School of Agriculture, Policy and Development

University of Reading

ICQC,R & ICGD Newsletter

May 2024

Feedback on Distributed Materials

We would be grateful if you could provide feedback on materials received via ICQC,R. In particular, we would be interested to know about any clones that have performed well in terms of, for example, yield and disease resistance.

Please also let us know about any data you have that could be added to ICGD, which will include a reference to the original source (see 'Get in Touch' for details).

Update to Quarantine Procedures

Following the discovery of a number of mild strain viruses of cocoa (CaMMV, CYVBV and CaPV), we are now incorporating PCR testing for these viruses in our routine quarantine procedures (Ullah *et al.*, 2021; Ullah *et al.*, 2023).

Proposed Clones for De-Accession

Since the purpose of the International Cocoa Quarantine Centre is to facilitate safe movement of cocoa germplasm, rather than conservation of germplasm, we periodically assess the demand for material held at the centre. Where necessary, we remove clones which have not been requested for a number of years.

This process is important to allow space and resources to be focussed on bringing in new clones for quarantine and distribution. On this basis, it is proposed to remove the five clones listed in Table 1.

Table 1. *The clones proposed for de-accession from ICQC,R*

CRU 70	RUQ 897
Cocoa Research Centre, Trinidad	
MAR 9	RUQ 557
Clone collected in Martinique	
PA 175 [PER]	RUQ 37
Collected from Parinari, Peru	
PA 299 [PER]	RUQ 1621
Collected from Parinari, Peru	
RIM 39 [MEX]	RUQ 487
Collected from Tuxclachico, Chiapas, Mexico	

Please let us know as soon as possible if you wish to receive any of these clones as they will be removed if there is no further demand for them within the next six months. However, they will continue to be held in the two international genebanks in Trinidad (ICG,T) and Costa Rica (IC3).

To Receive Material from ICQC,R

Germplasm from ICQC,R is usually provided as budwood, although we can also provide flowers buds for induction via somatic embryogenesis, small quantities of seed and leaves (e.g. for genetic studies). Material is supplied free of charge. Recipients are asked to sign a Standard Material Transfer Agreement for Plant Genetic Resources (FAO format), which ensures that material remains in the public domain.

To facilitate an export from ICQC,R we would normally require an import permit from the relevant authority in the recipient country. This should be sent to us (via e-mail attachment) at least two weeks before the date of shipment. The permit should state the plant material that you wish to import (e.g. budwood, seeds, flower buds) and any treatment required (e.g. pesticide and/ or fungicide treatment, if applicable). The plant material is provided with a phytosanitary certificate issued by the UK Animal and Plant Health Authority.

The full list of clones available can be found at:
www.icgd.reading.ac.uk/icqc/list.php

All new clones received at ICQC,R undergo extensive testing for viruses and other diseases over a two-year period before being made available.

The International Cocoa Germplasm Database (ICGD)

ICGD currently includes:

- Over 32,000 cocoa clone names, including synonyms
- Agronomic traits (including quality, yield and disease reactions) and morphological data
- Genetic fingerprints for more than 2700 clones
- Recommended planting materials in 19 countries
- Information on genomic and transcriptomic studies
- Origins, pedigrees and locations of material
- Over 2000 photographs and drawings

All information in ICGD is referenced to its original source and has been obtained from a wide range of publications, proceedings and reports, as well as directly from individuals from research institutions and genebanks.

ICGD is available free of charge, just visit:

icgd.reading.ac.uk

Recommended Planting Material

Information on planting materials recommended by the national authorities are provided as a guide and historic record, which can help users understand what material may be in farmer's fields. ICGD has been updated to include bi-parental crosses and seed garden parents, in addition to the recommended clones introduced previously.

Genomic/Transcriptomic Data

Genome information can aid the discovery of new genes and allows the development of molecular markers for a broad range of traits. ICGD incorporates background information on genomic and transcriptomic studies, including the clones or hybrids used, with links to the repositories that maintain the raw data.

