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Hot News from Abroad No.23

Investigation of Wheat Genetic Resources in Azerbaijan and Armenia

"Azerbaijan": Kazuhiro Sato, Associate Professor, Research Institute for Bioresources, Okayama University

"Armenia": Hisashi Tsujimoto, Professor, Faculty of Agriculture, Tottori University

Ongoing Column No.35

"Link Evaluator" : A Firefox Add-on

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Announcements

○ BMB2008

(Joint Meeting of the 31st Annual Meeting of the Molecular Biology Society of Japan & the 81st Annual Meeting of the Japanese Biochemical Society) Exhibitions of the National Bioresource Project (NBRP) are scheduled.

Date: Tuesday, December 9, to Friday, December 12, 2008

Place: Kobe Port Island

✈ Hot News from Abroad No. 23

Investigation of Wheat Genetic Resources in Azerbaijan and Armenia



The region that lies between the Black Sea and the Caspian Sea is known as Caucasus. The Caucasus Mountains are over 5,000 m high and span the middle of the region from east to west. The southern side is known as the Trans-Caucasus region. After the breakup of the Soviet Union, Georgia, Armenia, and Azerbaijan, which lie in this region (from west to east), attained independence, although territorial skirmishes continue even to date (Fig. 1). The region is known to the place of origin of wheat and barley, because of which highly mutated families of wheat are presumably cultivated here even now. Studying the wheat cultivars grown in this region was difficult when these countries were under the Soviet regime. From June to July, 2008, we investigated the genetic resources of wheat strains in Armenia and Azerbaijan in collaboration with the Vavilov Research Institute of Plant Industry in Russia (VIR), with support from a Grant-in-Aid for Scientific Research (representative: Kazuyoshi Takeda, Professor, Okayama University). Since these countries had been involved in territorial disputes until recently, separate teams were organized for the investigation.

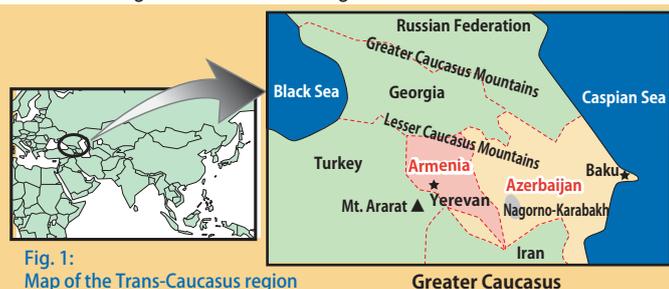


Fig. 1: Map of the Trans-Caucasus region

● Azerbaijan: Kazuhiro SATO, Associate Professor Research Institute for Bioresources, Okayama University

Azerbaijan lies at the edge of the region in which barley and wheat originated; therefore, ancestral strains of wheat are cultivated here, and it is an important region from the viewpoint of a genetic resource study. The region is bordered by the Caspian Sea in the east, the Greater Caucasus Mountains in the north, and the Lesser Caucasus Mountains in the west. The altitude varies greatly, from -28 to 4,485 m; 18% of the country lies below sea level, and the annual precipitation in the low-altitude area varies from 150 to 200 mm. Therefore, the region is extremely arid, and irrigation is necessary for agriculture. On the other hand, the region at the base of the Caucasus Mountains is a high-altitude area of cropland covered with greenery, and the annual precipitation ranges from 1,600 to 1,700 mm. The Silk Road connecting China and Georgia passes through Azerbaijan and, therefore, trade in this country has been flourishing for long. Recently, because of the discovery of oilfields in the Caspian Sea, the capital Baku is prospering with an unprecedented inflow of oil money, and this city has become a massive construction field, with numerous ongoing constructions.



