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Field Gladiolus (*Gladiolus italicus* Mill.) — Contaminant of Grain Storage Facilities in Southeastern Serbia during the Antique Period

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Summary: Archaeological excavations in southeastern Serbia have unearthed previously undocumented charred seeds from the early to late antiquity. These seeds exhibit a semispherical, laterally compressed, and angular morphology. Provisionally, they have been classified as Iridaceae. The macrobotanical remains closely resembled seeds of the extant *Gladiolus italicus* Mill. By charring modern field gladiolus seeds, the authors verified their initial findings, providing a valuable case study on the taphonomic processes that preserve the soft membranes of charred *G. italicus* seeds. The charring experiment revealed an additional morphological form among archaeobotanical finds. If the brittle seed membrane falls off due to exposure to high temperatures, the resulting seeds exhibit a „smooth" surface with a globose-pyriform (rounded, pear-shaped) shape. The presence of macro remains at the late Classical/early Hellenistic urban settlement of Kale-Krševica, built in the Greek style; the Late Roman imperial site of Felix Romuliana; and the Byzantine imperial site of Jusiniana Prima reveals that this plant species was a weed contaminant in fine-sieved grain storage facilities. Macrobotanical finds significantly contribute to understanding the introduction of this plant species into the weed flora of Serbia and encourage further research on its past distribution in the Balkans.
Keywords: archaeobotany, *Gladiolus italicus*, seed determination, taphonomy, weed flora, grain storages, southeastern Serbia, antique period

Introduction

Successful identification of charred plant remains recovered during archaeological excavations can be a particularly time-consuming and labor-intensive process. This is especially true for morphologically challenging taxa—for example, the identification of caryopsis and spikelet fork remains of *Dasypyrum villosum* (L.) Borbás (Kenéz et al., 2014) or the determination of seeds of *Lallemantia iberica* (M. Bieb.) Fisch. & C. A. Mey. (G. Jones & Valamoti, 2005). One of the most prominent archaeobotanical determination problems has been the so-called "new" glume wheat (*Triticum timopheevii* Zhuk. s.l.), whose recognition required extensive morphological comparison as well as, more recently, complementary molecular approaches (Czajkowska et al., 2020; Filipović et al., 2023). Although ancient DNA (aDNA) analyses can provide crucial support in distinguishing closely related cereal taxa, the retrieval and authentication of genetic material from charred remains is itself methodologically demanding and often extends the overall identification timeline.

Macrobotanical analyses from a late Roman/early Byzantine site in eastern Serbia (Felix Romuliana/Gamzigrad) uncovered charred seeds that were semi-spherical, irregular, laterally compressed, and somewhat cubical (Medović, 2008). The seeds, 2–3 mm long and distinctly wrinkled, displayed a dense, solid cross-section. Most of the seeds are wider at the chalazal pole. The ventral side is concave, whereas the dorsal side is convex. The micropylar region is acuminate with a distinctive hilar-end-hole. Seed morphology appears to correspond to their position within the capsule. Seed morphology is a key characteristic for taxonomic identification. If the seeds are relatively form-variable, it is even harder to determine the species.

Based on their angular form, the findings from Gamzigrad (Figs. 4 and 5) were provisionally classified as *Nigella* seeds (Medović, 2008). They haven't been determined satisfactorily. New macrobotanical findings emerged almost simultaneously during the excavations at the late Classical/early Hellenistic settlement of Kale-Krševica near the border of the Republic of North Macedonia, and the early Byzantine site of Justiniana Prima (Serbian Caričin Grad) near today's town of Lebane (Fig. 1). Unknown seeds that match the description were determined by the authors only to the family level as Iridaceae members. The seeds resemble those of the *Iris* family (pers. comm. Bojan Zlatković, Niš, Serbia, May 2018). Morphologically, the findings resemble *Iris pseudopallida* Trinajstić and *I. pallida* Lam.; however, the difference in size is substantial. Both species are members of the Pallida iris series, native to Dalmatia (Croatia).

