



Figure 1a, b. Habit of *Caulerpa lentillifera*. **c.** Habitat of *C. lentillifera*, exposed reef.

attachment to substratum to withstand the strong water currents. Plants prefer somewhat deeper localities and have been collected from rocks and rock pools of lower intertidal region and found associated with *Caulerpa macrophyssa* and species of *Dicthyota*.

Use of seaweeds as staple seafoods in human diet is well-known in Far East countries like Japan, Korea and China. Global food security will remain a worldwide con-

cern for the next 50 years¹⁰, due to growing differences in food-to-population ratio. This ever-increasing population is compelling us to opt for non-conventional, alternative food resources. Keeping in mind the potential of this alga as a vegetarian diet, it is worthwhile to consider it as suitable candidate for human food. I would further like to recommend culture experiments that may lead to large-scale cultivation of this alga in Indian waters.

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VAIBHAV A. MANTRI

Marine Algae and Marine Environment Discipline, Central Salt and Marine Chemicals Research Institute (CSIR), Gijubhai Badheka Marg, Bhavnagar 364 002, India
e-mail: salt@csir.res.in

Indian famines revisited

‘... the crops in India, as a whole have never failed, there has never been a single year when food supply of the country was insufficient for the people, and there must be something wrong, when failure in a single province brings on a famine, and the people are unable to buy their supplies from neighbouring provinces rich in harvests.’¹

While demanding scientific evidence from others, Bhatia² neither provides any evidence to support his statements nor adheres to logic. He does not provide any evidence

to support his assertion that crop failure was the sole and/or decisive cause of the Indian famines or to support that transgenic crops will never fail or have low failure rate. Worse, some of his core assertions are simply wrong.

My statement that crop failure was not the only cause of famines depicted in table 1 of the correspondence by Bhatia³, does not necessarily imply that the agrarian traditions based on ancient knowledge were the ‘best’, although it may be indeed true independently.

India is a subcontinent and as such the probability of crop failure on a national scale can rarely occur, if ever. Besides, India has a long coastline bordering the Indian Ocean, which in turn is a vast source of food. Therefore, crop failure can hardly cause famine in India, let alone with such a frequency and severity as was the case during the British occupation of India.

Deliberate political measures, supported by armed might, can, on the other hand, easily induce catastrophic famines, as has been demonstrated throughout history, in

India and elsewhere. Indeed famines are induced and used as instruments to control resistive populations by foreign occupiers. For example, between 1875 and 1900, during which period most of the severest famines in the entire Indian history occurred, annual grain exports from India increased from 3 to 10 million tons, a quantity that is equivalent to the annual nutrition of about 20 million people⁴. I should re-emphasize here that this haemorrhage ('As India must be bled...') occurred while the best lands were increasingly being used for non-food crops. During the famine of 1899–1900, when around 143,500 Beharis died directly from starvation, the province exported not only tens of thousands of bales of cotton, but an incredible 747,000 bushels of grain⁵. The 1942–45 famine is a direct consequence of the occupation policies in the form of (a) 'boat denial scheme', which resulted in the confiscation of 65,500 boats and as a consequence practically all fishing in the Bay of Bengal ceased and inland water navigation collapsed, (b) confiscation of land for military fortifications, which led to expulsion of 150,000 to 180,000 people from their land, making them homeless, and (c) export of food from the Bengal region in the framework of 'rice denial scheme'⁶.

Famines can also occur amidst plenty of food, if people are unable to buy it for the lack of money, which may result from severe unemployment. For example the official report on the 1899–1902 famine in Mumbai states: 'Supplies of food were at all times sufficient and it cannot be too frequently repeated that severe privation was chiefly due to the dearth of employment in agriculture (arising from drought)'⁵. Should we still continue to argue about the cause of the Indian famines during the occupation?

There is no point in recapitulating statistics after statistics to prove the fact that it was the policies of the occupiers – not crop failure – that have been the major, if not the sole cause of famines depicted by Bhatia³. Besides, the table is not complete. All these statistics naturally make the assertion by Bhatia³, 'Famines in India (listed in table 1 of ref. 3) were due to crop failure for several consecutive years' patently false.

Indeed it would be rather foolish to expect from a foreign occupation force to behave otherwise. Countries invade other countries in order to rob. This is a universal fact.

So-called traditional methods are certainly not rigid in the sense that they have not evolved or have not been adopted to suit

varying circumstances over time. Often these methods have high efficiency and minimum or no adverse environmental impact. They are called traditional because they are intrinsic to our societies and products of our civilizations. As anyone who has a rudimentary knowledge of history knows, science is not a prerogative of Europe or America alone. It is absurd to declare our methods as primitive and those of others as scientific. Do we have the scientific capability to create transgenic life forms? The answer is a clear yes. Whether we desire to release such life forms into the environment is a question of social responsibility.

Famines have little to do with traditional agricultural methods. I do not believe that the so-called Green Revolution should be regarded as a consequence of something different from traditional agricultural methods. After all, it is the introduction of new crop varieties bred by traditional methods on a large scale. Such 'revolutions' have been occurring all over the world throughout history. Is the introduction of potatoes and maize from the Americas to other parts of the world a 'modern' process? The reader is invited to learn how the traditional methods were coping with famines in a far more efficient way than the 'modern' occupation force of England⁵.

Besides, if crop failure is the cause of famines and transgenic crops are the way to prevent famines as Bhatia implies, are we to conclude that transgenic crops will never fail?

Transgenic crops contain foreign genes which make them either resistant to herbicides or enable them to produce toxins which are fatal to certain insects attacking these crops. Usually these toxins are also fatal to a class of 'harmless' insects as well. Targetting members of distinct classes will inevitably lead to targetting a broad spectrum of insects. This is what is called environmental poisoning. Coupled with gene flow, this would mean that we will have plants and animals in the environment which continue to manufacture toxins. Worse still, the population of such plants and animals may gradually increase. Indeed, naturally occurring plants and animals also produce such toxins. This does not mean that we need to add more, both qualitatively and quantitatively. I am not claiming that this will certainly occur. I am only claiming that this is a possible and a likely scenario, because no law of physics or for that matter, no law of biology categorically prevents it. There is nothing unscientific about it.

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M. KRISHNAPILLAI

Dadheru Khurd,
Dadheru Kalam,
Muzaffar Nagar
e-mail: ra_krish2002@yahoo.com

Response

As mentioned earlier¹, 'the purpose of communicating my comments to Tiwari's² call for reverting to 'Vedic' farming technology was that India cannot feed a population of billion plus without further modernizing its agriculture based on contemporary scientific knowledge and techniques'. I opposed his condemnation of the Green Revolution technology, and propagation of irrational belief that the traditional methods can feed the present population'. The word 'transgenic' was not mentioned anywhere in my comments³. In his response, Krishnapillai⁴ made a statement: 'Transgenic life forms have potential to poison the entire planet', which has no scientific basis, and hence, asked to provide evidence for the same¹. These are two unrelated issues: (1) the cause of famines in India listed in table 1 of my note³ and (2) transgenics. The causes of famines were stated in the previous correspondence¹. The mean foodgrains production in 1950–51 was 51 million tons from 97.3 million ha of cultivated area⁵. Per hectare productivity of traditional agriculture was 525 kg/ha (51/97.3 expressed in kg) that did not create adequate surpluses to sustain food availability during the periods of successive crop failures. The impact of the Green Revolution technology is well illustrated by enhanced wheat productivity in the country. In 1950–51, 12 million tons were produced from 14 million ha area under cultivation⁶ (mean yield = 857 kg/ha). In 1994–95, following the spread of new technology, 60