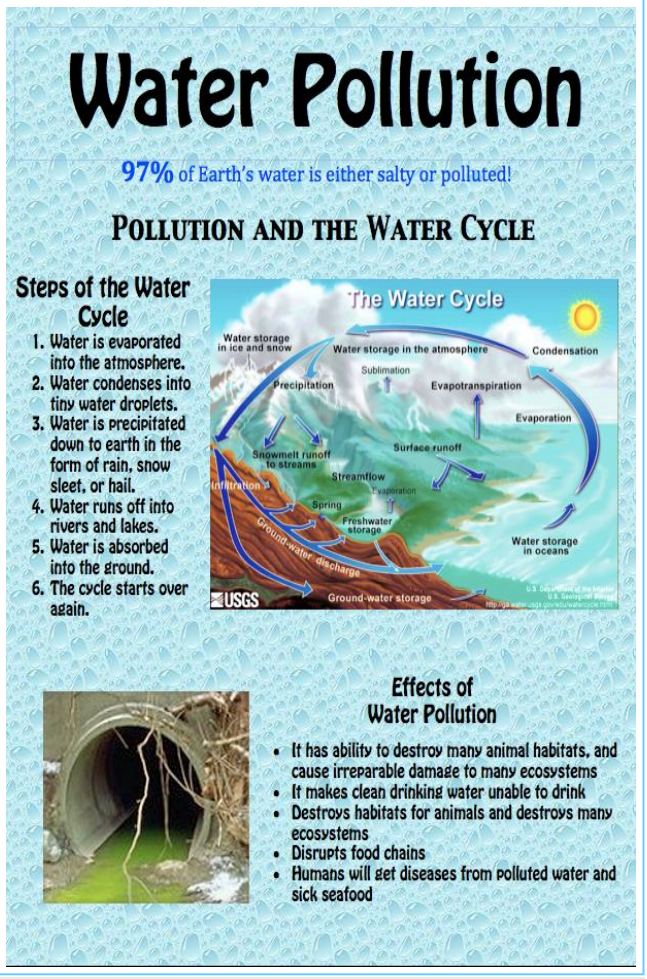
Ayurveda Facts

Remedy for Dengue, Malaria and Yellow Fever

- The best remedy is to take white inner bark of Neem (Neem antarchaal), Rasont (Daruhaldi) and Satva Giloy, all in equal quantity, ½ tsp with warm water. This protects from all types of infectious fevers.

- Juice of 1ft. long branch of Giloy and seven leaves of Tulsi; boiled and taken as a herbal drink enhances body's resistance level up to three times. It also increases platelets count, which decreases considerably in Dengue fever.



A REPORT ON A RARE CASE OF ABNORMAL BRANCHING IN *COCOS NUCIFERA* (ARECACEAE) FROM EASTERN INDIA

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This paper reports a case of abnormal branching in an individual of Cocos nucifera in a coconut plantation in Jalpaiguri district of West Bengal. The possibilities regarding the branching, has been discussed and the discussions are based only on morphological observations and not on the basis of any developmental or anatomical studies of the seedling.
Key words: Cocos nucifera, abnormal branching, Eastern India

In palms, the term 'branching' has been used to characterize any aerial forking of the axis, the production of lateral inflorescences, or new stems by means of underground suckering[1]. Tomlinson[2] proposed four architectural models of the palm, two of which include branching as a pattern. One of these is the Schoute's model in which the aerial axes branch by dichotomy and the other is the Tomlinson's model in which branching of the axis occurs from the base[3]. In angiosperms, the presence of dichotomous branching has long been a subject of controversy. It was first described by Schoute[4] in trunks of the palm *Hyphaene* based on morphological observations in which the bud bifurcated equally at the fork. This conclusion was supported by the observation of the arrangement of leaves and the presence of a triangular scale like structure at the level of the fork. Later Tomlinson and Moore[5] and Tomlinson[6] reported dichotomy in several other palms. Hallé and Oldeman[7] rejected the presence of dichotomous branching in *Hyphaene* based on features of the mature plant rather than on the basis of any developmental features. However in recent years, dichotomy has been confirmed in a dicotyledon *Asclepias*[8], in monocotyledons *Flagellaria*[9], *Nypa*[10], etc. based on developmental studies. Putative branching has been reported in other palms like *Allagoptera arenaria*[6], *Chamaedorea cataractarum*[11], *Eugeissona tristis*[12], *Jubaeopsis caffra*[13], *Nannorrhops ritchiana*[5], *Nypa*[10], *Vonitra utilis, V. thouarsiana* and *V. nossibensis*[5].

Abnormal branching has also been reported in many palm taxa like *Syagrus cocoides*[14], *S. romanzoffiana*[15], *S. vagans*[16], etc. The present paper reports the abnormal branching in one individual plant of *Cocos nucifera* in a coconut plantation in Jalpaiguri district of West Bengal. In order to determine whether any other individual in the population showed similar branching, the entire plantation was surveyed, but no other individual exhibited such branching.

Cocos nucifera has a trunk which is generally unbranched but very rarely coconut palms with branched trunks has been reported[17]. According to Pinheiro et al.[3], the most common causes for this abnormal branching in many palm taxa are damage to the apical meristem by insects or diseases, or lightning, which may split the terminal bud into two or more pieces that may develop into branches or mechanical shocks such as constrictions by vines[18-19] and other injury to the terminal buds (axillary or adventitious) to develop and replace the destroyed terminal bud. In such cases, inflorescences fail to develop flowers and instead produce branches[18].

In this case as observed in this individual of *Cocos nucifera*, branching seems to be due to some mechanical injury to the terminal bud either by lightning or by some insect pest, which has split it into two. It is a case of abnormal branching. True branching by suckering do not seem to be a possibility as that would have resulted in the formation of two different individual plants with two separate stems. Further no other individual in the population showed similar type of branching. Often branching might arise due to cleavage polyembryony, when two embryos are present in a single carpel or two seedlings in an individual seed as a result of the splitting of the embryo into two[20]. Whether this individual is an example of polyembryony or a result of true dichotomy, it would have required the developmental study of the seedling or anatomical studies to support this hypothesis. But at this stage no such study could be conducted and the present report is only based on morphological evidence.

