ИНСТИТУТ БОТАНИКИ НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК РЕСПУБЛИКИ АРМЕНИЯ
АРМЯНСКОЕ БОТАНИЧЕСКОЕ ОБЩЕСТВО
ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ԳԻՏՈՒԹՅՈՒՆՆԵՐԻ ԱԶԳԱՅԻՆ ԱԿԱԴԵՄԻԱՅԻ ԲՈՒՍԱԲԱՆՈՒԹՅԱՆ ԻՆՍՏԻՏՈՒՏ
ՀԱՅԿԱԿԱՆ ԲՈՒՍԱԲԱՆԱԿԱՆ ԸՆԿԵՐՈՒԹՅՈՒՆ
INSTITUTE OF BOTANY OF NATIONAL ACADEMY OF SCIENCES OF REPUBLIC OF ARMENIA
ARMENIAN BOTANICAL SOCIETY

ФЛОРА, РАСТИТЕЛЬНОСТЬ И РАСТИТЕЛЬНЫЕ РЕСУРСЫ АРМЕНИИ

Выпуск пятнадцатый

ՀԱՅԱՍՏԱՆԻ ՖԼՈՐԱՆ, ԲՈՒՍԱԿԱՆՈՒԹՅՈՒՆԸ ԵՎ ԲՈՒՍԱԿԱՆ ՌԵՍՈՒՐՍՆԵՐԸ

Պրակ տասնհինգերորդ

FLORA, VEGETATION AND PLANT RESOURCES OF ARMENIA

Issue fifteenth

Երեւան Yerevan Ереван 2004

R. A. HOVSEPYAN

ARCHAEOBOTANICAL FINDS OF SIX-ROWED BARLEY (*HORDEUM VULGARE*) FROM THE NEOLITHIC LAYERS (7TH–6TH MILLENNIA B. C.) OF THE ARATASHEN SETTLEMENT OF ARMENIA

The Neolithic site of Aratashen is at present known as the earliest period settlement on the territory of the Republic of Armenia from where we have archaeobotanical evidence of cultivated plants. Among the crops found in the Neolithic layers of the site *naked six-rowed barley* (*Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof.) and *emmer* (*Triticum dicoccum* (Schrank) Schuebl.) dominate. Remains of barley are represented as imprints of triplets, glumes and grains on pieces of clay constructions and buildings, as well as with charred grains – floated from fuel residues.

Հովսեփյան Ռ. Ա. Վեցշարք գարու (*Hordeum vulgare*) հնաբուսաբանական գտածոներ Հայաստանի Առափաշենի բնակատեղիի նեոլիթյան շերտերից (մ. թ. ա. 7–6-րդ հազարամյակներ): Առափաշենի նեոլիթյան բնակատեղին Հայաստանի Հանրապետությունում ներկայումս հայտնի հնագույն վաղ երկրագործական բնակատեղին է, որտեղ առկա են մշակաբույսերի վերաբերյալ հնաբուսաբանական փաստագրված տվյալներ: Հնավայրի նեոլիթյան շերտերից գտնված մշակաբույսերի մեջ գերակշռում են *վեցշարք մերկահատիկ գարին* (*Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof.) եւ *երկհատիկ ցորենը* (*Triticum dicoccum* (Schrank) Schuebl.): Գարու մնացորդները կավե կառույցների եւ շինությունների բեկորների վրա հասկիկների, թեփուկների, հատիկների դրոշմների, ինչպես նաեւ օջախներից ֆլոտացված ածխացած հատիկների ձեւով են:

Овсепян Р. А. Археоботанические находки шестирядного ячменя (*Hordeum vulgare*) из неолитических слоев (7–6 тыс. д. н. э.) Араташенского поселения Армении. Неолитическое поселение Араташен является пока древнейшим памятником в Республике Армения, где есть четко зафиксированные археоботанические сведения о возделывании культурных растений. Среди находок культурных растений из неолитических слоев местонахождения доминируют *голозерный многорядный ячмень* (*Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof.) и *пшеница двузернянка* (*Triticum dicoccum* (Schrank) Schuebl.). Остатки ячменя представлены отпечатками колосков, чешуй, зерен на кусках глиняных конструкций и строений, а также в виде обугленных зерен из очагов, полученных с помощью флотации.

