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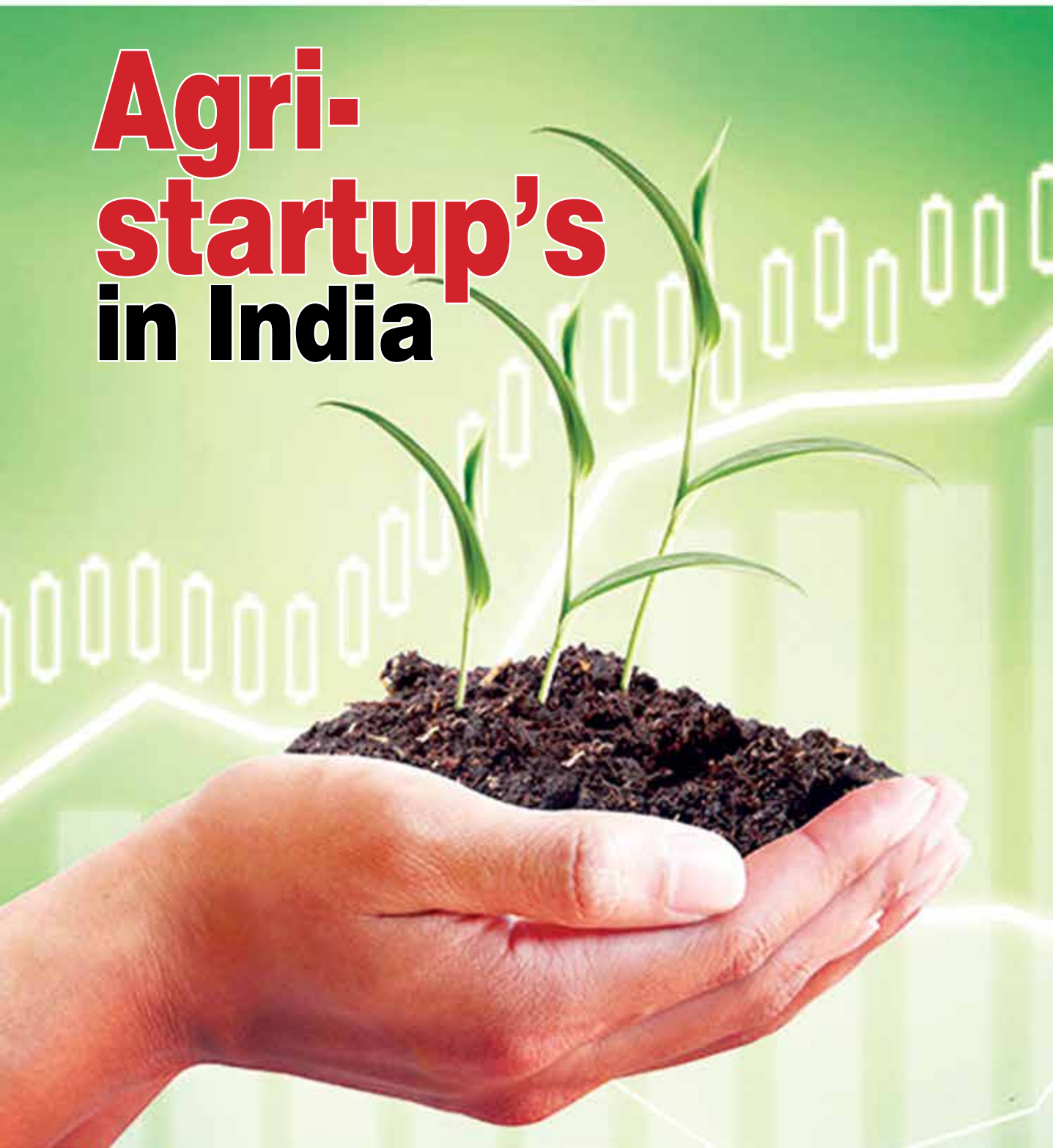

Agri-startup's in India

Lab to Land

Captive breeding of Marcia's Anthias for ornamental fish trade

Marcia's anthias, *Pseudanthias marciae*, is a colorful reef-associated marine fish found mostly in the north-western Indian Ocean. The species was first reported along the Kerala coast, in the Arabian Sea, by Rekha J. Nair from the Central Marine Fisheries Research Institute, Cochin. Researchers have attempted to develop captive breeding methods for Marcia's Anthias, but found it difficult: the larvae had low survival rate. So the ornamental fish is not easily available in the aquarium trade.

Image: Jenny Huang via Wikimedia Commons

Now, scientists from the Vizhinjam Research Center of the Central Marine Fisheries Research Institute have come out with a successful method for the captive breeding of Marcia's Anthias. They caught twelve juveniles from the wild. And developed the broodstock in a five-ton recirculation aquaculture system - in indoor tanks with a "controlled" environment. The recirculating systems filter and clean the water for the fish culture tanks. After six months, when the fish had reached sexual maturity, they were allowed to spawn naturally in the tank. The scientists collected the eggs from the overflow conduit, and transferred them to the larval rearing tank.

