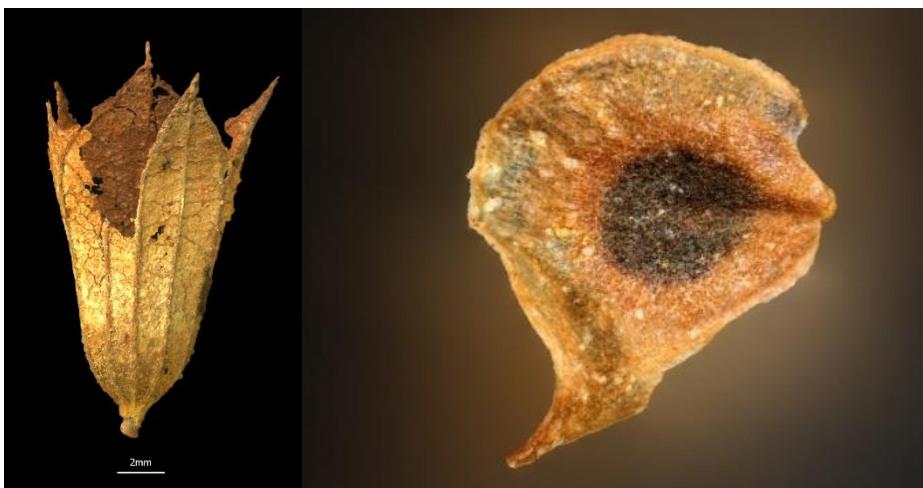




## Bar Ilan University National Natural History Collection of Seeds and Fruits



Timna: *Triticum dicoccum*, *Hordeum distichum*, 6,000 years old



Yoram Cave: *Hyoscyamus desertorum*, *Ranunculus asiaticus*, 3,000 years old

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**Collection:** National Natural History Collection of Seeds and Fruits

**Institute:** Bar Ilan University

**1. Inventory:** The collection was established by Prof. M. Kislev in the 1970's and has continued to be maintained ever since. It is comprised mainly of samples collected by M. Kislev and his students in Israel, as well as samples exchanged with various local and international institutions. It includes ~10,000 identified seed and fruit accessions, including wild species and domesticated plant varieties. An additional 3,000 collected samples are currently being processed for inclusion in the collection. The general coverage is of ~90% of Israeli flora. For each species we follow the accepted herbaria recording system – identification, date and location of collection, habitat and collectors name.

In addition, the collection includes: (i) Dr. Ludwig Pinner's collection of 900 accessions of Israeli wheat landraces; (ii) ~3,000 archaeobotanical accessions from ca. 800 taxa, including 15 extinct taxa, and ~300 taxa preserved by desiccation. The archaeobotanical accessions cover the range of plant remains from all periods in Israeli archaeology, from the Acheulean culture (ca. 800,000 years BP) onward. This is the largest such collection for Near Eastern archaeobotany worldwide.

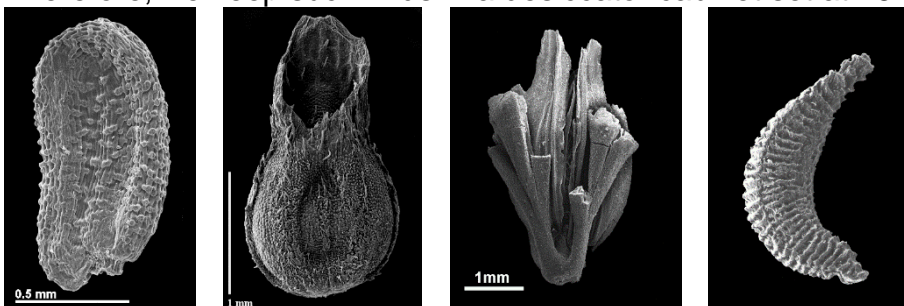
**2. Collecting additional samples:** We regularly go on collecting field trips throughout Israel. We also collaborate with the Kalanit group headed by Prof. Avi Shmida and Dr. Ori Fragman-Sapir (Hebrew University) – plant taxonomists from Hebrew U, in their plant tours to collect new specimens. We conducted 25 such field trips in the last 3 years, and another 6 are planned for 2018. Last year, we launched a project aimed to reach full coverage of the Israeli flora.

Collaboration is also ongoing with the Hebrew University Herbarium, the Institute for Cereal Crops Improvement at Tel-Aviv University, and the Israeli Gene Bank at the Volcani Center to complete the collection.

