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REPORT ON THE ANGLOPHONE AFRICAN LABORATORY TRAINING WORKSHOP ON DETECTION AND IDENTIFICATION OF LIVING MODIFIED ORGANISMS, ABUJA, 16-20 SEPTEMBER 2019

INTRODUCTION

1. At its ninth meeting, in decision CP-9/11, the Conference of the Parties serving as the meeting of the Parties to the Cartagena Protocol on Biosafety requested the Executive Secretary to continue to collaborate with relevant organizations and to build the capacity of developing countries in relation to the detection and identification of living modified organisms (LMOs) in the context of Article 17, in particular by focusing on regions that had not yet benefited from recent capacity-building activities.

2. Similarly, in decision CP-9/3 on capacity-building, the Parties also requested the Executive Secretary to facilitate and support the implementation of the priority capacity-building activities for supporting the implementation of the Cartagena Protocol.

3. With financial support from the Government of the Republic of Korea, through the Korea Biosafety Capacity-Building Initiative, and in collaboration with the Nigerian Federal Ministry of Science and Technology, the Nigerian National Biotechnology Development Agency, the Nigerian National Biosafety Management Agency and the International Centre for Genetic Engineering and Biotechnology (ICGEB), the Secretariat of the Convention on Biological Diversity organized the Anglophone African Laboratory Training Workshop on Detection and Identification of Living Modified Organisms, which was held in Abuja from 16 to 20 September 2019.

4. The objectives of the course were to provide theoretical and practical laboratory training for participants on the detection and identification of living modified organisms, including sampling, deoxyribonucleic acid (DNA) detection methodologies, analysis of results, interpretation of analytical results and reporting.

5. The training workshop consisted of plenary sessions and laboratory work. Documents for the course are posted at https://www.cbd.int/meetings/CP-DI-WS-2019-01.

6. In total, 22 participants attended the workshop, representing 15 countries from the Anglophone African region (annex II contains the full list of participants).

ITEM 1. OPENING OF THE WORKSHOP

7. The workshop was opened by Ms. Toyin Omozuwa, chairperson of the Local Organizing Committee, at 9:30 a.m. on Monday, 16 September 2019. In her remarks, Ms. Omozuwa welcomed all the participants and the resource team to Abuja, and to the National Biotechnology Development Agency. Participants and resource personnel were then given an opportunity to introduce themselves before proceeding to the opening remarks.

8. Ms. Shakirat Ajenifujah-Solebo, Deputy Director of the Agricultural Biotechnology Department at the National Biotechnology Development Agency, gave an overview of the goals for the training workshop. In her comments, she emphasized the importance of detection and identification of LMOs for enhancing the individual capacity of all participants and for the benefit of their countries. She

acknowledged the support of ICGEB, the Secretariat of the Convention on Biological Diversity and the National Biosafety Management Agency in the successful hosting of the training workshop.

9. Mr. Austein McLoughlin, from the Secretariat of the Convention, welcomed the participants to the course. He expressed gratitude to the Government of the Republic of Korea for its generous financial support through the Korea Biosafety Capacity-Building Initiative, ICGEB for their collaboration, and the Nigerian Government partners, the Federal Ministry of Science and Technology, the National Biosafety Management Agency, and the National Biotechnology Development Agency, for their support and cooperation.

10. Mr. Felix Moronta, from ICGEB, thanked the Nigerian Government hosts and the Secretariat for their collaboration in facilitating the workshop and highlighted the support of ICGEB for capacity-building in biosafety.

11. Mr. Rufus Ebegba, Director General of the National Biosafety Management Agency, welcomed participants to Abuja and wished them a successful workshop. In his opening remarks, he underlined the importance of ensuring the safety of biotechnology, as well as capacity-building activities in the field of biosafety.

12. Mr. Nashiru Oyekanmi, representing the Acting Director General of the National Biotechnology Development Agency, welcomed all participants and resource team members. He also encouraged participants to share knowledge on the subject of detection and identification of LMOs.