The larvae were fed on rotifers, small multicellular animals and small aquatic crustaceans. The researchers undertook necessary water quality management.

The scientists observed that the initial mortality of fish larvae is due to lack of adequate food. "In Maria's anthias larvae, the mouth opens on day three and the yolk is fully absorbed before day four. So feeding has to be initiated before day four. Otherwise complete mortality may result, says M K Anil, CMFRI.

"We are slowly understanding the needs of the ecological niche that we have to create for the survival and reproduction of the species. Wild planktons and abundant copepods - especially a pure culture of copepod nauplii, *Paracalanus crassirostris* - proved useful for rearing the larvae till the fish stage", says Gopalakrishnan, Director CMFRI.

Captive breeding of the ornamental species, Marcia's anthias, can be lucrative for aquarium farmers. The total trade in live marine ornamentals is around US$ 44 million annually, as per a Food and Agricultural Organization 2014 report. International trade shows an increasing trend with an average growth rate of about 14 % per year during the last decade.

The Central Marine Fisheries Research Institute offers extension activities for technology transfer to farmers and entrepreneurs.

Aquaculture. **492**.265-272 (2018)

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Tomato wilt bacteria: Evolution follows cultivation

In tomato, wilting is a common problem. The green leaves suddenly start wilting, and droop and then the plants die. If you cut the stem, you will see milky white ooze, confirming infection by *Ralstonia solanacearum*, a bacterium.

Recently, there was an outbreak of this disease in Kinathukadavu and Othakalmandapam, Tamil Nadu. Scientists from the Tamil Nadu Agricultural University collected samples from those locations and isolated pathogens. They also collected milky exudation from infected stems.

First they confirmed the identity of the bacterium by comparing the sequences of the 16S rRNA gene against gene database entries. The pathogen was further characterized to determine its race and biovar.

They tested infectivity of the pathogen varieties on brinjal, chilli and potato, besides tomato, and found that they caused typical wilting in brinjal and potato but not in chilli.

Then, using soil inoculation, the scientists checked the pathogenicity of the isolates. They observed wilt symptoms with characteristic drooping of leaves on inoculated seedlings within 4–5 days of inoculation.

"We found the morphology of bacterial colonies isolated from experimentally infected plants identical to that of inoculated bacteria, thus proving Koch's postulate - the bacteria must be present in every case of the disease" says Vibhuti, Tamil Nadu Agricultural University.

"Since the two villages are separated by about 7 kilometres, we asked ourselves whether they are genetically distinct. So we examined the genetic relationship between the two strains from the two different villages with a global collection of *R. solanacearum* strains", says Balamurugan, Tamil Nadu Agricultural University.

The phylogenetic tree clustered the strain from Kinathukadavu with the strains prevalent in the Andaman Islands, whereas the strain from Othakalmandapam is related to the strains from Kerala.

"The clonal relationship of the strain from Kinathukadavu with the West Bengal and Andaman Island strains suggests the possibility of lateral pathogen transmission to different tomato growing states in India" says A Kumar, IARI.

Ralstonia solanacearum is transmitted through seeds, often through infected ginger rhizomes, potato tubers and banana suckers also. So, farmers should be extra careful while selecting tomato seedlings, as this wilting spreads mainly through seedlings and planting materials.

Rotating the crop with non-host crops like paddy or brassica is also useful to ward off infections. Farmers are advised to flood the field 1 to 3 weeks before planting tomato to get rid of bacterial wilt, say the scientists. If a tomato plant gets infected, it should be removed and destroyed to prevent the spreading of bacterial wilt.

European J. Plant Pathol. **151** (3): 831-839 (2018)

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ICAR- Indian Institute of Horticultural Research

Biopolymer to Increase Vegetable Shelf Life

Consumers expect fresh vegetables. However, during transportation, maturation and infection degrade the fresh produce. This results in economic loss. Refrigerated transport is a solution. But it consumes energy and increases the price of vegetables.

To increase vegetable shelf life, scientists from the Mahatma Gandhi University, Kottayam, have recently come up with a solution: coating vegetables with chitosan, obtained from crustacean shells. Chitosan, a non-toxic polymer, is

used in several biological applications as drug carrier and antimicrobial agent.

Chitosan is insoluble in water. To make it more soluble, the team attached negatively charged tri polyphosphates with a positively charged amino group of chitosan. Now the question was: do nanoparticles of such chemically modified chitosan retain antioxidant and antimicrobial activity?

