I participated in WDCM training course as a correspondent of Iranian Fungal Culture Collection “IRAN…C”. I have got my PhD degree in Plant Pathology - Mycology from the Science and Research Branch of Islamic Azad University, Tehran, Iran, 2012. I have specialized in systematics of micro-Ascomycetes, and studies of teleomorph-anamorph connections and DNA barcoding of fungi, focusing on *Coniochaeta*, *Coniolariella*, *Preussia*, *Coniocecssia*, *Chaetomium* and *Aspergillus*. I joined the Iranian Research Institute of Plant Protection (IRIPP) as a Research Assistant in 2005. In my early career, I was involved in maintenance of living fungi at the Iranian Fungal Culture Collection. Then, in 2010, I was put in charge of management of the database of this culture collection.

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**Iranian Fungal Culture Collection (IRAN…C)**

**ABSTRACT**

To promote sharing and application of microbial resource information in developing countries, WFCC-MIRCEN World Data Centre of Microorganisms (WDCM) has launched three training courses since 2012. The 3rd WDCM training course, I just participated, was held on September 6-23, 2016 in Beijing, China. This course was organized by WFCC, UNESCO, IMCAS, and TG-AIM. In the early days, September 6-8, I could attend the 50th anniversary of the establishment of WDCM. While this training course, I could benefit from visiting some candidates of microbial culture collections throughout the world and increase my knowledge on some international data standards relevant to microbial resources information and some database management systems of microbial resources. Besides I got insights into genomic studies and DNA barcoding of various microorganisms, bioinformatics knowledge and tools, and manipulation of microbiological informatics platform.

**Key words:** Biobanking, Biodiversity, Bioinformatics, Genetic resources, Humans usages, Microbiology.
1. Brief introduction of our Culture Collection.

I. Herbarium Ministerii Iranici Agriculturae:

Iranian Fungal Culture Collection is, actually, one of the collections of the Herbarium Ministerii Iranici Agriculturae. In 1945, when the Faculty of Agriculture in Karaj was separated from the Ministry of Agriculture to join University of Tehran, Dr. Esfandiar Esfandiari (research assistant of Prof. Erwin Gauba) continued his work at the Plant Protection Research Division and founded the Herbarium Ministerii Iranici Agriculturae “IRAN”. He, as the first official curator of the Herbarium, worked tirelessly throughout his career to develop and enrich the Herbarium.

Fig. 1. Prof. Esfandiar Esfandiari.

Herbarium Ministerii Iranici Agriculturae is registered under the acronym “IRAN” in “Index Herbariorum” (Holmgren & Keuken 1974). Detailed information on this herbarium is now available on-line at Index Herbariorum database (http://sweetgum.nybg.org/ih). Its fungal reference collection has been registered in “International Mycological Directory”
(Hall & Minter 1994). This Herbarium has also been listed and recognized as a natural heritage (No. 26) at the “Cultural Heritage, Handcrafts and Tourism Organization of Iran”.

Fig. 2. The building of “Iranian Plant Protection Biodiversity and Genetic Resources Complex” where the Herbarium “IRAN” is located on its 3rd floor.
The mission of the Herbarium “IRAN” is to document, preserve, archive and expand the collection to make a thorough representation of Iranian flora, comprising vascular- and non-vascular plants, algae, fungi, lichens, and fungus-like organisms, with particular emphasis on important taxa in plant protection.

Fig. 3. Some specimens of the Herbarium “IRAN”.

The Herbarium “IRAN” houses voucher specimens of plant materials that were collected and identified through research projects mostly conducted by staff members of Department of Botany, Iranian Research Institute of Plant Protection. At present, six collections of the Herbarium “IRAN”, i.e. Fungus Reference Collection, Vascular Plant Herbarium,
Iranian Fungal Culture Collection, Weed Herbarium, Medicinal and Pesticide Plants Herbarium and Non-vascular Plants and Algae Herbarium contain some 80000 specimens of plants and some 20000 specimens of fungi, lichens and fungus-like organisms.