**3. Accession preservation:** As the collection is morphology-oriented, we do not keep live collections and accessions are kept without special preservation. The same is true for our archaeological assemblage, which is mostly charred and therefore does not require special storage conditions. However, some archaeological finds, mainly those from the hot and dry Judean Desert and the Arava, preserved by desiccation. Such find possess high potential for extraction of ancient DNA, as we already demonstrated in a recent *Nature Genetics* paper. The humid condition in the coastal plain can cause fungi contamination of desiccated plants. Therefore, we keep such finds in a desiccator cabinet set at 16°C and 25% humidity.



Collection cabinet



*Alisma plantago-aquatica*; *Valerianella muricata*; *Phalaris paradoxa*; *Crepis aspera*

**4. Personnel. Academic personnel:** 1 curator (Prof. E. Weiss), 1 manager (Dr. Y. Melamed), 1 emeritus curator (Prof. M. Kislev), 1 post-doc (Dr. S. Frumin). **Technical personnel:** 3 students for sorting and digitization, payed by hour. All academic personnel are partially supported by VATAT, students are partially supports by VATAT and partially by

the Faculty of Life Science. Permanent staff D. Levy of the faculty of life science is also support the collection.

**5. Catalog and databases:** The collection is digitized in an Microsoft Access database. For each accession we record species Latin name, Hebrew name, subspecies (if applicable), place of collection, date of collection, region, quantity of seeds/fruits, and name of collector or the source. We are currently updating the databases to include the specimens which are not recorded yet, to cover both the accessions in the collection and those still being processed. All units of record are undergoing proofreading. A printout of the inventory is present near the collection for review. Currently website is underway, with the help of the Faculty of Life Science and will be operated by their server. The collection website will finally include also bibliography, figures of archaeological finds, and our "Grass Grains Key". This unique key produced by our team, helps various researchers (taxonomists, ecologists, agronomists and archeobotanists) to identify easily and definitively Grains from the Grass family from the Mediterranean basin. At the same time, the archaeobotanical database is being prepared in the same way. We are currently updating and correcting the database and the collection's website; both current and archaeological databases will ultimately be available online.

**6. Physical infrastructure:** ~90 m<sup>2</sup> laboratory, fully equipped with necessary microscopes (8 stereoscopic microscopes – Wild M4, Olympus SZ51 and SZX9) and automated Olympus SZX-10 stereoscopic microscope + camera; equipment for handling the archaeological samples – flotation machine (Flote-Tech Model A), geological sieves. For storing the collection, we use Bariach-Sadan company fire-resistance cabinets. We have access to university botanical infrastructure, including glasshouses as well as access for university equipment facility for using JEOL/JSM-840 SEM.

**7. Local and international researchers using the collection:** the collection team consults plant identification in many cases, Police CSI units have consulted with us on several occasions. Researchers from all over the world consulting us for the identification of their plant remains from many archaeological sites. Such sites are: Yiftah'el, **Garfinkel, Y.** Hebrew U & **Halayla, H.** Israel Antiquities Authority; Shivta, **Ramsay, J.** SUNY Brockport & **Teper, Y.** Haifa U; Nitzana & Halutza, **Bar-Oz, G.** and **Teper, Y.** Haifa U; Tell es-Safi/Gath, **Maeir, A.** BIU; Yoram Cave, **Davidovich, U.** Tel Aviv University & **Marom, N.** Haifa U; Atilt-Yam, **Glili, E & Sharvit, Y.** Israel Antiquities Authority; Timna, **Ben-Yosef, E.** Tel Aviv University; Modi'in, **Tandler, A.** Israel Antiquities Authority; Nahal Mahanayeem, Dureijat, **Sharon G.** Tel Hai College; Ohalo II, **Nadel, D.** Haifa U; Gesher Benot Ya'aqov, **Goren-Inbar, N.** Hebrew U; Tei 'Eton, **Faust, A.** BIU; Tel Yarmut, **Paz, I** Israel Antiquities Authority; Gilgal I, **Bar-Yosef, O.** Harvard U, **Goring-Morris, N.** Hebrew U & **Gopher, A.** TAU; Nahariya, **Zuckerman, S.** Hebrew U; Ashkelon, **Srager, L.** Harvard U; Beth-Shemesh, **Bunimovitz, S.** and **Lederman, Z.** TAU; Msada, **Stiebel, G.** TAU; Herodion, **Porat, R.** Hebrew U. The international community is aware of our collection and several researchers working in the Middle East have come to use our collection. **J. Benes, K. Paclikova, M. Preusz, P. Houfkova, K. Kodykova, K. Lencova,** University of South Bohemia; **Orendi, A. Nicoli, M., Weide A.,** University of Tübingen; **Hedges-Knyrim, G. M.** University of Connecticut; **Borojevic, K.** Boston University.