Fig.1. The branched individual of *Cocos nucifera* in the marginal zone of the coconut plantation.

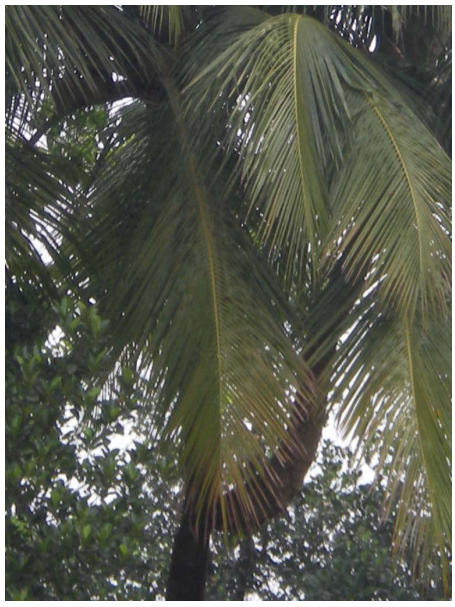

Fig. 2. A closer view of the branched coconut plant showing the point of bifurcation.

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TODAY'S MEDICNAL PLANT
Chlorophytum borivilianum: An Update

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Binomial Name(s): Chlorophytum Borivilianum
Kingdom: Plantae
Class: Monocotyledons
Series: Coronarieae
Family: Liliaceae
Genus: Chlorophytum
Species: C. borivilianum
Popular Name(s): Safed Moosli, Shaqaqule, Dholi Musli, Khiruva, Shedheveli, Swetha Musli, Taniravi Thang
Parts Used: Seeds and roots
Habitat: Northern and western India

Safed Musli is a medicinal plant, with small, usually white flowers, produced on sparse panicles up to 120 cm long. In some species of the plant, the panicle also bears plantlets, which take root on touching the ground. Since times immemorial, the tuber root and rhizome of the plant have been used for the purpose of curing human ailments and infections.

Uses & Benefits of Safed Musli

- Safed musli is a very popular aphrodisiac agent, with no side effects. It is often prescribed for enhancing male potency and overcoming signs of fatigue. It is particularly used for individuals with low sperm count and low libido.
- It is also regarded as an energy booster in asthmatic conditions. The roots of the herb are also used to strengthen the general immune system of the body.
- The tuber roots of the plant have been used since ancient times, to prepare nutritive tonic for sexual weakness and is used in Ayurvedic medicines even today.
- Safed musli proves useful as a nutritive tonic for both the mother and the fetus, during pregnancy and is also used to replenish the body fluids during the post-partum stage.
- The activities of vitamin C and antioxidant enzymes are also enhanced by the use of this plant species.
- Research has indicated that the plant species is used for curing diabetes and arthritic conditions.
- Safed musli is also beneficial in the treatment of natal and postnatal problems.
- Its regular use causes increase in the level of High Density Lipoprotein (HDL or good cholesterol) and decrease in the plasma and hepatic lipid profiles.
- Apart from rejuvenating the reproductive system, the herb prevents premature ejaculation and is also used in chronic leucorrhoea.

PLANT-PARASITIC NEMATODES

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Plant-parasitic nematodes are nearly microscopic, worm-shaped animals virtually invisible to the naked eye when in the soil. They can cause significant plant damage ranging from negligible injury to total destruction of plant material. The severity of plant injury resulting from nematode activity depends on several factors such as the combination of plant and nematode species and prevailing environmental factors including rainfall, soil types, land contour, and culture practices.

Although a few nematode species feed on above ground plant parts, such as leaves, stems, flowers, and seeds, the majority of these parasites feed on underground parts of plants, including roots, bulbs, and tubers. Because of this below ground, "hidden" feeding activity, nematode damage to plants cannot always be diagnosed readily.

Plant nematodes are tiny worms usually 0.25 mm to 3 mm long (1 / 100 " to 1 / 8 ") and cylindrical, tapering toward the head and tail. Females of a few species lose their worm shape as they mature, becoming pear-, lemon- or kidney-shaped. Plant parasitic nematodes possess all of the major organ systems of higher animals except respiratory and circulatory systems. The body is covered by a transparent cuticle, which bears surface marks helpful for identifying nematode species.

Plant parasitic nematodes feed on living plant tissues, using an oral stylet, a spearing device somewhat like a hypodermic needle, to puncture host cells. Many, probably all, plant nematodes inject enzymes into a host cell before feeding to partially digest the cell contents before they are sucked into the gut. Most of the injury that nematodes cause plants is related in some way to the feeding process.

Ectoparasitic nematodes feed on plant tissues from outside the plant; endoparasitic nematodes feed inside the tissues. If the adult female moves freely through the 61 soil or plant tissues, the species is said to be Amigratory. Species in which the adult females become swollen and permanently immobile in one place in or on a root are termed Asedentary. Migratory endoparasitic and ectoparasitic nematodes generally deposit their eggs singly as they are produced, wherever the female happens to be in the soil or plant. Sedentary nematodes such as root-knot (Meliodogyne spp.), cyst (Heterodera spp.), reniform (Rotylenchulus spp.), and citrus (Tylenchulus semipenetrans) nematodes produce large numbers of eggs, which remain in their bodies or accumulate in masses attached to their bodies.

The feeding/living relationships that nematodes have with their hosts affect sampling methods and the success of management practices. Ectoparasitic nematodes, which never enter roots, may be recovered only from soil samples. Endoparasitic nematodes often are detected most easily in samples of the tissues in which they feed and live (burrowing and lesion nematodes), but some occur more commonly as migratory stages in the soil (root-knot and reinform nematodes). Endoparasitic nematodes inside root tissues may be protected from those kinds of pesticides that do not penetrate into roots. Root tissues may also shield them from many
microorganisms that attack nematodes in the soil. Ectoparasites are more exposed to pesticides and natural control agents in the soil.

