

**Genetically Modified Organisms
(Control of Release) Ordinance Cap. 607
Expert Group**

**Report on the Survey of Genetically Modified Organisms
in Hong Kong**

Purpose

This paper reports to Members on the findings of the survey conducted on genetically modified organisms (GMOs) in local markets and farms during 2014-15 and 2015-16.

Background

2. The Agriculture, Fisheries and Conservation Department (AFCD) conducts regular surveys on GMOs in Hong Kong, covering various living organisms available from markets and farms which could possibly be genetically modified. Samples are collected according to the GMO survey plans, which are updated annually making reference to the list of GMOs commercialised or being under field trial overseas, with minor adjustments depending on sample availability or ad hoc issues. The surveys enable the Government to closely monitor the status of GMOs in Hong Kong and to serve as a complementary enforcement measure under the Genetically Modified Organisms (Control of Release) Ordinance, Cap. 607 (the Ordinance).

3. Surveys in the last few years have found that a substantial proportion of papaya fruits sold as food in the market and papaya plants grown in the local environment are GMOs. Besides, a small amount of agricultural products which were intended to be used as food, feed or for processing or for contained purposes, including soybean, watermelon, radish, wheat, animal feed, and carnation, were found to be genetically modified¹. On the other hand, genetically modified (GM) zebra

¹ Please refer to the following website for the results of GMO surveys from 2008 to 2014.
http://www.afcd.gov.hk/english/conservation/con_gmo/gmo_edu/gmo_edu_survey.html

fish (*Danio rerio*) and rice fish (*Orzias cf. laticeps*) were found in aquarium fish markets.

4. In 2014-15 and 2015-16, we collected and tested 1225 and 520 samples, respectively, covering a variety of fruits, vegetables, grains, ornamental flowers and aquarium fish. In order to find out the extent of planting of GM papaya in Hong Kong, we have included 608 locally grown papaya samples for testing in these two years. Papayas tested positive for genetic modifications were further tested to identify their variety. The survey of these two years also included 50 aquarium fish samples which were claimed or suspected to be fluorescent. In addition, we also sampled some wild-caught native rice fish (*Oryzias curvinotus*) in 2015-16 to see if they carry the GM markers.

Results

5. Summaries of the GMO test results for 2014-15 and 2015-16 are at **Annex 1 and 2**. Among the 1,745 samples collected, GMO were found among the locally grown papaya plants (369 samples), papaya fruits from markets (87 samples), and aquarium fish, including zebra fish and rice fish (32 samples).

6. The GM papaya made up 61% (369 out of 608) of the locally grown papaya plants sampled and 68% (87 out of 128) of the papaya fruits sampled from markets in 2014-15 and 2015-16. These percentages of GM papaya are similar to the range observed in the last three years from 2011 to 2014, i.e. 49-60% for locally grown papaya plants, and 48-69% for papaya fruits from the markets².

7. **Annex 3** shows the identities of the locally grown GM papaya samples (A) and GM papaya fruit samples from markets (B). All of the 369 locally grown GM papaya samples in 2014-15 and 2015-16 belong to GM strains that are engineered to be resistant to the *papaya ringspot virus* (PRSV). Among them 292 samples were found to belong to the TW-lines³ (79% of the locally grown GM papaya), 59 samples

² See Table 1 and 2 (p. 3 and 4) of earlier Discussion Paper GMO/04/2015 in the 3rd Meeting of the GMO Expert Group:
http://www.afcd.gov.hk/english/conservation/con_gmo/gmo_exp/files/Discussion_Paper_GMO_04_2015.pdf.pdf

³ The TW-lines include two GM varieties, i.e. the transformation events 16-0-1 (U.S. Patent No. US8258282-B2 by Yeh S.-D. et al.) and 18-2-4 (U.S. Patent No.: US8232381-B2 by Yeh S.-D. et al.). These two GM varieties are resulted from the same vector plasmid and carry very similar transgene insert, but they differ in their insert position and the sequence of the transgene insert margins.

were Huanong-1⁴ (16%), two samples were 55-1 (“CUH-CP551-8” or commonly called “Hawaiian Papaya”⁵) (0.5%), and 15 samples (4%) were hybrids of two or more GM strains⁶. The 2014-15 survey also found a locally grown papaya sample which was tested positive to a GM-strain that was developed to be resistant to both PRSV and the *papaya leaf-distortion mosaic virus* (PLDMV)⁷, hereafter called Double Resistances or DR.