The research group is comprised of Hiroyuki Tanaka, an associate professor from the Faculty of Agriculture, Tottori University, and I from Japan, 2 specialists from VIR and 2 researchers and a driver from Azerbaijan. We traveled by road and collected barley and wheat strains for 10 days from June 28 to July 7, focusing on the northern region of the country, which is approximately one-fifth the size of Japan. We collected approximately 300 samples including a variety of cultivated and related species of barley and wheat at a total of 68 locations where the altitude varies from -24 to 951 m. The specialists from VIR and researchers from Azerbaijan contributed greatly to the sample collection. Thanks to the full support from VIR, we were allowed to carry all the samples out of the country and even distribute them to other researchers and research institutes. The diversity of the indigenous strains of cultivated wheat is small because of the influence of the Soviet style of extensive farming; however, as researchers of wheat families, we were highly impressed by the widespread distribution of barley and wheat species including *Hordeum spontaneum*, a subspecies of ancestral wild-type barley; *Hordeum bulbosum*, a perennial and self-incompatible species harboring bulbs; and *Aegilops tauschii*, a species carrying the D genome of wheat.



Picture taken in front of a wheat field, with the scenic Greater Caucasus Mountains at the back (Dr. Sato is the third from the right)

In contrast to Armenia, which is largely Christian, its neighboring country Azerbaijan is an Islamist country that has strong ties with Iran, a country with which it shares both ethnic and cultural borders. However, the religious laws are slightly relaxed in Azerbaijan, and every night, we drank vodka in Russian style. The staple food of Azerbaijan is a slightly stiff, flat bread made from bread wheat, whereas the bread baked by sticking it on the inside of a tandoor (an open clay oven) was made from macaroni (durum) wheat. The locals have cultivated diverse species of wheat over the last several thousand years. We greatly appreciate that they kindly shared these wheat and their ancestral strains with us. The local people are very friendly, and they bade us a fond farewell when we left. Our aim when we set out to Azerbaijan, i.e., sample collection for academic purposes, was successfully accomplished.



Bread made from macaroni (durum) wheat baked in a tandoor (clay oven)



Armenia: Hisashi TSUJIMOTO, Professor
Faculty of Agriculture, Tottori University

Armenia lies in the mid-southern region of the Trans-Caucasus region; it occupies 29,800 km², and most of the country is covered by mountains. Armenia shares borders with Georgia and Azerbaijan in the north and Turkey and Iran in the south; an enclave of Azerbaijan and Nagorno-Karabakh, an unapproved country (former autonomous region), also exists. Accordingly, Armenia is a politically complex country. Moreover, most of the population of 3.21 million comprises Christian Armenians, who use their own alphabets. Hence, Armenia is an unusual country, considering that all its neighbors except Georgia are Islamic.

The research team included Hidetaka Nishida, assistant professor, Faculty of Agriculture, Okayama University; 2 researchers from VIR; and wheat researchers from Armenia. We were based in the capital Yerevan and Ashtarak, and we went out on several day trips to conduct the investigation. Since the southern region of the Ararat basin is extremely arid in summer, the autumn-sown wheat and barley cultivated here require irrigation. In contrast, the northern and eastern regions are highlands, where we observed grazing and spring-sown wheat and barley cultivation. Scheduling a visit according to the harvest seasons is important when investigating genetic resources of wheat varieties. This time, the harvest season and our research schedule matched perfectly and, therefore, we could collect a variety of species of wheat, barley, rye, and related wild-type species (Fig. 2). However, we could not collect the seeds of the wheat species in the mountainous region because most of the plants here were still before or in blossom.



Fig. 2: Scenery in Armenia
Mt. Ararat can be seen in the distance (5,165 m; Turkey); Noah's ark is believed to have drifted here.
Many varieties of wild-type wheat plants grow in the arid area in the front of the mountains.

We collected the seeds of bread wheat, Emmer wheat (cultivated); Armenian wheat (wild type); wild-type einkorn wheat, which belong to the genus *Aegilops* (4 species); barley of the genus *Hordeum*; its direct ancestral wild-type subspecies *H. spontaneum*; and *Secale* (3 species). We collected 180 items in total; however, some seeds were immature and needed to be grown to maturity for use as genetic resources in research.