Foliar nematodes (Aphelenchoides spp.) are migratory nematodes that feed on or inside the leaves and buds of ferns, strawberries, chrysanthemums and many other ornamentals. They cause distortion or death of buds, leaf distortion, or yellow to dark-brown lesions between major veins of leaves. Other nematodes that attack plants above ground, but are not common in Florida, cause leaf or seed galls. Still others cause deterioration of the bulbs and necks of onions and their
relatives.

Symptoms of Plant damage

Initially symptoms are similar to lack of or improper fertilization, too little or too much water, improper soil pH, poor soil, or other environmental factors.Oval areas or irregular patches in the field with poor plant growth ranging from a few feet to hundreds of feet across.Poor, sickly growth, wilting, yellowing, stunting, and premature plant aging

Field history. Accurate field history can provide valuable clues to the identity of nematode and other pest problems. A nematode that has been present in the field in recent years is probably there yet, and is likely to injure susceptible crops if environmental conditions are favorable. Production records that show a gradual decline in yields over a period of years despite no change in cultural practices may indicate progressive development of a nematode problem. A nematode infestation in a new field usually begins in a small area. It gradually intensifies in the original spot and is spread through the field by cultivation, harvest, erosion and other factors that spread infested soil or plant parts. Therefore, the total effect of a recently introduced nematode is a gradual production decline for the field, as the percentage of the field that is involved and the
severity of damage at any given area in the field increase over the years.

Laboratory assay. Laboratory analysis of soil and/or plant tissue samples is often necessary to complete a diagnosis. In the lab, nematodes are extracted from parasitic nematodes, but rather reduce the population(s) to levels below which economic damage occurs.

When control measures are recommended, it is often necessary to repeat the measures periodically to maintain satisfactory plant growth.The following widely recognized Integrated Pest management (IPM) strategies are critical to management of plant-parasitic nematodes.

Prevention: This strategy should be the first line of defense. Prevention is the practice of keeping a population of nematodes from infesting a site and specific tactics include:

- Education regarding nematode presence, biology, and management.
- Survey sampling of an intended planting site to determine the degree of existing nematode activity.Use of nematode free transplants.
- Careful Examination of transplant roots before planting. Plants already infected when put into the ground will not grow well and can introduce nematodes to the site that attack present and future susceptible plantings.
- Weed control as a means of eliminating nematode ac-

cess to alternate hosts.

- Sanitation practices such as cleaning of equipment between sites of operation.

Crop rotation is a very old practice for reducing soil-borne problems. Many nematodes, soil-borne disease organisms and insects can reproduce and survive on only a few plants. Repeatedly planting a field with the same crop without interruption will enable any organisms that reproduce successfully on that crop to continue to increase. Rotation to non-host crops may interrupt nematode reproduction and allow natural mortality factors to reduce their numbers. By carefully planning the sequence of crops to be planted in a particular field it may be possible to avoid excessive build-up of pests of all of the major cash crops in the cycle.

Crop root destruction gets far less credit than it deserves as a nematode management practice. Nematodes, soil-borne diseases and many soil-borne insects will continue to feed and multiply on crop root systems as long as they remain alive. When soil temperatures are high, each month that a root system continues to live represents an additional generation and potential increase of about 10-fold for many nematodes. Even when soil temperatures are gradually declining, a two-month period may support at least one additional generation. Therefore, destroying root systems as soon as a crop is finished can stop nematode reproduction and should encourage their decline through normal mortality.

Flooding may sometimes be used to help reduce numbers of nematode pests. It is practical only where the water level can be controlled easily and maintained at a high level for several weeks. Where flooding can be practiced, alternating periods of about two or three weeks of flooding, drying and flooding again are apparently much more effective than a continuous period of flooding. The soil should be worked during the periods of drying to increase aeration and drying of soil and to prevent weed growth while the soil is exposed. Flooding probably kills nematodes by providing a long period without host plants rather than by some direct physical effect on the nematodes.

Resistance: Another limitation to using nematode resistance as a major management practice is that high temperatures often weaken or destroy the resistant effect. Tomatoes A resistant to root-knot nematodes may not be able to limit nematode reproduction or effects if soil temperature is hotter than 81^0F. It also is still necessary to use other methods to control any other nematodes that are present, because the resistance against one or two species is not going to affect the ability of any other nematodes to injure the crop.

Chemical Management

Chemical control involves the application of certain volatile (fumigants) and nonvolatile nematicides to the soil to reduce nematode populations. It is important here to note:

- There are some nematode problems for which there currently is no legal, effective nematicide.
- Chemical management reduces nematode populations for a limited period of time. Nematodes that escape treatment can resume feeding when the chemical is gone.
- Nematicides are severely restricted for landscape application.
- Because they are highly toxic, several nematicides that are registered for ornamental plants are restricted to commercial production.

There is presently no effective nematicide that may be applied legally to ornamentals already planted in the landscape.

Biological Control

Many different bacteria and fungi that are nematodes= natural enemies have been isolated from nematode populations apparently being kept at low levels by the bacteria and fungi. Nematologists have been able to use some bacteria and fungi to reduce populations of some kinds of nematodes under laboratory conditions, but successes at the full-scale field level have been few. Most organisms recognized as promising for biological control of one or more nematode pests are quite specific in which nematodes they will attack, have been very difficult to culture in sufficient quantities to be useful for field application, or both. The conditions under which each is most effective are often quite specific and limited. Commercially effective biological control as a means to reduce the effects of nematodes on any cultivated crops may still be many years away.