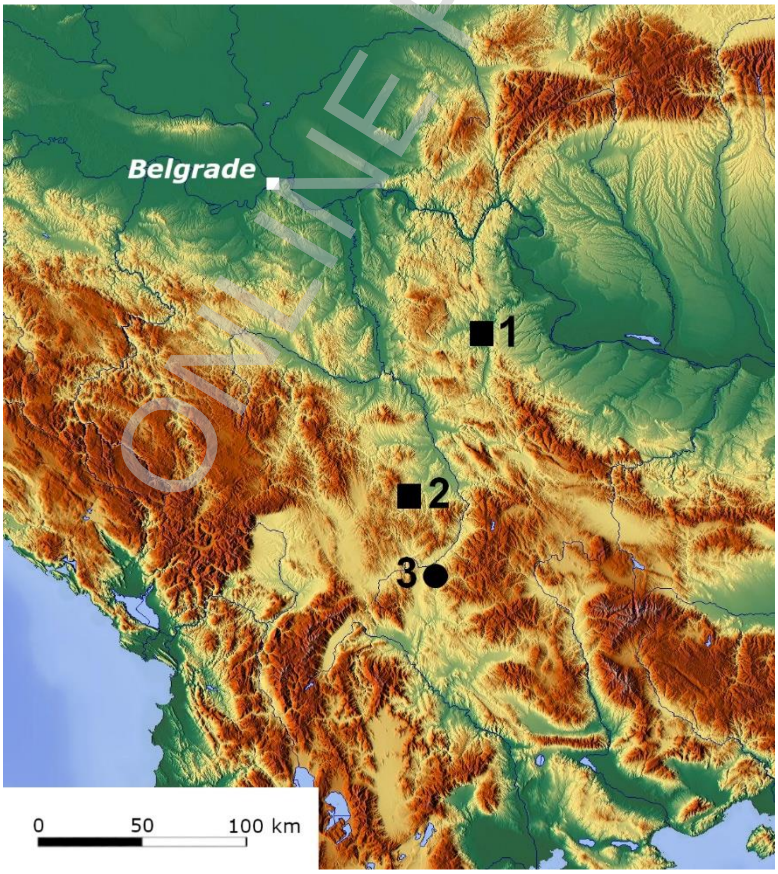

Figure 1. Archaeological sites in Serbia containing charred seed remains likely belonging to the species *Gladiolus italicus*: 1. Felix Romuliana, 2. Justiniana Prima, 3. Kale – Krševica. Black squares indicate late Roman/early Byzantine sites; black circles indicate late Classical/early Hellenistic sites.

Materials and Methods

Charred plant material at three archaeological sites in eastern and southeastern Serbia was obtained by flotation of the substrate from archaeological features; two by manual bucket flotation and one by flotation drum (Justiniana Prima). In the laboratory, samples were fractionated with a table sieve set and separated into >3 mm, >1.5 mm, and >355 µm fractions to enable efficient processing of the dried sieving residues. The sieving residues were sorted and identified under a stereo-microscope, using magnifications of 10x to 45x.

For identification literature (Bojňanský & Fargašová, 2007; Cappers et al., 2012; Neef et al., 2012; Szilárd, 1967), as well as the reference collections of the Institute of Pre- and Protohistoric Archaeology at Kiel University and the Museum of Novi Sad, were used. Additionally, colleagues specializing in botany were consulted to evaluate potential candidate taxa: Helmuth Kroll, PhD, University of Kiel, Germany; Tsvetanka Raycheva, Prof., University of Plovdiv, Bulgaria; Božena Mitić, Prof., University of Zagreb, Croatia; Slađana Jevremović, PhD, University of Belgrade, Serbia; and Bojan Zlatković, Prof., University of Niš, Serbia. Johannes Ulrich Urban supplied us with fresh *G. italicus* seeds from Portugal for comparison purposes.

In August 2018, a charring experiment on field gladiolus seeds obtained from retail sellers in Greece took place in Novi Sad. The charring experiment was conducted to produce modern reference samples whose characteristics could be directly compared with those of charred archaeological specimens. The study examined the effects of controlled and uncontrolled heat treatments on two groups of freshly harvested field gladiolus seeds. One group of dried, fresh seeds was exposed to 200°C heat in an oven for 60 minutes. The other group of fresh seeds was placed in sand beneath a burning fire on the shore of the Danube River in Novi Sad, with exposures of 5, 10, and 15 minutes. The seeds from both experimental groups were encased in aluminum foil. The open-fire charing simulation was limited by the absence of temperature monitoring, leaving the actual thermal conditions unknown and preventing accurate comparison, interpretation, and reproducibility of the seed-exposure treatments.

Results

Identification

Since the seeds were recovered from cereal-mass deposits and from contexts associated with grain processing and storage at Kale, Felix Romuliana, and Justiniana Prima, their most probable origin is the weed flora of arable fields. Members of Iridaceae grow in many different habitats, but few species are listed in the weed flora of former Yugoslavia (Čanak et al., 1978). Most of the limited species are the weeds found in pastures, hayfields, and forests. However, in the diverse weed flora of today's south-eastern Serbia (355 species from 12 families), there are no representatives of the Iridaceae family (Ranđelović et al., 2005; Vrbnicanin et al., 2009). The same is true for the Republic of North Macedonia (Kostov & Pacanoski, 2007).

The similar size and shape of the seeds initially led authors to examine field gladiolus (*Gladiolus italicus* Mill., syn. *G. segetum* Ker-Gawl.) more closely. This cormous perennial is commonly found as a weed in cultivated and fallow fields throughout the Mediterranean region (Tan & Edmondson, 1984).

