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A NEW SPECIES *BRASSAIOPSIS MIRABILIS* KOL. FROM EARLY PLIOCENE FLORA HORTUN-1 (ARMENIA)

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Hortun-1 is one of the richest fossil floras of Armenia and dates from Early Pliocene (Early Akchagil). The studied material includes more than 2100 samples kept in the Institute of Botany of NAS RA, in the Palaeobotanical storage. As a result of the study, 4 imprints of leaves of *Brassaiopsis mirabilis* Kol. were determined, which were the first brought for the fossil floras of Hortun and for the whole Armenia. Samples give an opportunity to make a conclusion on climate change.

Keywords: Hortun-1, clay sediments, *Brassaiopsis mirabilis* Kol., Early Pliocene, Early Akchagil, palaeoclima.

Introduction. The present work is devoted to the study of fossil flora of Hortun-1 locality. Geological sediments containing fossil flora belong to the third suite of the Yelpin series of West Vayots Dzor Marz and dates as Early Pliocene, Early Akchagil [1–3]. This locality is situated nearby the former village Hortun in Ararat Region and contains plant remains in the form of imprints of leaves and fruits [4]. Until 2014 only one outcrop of geological layers with 30–40 *m* height and 90 *m* length was known. In 2014, during the expedition the authors discovered two more outcrops there, north-east from general one. Though they are not very large (about 5 m^2), but contain many imprints.

The fossil flora of Hortun-1 locality was first studied by A.L. Takhtajan and N.G. Goghtuni, later by I.G. Gabrielyan and A.S. Papikyan [5–14].

Materials and Methods. The studied material includes gatherings of 1946–2015 from Hortun-1 Early Pliocene flora (more than 2100 samples). The samples are kept in the Institute of Botany of NAS RA, in Palaeobotanical storage. The imprints were compared with the leaves of modern species of Araliaceae kept in the Herbarium of the Institute of Botany on the basis of Comparative Morphology method [15]. Fossil leaves were compared also with fossil and modern leaves of the other locations of Northern Hemisphere. The data were developed statistically [16].

As a result of the study for the first time for Armenia 4 imprints of leaves of *Brassaiopsis mirabilis* Kol. were determined. State of preservation of fossils is various.

Results and Discussion. *Brassaiopsis mirabilisis* is first brought for the fossil flora of Hortun-1 and for all Armenia either.

Systematics

Division Magnoliophyta Cronq., Takht. & W. Zimm.

Class Magnoliopsida Brongn.

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Family *Araliaceae Juss*., Nom. Cons.
Genus *Brassaiopsis* Decne. & Planch.
Species *Brassaiopsis mirabilis* Kolakovsky, 1964.

Samples. Γ'–341 a; Γ'–600 b; Γ'–1135 a; Γ'–1290 b.

The specimens Γ'–600b and Γ'–1135a are saved in the part of base of leaves and upper part of petioles, Γ'–341a and Γ'–1290 b are saved in the middle part of leaves. Preserved part of Γ'–1135 a has 5 *cm* length and 4.2 *cm* width. General veins are enlarged, merged at the point where they exit the petiole. They are fan-shaped, divergent under angle 20–30°, 1.5 *mm* width. Secondary veins are double thin and few. Tertiary veins depart almost at a right angle to the general veins, branched in the middle and create generally incorrect oblong large cells. Fourth order veins create a dense network of alveolus. Conservation remains of veins and sheets like a chard show that the leaves were very thick which is characteristic for the species living today. The margins are distantly serrulated. Petioles at specimen Γ'–1135a have 4.1 *cm* length and 0.7 *cm* width (see Figure).

Brassaiopsis mirabilis Kol.: 1) Γ' – 1135a; 2) Γ' – 600b.

Comparative Remarks. *Brassaiopsis* is a genus of shrubs from family *Araliaceae*, which was first described in 1854 [17]. There are about 45 species distributed in Asia from the Himalaya through China, Vietnam, Thailand to Indonesia. 24 species (ten endemics) are known from S and SW China [18]. 4 species are included in the IUCN Red List as endangered species (*Brassaiopsis simplex* (King) Stone, *B. minor* Stone, *B. acuminate* Li, *B. kwangsiensis* C, Ho) [19].

There are two types of leaves in this genus: palmately-lobed and palmately-pinnate. The first type has a sharply serrated or sharp-toothed edges of the lamina for the most part. But the second group has a distantly serrulated edge of lamina as that of *B. palmata* Kurz (*B. hainla* (Buchanan–Hamilton) Seemann), which is closely related to the fossil leaves of *B. mirabilis*. They are similar by venation (5 general enlarged veins, double thin secondary veins, dense alveolus network), by distantly serrated margins and very thick petiol. Therefore, the mentioned type is the closest modern equivalent to the discussed fossil specimens.

Studied leaves have similarities with another representative of the family *Araliaceae* – *Kalopanax septemlobus* (Thunb. ex A. Murr.) Koidz. But petiols of *Kalopanax septemlobus* never reach 5–7 *mm* thickness, they are quite thin, almost similar to the general veins.

B. mirabilis was described by A.A. Kolakovsky in 1964, who undertook an analysis of a rich Pontian flora locality by the Kodori River, near Meore-Atara village [20], the age of which is similar to the locality Hortun-1.

According to A. Kolakovsky, this Kodorian flora is unique and one of the richest in Eurasia. The Kodorian flora was mainly composed of subtropical plants (30.5%), especially in riparian forests and lower mountain belt communities [21]. One such community was formed of *Quercus neriifolia, Salix varians, Alnus subcordata*

and *Myrica lignitum*. Swamp forests were composed of *Alnus subcordata* and *Salix varians*, judging from the distinct layers of leaves and catkins present in the deposits. In Hortun-1 *Alnus subcordata* and *Salix varians* also were described [6, 12], there are some other similarities between both these floras.

Conclusion. All these facts allow us to conclude that in Pliocene epoch in Armenia was dominated continental-lake mode, with the accumulation of powerful volcanic and freshwater-lake formations. This is evidenced by the climate analysis done in 2001 [22].

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