The Neolithic settlement of Aratashen is located 1.5 km to the southwest of Vagharshapat (Echmiadzin; the Ararat valley), close to the village with the same name. The site is situated on the right bank of the Kassakh River, at an altitude of 852 m above sea level (Fig. 1).

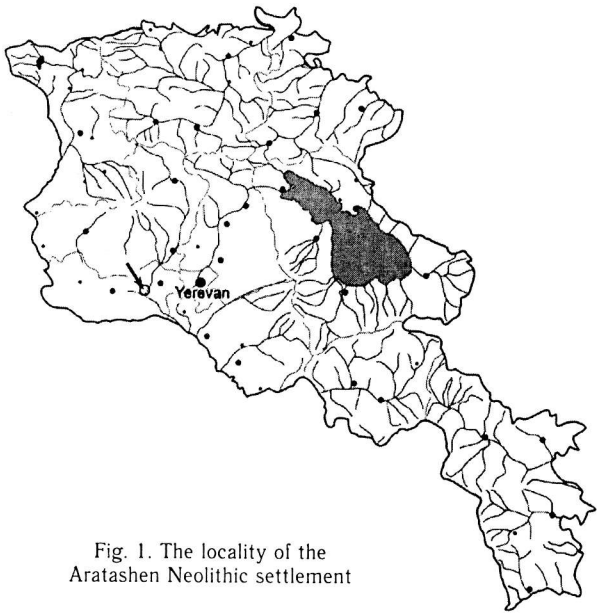

Fig. 1. The locality of the Aratashen Neolithic settlement

Ameliorative works destroyed the surface of the settlement. The settlement has cultural layers up to 2.5 m deep (Badalyan et al., 2002). The cultural layers of settlement are divided to 2 – upper and lower levels (from present surface down to 0.7–1 m depth and from 0.7–1 m to 2.5 m depth). Radiocarbon data indicate that the upper chronological limit of the lower level is 5800–5500 B. C. (Ly2268, Ly2259).

Archaeobotany of the lower layers of Aratashen were studied in 2003–2004.

Aratashen site is at present known as the earliest period settlement in Armenia where was discovered archaeobotanical evidence of cultivated plants. Inside of the archaeobotanical finds from the site are quantitatively dominated by *naked six-rowed barley – Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof. (=*Hordeum vulgare* L. subsp. *vulgare* var. *nudum*) and *emmer – Triticum dicoccum* (Schrank) Schuebl. The remains of barley are represented by empty imprints of broken glumes, complete triplets, bases of triplets and imprints of grains with charred remains – on the pieces of clay constructions and buildings, as well as with charred grains floated from hearths.

In the clay constructions (ovens and/or reservoirs), sun dried mud bricks and daub of the walls of dwellings (Fig. 2) remains of *barley* are accompanied with imprints of spikelets and glumes of *emmer* (*Triticum dicoccum*; cereal), capsules of *desert alyssum* (*Alyssum desertorum* Stapf; weed), legumes of *small-seeded lentil* (*Lens culinaris* Medik. subsp. *microsperma* (Baumg.) Bar.; pulse), sometimes – capsules of *false-flax* (*Camelina microcarpa* Andrz.; cruciferous oilcrop) and legumes of *bitter vetch* (*Vicia ervilia* (L.) Willd.; pulse). The imprints of those glumes, spikelets, triplets, capsules and legumes were mainly empty, but they sometimes include charred grains and seeds, which are accidentally incorporated into clay.

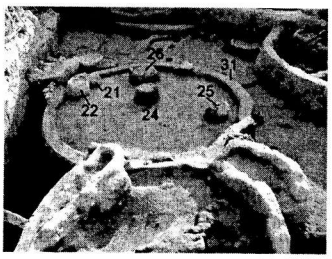

Fig. 2. Some structures and buildings (walls) from the Neolithic layers of the Aratashen settlement (structures № 21, 22, 24, 25, 26, 31).

By flotation of fuel residues (Fig. 3) were detected grains of *naked six-rowed barley* and *emmer*, seeds of *small-seeded lentil*, as well as seeds of *Bolboschoenus maritimus* (L.) Palla (wetlands' plant), *Chenopodium* sp., *Amaranthus* sp. (weeds).

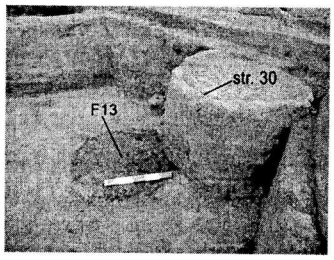

Fig. 3. Hearth (F13) from the Neolithic layers of Aratashen settlement.