13. Mr. Nasiru Ibrahim, Director, Agricultural Biotechnology Department of the National Biotechnology Development Agency, thanked the Minister of Science and Technology, Mr. Ogbonnaya Onu, for his support for the workshop. Furthermore, he thanked the local organizing team and the international representatives for their collaboration in organizing the workshop. Finally, he wished all attendees a successful workshop.

14. Following the opening remarks, Ms. Ajenifujah-Solebo introduced the programme of work (see annex I), which was based on the provisional programme of work annexed to the annotated provisional agenda (CBD/CP/DI/WS/2019/1/1/Add.1).

15. On Tuesday, 17 September 2019, further opening remarks were given. Mr. Alex Akpa, Acting Director General of National Biotechnology Development Agency, commended the local organizers, the Secretariat and ICGEB for convening a meeting for participants from a number of different countries, aimed at sharing their experiences and deepening their knowledge in the area of detection and identification of LMOs.

16. Following Mr. Akpa, the Minister of Science and Technology, Mr. Ogbonnaya Onu, addressed the participants. In his statement, he welcomed all attendees to Nigeria and emphasized the importance of science, technology and innovation while also ensuring the safety of genetic engineering and biotechnology. Furthermore, he thanked the sponsors and partners of the workshop, such as the Secretariat, ICGEB, the National Biosafety Management Agency and National Biotechnology Development Agency, for bringing capacity-building to Nigeria. He declared the workshop open and wished participants and resource persons a successful training programme.

17. On the basis of the provisional agenda prepared by the Secretariat, the following agenda was adopted:

1. Opening of the workshop:
2. Overview of biosafety and the Cartagena Protocol on Biosafety:
    - 2.1. Introduction and history of living modified organisms;
    - 2.2. Overview of the Cartagena Protocol on Biosafety and the Biosafety Clearing-House.
3. Introduction to the detection and identification of living modified organisms:
    - 3.1. Handling and preparation of test samples for detection and identification;
    - 3.2. DNA detection and identification methodologies;

3.3. Experimental design, data analysis and reporting;
3.4. Quality assurance and control in the detection and identification of living modified organisms;
3.5. Method verification;
3.6 Review of LMO analytical workflow.

4. Biosafety frameworks for the detection and identification of living modified organisms:
4.1. African GMO Network;
4.2 Overview of the detection and identification of living modified organisms and biosafety regulations in Nigeria;
4.3. ICGEB e-Learning platform for biosafety;
4.4. Sharing experiences of detection and identification in the African region.

5. Conclusions and recommendations:
5.1. Evaluation of the workshop and feedback;
5.2. Closure of the workshop.

ITEM 2. OVERVIEW OF BIOSAFETY AND THE CARTAGENA PROTOCOL ON BIOSAFETY

2.1 Introduction and history of living modified organisms

18. Mr. Abolade Afolabi, Professor of biotechnology at the Sheda Science and Technology Complex, presented a historical overview of the techniques used when creating and developing LMOs, considering techniques as Agrobacterium-mediation transformation and particle bombardment, and how those techniques differed from traditional plant breeding techniques.

2.2 Overview of the Cartagena Protocol on Biosafety and the Biosafety Clearing-House

19. Under this agenda item, Mr. Austein McLoughlin, from the Secretariat of the Convention on Biological Diversity, provided an overview of the general concepts related to biosafety and the Cartagena Protocol on Biosafety, as follows:

(a) History of the Cartagena Protocol and main provisions;

(b) Relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Cartagena Protocol;

(c) Overview of ongoing related activities;

(d) Review of how to use the Biosafety Clearing-House to find information related to the detection and identification of LMOs.

ITEM 3. INTRODUCTION TO THE DETECTION AND IDENTIFICATION OF LIVING MODIFIED ORGANISMS

3.1. Handling and preparation of test samples for detection and identification

19. Under this agenda item, Mr. Felix Moronta presented the theory for the handling and preparation of samples for use in analytical workflows. In particular, the session focused on sample management and homogenization, including sample size, sample processing, mass reduction, storage and avoidance of contamination. He also highlighted the international standards ISO 6497, 17025 and 24276[1] related to sampling of feed stuffs, testing and calibration laboratories and methods for analysis for the detection of genetically modified organisms (GMOs) and derived products.