8. As for the 87 GM papaya fruits from the markets sampled in 2014-15 and 2015-16, 61 samples were of the TW-lines (70% of the GM papaya fruits from markets), 24 samples were 55-1 (28%) and two samples were Huanong-1 (2%).

9. As for aquarium fish samples, out of the 50 samples collected in the 2014-15 and the 2015-16 surveys, 32 fish samples were found to be GM positive, including zebra fish and rice fish samples. Among these 32 samples, 29 samples were zebra fish modified with red fluorescent protein gene, and the remaining three were rice fish modified with green fluorescent protein gene. On the other hand, none of the native rice fish caught in the wild was found to be genetically modified.

GM papaya

10. The Genetically Modified Organisms (Control of Release) (Exemption) Notice, Cap. 607B (the Notice) exempts all varieties of GM papaya from the application of section 5 of the Ordinance, which provides that a person must not knowingly cause a GMO to be released into the environment or maintain the life of a GMO that is in a state of being released into the environment. Therefore, it is not an offence under the Ordinance that a person grows or maintains in the field the GM papaya found in the present surveys.

⁴ Guo, J., Yang, L., Liu, X., Guan, X., Jiang, L. and Zhang, D. 2009. Characterization of the Exogenous Insert and Development of Event-specific PCR Detection Methods for Genetically Modified Huanong No. 1 Papaya. *J Agric Food Chem.* 57:7205-7212.

⁵ USDA/APHIS. 1996. USDA/APHIS petition 96-051-01P for the determination of nonregulated status for transgenic sunset' papaya lines 55-1 and 63-1: environmental assessment and finding of no significant impact. http://www.aphis.usda.gov/brs/aphisdocs2/96_05101p_com.pdf

⁶ These samples carry markers of both TW-lines and Huanong-1.

⁷ Kung, Y.-J., Bau, H.-J., Wu, Y.-L., Huang, C.-H., Chen, T.-M., and Yeh, S.-D. 2009. Generation of transgenic papaya with double resistance to papaya ringspot virus and papaya leaf-distortion mosaic virus. *Phytopathology* 99(11): 1312-20.

11. Moreover, the Ordinance does not require prior approval for the import or use of GMOs intended for direct consumption as food or feed, or for processing (GMOs-FFP), such as the GM papaya being sold as food in markets found in the present surveys. However, when the shipments of the GM papaya are being imported, they have to be accompanied with prescribed documents to enable easy identification of the GMOs and to provide the contact points for further information.

GM aquarium fish

12. GM fluorescent fish being kept in contained setting for research purposes or aquarium display does not require prior approval for their import and use. On the other hand, it is an offence under the Ordinance to knowingly release the GM fluorescent fish into the environment like streams and rivers⁸. AFCD regularly inspects aquarium fish shops selling GM fluorescent fish to see if appropriate measures are taken to prevent the fish from escaping to the environment. The collected aquarium fish sampled were found to be sold in sealed transparent plastic bags and thus they are unlikely to be released into the environment.

13. Aquarium fish retailers found to sell GM fluorescent fish during our market survey were issued letters to remind them about the controls of the Ordinance and the relevant import/export documentation requirements. They were also reminded to take measures to confine their GM fish in contained use and to advise their customers of doing so to prevent the environmental release of these GMOs. In addition, circular letters together with relevant promotional pamphlets were distributed to 60 local shops participated in aquarium fish trade in May 2016, to remind them about the controls of the Ordinance. Moreover, 1,600 copies of updated promotional pamphlets on controls of the Ordinance and GM aquarium fish were also distributed in nine country park visitor centres and the Hong Kong Wetland Park, to remind the public not to release GM aquarium fish to the environment.