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SAVE HOUSE SPPAROW

NUTRITIONAL IMPORTANCE OF KAKADU PLUM

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The kakadu plum (***Terminalia ferdinandiana***), also called the gubinge or the billygoat plum, is a flowering plant native to Arnhem Land in northern Australia. Despite their name, the fruits of the kakadu plum plant - simply called kakadu plums - are more closely related to the almond than the plum, and they are unusual for fruits insofar as they remain on the plant after ripening. Australian Aborigines have treasured the plums for thousands of years due to their health benefits, although the fruits are not well-known outside of their native country. Let's take a close look at those benefits. Undoubtedly the kakadu plum's greatest claim to fame is that it contains the highest vitamin C concentration of any food on Earth.

Indeed, a report by the Australian Government's Rural Industries Research and Development Corporation (RIRDC) demonstrated that kakadu plums contain between 1,000-5,300 mgs of vitamin C per 100 grams(compared with 50 mg/100g for oranges), possibly the highest known of any fruit. Vitamin C is an important antioxidant that improves brain function and fortifies the immune system. Kakadu plums contain phytochemicals such as gallic acids, which has been shown to fight bacteria, viruses, and fungi. It also contains ellagic acid, a potential cancer fighting agent. According to a study published in the March 2006 edition of *Toxicological Sciences*, gallic acid contains significant anti-inflammatory properties and can be used to treat inflammatory allergic diseases. Moreover, a study published in the January/February edition of Anticancer Research showed that ellagic acid can kill cancer-causing cells and lower estrogen's role in contributing to breast cancer. Despite their relative obscurity as a whole food, kakadu plums (or rather, their extracts) are starting to become more common in international cosmetic products. This is because the fruits contain a large amount of trace minerals and antioxidants that nourish and invigorate the skin, including vitamin E, zinc (Zn), iron (Fe), folate, lutein, and the aforementioned vitamin C.

Antioxidants like vitamins C and E are especially important for skin health because they neutralize cell-damaging free radicals, thereby guarding us from the premature aging effects associated with such damage. Kakadu plums contain respectable amounts of calcium (Ca) and magnesium (Mg). The importance of calcium for building bones and teeth is well-known, but most people don't realize that we also need magnesium to help us absorb that calcium. Since these fruits contain both, they are an excellent guard against osteoporosis and other bone-related conditions. Kakadu plums are rich in dietary fiber, a plant food that clears accumulated waste from the colon and induces intestinal peristalsis. This makes kakadu plums a superb natural cure for constipation. Also, since fiber absorbs water from the colon, it also contributes towards a feeling of fullness. This fact, coupled with kakadu plums' low calorie and fat content, makes them an effective weight loss food. *T. ferdinandiana* was used as a traditional medicine for the treatment of numerous ailments. The fruits were eaten by Australian Aborigines on long treks or hunting trips and were considered more valuable as a medicine rather than as a food. The inner bark of the tree was used to treat a variety of skin disorders and infections including wounds, sores and boils.It is also effective in controlling fungal infections such as ringworm, and in the treatment of bacterial infections including its use in treating leprosy. A recent study has reported on the antibacterial activity of *T. ferdinandiana.*

Recently, *T. ferdinandiana* has been attracting attention due to its interesting phytochemistry. In particular, extremely high levels of ascorbic acid (vitamin C) have been reported for *T. ferdinandiana* fruit. Indeed, *T. ferdinandiana* is now known as the richest source of vitamin C of any fruit in the world, with levels over 900 times higher than the same weight of blueberries. Some studies have estimated the levels of ascorbic acid in *T. ferdinandiana* fruit to be as high as 5.5 % of dry weight, in comparison to ~0.5 % dry weight in oranges, grapefruit and limes. Ascorbic acid is well known for its ability to scavenge free radicals and thereby reduce oxidative stress. As the induction of oxidative stress is known to be associated with some cancers, cardiovascular disease, neurodegeneration disorders, diabetes and obesity,

the high levels of ascorbic acid associated with *T. ferdinandiana* fruit may also have beneficial health related bioactivities. Research has indicated that the kakadu plum contains ~ 2907 mg of vitamin C in only 100 grams of fruit. This level far exceeds that of the orange, and ranks it among the highest producers of natural vitamin C.The kakadu plum can be eaten raw, especially if it is ripened to a pale yellow color. This fruit also is often made into jams, jellies, sauces, juices, and sorbets. Diet and nutrition companies have worked to convert the plums to powder while maintaining the high vitamin C content so that it can be added to drinks or other food sources. Some cosmetic companies use the kakadu plum in their lotions, eye serums, and lip balms as well.