[1] Animal feeding stuffs – Sampling: https://www.iso.org/standard/12872.html;
General requirements for the competence of testing and calibration laboratories: https://www.iso.org/standard/39883.html;
Foodstuffs – Methods of analysis for the detection of genetically modified organisms and derived products: https://www.iso.org/standard/37125.html;

20. Following the theoretical background, participants performed DNA extractions of cotton (*Gossypium hirsutum*), soybean (*Glycine max*) and maize (*Zea mays*) seeds using either a commercial DNA extraction kit or cetyltrimethylammonium bromide extraction methodologies. The participants then learned how to assess and interpret the quality of their DNA extractions using gel electrophoresis and spectrophotometry.

3.2. DNA detection and identification methodologies

21. Under this agenda item, Mr. Frank Narendja, from the Environment Agency Austria, and Mr. Felix Moronta provided a theoretical background for the qualitative and quantitative detection and identification of LMOs, considering protein and DNA screening methodologies. The presentations provided information on lateral strip testing, enzyme-linked immunosorbent assay and different types of polymerase chain reaction (PCR) protocols, such as qualitative PCR, real-time PCR and nested PCR. A matrix screen approach was also presented, and participants further recognized a variety of factors (environmental conditions, monoclonal antibody specificity, etc.) that could affect protein detection methodologies and briefly reviewed new technologies for detection and identification.

22. After acquiring a theoretical training on PCR, participants had an opportunity to gain practical experience by performing PCR to detect *Agrobacterium tumefaciens cp4-espsps*, soybean *lectin*, *Bacillus thuringiensis cry 1Ab/Ac* and maize *alcohol dehydrogenase 1* genes. The results of the PCR were interpreted using gel electrophoresis.

3.3. Experimental design, data analysis and reporting

23. Participants took part in a seminar detailing experimental design, data analysis, and interpretation. Mr. Narendja highlighted different factors in quantitative analysis, including limit of detection, amplification efficiency, linearity and consistency. The ISO 21570:2005(E)[2] standard was also presented. In that session, participants learned how to write a report and how to communicate the results of a laboratory analysis to the regulatory authority effectively. Reporting guidelines and the use of appropriate language in a scientific report was stressed. Differences in the ISO 21570 and 24276 were detailed. Ms. Ajenifujah-Solebo took participants through the interpretation of the data generated from the practical laboratory experiments, the use of reference methods in the identification and detection of LMOs and information required to identify and detect LMOs using element- or taxon-specific experiments. Participants presented their results from their PCR analysis in the form of a report. Some participants followed the ISO 21570 standard.

3.4. Quality assurance and control in the detection and identification of living modified organisms

24. During this session, workshop facilitators presented the aspects of quality assurance and control, focusing on laboratory organization and method verification, in the context of internationally recognized standards. Furthermore, participants considered sources of validated information for use in the detection and identification of LMOs, such as the following databases: EUropean GMO INItiative for a Unified database System, GMO Detection Method Database, CropLife International Detection Methods Database, GMO Seek, European Union Reference Laboratory for GM Food and Feed Joint Research Centre (JRC) GMO-Matrix application, Organisation for Economic Co-operation and Development Biotrack Product Database and International Service for the Acquisition of Agri-Biotech Applications GM Approval Database.

3.5. Method verification

25. In responding to requests from the participants, Mr. Narendja presented on method verification, detailing method development, in-house validation, inhibition, collaborative trails and verification. The JRC Scientific and Technical Report EUR 24790-2011[3] was highlighted as a useful resource.

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[2] Foodstuffs – Methods of analysis for the detection of genetically modified organisms and derived products — Quantitative nucleic acid based methods: https://www.iso.org/standard/34615.html

[3] Verification of analytical methods for GMO testing when implementing interlaboratory validated methods (Hougs et al., 2017), available at http://gmo-crl.jrc.ec.europa.eu/ENGL/docs/WG-MV-Report-version-2.pdf

3.6. Review of LMO analytical workflow

26. As a summary for all participants, a video from the European Commission JRC was shown that demonstrated all steps in the analytical flow of LMO testing, from sampling to interpretation of the analysis.

