



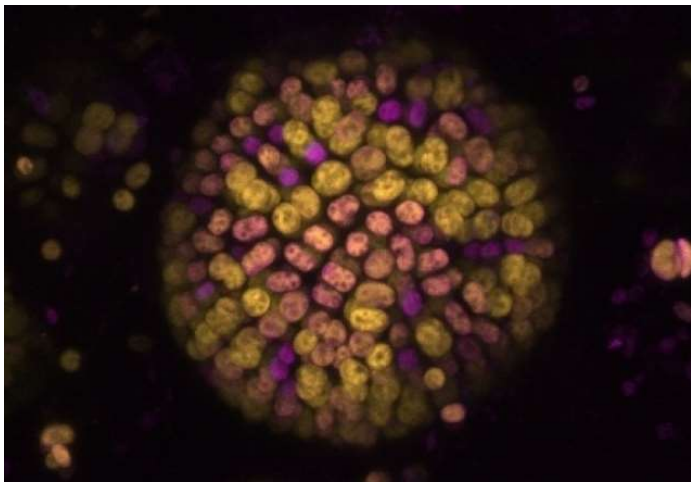
## **New Type of Photosynthesis discovered in Cyanobacteria mediated through “Chlorophyll-f” in shaded environment**

- J. H. Meshram

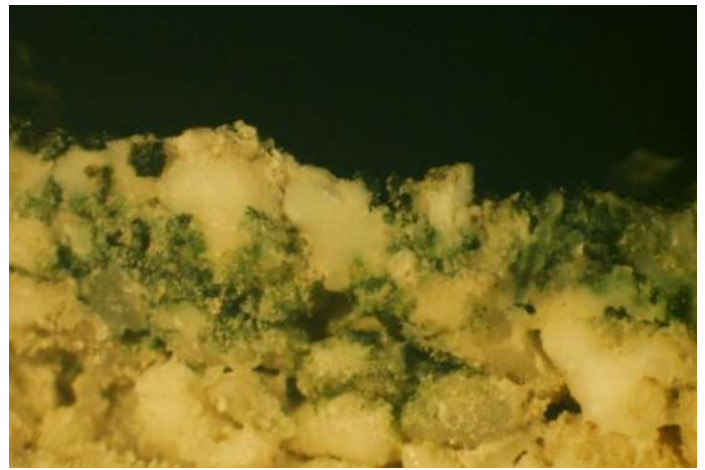
Most life on the earth living things like plants, algae, and even some microorganisms - gain energy due to photosynthesis, a process where sunlight, water, and carbon dioxide are used to make plant food. Chlorophyll-a is present in all plants, algae and cyanobacteria which absorbs light from visible red light for photosynthesis. Newly discovered Chlorophyll-f not only harvest the light but play the key role in photosynthesis under shaded conditions, and it is using lower-energy infrared light to do the complex chemistry. This is an important discovery in photosynthesis, a process that plays a crucial role in the biology of the crops that feed the world. Chlorophyll-f based photosynthesis, this third type of photosynthesis, is only used in special infrared-rich shaded conditions but in normal light conditions, the standard red form of photosynthesis is used. A new study published in Science reported that certain bacteria don't need white light, and instead use far red light for photosynthesis. The wavelength of visible light or white light is 400 to 700 nanometre, and till now plant biologists believed that all plants used red light (680 to 700 nm) for oxygenic photosynthesis. The new study shows that many cyanobacteria or blue-green algae can carry out photosynthesis in the far red light or near infrared light of 750 nm.

Plants and cyanobacteria use chlorophyll- rich photo-system complexes (Photosystems I and II) to convert solar energy into the chemical energy that powers life. Chlorophyll 'a' photochemistry, using red light (680 to 700 nm), is near universal and is considered to define the energy “red limit” of oxygenic photosynthesis. A new biophysical studies on the photosystems from a cyanobacterium grown in far-red light (750 nm), charge separation in photosystem I and II uses chlorophyll-f at 745 nm and chlorophyll-f (or d) at 727 nm, respectively. Each photosystem has a few even longer-wavelength chlorophylls-f that collect light and pass excitation energy uphill to the photochemically active pigments. These photosystems function beyond the red limit using far-red pigments in only a few key positions.