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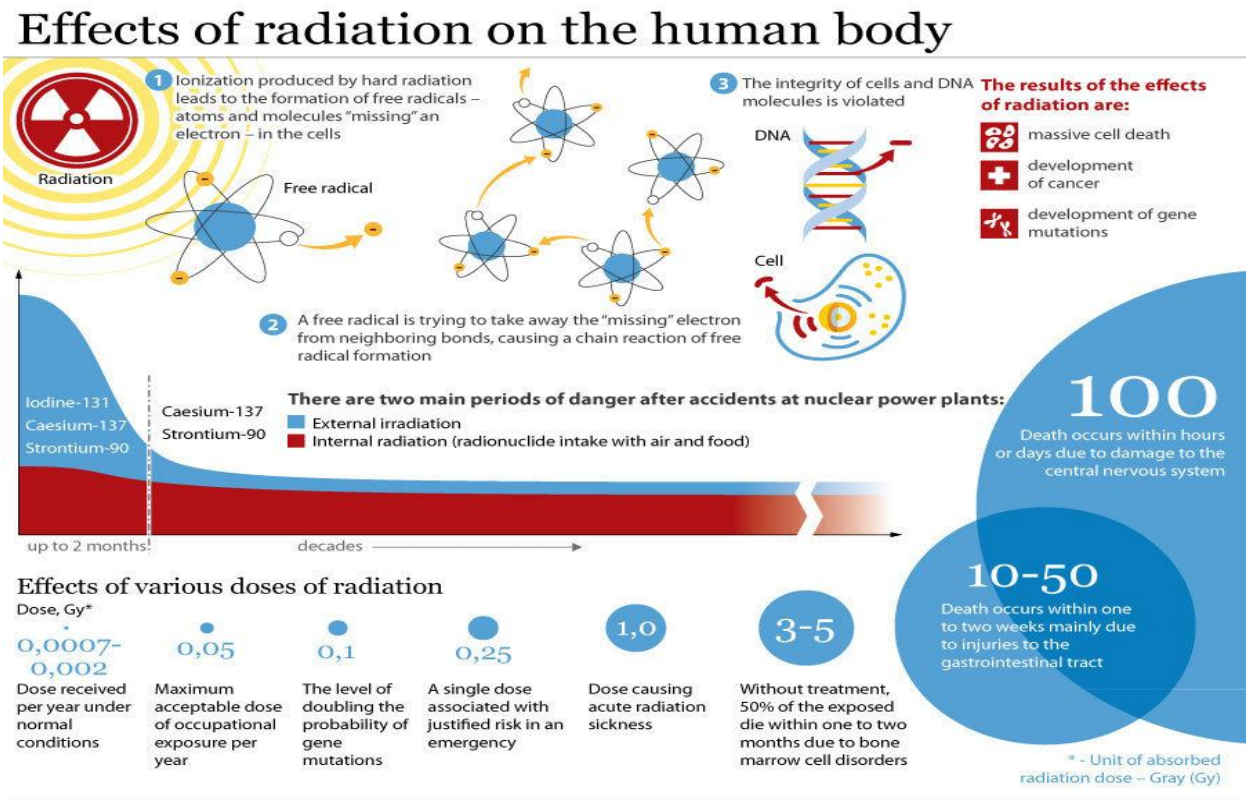