ITEM 4. BIOSAFETY FRAMEWORKS FOR THE DETECTION AND IDENTIFICATION OF LIVING MODIFIED ORGANISMS

4.1 African GMO Network

26. Ms. Ajenifujah-Solebo presented recent updates and developments of the African GMO Network since the joint meeting with the European Union JRC in October 2018. In particular, participants were urged to participate in the regional laboratory networks in the western, central, eastern, and southern African regions.

4.2. Overview of the detection and identification of living modified organisms and biosafety regulations in Nigeria

27. Ms. Josephine Amedu, Head of the GM laboratory at the National Biosafety Management Agency, presented an overview of the structure and role of the Nigerian biosafety framework with respect to the analysis and regulation of LMOs. Ms. Chinyere Nzediru made presentations on dossier assessment and the approval process of the National Biosafety Management Agency for applications on GMO activities at containment, field trials and commercial release stages.

28. Following the presentations, the session on the National Biosafety Management Agency started with participants and resource team given a tour of the National Biosafety Management Agency's molecular biology laboratory and associated facilities. During the tour, Mr. Ebegba welcomed the participants and resource team to the National Biosafety Management Agency and emphasized the commitment of Nigeria to the Convention on Biological Diversity and the Cartagena Protocol on Biosafety. He mentioned that developing detection and identification capacities were essential for the effective implementation of the Convention and the Protocol.

4.3. ICGEB e-Learning platform for biosafety

29. Mr. Felix Moronta gave an overview of the ICGEB e-Learning Showcase[4] modules on biosafety and how participants, and their institutions, would be able to access tools to promote capacity-building online.

4.4. Sharing experiences of detection and identification in the African region

30. Following a presentation of the results of their PCR analysis, participants reported on the group assignment to share their national experiences regarding the status of biosafety legislation, as well as detection and identification of LMOs in their respective countries.

ITEM 5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Evaluation of the workshop and feedback

31. An evaluation form was distributed to the participants to collect their feedback on the workshop. The responses are summarized in annex III.

5.2. Closure of the workshop

32. Following the customary exchange of courtesies, the workshop closed at 1.30 p.m. on Friday, 20 September 2019.

[4] https://showcase-icgeb.elearning.it/

Annex I

PROGRAMME OF WORK FOR THE ANGLOPHONE AFRICAN LABORATORY TRAINING WORKSHOP ON DETECTION AND IDENTIFICATION OF LIVING MODIFIED ORGANISMS

Date	*Activity*
Monday, 16 September 2019	
Morning	**Item 1. Opening of the workshop**
	Registration of participants
	Welcoming remarks Organization of work
	Item 3. Introduction to the detection and identification of LMOs
	Item 3.1. Handling and preparation of test samples for the detection and identification of living modified organisms
Afternoon	Item 3.1. (*continued*)
Tuesday, 17 September 2019	
Morning	Item 1. Welcoming remarks (*continued*) Item 3.2. DNA detection and identification methodologies for LMOs
Afternoon	Item 3.2. (*continued*)
Wednesday, 18 September 2019	
Morning	Item 3.2. (*continued*)
	Item 3.3. Experimental design, data analysis, and reporting
Afternoon	Item 3.3. (*continued*)
	Item 3.4. Quality assurance and control in the detection and identification of LMOs
	Item 4: Biosafety frameworks for detection and identification of LMOs
	Item 4.1 African GMO Network
Thursday, 19 September 2019	
Morning	Item 3.5. Method Verification
	Item 3.6 Review of LMO analytical workflow
Afternoon	Item 4.2 Overview of the detection and identification of LMOs and biosafety regulations in Nigeria
Friday, 20 September 2019	
Morning	Item 4.3 ICGEB e-Learning Platform for biosafety
	Item 3.3 (*continued*) Presentation of report
	Item 4.4 Sharing experiences of detection and identification in the African region
	Item 5. Conclusions and recommendations of the workshop
	Item 5.1. Evaluation of the workshop and feedback
	Item 5.2. Closure of the workshop

Annex II

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Annex III

EVALUATION QUESTIONNAIRE AND RESULTS

Participants were invited to evaluate the course by completing the questionnaire below. Participants were instructed to select the answer that best reflected their assessment of the course.