Some small, mineralized pieces of an herbivore's coprolite were also found in the fireplaces.

All plants found from at lower level of the Aratashen settlement are edible (have edible seeds or fruits; Hillman, Colledge, Harris, 1989).

Description of the finds of barley. Rachis tough, its remains (imprints) consist of up to 5–6 internodes. Internodes 2.5–3.1 mm length, 0.9 mm width in the bottom, 1.6–1.8 mm width at the top.

Triplet with three spikelets, in average 15 mm length, 13 mm breadth. Middle grains in glumes 11–15 mm length,

3.8–4 mm breadth, lateral grains in glumes slightly bent and asymmetrical (Fig. 7) – 9 mm length, 3–3.5 mm breadth.

Internal (ventral) flower-glumes with furrow; external (dorsal) flower-glumes with 3 longitudinal edges on dorsal side: central and 2 marginal (the external flower-glumes of barley have also 2 lateral edges, which are not represented on the fractures of imprints).

Charred grains naked, narrowly ellipsoid, ellipsoid, narrowly egg-shaped or egg-shaped (the middle part of the last form swollen as a result of carbonization), (3.75–)5.09 (–7.35) mm length, (1.95–)2.86(–4) mm breadth and (1.25–)2.02(–3.25) mm thickness; slightly dorso-ventral compressed, widest in the middle, sometimes in the lower half, thickest in the middle; grains more narrow on the upper half; apex narrow, rounded or truncated, thinner than the base; dorsal site more convex than the ventral; on some grains are visible 2 dorsal marginal fine edges, which spread from the base to the apex, distance between those edges 1–1.6 mm in the middle of grain, on dorsal site of some samples is visible the central longitudinal strip, too; ventral furrow of the grains have (0.25–)0.37(–0.63) mm width in the middle, it stays narrow near the apex and base. On the surfaces of well preserved grains visible longitudinal linearity. Surface of some grains cross-shriveled.

Germ egg-shaped, (0.88–)1.22(–1.88) mm length, (0.85–)1(–1.38) mm breadth.

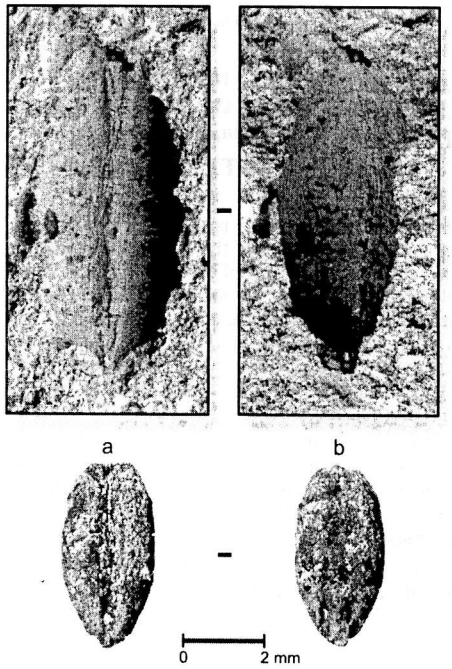

Fig. 5. Imprint with charred grain of *naked barley* (UF 320): a – the ventral side, b – the dorsal side