Below, we list some of our observations during this investigation. First, wild-type wheat species related to cultivated wheat and barley, such as Armenian wheat, wild-type einkorn wheat, and wild-type subspecies of barley, were poorly distributed, though this observation differed from what was previously reported by Armenian researchers. These wild-type wheat species share their optimal growth area with the cultivated wheat and barley species; therefore, niches of these wild-type species have been deprived by cultivated species as a result of cultivation. In particular, the deterioration of social conditions has apparently resulted in the loss of the land on which wild-type species grew. Second, only a few indigenous strains of bread wheat remain, and they are mostly species cultivated in the former Soviet era. Forced supervision of agricultural practices and the introduction of irrigation during the Soviet era probably led to the extinction of the indigenous strains, which were suitable for traditional cultivation. In some extremely arid and non-irrigated fields, the cultivation of indigenous Emmer wheat was observed. This strain is a crucial genetic resource for research on drought resistance. Furthermore, we found the ecology of a wild-type rye interesting. While examining the rye plants growing in wheat fields, we found that the ears of only some plants had dropped. We inferred that rye adopts 2 survival strategies: self-replication as a weed and replication by cultivation with wheat. Domestication of wild-type rye in this area is still under progress.

※ **Niche** : Environmental factors in a certain area exploited by a species



In front of a wheat field: photograph taken by Dr. H. Nishida (Prof. Tsujimoto on the far left)

10 minutes
Information Technology - 35 -



"Link Evaluator": A Firefox Add-on



Have you ever encountered broken links on your website? If your website has many links, then it will be difficult to click on each of them and check that they are not broken. I am introducing "Link Evaluator", a Firefox extension that helps users determine if there are any broken links on the webpage that they are viewing. In order to use "Link Evaluator," you must first install Firefox.

Let's install "Link Evaluator"!

"Link Evaluator" is compatible with Mozilla Firefox version 1.5 or more advanced versions. If Firefox version 3 is installed on your computer, "Link Evaluator" can be installed by following these steps.

- 1 Go to your browser's "Tools" menu and select "Add-ons".
- 2 In the "Add-ons" window, select "Get Add-ons", type "Link Evaluator" in the textbox and press Enter.
- 3 Select "Link Evaluator" from the list of add-ons and click the "add to Firefox" button.
- 4 Install the software by clicking "Install now".
- 5 Once the installation has completed, restart Firefox by clicking on the "Restart Firefox" button which will appear in the Add-ons window.

Let's use "Link Evaluator"!

I will use the "Link Evaluator Examples" webpage as an example. (<http://nj.oclc.org/linkevaluator/examples.html>)

- 1 Open the website that you want to check for broken links with Firefox.
- 2 Go to your browser's "Tools" menu, select "Link Evaluator", and then select "Evaluate Links" from the sub-menu (Fig. 1).
- 3 Each link will be checked. Valid links will be highlighted in green, broken links or links with authentication failure will be highlighted in red and timed-out links in orange (Fig. 2).

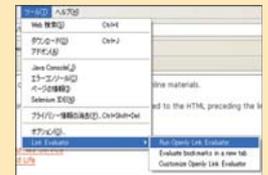


Fig. 1: Screen showing the view during application

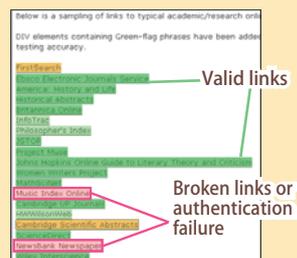


Fig. 2: Screen showing the results

Glossary

※ **Pay per click advertising** : Ads are displayed for free and advertisers only pay when a user actually clicks on the ad.

(Yuka TAKAHASHI, Center for Genetic Resource Information)

Editor's Note It is surprising that such rich diverse wheat genetic resources can be found in the Caucasus region where warning is occasionally issued for visitors. We are so accustomed to the plentiful crop provided by an improved homogeneous species that this different kind of richness overwhelms us. It must be due to the trusting relationship between the researchers that the collected plants were allowed to be carried out of the country and redistributed. (Y.Y.)

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