Submission of information related to the detection and identification of living modified organisms pursuant to paragraph 3 of decision CP-10/11

Part I. Endorsement of submission

Name of Country/Organization: Outreach Network for Gene Drive Research

Name of Cartagena Protocol Focal point/Head of Organization endorsing: Isabelle Coche

Signature of the Cartagena Protocol Focal Point/ Head of Organization:

Date: November 24, 2023

Part II. Submission of information

In decision CP-10/11, the Conference of Parties serving as a meeting of the Parties to the Cartagena Protocol on Biosafety (COP-MOP) invited Parties and relevant organizations to submit information on their experience with new detection techniques, detecting newly developed and unauthorized living modified organisms and developing reference materials, as well as ongoing collaborations involving national and regional laboratories. At its twenty-sixth meeting, the Subsidiary Body on Scientific, Technical and Technological Advice to consider the information submitted and prepare a recommendation on the need to update Biosafety Technical Series 05: *Training Manual on the Detection and Identification of Living Modified Organisms in the Context of the Cartagena Protocol on Biosafety*.

Based on this, please submit information on the following areas:

1. New techniques or tools for the detection and identification of living modified organisms
2. Experience with:
    a. New detection techniques
    b. Detecting newly developed and/or unauthorized living modified organisms
    c. Developing reference materials
3. Collaborations or agreements between national and/or regional laboratories

Submission of supporting documentation:

For any publication that you may want to share as part of your submission, kindly include:

1. Name of publication(s), author, date and DOI or URL link.
2. Attach in pdf format any publication you have listed above.

The Outreach Network for Gene Drive Research brings together researchers and other experts working in the field of gene drive research for the public good. Gene drive research has been developing over the past 20 years and there are numerous ongoing efforts to develop guidance and best practices to guide the development of gene drive LMOs, including under the CBD.

Item 1 - New techniques or tools for the detection and identification of living modified organisms

Detection and identification are important considerations for both experimental field releases (for research purposes) as well as for possible use of gene drive LMOs to control vector borne diseases or invasive alien species in the future.

Current discussion on detection and identification methods and whether gene drive LMOs would require new techniques or tools have largely noted that gene drive organisms in themselves do not present significant challenges for detection and identification compared to other LMOs. In general, it is not expected that there would be as many different gene drive constructs as they have been genetically modified traits developed for use in crops, so the number or variety of organisms to be potentially detected will be much more restricted.

There are however likely to be differences in the strategies adopted for detection and identification of gene drive LMOs compared to previous (crop) LMOs. Whereas one of the core interest in detection and identification of crop LMOs has been linked to trade compliance, for gene drive LMOs which address issue of vector borne diseases or biodiversity loss, the purpose and usefulness of detection and identification may differ, to compliance, in cases where gene drive LMOs might move across boundaries to areas where they are not approved, but also would be useful for monitoring for efficacy and ecological impacts. This may impact how detection and identification is conceived and carried out for gene drive LMOs.

Nonetheless, there some relevant technical challenges to consider which could be addressed effectively through collaborations of expert centers and gene drive:

1. It is important to **establish validated methods** for detection and identification: This has been achieved in other areas by "ring testing" - testing of the same methods in different laboratories, and reporting of results, prior to validation of the methodology, so a harmonised system of testing and validation is established. This should also apply to standardized reagents such as primers for PCR if that method is used and to other key relevant reagents. This would help ensure that laboratories can be effective in detecting and identifying gene drive LMOs and that the findings are reliable.

2. **Applicability across species**: An additional consideration for detection and identification of gene drive LMOs is the fact that gene drive approaches could be applied in very different organisms, so it will be necessary to ensure that the chosen approach works for the specific

specie(s) concerned and acknowledge that depending of the species in which the gene drive construct is inserted, there may need to be different considerations for different gene drive LMOs. For example, for gene drive mosquitoes, if the modified mosquitoes being released belong to one of the *An.gambiae* species that is part of a species complex, then the detection methodology would need to work in all of the members of the species complex and not just in the released species. This is important because the genetic modification could be transferred to other species in the complex through hybridisation, but the different mosquitoes within the complex would have different genomic signatures. This is an important consideration in mosquitoes, but may not necessarily be applicable to other gene drives organisms.

3. **Storage stability**: Unlike seeds which can be stored for many years in appropriate conditions, whole organisms such as mosquitoes themselves may not be suitable long term storage material, so laboratories would need to store extracted DNA. As this may be new, it would be useful to establish agreed methodologies and standards regarding storage stability and sample stability, including studies to establish how long DNA can be stored before needing to be refreshed. It will also be important to build the concomitant capacity in suitable storage facilities, such as -80C freezers. This would help ensure laboratories are ready to conduct analysis on potential gene drive LMOs ahead of a possible field release.

4. **Reference samples**: In order to have robust detection and identification methods, it will be important to have stocks of reference samples made from known gene drive organisms, and possibly from reference wild type organisms in some cases. This requires establishing a reliable supply chain for such samples, including who can provide the samples, how are the samples provided, how the samples are refreshed if necessary, etc. One of the challenge will be to establish who can provide refreshed samples after a period of time, if developers no longer maintain the specific strain of gene drive organisms. These are technical considerations which come in addition to the discussion on storage stability (as discussed above) for such reference samples, and which are different for gene drive LMOs compared to crop LMOs.

5. **Establishing the appropriate identifiers**: Gene drive constructs are frequently inserted at a docking site in the genome, which is generally the same genetic sequence, whereas crop LMOs have random insertions, and therefore can have unique identifiers based on their genetic sequence across the construct insertion point. So unique identifiers are unlikely to be obtainable in gene drives, and an internal (to the construct) sequence might be more appropriate and effective. This is also better for split drives, as each element of the split drive could have its own internal identifier.

6. **Sampling strategies and detection limits**: Sampling strategies for detection need to be established and agreed upon to ensure they are robust and statistically defensible and respond to the rational for doing monitoring and detection for gene drive LMOs. This includes establishing a detection limit or threshold, which needs to be based on the characteristics of the detection tools to be used. However, the rational for carrying out detection activities may be different for

gene drive LMOs than they have been for other LMOs and so the strategies and detection limits will need to be coherent with that rational. For example, the sampling strategy for gene drive LMOs used for vector borne disease control or invasive alien species control will be very different from that used for agricultural LMOs, where samples are mostly taken from defined points of entry and defined sample spaces (grain containers, etc.). Gene drive LMOs are likely to be sampled in nature over larger areas and defining strategies for this sampling will be a novel element.

References

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