The database also incorporates transcriptome data and can include information not associated with specific clonal material (i.e. the sample is only labelled as *Theobroma cacao*). Such samples do not feature in the search routines, though the information can be accessed (and exported to Excel) from the 'Genomic/Transcriptomic Information Hub' (see below).

Information Hubs

New 'Information Hubs' provide a summary of the information in the database and allow access to specific data through simple links. However, the same detailed clone information can be accessed from any of the hubs, and the output can be submitted for further searches. There are currently four information hubs:

Genetic Resources: The initial output lists the locations (international, national and quarantine collections) of cocoa genetic resources, with the option to view/search accession lists. A 'More Information' button gives a summary of the accessions that are only maintained in the selected collection, and those that are duplicated in just two or three other genebanks (based on accession name, taking account of known synonyms/homonyms).

Planting Material: A summary of each cocoa-growing country's list of recommended clones/seedlings, as established by the national authorities. The initial page lists all the countries with data and gives the number of recommended clones, bi-parental crosses, or seed garden parents for the country. The list can be searched further or exported to Excel, and the full details of any of the clones/hybrids can be accessed.

The 'More Details' link goes to a detailed summary of the planting materials recommended for that country, listed by category (clone, bi-parental cross, seed garden parent) and grouped by reference and region/seed garden location, with links to more information.

Below the list of countries is a list of all the clones/hybrids that have been recommended, with a list of countries each has been recommended in (grouped by clone, bi-parental cross, seed garden parent).

Genome / Transcriptome: The initial page provides a summary of the BioProjects (references) in the database, including:

- BioProject identifier (with links to data repositories).
- Focus of study (for example, population analysis, disease reactions).
- Library Source (genomic and/or transcriptomic)
- Number of BioSamples, Clones, Runs, Experiments, and SampleSources (site samples were collected).

'Focus of Study' and 'Library Source' can be used to filter the output to only show studies with matching descriptors.

For each Bioproject displayed, there are the options to 'List plants' (the clones/hybrids used in the study), 'Search plants', and 'View data' (with the option to export to Excel).

Advanced Search: The original search routines that allow users to search all data and combine searches in a variety of ways.

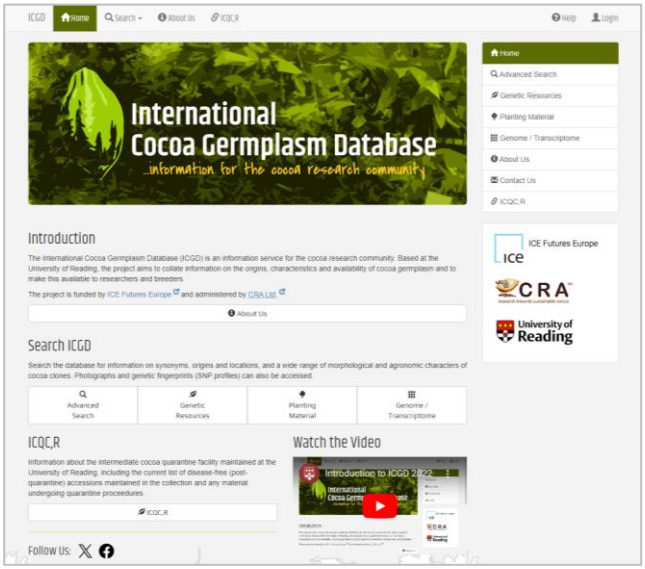

Figure 1. *The ICGD home page, with links to the new information hubs*

Cocoa Viruses Webinar

Videos of the Cocoa Viruses Webinar held in April 2023 are available on the Cocoa at Reading website: research.reading.ac.uk/cocoa/virus-webinar-2023

Session 1: Mild Strain Viruses.
Session 2: Cocoa Swollen Shoot Virus Disease.