To check this, they tested the chitosan nanoparticles against four plant pathogenic fungi - *Rhizoctonia solani, Fusarium oxysporum, Colletotrichum acutatum*, and *Phytophthora infestans*. As anticipated, the chitosan nanoparticles inhibited the growth of the pathogens *in vitro*.

"The high surface charge of the chitosan nanoparticles disturbed the cell membrane of the fungi", says M S Jisha, Mahatma Gandhi University. "Since they are very small, the modified nanoparticles are easily absorbed by fungal cells causing cellular disorganization".

The team also observed the reducing ability of the chitosan nanoparticles towards ferric ion and superoxide radicals - evidence that the chitosan nanoparticles had significant antioxidant activity.

The scientists coated brinjal, chilli and tomato with the chitosan nanoparticle solution and analyzed the physiological effects. All vegetables coated with the chitosan nanoparticles showed less than 1% weight loss, whereas uncoated brinjal, chilli and tomato showed weight loss of about 20% and more.

The dense structure of chitosan nanoparticles prevents water loss and acts as an effective gas barrier. Consequently, the coated vegetables exhibited increased shelf life.

The team tested the nanoparticles against human fibroblast cells and found no significant cytotoxic effects. This suggests that the chitosan nanoparticles can be ideal to apply on edible products.

Producing this nanoparticle cost effectively will help vegetable farmers, traders and consumers. Another advantage to bear in mind is that the nanoparticles are biodegradable and enhance nutrient availability, when added to soil.

Int. J. Biol. Macromol., **114**: 572-577 (2018)

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Role of soil microbes in Mangrove reforestation

It is estimated that 700 sq. km of mangrove forests in Kerala have shrunk to a mere 30 sq.km. This alarming decline can be attributed to various reasons but the urgency is to restore mangrove vegetation. Mangrove forests provide vital ecosystem services: seashore stabilization, food and shelter for aquatic organisms, as well as fodder and fuel wood for local communities.

Coastal soil has high salinity and low organic matter. This is not conducive to easy establishment and growth of mangrove vegetation. Inoculating seedlings with beneficial microbes can help successful reforestation. So, Karthikeyan and Siva Priya from the Institute of Forest Genetics and Tree Breeding, Coimbatore investigated the role of soil microbes in the growth of *Bruguieria sexangula* – the oriental mangrove.

They did a preliminary field survey at Panangadu, Kochi and identified a few, well grown, mature oriental mangrove trees. They isolated two bacteria that fix nitrogen, *Azotobacter chroococcum* and *Azospirillum brasilense*, and two phosphate-solubilizing bacteria, *Frateruria aurantia* and *Bacillus megaterium*. All four microbes were cultured and mass multiplied in broth. The team then collected oriental mangrove propagules and raised them in sterilized soil.

The germinated propagules in the nursery were treated with cultured broth in different combinations. The team monitored soil and plant nutrient status for the different microbial treatments. After six months of inoculation, the growth of the seedlings was evaluated.

"A cocktail of all four microbes showed better growth performance. The soil nutrient status also improved", says Siva Priya, IFGTB.

"Microbes establish themselves in soil and regenerate continuously. So, treating seedlings at the nursery stage is a one-time fertilization", says Arumugam Karthikeyan, IFGTB.

Now, the forest department and other stakeholders need to utilize these microbes for successful mangrove afforestation.

J. Forestry. Res. **29** (4): 1093-1098

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Goat adaptation to climate change

Salem Black and Osmanabadi goats are distinct indigenous goat varieties – one originating from Osmanabad in Maharashtra and the other from Salem in Tami Nadu. While the Salem Black is black, you can find patches of white or brown on some Osmanabadi goats. The average Osmanabadi variety is slightly heavier, and has more separable fat and higher protein content. But in terms of the organoleptic properties, Salem Black has the advantage.

In the event of the forewarned climate change to higher temperatures, how will these two varieties respond? Will the quality of meat change in response to heat stress? Veerasami Segian from the ICAR-National Institute of Animal Nutrition and Physiology, Bangalore, set to find out.

The study involved the cooperation of the Kerala Agricultural University, the Kerala Veterinary & Animal Sciences University, the Hebbal Veterinary College and the National Institute of Veterinary Epidemiology & Disease Information, Karnataka.

The team sourced 12 goats each of the two varieties from their geographical origins. And six from each variety were exposed to the sun in the months of April-May while six from each variety were kept in shade. At the end, the team conducted a wide variety of tests to understand the tolerance of the two varieties to heat stress.

Heat stress affected both species. But it appears that Salem Black would win hands down in the event of warming. The breed is better adapted to heat than the Osmanabadi. The appearance, the texture, juiciness and flavour of the Salem Black are less affected by heat stress than in the case of the Osmanabadi.

The study has implications on present animal husbandry practices. Your goats will fare better if you don't tie them up in sunlight.

Meat Sci. **141**: 66-80 (2018)

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