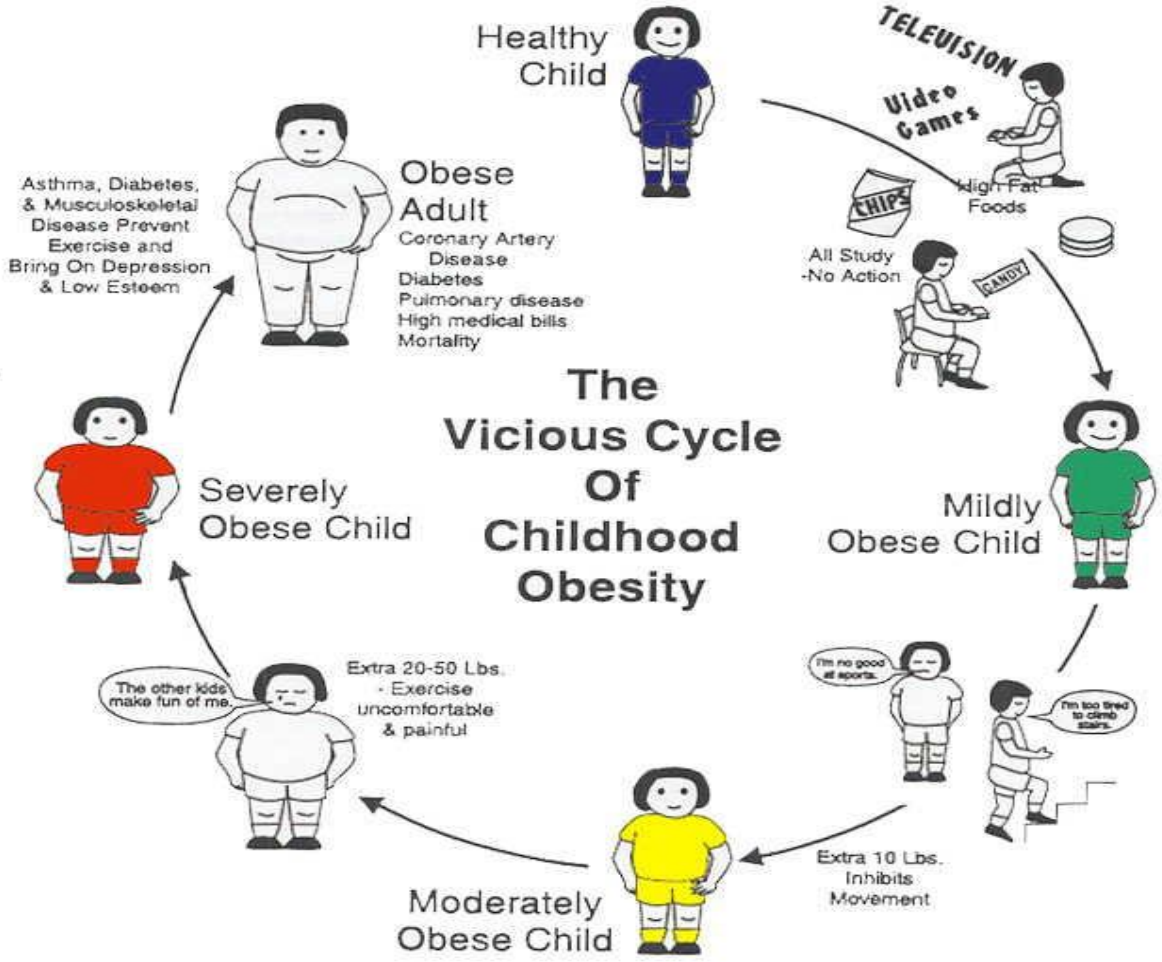

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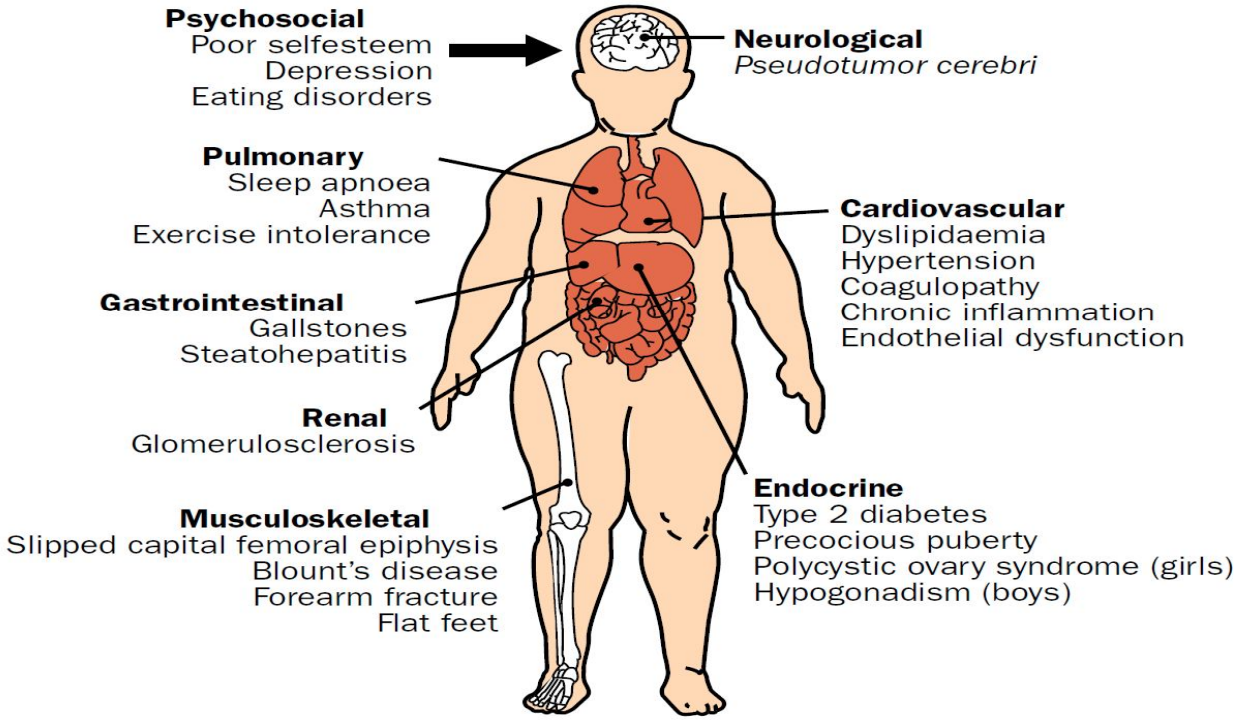

LONG LASTING INSECTICIDAL NETS - BREAKTHROUGH IN MALARIA PREVENTION

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Malaria is responsible for 300 million to 500 million cases annually across the world (www.malariasite.com). Forty percent of world population lives in malaria endemic areas (Sturchler et al 1990). Malaria is the fifth cause of death from infectious diseases after respiratory infections, HIV/AIDS, diarrhoeal diseases and tuberculosis (www.cdc.gov/malaria). The situation of malaria incidences is even more severe in Africa which is responsible for 270 million clinical cases each year, which mostly includes children under five (http://www.rbm.who.int/docs/malaria launch 2007). Malaria not only affects the health but also the wealth of the country as it has direct or indirect consequences on economic development. The most vulnerable population includes infants, young children, pregnant women and forest dwellers, tribal people and travelers (http://www.searo.who.int). Different approaches are used for malaria control, which include chemotherapy, immunization and vector control methods. Control of malaria vectors is very difficult as it depends upon the different ecological settings, environmental conditions, diverse breeding places and different climatic conditions. Insecticide treated mosquito nets have emerged as potential low cost vector control tools, which reduce the man-vector contact thereby preventing transmission and reducing morbidity and mortality due to malaria. Since they are quite useful in reducing the vector population, the major drawback lies in the fact that they need to be re-treated with pyrethroid insecticide at frequent intervals and erratic dose of insecticide on the fibres on the netting materials. As a result, a new technology of long lasting insecticidal net (LN) have emerged.

Long lasting insecticidal net commonly abbreviated as (LLIN or LN by WHO) is "A net treated at factory level with insecticide either incorporated in to or coated around fibres resisting to multiple washes and whose biological activity lasts as long as the net itself" (3/5 years) for polyester/polyethylene nets" (WHO, 2001, 2003, 2004, 2007). In other words LN is the net which is treated at factory level by a process that binds or incorporates insecticide into the fibres and maintain its biological efficacy against vector mosquitoes for at least 3 years under recommended condition of use in the field thus obviating the need for regular insecticide retreatment. The efficacy of LN can be expressed for terms of wash resistance of maintaining sufficient insecticide concentration for more than 95% of knockdown of target mosquito vector species and more than 80% mortality for at least 20 serial washings in laboratory. The insecticidal activity of the nets should persist for at least 20 WHO standard washes (WHO, 2005). LNs play a significant role in the prevention and control of vector-borne disease, especially malaria. They provide personal protection, and, in settings with sustained high levels of coverage and anthropophilic vectors, they can reduce transmission and protect the entire community. For malaria control with LNs, WHO now recommends universal coverage. It is assumed that LNs have a relatively uniform lifespan of about 3 years. Thus, it is often assumed that mass distribution campaigns at 3-year intervals are enough to maintain adequate levels of net coverage throughout the 3-year interval.

In principle two methods are used for producing LNs:-

Incorporation Method: Monofilament (1 yarn) Incorporated technology. The insecticide is incorporated in the polyethylene yearns. Most of the insecticide is inside the yarn, where it is protected against external factors like sunlight. Through a controlled release system the insecticide migrates to the surface. This method is highly mechanized which includes the incorporation of insecticides in to master batches of a synthetic fiber polymer (polyethylene) which is subsequently used to produce a yarn for knitting and sewing nets. The method is currently used to produce Olyset® net (permethrin incorporated into polyethylene), Duranet® (alphacypermethrin incorporated into polyethylene) and Netprotect® (deltamethrin incorporated in to polyethylene). The colours process is done when the yarns are extruded. The colors do not have any effect on the efficacy of the net.

