

plagiarism cases in the institutes. Undoubtedly, technological measures available today are effective to detect plagiarism and act as a deterrent to some extent. The threat perception of plagiarism is so manifest that just about every higher education and research institution wants access to a plagiarism-detection software.

In the era of instant access to journals, databases and other internet-based educational and research resources, it is natural that researchers are keen to have access to the plagiarism check tools too. In some universities, every student has access to the anti-plagiarism software. But is that a preferred situation? Imagine an author writing a paper, running it through the plagiarism detection tool, moderating portions that show similarity, re-checking and iterating till the software reports 0% similarity.

Unlike electronic journals and databases, plagiarism checking tools should not be ubiquitous in an institute, because it also has cost implications. Most anti-plagiarism softwares have pricing models based on the number of pages or documents checked. So, ideally speaking, a plagiarism-checking tool should be made available only to a monitoring team or to the librarian, so that rampant use leading

to potential misuse and overriding costs can be avoided.

In any case, a software is not required to disguise plagiarism. All that needs doing is to rewrite or carefully paraphrase texts so that 'similarity checking' done by the software is rendered ineffective as is the case with fabricated papers which the plagiarism tools cannot detect. The moot point is that, in spite of the availability of the 'similarity checking' based plagiarism softwares, producing seemingly clean but plagiarized copies are not difficult. This is where the concept of citation-based plagiarism detection (CbPD) comes in.

Bela Gipp in his 2013 doctoral thesis, 'Citation-based plagiarism detection: Applying citation pattern analysis to identify currently non-machine-detectable disguised plagiarism in scientific publications' showed, how well-disguised plagiarism, that otherwise is undetected by the existing plagiarism tools can be tracked by the citation-based model<sup>3</sup>. This model has garnered much attention, given that it goes beyond conventional similarity check and is based on analysing citation patterns of a questionable article and detects plagiarism, even if the text has been adequately disguised. To put it simplistically, citation-

based plagiarism detection goes beyond checking for similarities in the text and identifies and analyses similar patterns in the citation sequences of academic documents to compute similarity. In the case of articles in non-English languages, similarity checks would be ineffective but citation checks productive. While the model does not claim to be a replacement for existing 'similarity based' plagiarism checking tools, it does open new avenues for developing or integrating the mechanism into existing plagiarism or bibliographic tools.

1. Mukhi, S., *Curr. Sci.*, 2016, **110**(6), 955-956.
2. [http://www.thehindu.com/news/cities/Tiruchirapalli/ugc-mandates-universities-to-check-theses-with-antiplagiarism-software/article-7938979\\_ece](http://www.thehindu.com/news/cities/Tiruchirapalli/ugc-mandates-universities-to-check-theses-with-antiplagiarism-software/article-7938979_ece)
3. Gipp, B., Citation-based plagiarism detection, 2014; <http://gipp.com/wp-content/pape-rcite-data/pdf/thesisbelagipp.pdf>

G. MAHESH

*CSIR-National Institute of Science  
Communication and Information  
Resources,  
14-Satsang Vihar Marg,  
New Delhi 110 067, India  
e-mail: gmahesh7@gmail.com*

## Grafted papayas: a boon for dioecious papaya industry

Papaya (*Carica papaya* L.), regarded as the 'Wonder fruit of tropics and sub tropics', belongs to the family Caricaceae. The importance of papaya to agriculture and the world's economy is demonstrated by its wide distribution, substantial production in the tropical countries, besides its high nutritive value.

As papaya is more commonly propagated from seeds, its cultivation is hindered by problems due to the inherent heterozygosity, dioecious nature and susceptibility to a large number of viral diseases. Besides, plants grown from seeds of open pollinated flowers result in a mixture of genotypes, with a considerable variation in disease susceptibility, fruit quality and yield<sup>1</sup>. Moreover, a wide variability in sex expression and fruit characters is usually observed even in small population. In dioecious cultivars of papaya, equal probability of male and female plant population poses the prob-

lem of rouging excess male plants. Vegetative propagation method can be an alternative to seed propagation to overcome these constraints. Plants produced by vegetative propagation through grafting are known to be true to type in preserving the genotype of cultivars in any crop.