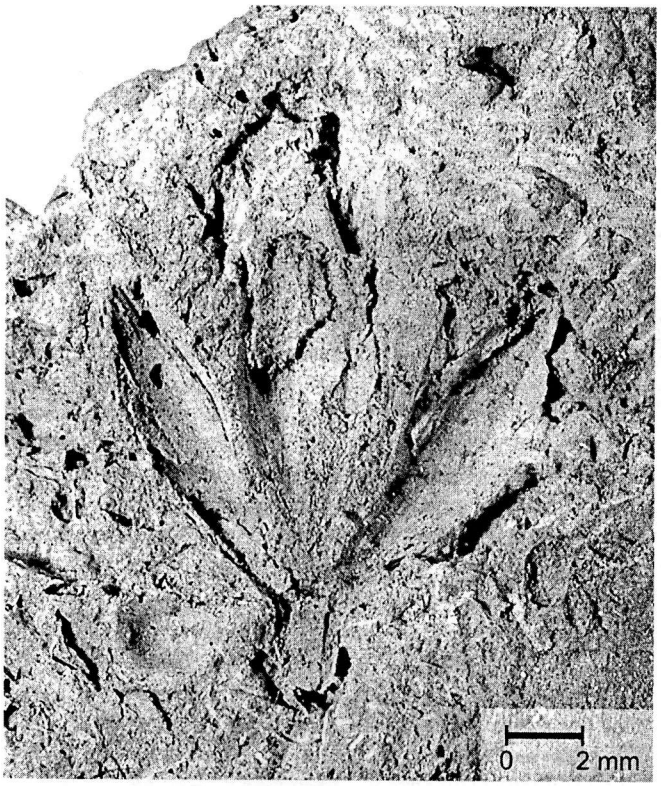

Fig. 4. Imprint of triplet of *naked six-rowed barley* (*Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof.; str. K06).

Polymorphy of grains is caused by heteromorphy of them inside the triplets (the lateral grains are considerably smaller, asymmetrical and narrow), as well as by various types of thaphonomy. As a result of cooked grains become more or less swollen, have puffings (usually apical, Fig. 7) and some details of surface eliminated. Part of grains broken on margins and lack germ.

Barley remains from building clay – imprints of empty triplets (Fig. 4), bases of triplets, broken glumes, as well as imprints with charred naked grains belong to *naked six-rowed barley* – *Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof. (Table 1; Fig. 5, 6). Imprints and charred remains of grains are certainly naked and encountered rarely. Empty triplets, internodes with bases of glumes and broken in the base glumes are typical for the *naked six-rowed barley* and can be products of trashing (Yanushevich, 1976). Awns are absent in archaeobotanical material: maybe awns were broken because of trashing or the studied barley was awnless. The presence of imprints of rachises with 4–6 internodes proves that rachis was tough. The sizes of the internodes match that studied barley had lax spikes (in our case proximally 13 internodes per 4 cm rachis; Gandilyan, 1980).

Table 1. Imprints and charred remains of *naked six-rowed barley* from the clay constructions of the Neolithic layers (7th–6th millennia B. C.) of the Aratashen settlement.

Location	***Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof.**	
№	Imprints (Pieces of ears, complete triplets, bases of triplets, glumes and/or rachis)	The number of charred grains from imprints
UF 237	+	-
UF 273	+	1
UF 318	+	1
UF 320	+	1
UF 324	+	3
Str. K01	+	-
Str. K02	+	2
Str. K06	+	1
Str. K09	+	-
Str. 3	+	-
Str. 19	+	1
Str. 24	+	-
Str. 25	+	-
Str. 26	+	-
Str. 31	+	-
Str. 34	+	-
Total	+	10

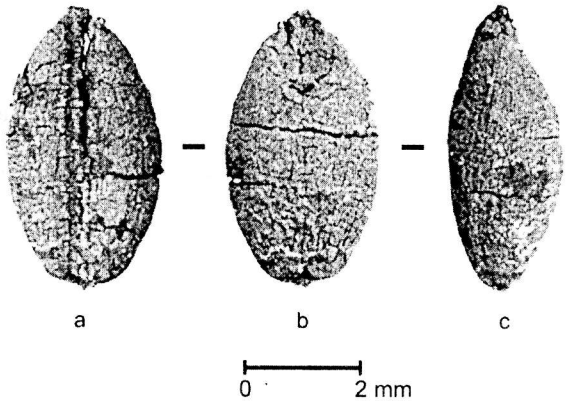

Fig. 6 Charred grain of *naked barley* from imprint (str K02). a – the ventral side, b – the dorsal side, c – the lateral side

Part of the charred grains from the hearths is relatively smaller, asymmetric and narrower, which proves that they belong to *six-rowed barley*. Floated from the hearths charred grains chiefly have well preserved surface, but lack even remains of flower-glumes. That phenomenon allows us to propose that the floated grains (or part of them) also belong to the *naked six-rowed barley* – *Hordeum vulgare* L. subsp. *vulgare* convar. *coeleste* (L.) A. Trof. (Table 2).

The quantity of impressions of barley remains varies from some imprints up to 50 per 1 liter sediment. The grains are very rare in clay and always represented as impressions of grains or triplets with charred remains.

Table 2. Finds of charred grains of *naked six-rowed barley* detected during flotation of the Neolithic layers (7th–6th millennia B. C.) of archaeological sediments of the Aratashen.