14. Besides, freshwater habitats are closely monitored under AFCD's territory-wide biodiversity survey programme for presence of exotic fish, including the GM aquarium fish. So far, zebra fish has not been found in our biodiversity survey programme. The GM rice fish samples belong to a species (*Oryzias* cf. *latipes*), which has not been found in the freshwater habitat in the countryside of Hong Kong. We will also continue our survey of the native rice fish *Oryzias*

⁸ Section 5 of the Ordinance.

curvinotus to monitor the presence of the fluorescent protein gene in the local population.

Advice Sought

15. Members are invited to note the survey results and provide views and comments.

Agriculture, Fisheries and Conservation Department
February 2017

Summary of GMO Test Results 2014/15

	Number of tested samples	Surveyed species	Number of positive samples	Species of samples with positive result
Fruits from markets	108	Apple, grape, melon, papaya, pineapple, <i>Prunus</i> , watermelon	53	Papaya
Vegetables from markets	152	Avocado, beetroot, <i>Capsicum</i> , french bean, cowpeas, eggplant, gourd, maize, pea, potato, sugar cane, tomato	0	
Animal feeds	20	Animal feed (mixed seeds), <i>Avena</i> , maize, rice, sunflower	0	
Other foods from markets	25	Flaxseed, peanut, millet, soybean, wheat	0	
Seeds	110	Alfalfa, beetroot, <i>Brassica</i> , <i>Capsium</i> , eggplant, gourd, maize, melon, papaya, tomatillo, sunflower, tomato, watermelon	0	
Locally grown crops	779	Beetroot, <i>Brassica</i> , <i>Capsicum</i> , cassava, cowpeas, eggplant, gourd, maize, papaya, pea, pineapple, potato, radish, rice, sugar cane, tomato, watermelon	345	Papaya
Ornamental flowers and aquarium fish	31	Carnation, rose, <i>Pterophyllum</i> , <i>Puntius</i> , <i>Rasbora</i> , rice fish, zebra fish	9	Zebra fish
Total	1225		407	Papaya, zebra fish

Summary of GMO Test Results 2015/16

	Number of tested samples	Surveyed species	Number of positive samples	Species of samples with positive result
Fruits from markets	77	Apple, <i>Cucumis</i> , grape, papaya, pineapple, <i>Prunus</i> , watermelon	34	Papaya
Vegetables from markets	68	Beetroot, <i>Capsicum</i> , eggplant, gourd, maize, potato, soybean, sugar cane, tomato	0	
Animal feeds	11	Animal feed (mixed seeds), maize, sunflower	0	
Other foods from markets	30	flaxseed, peanut, soybean, wheat	0	
Seeds	99	Alfalfa, beetroot, <i>Brassica</i> , <i>Capsium</i> , <i>Cucumis</i> , eggplant, gourd, maize, papaya, radish, rice, sunflower, tomato, watermelon	0	
Locally grown crops	182	Beetroot, <i>Brassica</i> , <i>Capsicum</i> , cassava, eggplant, gourd, maize, papaya, potato, radish, rice, sugar cane, tomato, watermelon	24	Papaya
Ornamental flowers and aquarium fish	53	Carnation, rose, rice fish, zebra fish, wild caught <i>Oryzias curvinotus</i>	23	Rice fish, zebra fish
Total	520		81	Papaya, rice fish, zebra fish

Test results for papaya sampled in 2014/15 and 2015/16**A) Locally grown papaya plants**

Year		2014-15	2015-16	Overall
Samples collected		565	43	608
GM positive		345	24	369
Strains	TW-lines	273	19	292
	Huanong-1	55	4	59
	55-1	2	0	2
	DR	1	0	1
	Hybrid (TW-lines x Huanong-1)	14	1	15

B) Papaya fruits from markets

Year		2014-15	2015-16	Overall
Samples collected		78	50	128
GM positive		53	34	87
Strains	TW-lines	38	23	61
	Huanong-1	2	0	2
	55-1	13	11	24