Grafting and inarching of promising papaya hybrids and inbreds onto *V. cauliflora*, a wild resistant to PRSV-P was found to delay the symptom expression in papaya<sup>2</sup>. The studies related to effect of rootstocks on growth, development and fruiting of cv. Trang Nguyen on six papaya varieties selected as rootstock showed that top grafting on papaya LD-1999 gave the highest percentage of survival (83.91% and 75.15%)<sup>3</sup>. Both the papaya LD-1999 and Kaegdum varieties gave significantly shorter seedlings than the control. In evaluation of phenology and production of *Carica papaya* 'Honey Gold' under cool subtropical conditions<sup>4</sup>,

the vegetative propagation of selected, red fleshed hermaphrodite types ensured the production of fruits of outstanding quality for discerning markets.

The grafting success (about 80%) through cleft method in 'Eksotika' papaya at nursery stage stressed the advantage of grafted papaya trees as they bear fruits much lower and earlier and are dwarf in stature with longer economic life cycle<sup>5</sup>. There is also potential in utilizing rootstocks for tolerance to 'wet-feet' and soil-borne diseases. A better approach of obtaining 100% hermaphrodite stand is by cleft grafting papaya seedling using healthy disease-free scions<sup>6</sup>. The higher percentage of success (80%) by side grafting was obtained after 15 weeks on the vigorous, well fertilized stocks surface sterilized with 10% sodium hypochlorite<sup>7</sup>.

Hence clonal propagation of papaya by cutting or grafting would be of great help

## CORRESPONDENCE

to the papaya industry. Attempts have been made in this direction in other papaya-growing countries such as South Africa, Brazil and USA. The effect of grafting on the fruiting of TaiNung No. 2 and TaiNung No. 5 papaya varieties revealed that grafted plants are shorter than the ungrafted seedlings; they did not show incompatibility between scion and rootstock and yielded better than ungrafted papaya trees<sup>8</sup>. In India, the cleft graft combination of Co. 2/9-1(D) performed during January, registered the maximum survival percentage under Coimbatore conditions<sup>9</sup>.

Thus by vegetative propagation, there is a possibility of maintaining the original characteristics of the parent plant apart from several advantages such as higher yield, lower fruiting height,

longer cropping span. The technique would be a great boon in papaya production especially the dioecious types.

1. <http://www.acgssr.org/BioTechnology/V2N2December1999/fullpaper/p.22.pdf>
2. Villegas, V. N. *et al.*, In Annual Scientific Conference, Philippines, Baguio City, 1997.
3. Nhat Hang, N. T. and Chau, N. M., 2000; [www.sofri.ac.vn/english/research\\_program/2000/trangnguyen.pdf](http://www.sofri.ac.vn/english/research_program/2000/trangnguyen.pdf)
4. Allan, P., *Acta Hort.*, 2007, **740**, 217–223.
5. Chong, S. T. *et al.*, *Acta Hort.*, 2007, **787**, 273–276.
6. Chong, S. T. *et al.*, In First International Symposium on Papaya, Genting Highlands, 2005, pp. 22–24.
7. Allan, P. *et al.*, *Acta Hort.*, 2010, **851**, 253–258.

8. Weng, S. W. and Yang, Y. S., 1999; <http://ir.lib.nchu.edu.tw/handle/309270000/30125>
9. Senthilkumar, S., PG dissertation submitted to TNAU, Coimbatore, India, 2011.