Locality	***Hordeum vulgare* L.** (naked)	
№	The volume of floated sediments (liter)	The number of grains
F 13	40	64
Str. 48	20	6
UF 341	30	4
UF 291	50	3
UF 294	20	1
Total	**160**	**78**

The *naked barley* was mainly used for food (Zohary, Hopf, 2000) and was the one of the general crops in the Aratashen. In the Near East archaeological sites in which the *naked six-rowed barley* predominates, it tends to be 7th, 6th millennia B.C. (Zhukovski, 1971; Kislev, 1992).

The *naked six-rowed barley* in Armenia is known also from the Eneolithic period (Shengavit), the Urartian period (Karmir-Blur, etc.) and from the Bronze Age. The mentioned barleys were also awnless, but had spherical grains unlike to barley from the Aratashen. The *naked barley* at present doesn't grow in Armenia, and the six-rowed forms are grown now exclusively under moist conditions. More large distribution of the *six-rowed barley* in the past caused by more moist climatic conditions of Armenia in the abovementioned periods (Tumanyan, 1948; Gandilyan, 1997).

From the upper level of Aratashen *Hordeum vulgare* L. was identified by G. Willcox (in preparation).

Acknowledgements: I would like to thank all members of Aratashen team, in particular R. Badalyan, P. Lombard, C. Chataigner, P. Avetisyan, who kindly provided information about archaeological situations, radiocarbon data and photos of the site. As well as my sincere thanks to G. Willcox, E. Nazarova, I. Gabrielyan for professional advice and B. Gasparyan, D. Arakelyan for kindly provided technical support.

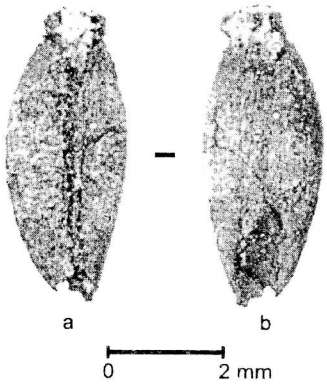

Fig. 7. Charred lateral (right) grain of *naked barley* from imprint (UF 273, str. 19): a – the ventral side, b – the dorsal side.

REFERENCES

Badalyan R., Lombard P., Avetisyan P., Chataigner C. 2002. The Neolith-Eneolithic culture of the Ararat valley (by materials of Aratashen locality) // Ancient culture of Armenia, 2, "Science", Yerevan, pp. 5–12. (in Russian)

Gandilyan P. A. 1980. Identifier of wheat, aegilops, rye and barley. Publ. of the Acad. of Sciences of the Arm.SSR, Yerevan, 287 p. (in Russian)

Gandilyan P. A. 1997. Archaeobotanical evidence for evolution of cultivated wheat and barley in Armenia // Origins of Agriculture and Crop Domestication, Aleppo, pp. 280–285.

Hillman G. C., Colledge S. M., Harris D. R. 1989. Plant-food economy during the Epipalaeolithic period at Tell Abu Hureyra, Syria: dietary diversity, seasonality, and modes of exploitation // Foraging and farming: The evolution of plant exploitation, UNWIN HYMAN, London, pp. 240–268.

Kislev M. E. 1992. Agriculture in the Near East in the VIIth millennia B. C. // Préhistoire de l'agriculture: Nouvelles approches expérimentales et ethnographiques, Monographie du CRA n° 6, éd. CNRS, Paris, pp. 87–93.

Tumanyan M. G. 1948. The main periods of barleys evolution in the Armenia // Handbook of the Acad. of Sciences of the Arm. SSR: Biological and Agricultural sciences, vol. I, 1, Yerevan, pp. 73–85. (in Russian)

Yanushevich Z. V. 1976. Cultivated plants of south-west of USSR by palaeobotanical studies. "Shtiintsa", Kishinev, 216 p. (in Russian)

Zhukovski P. M. 1971. The cultivated plants and their relatives. 3rd edition, "Kolos", Leningrad, 752 p. (in Russian)

Zohary D., Hopf M. 2000. Domestication of Plants in the Old World: The origin and spread of cultivated plants in West Asia, Europe and the Nile Valley. 3rd edition, Oxford University Press, 316 p.

Yerevan State University, Faculty of Biology, Department of Botany, 375049 Yerevan, Alek Manukian 1