by manipulating the opening/covering time of the greenhouse by the polythene sheets. Very less irrigation and nutrients are provided so that the plants in the greenhouse just survive and produce small-sized roots called 'rootlets'. These rootlets (about 12 g each) enter directly in the reproductive phase. The rootlets are harvested and transplanted in the field in March for commercial seed production (Figure 1).

On the basis of three years' (2009–2011) field experiments, it was found that rootlets induced seed stalk and inflorescence 70–80 days after transplantation and produced seeds in October during the same year. Therefore, with this technology one phase (root production phase) can be avoided completely using an eco-friendly method and high-quality seeds can be successfully produced in one year. Including the losses during handling and storage for the next season about 2.0 metric tonne carrots can be made available for table purposes; otherwise, these would have been used for seed production in the 'root to seed' method.

Higher seed yield per hectare and quality were recorded with 'rootlet to seed' compared to 'root to seed' method, apparently due to the contribution of maximum seeds from first- and second-order umbels. However, higher seed yield per plant was observed in 'root to seed' method, and the third- and fourth-order umbels contribute in seed yield in this method. Seeds produced in the third- and fourth-order umbels are inferior in quality than first- and second-order umbels, because these small-sized seeds contain higher levels of carrotal substance which inhibits germination and adversely affects the vigour[4]. Therefore, high germination percentage and seed vigour were observed in the seeds produced using 'rootlets to seed' technology.

With the adoption of 'rootlet to seed' technology developed by DIHAR, food used for seed production as carrot roots (2.0 metric tonne/ha) can be saved and good quality seed can be produced in one year at almost one-third cost in comparison to the conventional method.

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Plastic litters: a major environmental issue in Chilika lagoon

Chilika Lake is the Asia's largest brackish water lagoon situated in Odisha along the Indian east coast. It is one of the biodiversity hotspots and a good source of fishery in coastal wetlands of the entire east coast. Its Nalaban Island bird sanctuary serves as a wintering ground for thousands of migratory and resident birds every year. It is also one of the few lagoons in the world which supports congregation of Irrawaddy dolphins. The lake since its origin about 5000 years ago is providing an array of goods and services to the local community. At present more than two lakh fisher folk population living in and around the lake are obtaining their livelihood from this lake. The health, tranquility and peace of the lake have been affected, rather severely, during the last few decades due to natural hazards and anthropogenic interventions. One of the important polluting attributes figured in recent years in this lake is the plastic litter fall.

The use of plastic materials in various fields including fishing has increased tremendously due to their low cost and durability. Plastics are usually non-biodegradable; microbe and other organisms living in the natural environments cannot break down these polymers. Therefore, plastic materials such as carry bags, bottles, food wrappers, residual and damaged fishing nets pose a potential threat to the environment and the biota. Plastic litters are entering into coastal ecosystems from many different sources, especially through the dumping of damaged carry bags, bottles, packing materials, ropes and other materials used in navigation and residues of fishing nets, etc. Synthetic materials like biologically non-degradable nylon fabrics are widely used in the preparation of fishing nets and fishermen dump the damaged nets in the natural environment ignoring their adverse impacts on the biota. The plastic litter fall in coastal wetlands has in fact been recognized as a nuisance practice.

Plastic litters are entering into the Chilika lagoon from many different sources (Figure 1). These include plastic waste of domestic and industrial origin through rivers and rivulets debouching freshwater into the lake and dumping of damaged plastic nets and net residues used in 'gheri' culture (pen culture). Of late, dumping of plastic materials like bottles, packing materials, water pouches, carry bags, etc. has aggravated the situation. The villages surrounding the lagoon have no proper waste disposal and management system, which promotes the addition of residual plastic into the lake system. The plastic litter fall therefore has emerged as a new environmental problem threatening its health and the inhabitants.

Plastic litters can interfere in the ecosystem functioning of an aquatic environment in more than one way. The organisms of all trophic levels and living as plankton and nekton in the pelagic realm and benthos are affected by persistent litter fall. It has been well established that these litters could alter the strength of biological interactions leading to the death of fragile benthic organisms, besides destroying the habitats. The resident and migratory birds usually depend upon the benthic organisms which serve as their food. Thus plastic litter fall could affect the bird populations of wetlands. Further, Sandilyan and Kathiresan[1] have observed that the carry bags hanging on the mangrove tree branches produce a peculiar sound during wind flow that disturbs the foraging of migratory and resident birds in Pichavaram mangrove area. The Chilika Lake

Figure 1. Plastic litter (***a***) near Sipakuda inlet (the eastern region of the lagoon), (***b***) Barkul jetty (western region) and (***c***) Rushikulya rookery.

being a paradise of thousands of migratory and resident birds coming from far away places like Caspian Sea, Lake Baikal, Aral Sea and remote places of Russia, Mangolia, central and southeast Asia, etc., may face a similar repellent situation owing to dense accumulation of plastic bags.

It has been widely reported that the discarded and lost fishing nets in wetlands continue to trap and catch fishes and other valuable species, which is commonly known as 'ghost fishing'. In the Chilika lagoon also, instances of fish and shellfish trapping in damaged and discarded nets have been reported. This is a cause of concern with regard to conservation of biodiversity.

The Chilika lagoon is connected to the Bay of Bengal close to the Olive Ridley sea turtle mass nesting site of Rushikulya estuary. The turtles during their migration and stay in the coastal waters are often entangled in the nets and die due to drowning. Further, they often ingest plastic litters that enter into coastal waters and face serious health problems, often leading to death. Thus plastic litter fall into Chilika lagoon indirectly affects the Olive Ridley turtle population also. The plastic waste thrown on the shore interferes with the nesting process on the beach.

Plastic residues floating in water attract and hold polychlorinated biphenyl (PCB), dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), etc. which are hydrophobic and highly toxic[2]. They are capable of uptaking one million times their background levels of these toxic materials, which are not readily soluble in water[3]. The plastic litters with accumulation of such toxic pollutants act as poison pills to many organisms when they ingest the plastic remains found suspended in water along with food stuff. The Chilika Lake receives PCB, DDT and DDE and other such toxic pollutants as residues from a variety of sources. The plastic remains in the Chilika water, therefore, are bound to absorb these toxic compounds that are ultimately eaten by birds and fishes having serious ecological consequences.

The key to solve the litter problem in marine environment is their management at source that can be achieved through waste prevention, minimization, reuse and recycling. Three measures (3Rs) such as reduce, reuse and recycle are recommended to combat this pollution. As regards to the Chilika lagoon, which is vulnerable to a series of environmental hazards, the best option could be imposing a strict ban on the usage of plastic materials and disposal of such waste directly or indirectly into the lagoon. Such an exercise can only reduce the plastic litter pollution of this precious brackish water lagoon and its inhabitants. The need of the hour, therefore, is proper quantification of plastic litters entering the lake system from various sources and selection of the best option for their management. It should be one of the important components of the Chilika management exercise taken up by the government under its Integrated Coastal Zone Management plan.

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New host record for *Nerocila sigani* (Isopoda: Cymothoidae) from Odisha coast, India

The isopod parasite *Nerocila sigani* was first described from the Persian Gulf by Bowman and Tareen[1] from the rabbit fish *Siganus oramin* (Bloch and Schneider). They also described another species[1], *Nerocila* (*Nerocila*) *arres* from five different fish species, namely *Siganus oramin* (Siganidae), *Epinephilus tauvina* (Epinephilidae), *Acanthopagrus latus* (Sparidae), *Nemipterus japonicus* and *Nemipterus tolu* (Nemipteridae) which is synonymized under *Nerocila sigani*.