S. SENTHILKUMAR<sup>1,\*</sup>  
N. KUMAR<sup>2</sup>  
K. SOORIANATHASUNDARAM<sup>3</sup>  
K. ARUN KUMAR<sup>1</sup>

<sup>1</sup>*School of Agriculture,  
Lovely Professional University,  
Phagwara 144 411, India*

<sup>2</sup>*Horticulture College and Research  
Institute, and*

<sup>3</sup>*Department of Fruit Crops,  
Tamil Nadu Agricultural University,  
Coimbatore 631 003, India*

\*e-mail: [senthilshanmugam87@gmail.com](mailto:senthilshanmugam87@gmail.com)

## CO<sub>2</sub> levels and coral reefs

Existing atmospheric carbon dioxide (CO<sub>2</sub>) concentration at 400 ppm is worrisome<sup>1</sup>. One major reason for this is, dwindling CO<sub>2</sub> sinks. We are losing our natural capital, e.g. one of the available CO<sub>2</sub> sinks – coral reef – ‘the underwater forests’ which provide us the services by burial of CO<sub>2</sub> in their skeletons along with their photosynthetic symbiotic inhabitants (zooxanthellae). They play a significant role within an ocean ecosystem by providing food and habitat for 550,000 to 1,330,000 species<sup>2</sup>. This highlights the indirect but crucial contribution of corals in sequestering atmospheric carbon because oceans sequester 20–35% of anthropogenic CO<sub>2</sub> emissions<sup>3</sup>. It has been reported that coral reefs confer 7–15% of global calcium carbonate production, leading to carbon sequestration<sup>4</sup>. Corals carry a great socio-economic potential and bestow human life with valuable goods and services which accounts to an estimated value of over \$31 billion (US\$, 2014) annually, for all reefs combined. They support tourism through their aesthetic value, have biomedical uses, provide coastal protection and other industrially valuable compounds. But we as a human race ignored this natural wealth and eco-

logical infrastructure and have driven this marine wealth to depletion through our devastating actions. Warm water, destructive fishing practices, ocean acidification coupled with other factors led to massive destruction of corals<sup>5</sup>. This is evident from the adverse effects on the Great Barrier Reef, which in the recent years (1985–2012) has resulted in 50.7% of decline in the initial coral cover<sup>6</sup>; this will surely affect the whole ecosystem and the CO<sub>2</sub> balance thereby. However exact increase of CO<sub>2</sub> levels is not reported. Let us understand and manage our actions to save this iconic underwater property. Initiatives for their protection and prevention are however being taken by various government organizations but it is every individual’s responsibility to halt the anthropogenic damage to their fragile environment. Recently, a coral bleaching index was reported; designed for the purpose of standardizing and comparing the susceptibility of coral reefs to thermal bleaching<sup>7</sup>. Even some models are being applied for the evaluation of coral reef ecosystems to review diverse environmental effects on them<sup>8</sup>. Hopefully, these initiatives to preserve coral reefs will be a step to level off or may be to decrease the existing levels of CO<sub>2</sub>.

1. Monastersky, R., *Nature*, 2013, **497**, 13–14.
2. Wear, S. L. and Thurber, R. V., *Ann. N.Y. Acad. Sci.*, 2015, **1355**, 15–30.
3. Khatiwala, S., Primeau, F. and Hall, T., *Nature*, 2009, **462**, 346–349.
4. Zarate-Barrera, T. G. and Maldonado, J. H., *PLoS ONE*, 2015, **10**, e0126627.
5. Ganguly, S., *Int. J. Pure Appl. Biosci.*, 2016, **4**, 166–167.
6. De’ath, G., Fabricius, K. E., Sweatman, H. and Puotinen, M., *Proc. Natl. Acad. Sci.*, 2012, **109**, 17995–17999.
7. Swain, T. D. *et al.*, *Global Change Biol.*, 2016, **22**, 2475–2488.
8. Weijerman, M., Fulton, E. A. and Brainard, R. E., *PLoS ONE*, 2016, **11**, e0152577.

RITIKA VERMA  
ANIL KUMAR  
SUDHIR KUMAR\*

*Department of Biotechnology and  
Bioinformatics,  
Jaypee University of Information  
Technology,  
Waknaghat,  
Solan 173 234, India*  
\*e-mail: [syalsudhir@gmail.com](mailto:syalsudhir@gmail.com)