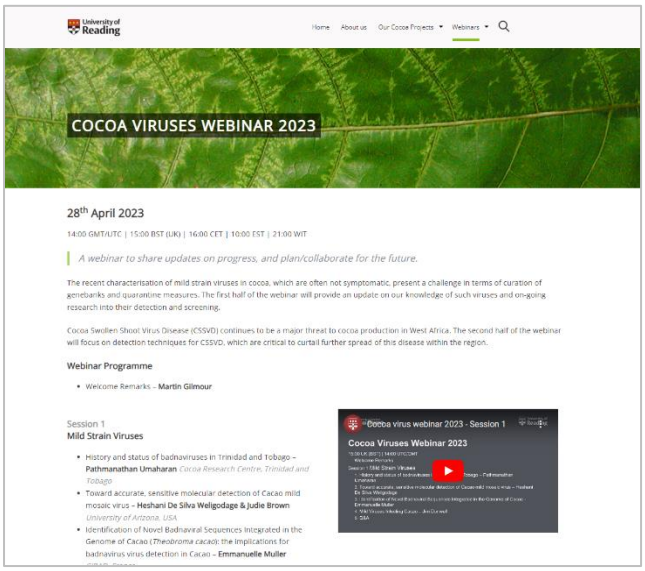

Figure 2. *The cocoa viruses webinar page with links to videos of both sessions*

Digital Data Collection in the Field

A new page has been added to the Cocoa Research at Reading website about our work on barcode-based digital data capture in the field, which includes a video of the presentation given at CARDS23: research.reading.ac.uk/cocoa/projects/digital-data-collection-in-the-field

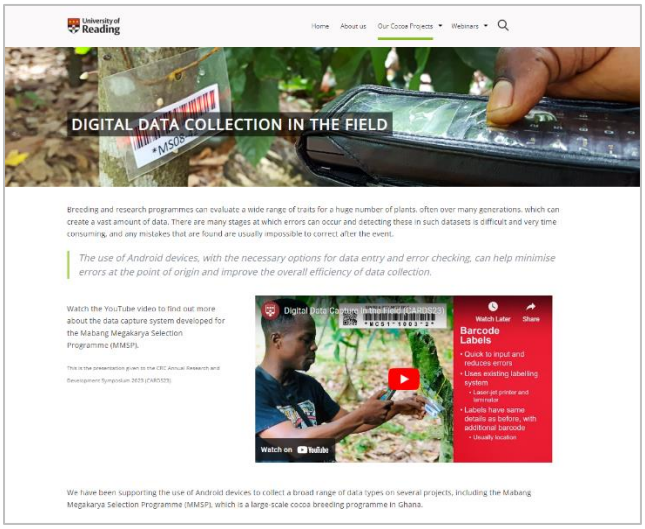

Figure 3. *The new web page on digital data capture*

Get in Touch

Enquires or further information on ICQC,R and how to receive germplasm should be directed to:

Andrew Daymond
a.j.daymond@reading.ac.uk

Please let us know if there is any clone that you would like to us to bring in to quarantine and we will endeavour to do so.

Enquiries regarding ICGD should be directed to:

Chris Turnbull
c.j.turnbull@reading.ac.uk

Your input is greatly appreciated!

Please get in contact if you have any new data available to include in ICGD. All data is fully referenced to its original source and can incorporate links, such as a DOI to a paper or a project webpage.

We also appreciate any feedback you may have, so whether you have suggestions for areas of future development or have noticed an error in the data, please get in touch.

Acknowledgements

Thank you to all the cocoa researchers and breeders who have provided information and feedback to the ICGD project.

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References

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https://doi.org/10.3390/v13112152

Ullah, I., Kamran, M. and Dunwell, J.M., 2023. Identification of a novel polerovirus in cocoa (*Theobroma cacao*) germplasm and development of molecular methods for use in diagnostics. Pathogens, 12(11), p.1284.

https://doi.org/10.3390/pathogens12111284