We actively invite researchers from Israel and abroad to actively bring their finds to be identified in our collection. We would like to invite researchers from the Middle East, including Palestinians, to collaborate with us based on the collection and the know-how.

**8. Policy of use for external users:** The collection is freely available to all researchers interested in visiting and using it; no fees are requested. Applications for visiting the collection or establishing collaboration are typically accepted via e-mails to E. Weiss or Y. Melamed. It is important to note that due to recent geopolitical situation In the Middle East, Israel has become a desirable place for fieldwork. This has increases the international interest of the

collection. When the collection will be advertised and became a public domain we anticipate greater public interest by the scientific community. In addition, we are willing to contribute spare seeds to other research projects, including going to field trips searching for needed species.

**9. International collaboration with similar collections:** The collection collaborates with several herbaria, mainly in exchanging plant material: Kew Botanical Garden Herbarium, UK; Leibniz Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany; Herbarium of the Botanical Garden and Botanical Museum, Berlin-Dahlem, Germany; The University of Palermo Herbarium Mediterraneum, Palermo, Italy; USDA National Plant Germplasm.

**10. Membership in International organizations:** E. Weiss is a Committee Member, the International Work Group for Palaeoethnobotany.

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**12. Personal addendum:** The collection is Prof. M. Kislev's lifework, which he continues to supervise even after his retirement. Kislev was supported throughout his career with student scholarships and a technician. The research aided by this collection earned an unprecedented number of 21 top-tier publications (in *Nature*, *Nature Genetics*, *Science*, *PNAS*, *Scientific Reports* among others), by Kislev, Weiss, and colleagues. E. Weiss was nominated as the collection's curator two years ago. Weiss is a faculty member of the Land of Israel Studies and Archaeology Department, but the collection continues to be managed in the Faculty of Life Science, which supports some of its operation. The current technical personnel are relatively small and transient. Since the collection is currently in a blooming stage of growth and investment in research, organizing and cataloging is ongoing. One of my first actions was to set a goal for **full coverage of Israeli flora**, with at least three accessions from each species.

A second goal is to strengthen the **international collaboration**. As an example, a few researchers already visited in the last two years, I invited colleagues to visit and use the collection. Some have already visited (e.g. groups of researchers from University of South Bohemia, University of Tübingen and University of Connecticut) and used the collection to identify their plant remains, and I hope many more will soon follow.

**Collection digitization:** in addition of simple description of the specimens we plan to improve the diagnosis using 3D geometric morphometrics of seeds and fruits. To this end we applied and gained VATAT post-doc grant (S. Frumin), for applying 3D morphological study of grass grains. This is an important part in future dissemination of this information, as it will allow the collection to be queried and analyzed by international scholars. It will also enable access by 'virtual visitors' unable to visit the collections in person – as is becoming common practice in leading herbaria.

We hope to apply the 3D documentation of grass seed morphology to the already existing "computerized key for the grass species of the Near East" we created few years ago. This will enable accurate identification and improve confidence in grass species taxonomic identifications. Our aim is to ultimately cover the entire flora - and contribute new data to taxonomical classification. In addition, by using 3D printers, we will be able to replicate the collection and share it with colleagues.

Digitization is a central issue in collections care these days and it needs continue updates and dedicated personnel.

**Needs for future care and research in the collection:** Like other such institutions worldwide, maintaining and using the collection as it expands and develops requires more personnel – academic and technical. To sustain this unique collection, we will need a permanent technical assistant in addition to Dr. Melamed for sorting and documentation. We ask for a continued support for Dr. Melamed. The routine nature of collection's work, i.e., collections, identifications and cataloging, did not allow Dr. Melamed to do research and to create academic returns which justify integration to an academic position. For this reason – a permanent continued support is needed for Dr. Melamed.

Thanks to the VATAT's appreciation of the collection's importance, we have come a long way over the past two years organizing and improving the collection and making it accessible to researchers. We hope that the VATAT will continue its commitment to the continuation and growth of the collection.