Coating Method: Multifilament (36 yarns) Impregnation technology. This method involves coating of the fibres with insecticides mixed with binder by spraying or dipping techniques. This matrix slowly releases the insecticide over time, but especially during washing. Surface treatment techniques include highly automated fiber treatment during net production. This method is currently used to produce PermaNet®2.0, which is coated with deltamethrin on polyester net and Interceptor net which has alphacypermethrin coasted on the polyester fibres. The colour process is done by dipping polyester fabric in colour bath prior to impregnation. Different brands of insecticidal mosquito nets produced by different manufacturers have been recommended by WHOPES for use as LNs (http://www.who.int/whopes). According to the latest reports of the WHOPES working group committees July 2011 (http://www.who.int/whopes/recommendations/wgm/en/) Olyset® net, PermaNet® 2.0 and Yarkool net got the full recommendations for use where as some other products such as Interceptor®, Duranet® and Netprotect® (ICON® Life), Life ® net, Dawa Plus® 2.0, Perma®Net 2.0.2.5 and Perma®Net 3.0 have got the interim recommendations for use as LN. LN products may be given a full recommendation if they meet WHOPES criteria after 3 years in large scale field trials. Interim recommendations on the use of LN products for malaria prevention and control may be given, if they are made with a WHO-recommended insecticide; they have satisfactorily completed laboratory ans small-scale field testing for efficacy; and, after at least 20 standard WHO washes, they perform as well as or better than a conventionally treated net washed until just before exhaustion. An interim or full WHO recommendation for use of an LN product implies that WHO has evaluated that product for safety and efficacy and that it met the criteria and requirements of the organization. A List of WHOPES recommended LN products are given below:

WHO recommended long-lasting insecticidal mosquito nets (LNs) / recommendation / whether published

Olyset® Permethrin incorporated into

polyethylene / Full / Published

PermaNet® 2.0 Deltamethrin coasted on polyester / Full / Published

Yorkool® LN Deltamethrin coasted on polyester / Full / Published

DawaPlus®*2.0* Deltamethrin coated on polyester / Interim / Published

Duranet® Alpha-cypermethrin incorporated into polyethylene / Interim / Published

Interceptor® Alpha-cypermethrin coated on polyester / Interim / Published

LifeNet® Deltamethrin incorporated into polypropylene / Interim / Published

Netprotect® Deltamethrin incorporated into polyethylene / Interim / Published

PermaNet® 2.5 Deltamethrin coated on polyester with strengthened border / Interim / Published

PermaNet® 3.0 Combination of deltamethrin coated on polyester with strengthened border (side panels) and deltamethrin and PBO incorporated into polyethylene (roof) / Interim / Published

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ARSENIC MITIGATION: THE WAY FORWARD

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There were waterborne diseases such as diarrhea in Bangladesh due to the drinking of untreated water several decades ago. During the 1970s, UNICEF and some international donor agencies advised the Government of Bangladesh to tap groundwater for drinking purposes[1]. Drinking this groundwater actually reduces the level of diarrhea, but at the same time it is increasing the risk of arsenic poisoning, leading to arsenicosis, hyperpigmentation, gangrene, and finally cancer. The latency time of cancer symptoms is 15-30 years depending on arsenic content in the water and the period of ingestion. Local poor people are not actually aware of arsenic poisoning. They still think that tube well water is good quality and that it is much better than the surface water, whether it is contaminated with arsenic or not. Some social problems have emerged other than health risk from arsenic poisoning. There is a very common tendency to ostracize people who have visible arsenic symptoms on their body, particularly different types of skin lesions or gangrene. People with arsenic poisoning can't even go outside of their own home and they can't participate in any social gathering. There are even problems within families causing parents to separate or the infected to leave home. They are isolated from society; they find it difficult to get a job and children cannot go to school. These are the kinds of social problems in Bangladesh within arsenic-affected communities[2].

If you think about risk to arsenic poisoning, two issues should be considered: (a) health risk with disease incidence; and (b) social implications. Arsenic is a documented carcinogen and if people ingest arsenic contaminated drinking water for a long time, there is the possibility of non-malignant symptoms as well as different cancers. There is a large literature regarding arsenic and health issues but the social implications of arsenic poisoning have yet to be focused on strongly. There are serious social problems for the arsenic-affected people in Bangladesh, starting with children being excluded from school, followed by social isolation and family dislocation. In 1997, the government established an umbrella organization — BAMWSP (Bangladesh Arsenic Mitigation and Water Supply Project) for arsenic mitigation in Bangladesh. BAMWSP developed a policy in 2004 for arsenic-safe water options and these were: rain water harvesting, deep tube wells, pond-sand-filters and dug wells. In 2005 there was an assessment of the options and the installation of deep tube wells was banned by the government until it could be determined whether the arsenic-safe deep aquifer was protected by an impermeable layer. If the deep aquifer is ever contaminated with severe levels of arsenic, there will be no option for arsenic-safe drinking water. Furthermore, the other options are not working properly in Bangladesh. Therefore, government needs to formulate a constructive policy to save her people from arsenic poisoning. It is worth noting that about 80 million people in Bangladesh are at risk of arsenic poisoning. Since the educated portion of the population in Bangladesh is not large, it is sometimes difficult to convey awareness messages regarding arsenic poisoning. Some understand arsenic hazard, but others confuse arsenic with iron. This is because the messages are sometimes complicated and lack clarity. Generally, people think that arsenic poisoning is a contagious disease that spreads quickly. This is a common misconception in rural Bangladesh[3]. If a mass awareness campaign is possible to alert the rural people, and if they can be provided with arsenic-safe water, the arsenic problem will be minimised in Bangladesh. Arsenic-safe water is the only curative medicine for arsenic-related diseases at the primary stage.