II. Iranian Fungal Culture Collection:

History:

Iranian Fungal Culture Collection “IRAN…C” was founded in 1968 by Prof. Djafar Ershad who transferred a few fungal isolates from BBA (Biologische Bundesanstalt für Land- und Forstwirtschaft, Institut für Mikrobiologie, Berlin, Germany) to this culture collection. Prof. Djafar Ershad is the most influential mycologist of Iran whose students largely formed the next generation of Iranian mycologists. This culture collection was further developed by Prof. Rasoul Zare, current director of the collection, who transferred some fungal isolates from IMI (CABI BioScience, Egham, UK) and CBS (Centraalbureau voor Schimmelcultures, Utrecht, The Netherlands) to the “IRAN…C”, 2000-2006. Since then, most of the fungal isolates that were deposited in this culture collection were originated from various substrates in Iran. He launched the in-house database management system of the “IRAN…C” in 2000. In 2004, he equipped the laboratory adjacent to this culture collection and developed molecular techniques for precise identification.
of its fungal cultures. This collection has been registered in 2009 at the World Federation of Culture Collection under the code “IRAN WDCM 939”.

Fig. 4. Prof. Djafar Ershad.  
Fig. 5. Prof. Rasoul Zare.

**Type of specimens:**

Iranian Fungal Culture Collection houses living cultures of fungi with particular emphasis on important taxa in plant protection, including entomopathogenic, nematophagous and fungicolus fungi, plant pathogens, mycotoxigenic fungi and fungi producing biochemical and pharmacological metabolites.

**Specimens storage:**

The living cultures of fungi are preserved in the “IRAN…C” on agar slants, under sterile distilled water, in sterile soil, and freeze-dried, all stored in a cold room (7-10°C).
Fig. 6. Different methods of preservation in Iranian Fungal Culture Collection.

**Number of specimens:**

Iranian Fungal Culture collection houses 2197 fungal isolates belonging to 258 genera and 830 species. The oldest specimen from Iran (IRAN 1897 C) is *Peniophora pseudonuda* Hallenb. that was isolated by Nils Hallenberg from decaying wood in Gorgan (Iran), 1978. However, the oldest specimen from other countries (IRAN 1359 C; CBS 409.67) is *Verticillium subfasciculatum* (Petch) Samson & W. Gams that was isolated by M.H. Teernstra-Ecken from an insect (*Heleomyzidae*) in the Netherlands, 1905.
Table 1. Statistics of specimens in the Iranian Fungal Culture Collection, updated on August 21, 2016.

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total specimens</td>
<td>2197</td>
</tr>
<tr>
<td>Specimens from Iran</td>
<td>1606</td>
</tr>
<tr>
<td>Specimens from other countries</td>
<td>591</td>
</tr>
<tr>
<td>Genera</td>
<td>258</td>
</tr>
<tr>
<td>Species</td>
<td>830</td>
</tr>
<tr>
<td>Species from Iran</td>
<td>610</td>
</tr>
<tr>
<td>Species from other countries</td>
<td>251</td>
</tr>
<tr>
<td>Type specimens</td>
<td>75</td>
</tr>
<tr>
<td>Type specimens from Iran</td>
<td>41</td>
</tr>
<tr>
<td>Type specimens from other countries</td>
<td>34</td>
</tr>
</tbody>
</table>

**Distinctive properties of the collection:**

Iranian Fungal Culture Collection is the largest and richest fungal culture collection in Iran and in the Middle East, providing most of the fungal strains required for research studies in Iran. According to the statistics issued by WDCM (not updated), 195 fungal cultures of the “IRAN…C” have been cited in 216 papers. Besides, sequences of 194 strains of this culture collection have been cited.
Laboratory equipments adjacent to the Iranian Fungal Culture Collection:

– Optical instruments including various stereo-microscopes and compound light-microscopes.

– Incubators, autoclaves, germinators and microtomes (freezing and paraffin).

– Safety cabinets and fume hoods.

– Freeze-drying equipments.

– Photomicrography equipments.

– Molecular biology equipments including DNA concentrator, gel-documentation system, spectro-photometer, -40°C freezer, and various types of precision digital weighing scales, pH-meters, PCR machines, centrifuges, electrophoresis equipments, and Macintosh computer for advanced clustering and phylogenetic analyses.
Fig. 7. Laboratory equipments adjacent to the Iranian Fungal Culture Collection.