The questionnaire was completed by 22 participants. The number of respondents for each option is shown below. Overall, the participants found the workshop helpful and felt that they were leaving with a greater understanding of how to detect and identify living modified organisms. In particular, the theoretical presentations regarding the quantitative methodologies and verification were found to be the most liked portion of the workshop. Participants found the presentations on the Biosafety Clearing-House and real-time polymerase chain reaction help as well. The opportunity for participants to network and connect with other professionals in the region was valuable.

Regarding the practical session, participants found the sessions useful. However, some participants suggested that improved organization of the practical sessions and practical exercises on quantitative polymerase chain reaction would improve future workshops. A few participants noted that the workshop could be extended for an additional three days to a week to allow for further practical training in the area of detection and identification. Furthermore, a few participants requested more of a focus on validation and verification methods during the theoretical section.

A. Overall assessment			
	# of Yes	**# of No**	**% of Yes**
1. During the workshop, were you able to acquire knowledge related to:			
(a) The Cartagena protocol and its approach towards detection and identification of LMOs	22	0	100
(b) A theoretical understanding of how LMOs are detected and identified	22	0	100
(c) Practical (laboratory) experience in the detection and identification of LMOs	20	1	95

	Exceeded	**Met**	**Partly met**	**Did not meet**	**Percentage exceeded**	**Percentage met**
2. To what extent were your expectations regarding the workshop met?	2	14	4	1	10	67
	Very relevant	**Somewhat relevant**	**Not relevant**	**Percentage relevant**	**Percentage somewhat relevant**	
3. How	18	4	0	82	18	

B. Content and facilitation of the workshop							
	Average rating	**Excellent**	**Good**	**Adequate**	**Poor**	**Very Poor**	**Not Applicable**
The objectives of the workshop were clear	4.4	9	12	1	0	0	0

B. Content and facilitation of the workshop							
	Average rating	**Excellent**	**Good**	**Adequate**	**Poor**	**Very Poor**	**Not Applicable**
Quality of the training material	4.1	8	11	1	2	0	0
Quality of presentations	4.3	11	8	2	1	0	0
Organization of the sessions	3.3	1	9	9	2	1	0
Balance and relevance of topics	4.0	5	12	4	0	0	0
Overall assessment of the facilitators	4.1	6	8	3	1	0	0
Usefulness of each topic							
Opening of the workshop	4.1	6	8	3	1	0	0
Overview of Biosafety and the Cartagena Protocol on Biosafety	4.1	5	12	2	1	0	0
Introduction to the detection and identification of LMOs	4.4	9	10	1	0	0	0
Biosafety frameworks for the detection and identification of LMOs	4.2	9	9	4	0	0	0
Overall clarity of the workshop	4.0	5	12	4	1	0	0
Overall assessment of the workshop	3.8	3	14	3	2	0	0

Note: Excellent = 5, Good = 4, Adequate = 3, Poor = 2, and Very Poor = 1

C. Logistics							
	Average rating	**Excellent**	**Good**	**Adequate**	**Poor**	**Very Poor**	**Not applicable**
Time for distributing the invitations, agenda, and relevant materials	4.5	12	9	1	0	0	0

Sufficient time for discussion and participation	4.1	7	9	5	0	0	0
Delivery time of travel arrangements and expenses	4.3	11	6	4	0	0	1
Duration of the workshop	3.8	4	9	7	1	0	0
Quality of the venue and facilities	3.6	3	10	6	1	1	0
Planning and overall organization	3.8	4	12	3	1	1	0

Note: Excellent = 5, Good = 4, Adequate = 3, Poor = 2, and Very Poor = 1