All photosynthetic organisms use chlorophyll-a for the process, but the researchers found that when cyanobacteria was grown in near- infrared light, chlorophyll a shuts down and a special chlorophyll, chlorophyll-f, performs the same task. Chlorophyll-f, which was long believed to be a helper in harvesting light, has now been found to play an important role in photosynthesis in shaded environments. Dr Andrea Fantuzzi, from the Department of Life Sciences at Imperial College, London reported that finding a type of photosynthesis that works beyond the red limit changes our understanding of the energy requirements of photosynthesis. This provides insights into light energy use and into mechanisms that protect the systems against damage by light.



Colony of cells where colors represents chlorophyll-a and -f driven photosynthesis



Cross-section of beach rock (Heron Island, Australia) showing chlorophyll-f containing cyanobacteria (green band) growing deep into the rock, several millimetres below the surface

**Reference:** Nürnberg et al., (2018). Photochemistry beyond the red-limit in chlorophyll f-containing photosystems' *Science*, 360 (6394): 1210-1213.

### International Yoga Day Organized at ICAR-Central Institute for Cotton Research, Regional Station Sirsa on 21<sup>st</sup> June, 2018

The international Yoga Day was organized at ICAR-Central Institute for Cotton Research, Regional Station Sirsa on 21st June, 2017 from 7.0-8.0am. Dr.O.P. Tuteja, Principal Scientist and In charge, ICAR-CICR Regional Station Sirsa welcomed the Yogacharya (Trainer) Shri Suresh Tayal, All staff and their family members for their participation. Many Assanas were demonstrated and performed by the trainer and were also practiced by the participants. The hour long activity was very useful and enjoyed by one and all. Refreshments were also served to the participants.



# Inter-state panel of experts to save cotton from whitefly

SUSHIL MANAV  
TRIBUNE NEWS SERVICE

CHANDIGARH, JULY 3

Agriculture scientists from Haryana, Punjab and Rajasthan will work in tandem to combat the challenge of whitefly, cotton leaf curl virus (CLCuV) and other infestations on cotton crop in the three states this year.

A panel comprising agriculture scientists from Chaudhary Charan Singh Haryana Agriculture University, Hisar; Punjab Agriculture University, Ludhiana; Swami Keshwanand Rajasthan Agriculture University, Bikaner; officers from the state agriculture departments of the three states and scientists of Sirsa-based Central Institute for Cotton Research (CICR), has already begun survey of the cotton fields in different groups.

Cotton has been planted on 6.40 lakh hectares in Haryana, 3 lakh hectares in Punjab and 2.30 lakh hectares in Sri Ganganagar and Hanumangarh districts



Farm workers in a cotton field. FILE PHOTO

of Rajasthan which comprise the cotton belt of north India.

Whitefly is a pest which damages crops by sucking sap from cotton leaves and also acts as carrier for CLCuV that destroys the crops by curling the leaves thereby hampering photosynthesis process which is necessary for growth of plants.

The region had witnessed the diseases in epidemic

form in 2015 when the cotton crop on entire 5.80 lakh hectares in Haryana, 4 lakh hectares in Punjab and that in Sri Ganganagar and Hanumangarh districts of Rajasthan was damaged.

Dr Dilip Monga, head of CICR, said that the panel "Inter-State Consultation and Monitoring Committee" will meet regularly to share information about whitefly in a particular region and devise com-

mon strategy to combat the attack.

The last meeting of the panel was recently held in Bathinda.

He has said that the crop so far is very good in all the three states and whatever little infestation of whitefly and thrips was being witnessed during 3rd and 4th week of June has been washed away by rains now.

"Climate so far has remained conducive to the crop. Atmospheric temperature remained mild till May 20 when high mercury could have burnt the saplings. Most of the sowings were over by May 20. Rains by June end and at the start of July are considered boon for cotton crop for its vegetative growth and exactly this has happened this year," said Dr Monga.

In Haryana, Sirsa, Fatehabad, Hisar, Jind and Bhiwani districts which are considered cotton belt of the state have witnessed good rains up to 60 mm in the past one week.



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