2. Benefits from the training courses.

– Attending the 50th Anniversary of WDCM that was held on September 6-8, 2016 in Beijing, China. In this symposium, we could meet some researchers from different countries mostly involved in preservation, identification, utilization, genetic studies,
bioinformatics and database management systems of microbial resources.

− Attending the training course held by WDCM on September 7-23, 2016 at the Institute of Microbiology, Chinese Academy of Sciences (CAS). In this training course, we could benefit from:

1. Visiting some candidates of microbial culture collections throughout the world. In this training course, 15 researchers from various countries including Argentina (1), Brazil (2), Bulgaria (1), China (1), Fiji (1), Greece (1), India (2), Iran (3), Romania (1), Russia (1) and Thailand (1) had been participated.

2. Acquiring some information about Chinese Academy of Science (CAS) including its structure, duties, facilities, staff members, positions for international students and scholarships, and some ongoing research projects.

3. Increasing our knowledge about some international data standards relevant to microbial resources information including OECD best practice guidelines, CABRI (Common Access to Biological Resources and Information), MINE (Microbial Information Network Europe), ABCD (Access to Biological Collections Data Standard), Darwin Core, MIGS\MIMS (Minimum Information about a (Meta) Genome Sequence) MIMARKS (Minimum Information about a MARKer gene
Sequence), StrainInfo and MCL (Microbial Common Language).

4. Boosting our information about some database management systems of microbial resources including iCollect (An Enhanced Solution for Biological Resources Management), WFCC (World Federation for Culture Collections), WDCM and its databases, i.e. CCINFO (Culture Collections Information Worldwide), ABC (Analyzer of Bio-resource Citations), GCM (WFCC Global Catalogue of Microorganisms), WDCM Reference Strain Catalogue and Statistics on Patent Microorganisms.

5. Getting insights into genomic studies and DNA barcoding of microorganisms, bioinformatics knowledge and tools, and manipulation of microbiological informatics platform.

3. Suggestion on WDCM work.

- Updating the statistics of registered culture collections every three or six months.

- Enhancing the visibility of online catalogues of culture collections participated in GCM.
– Organizing some international workshops periodically to enhance the skills of experts involved in activities of microbial culture collections.

– Establishing scientific collaborations with culture collections of developing countries to improve their infrastructure and techniques for long-term and stable preservation of microbial resources, and also database management systems.

– Assisting the microbial culture collections of developing countries to standardize the acquisition and description of their data according to ISO/TC 276.

– Releasing the updated news on workshops, symposiums, conferences, research projects, fellowships, etc., relevant to management and utilizations of microbial resources.

– Acting as an interconnection among all registered culture collections in WDCM to establish an efficient system of exchanges of microbial resources relevant information and technologies.

4. Comments or suggestion on the training courses.

This training course could benefit from:

– Focusing on the outlines of the training course and reducing some irrelevant subjects presented while the course.
- Organizing some visits from laboratories, collections, herbaria, and other relevant facilities existing in CAS and some other universities or organizations of China.

- Inviting some scientists from the well-organized microbial culture collections throughout the world as teachers of the course.

- Involving some practices on isolation, purification and identification of various microbial resources using the classic and modern techniques, and also relevant genomic studies of microorganisms.

- Involving some more practices on in-house database management systems of culture collections and also bioinformatics tools.

5. Suggestion on further cooperation between WDCM and your collections.

We would expect WDCM to assist us in:

- Management of our in-house database management system.

- Improving the dissemination of our online catalogue.

- Increasing the visibility of our culture collection and easing the ordering and exchanging process of our culture collection.

- Establishing collaborations with our culture collection about gene and genome sequencing of some important fungal cultures existing in the “IRAN…C”.
Acknowledgments:

I would like to express my gratitude to the WDCM for providing me with the opportunity to participate in this training course. Dr. Juncai Ma and Dr. Linhuan Wu are thanked for their assistance in dissemination of online catalogue of the Iranian Fungal Culture Collection. I am also thankful to Miss Jianyuan Zhang and Dr. Qi Heyuan for their great contribution in processing of WDCM training course.