There is arsenic poisoning now in 70 countries around the world and about 80 million people are at risk of arsenic poisoning in Bangladesh alone. At the beginning of arsenic detection in Bangladesh groundwater in 1993, a good number of international institutions, donors, research institutions and international NGOs contributed their efforts both in research and mitigation. The British Geological Survey (BGS) with the financial supports from the DfID/NERC conducted research on groundwater arsenic poisoning. Some foreign institutions, like Columbia University (USA), KTH (Sweden), Jadavpur University (India) are still working on arsenic in Bangladesh. The Institute of Hazard, Risk and Resilience (IHRR) can play a role in research on this issue. The objectives of the IHRR can be achieved with long-term research on different natural disasters that are frequent in Bangladesh. The recent Link Programme with Jahangirnagar University under the British Council INSPIRE programme can be the beginning of the research initiative. If you consider the Bangladesh standard permissible limit for drinking water that is 50µg/L of arsenic, around 30% of the tube wells are found to be contaminated; but this figure is more than doubled if the WHO guideline value (10µg/L) is used. There is a lot of literature regarding the permissible limit of ingesting arsenic from drinking water. The guideline value of 50µg/L does not provide full protection from arsenic poisoning, but the implementation of the WHO standard would be very expensive. The existing mitigation options for arsenic-safe drinking water are not working properly and there is no regular monitoring of drinking water quality. There is still ongoing research on safe water options in Bangladesh, and there is debate about which technology is suitable and sustainable[4]. The low-cost technologies are suitable for the rural poor but might not be sustainable. High-tech options are most applicable for towns and cities but they are expensive and not all consumers are able or willing to pay the cost of arsenic-safe water. Both quantitative and qualitative enquiry are useful for social hazard and risk research on arsenic poisoning in Bangladesh, but qualitative methodologies seem to me to be the most reliable and effective in this regard. **Coagulation/filtration** (also known as flocculation) removes arsenic by coprecipitation and adsorption using iron coagulants. Coagulation/filtration using alum is already used by some utilities to remove suspended solids and may be adjusted to remove arsenic. But the problem of this type of filtration system is that it gets clogged very easily, mostly within two to three months. The toxic arsenic sludge are disposed of by concrete stabilization, but there is no guarantee that they won't leach out in future[5-7].

Iron oxide adsorption filters the water through a granular medium containing ferric oxide. Ferric oxide has a high affin-

ity for adsorbing dissolved metals such as arsenic. The iron oxide medium eventually becomes saturated, and must be replaced. The sludge disposal is a problem here too. **Activated alumina** is an adsorbent that effectively removes arsenic. Activated alumina columns connected to shallow tube wells in India and Bangladesh have successfully removed both As(III) and As(V) from groundwater for decades. Long-term column performance has been possible through the efforts of community-elected water committees that collect a local water tax for funding operations and maintenance. It has also been used to remove undesirably high concentrations of fluoride.

Ion Exchange has long been used as a water-softening process, although usually on a single-home basis. Traditional anion exchange is effective in removing As(V), but not As (III), orarsenic trioxide, which doesn't have a net charge. Effective long-term ion exchange removal of arsenic requires a trained operator to maintain the column.Both **Reverse osmosis** and **electrodialysis** (also called *electrodialysis reversal*) can remove arsenic with a net ionic charge. (arsenic oxide, As_2O_3, is a common form of arsenic in groundwater that is soluble, but has no net charge) Some utilities presently use one of these methods to reduce total dissolved solids and therefore improve taste. A problem with both methods is the production of high-salinity waste water, called brine, or concentrate, which then must be disposed of.

Despite an abundance of water filters in the market, access to safe drinking water remains a challenge for India and other developing countries. According to WHO, "Every year there are 2 million diarrhoeal deaths related to unsafe water, sanitation, and hygiene. The vast majority of them are children under five." IIT Chennai researchers have invented a cheap water filter, which they claim could be helpful in achieving the United Nations millennium development goal of sustainable access to safe drinking water. The filter, described in *PNAS* on May 6, uses nanomaterial to remove diseasecausing microorganisms and toxic heavy metals from water. It works by constantly releasing silver ions, which are an effective disinfectant, into the water. Several silver-based anti-microbial devices have been designed in the past but have not been viable. One of the reasons being presence of organic and inorganic impurities in water that cling onto nanoparticle surface and hamper sustained release of silver, say the researchers.To find a way around this technical constraint, the researchers formulated a cage-like nanocomposite of aluminium oxyhydroxide–chitosan with silver particles embedded in it. This composite ensures sustained release of silver ions into the water in an amount significantly less than the permissible limit set by the US Environment Protection Agency (EPA). This eliminates a need for secondary filtrations to remove excess silver ions, say the researchers. Silver nanoparticles remain intact as the aluminium cage reduces their contact with chemicals that might anchor on them. "What we have is a complete purifier. This takes care of all contaminants in water—microbial, heavy metal, organics. All of this is done with advanced materials. There is no solution of this kind anywhere. The device is efficient in the sense that it provides clean water as per EPA standards. It costs just 6-7 paise/litre for microbially as well as chemically safe water."However, Ashok Gadgil, division director and faculty senior scientist at Environmental Energy Technologies Division of Lawrence Berkeley National Laboratory (EETDLBLN) in the US says, "The arsenic removal in the *PNAS* paper was reportedly tested in arsenic-spiked tap-water. In our experience, Indian tap water has pretty low phosphate ion concentration. However, these ions appear in high concentrations in groundwater and compete for the same sites that are intended to capture and remove arsenic." So, the performance and affordability of the system for removing arsenic from real groundwater would be different from that with spiked tap-water, and those results are not presented in the paper. Another issue left unexplored in the study is the fate of the arsenic-laden sludge formed after removing arsenic from water[8].

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