The seeds of *G. italicus* are angular, pyriform, globose, and wingless (Cuenod et al., 1954), 4–4.8 long x 2.7–3.2 mm wide (Bojňanský & Fargašová, 2007). The dimensions of the recent seeds of field gladiolus from Ukraine are 4–4.8 x 2.7–3.2 mm (Zhygalova et al., 2014). In Tunisia, capsules contain an average of 23.1–30.2 seeds, with seed diameters ranging from 2.99 to 3.18 mm. The mean weight of 1000 seeds is 15.8-16 g (Emna & Faouzi, 2015). In Crete, the seeds are approximately 3–5 mm long. The embryo is large and linear. The mean seed mass is 11.79 ± 0.37 mg (Mavroeidi, 2015). In Turkey, triquetrous seeds measure 3−3.5 × 2−2.5 mm (Tan & Edmondson, 1984). Macrobotanical specimens recovered in Serbia exhibit reduced size, likely due to shrinkage during charring (Figs. 2–6). The shapes of both charred and modern seeds vary considerably, which is typical for seeds that must compete for space inside their capsules.

The charred seeds tentatively attributed to *Gladiolus italicus* from the Serbian archaeological sites exhibit irregular morphological features, and no aDNA evidence is available to support a secure identification. Furthermore, similar finds are not documented in the existing archaeobotanical literature. These remains will therefore be referred to in the text as *Gladiolus* cf. *italicus*.

Archaeological and archaeobotanical context
Kale-Krševica

The settlement of Kale at Krševica was established at the beginning of the 4th century BC. It lasted until the first decades of the 3rd century BC. The acropolis with large suburbs had all the characteristics of an urban settlement built according to Greek models (Popović et al., 2012). In a single macrobotanical mass sample (220 g), sixteen *Gladiolus* cf. *italicus* seeds were determined (Figs 2 and 3). They weigh 42 mg. The sample consisted mainly of einkorn, hulled barley, and spelt wheat grains (Tab. 1). The main weedy infestants were big-seeded corncockle (*Agrostemma githago* L.), darnel (*Lolium temulentum* L.), and several *Galium* species (G. spurium L., G. aparine L., G. tricornutum Dandy), which are hard to eliminate by crop processing. Among weeds, there were also remains of imagos, pupae, and larvae of the granary weevil (*Sitophilus granarius* L.) (Medović, 2020).

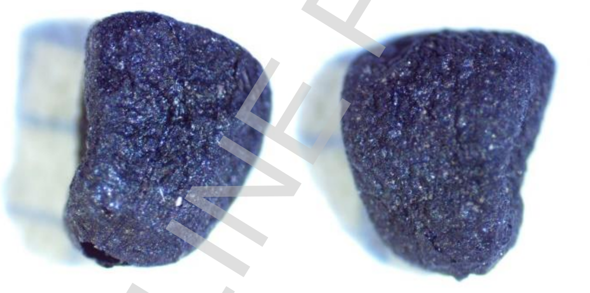

Figure 2. Charred, ca. 3 mm long and ca. 2.5 mm wide *Gladiolus* cf. *italicus* seed from the settlement of Kale at Krševica. Photo: A. Medović.

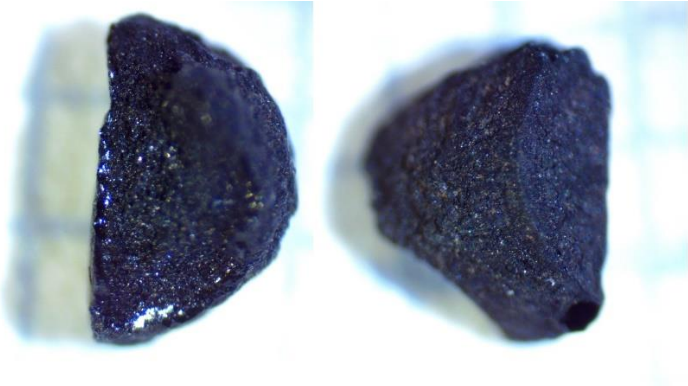

Figure 3. Charred *Gladiolus* cf. *italicus* seed from the settlement of Kale at Krševica. The cross-section of the seed (left) displays a solid endosperm and a glazed surface layer. Photo: A. Medović.

Felix Romuliana

Felix Romuliana is a late Roman to early Byzantine archaeological site in eastern Serbia. One of the Tetrarchs, Emperor Galerius, built the imperial palace at the end of the 3rd century. Later, the site became a modest settlement of farmers and craftsmen and persisted until the early 7th century. Archaeobotanically, four late Roman layers (3rd to 5th century) and two early Byzantine layers (6th century) were examined (Medović, 2008). *G.* cf. *italicus* seeds (Fig. 4 and 5) are only found in three layers, one from the fifth and two from the sixth century. These layers showed the highest prevalence of charred plant artifacts compared to others. In a 5th-century granary (during the „refugium" period), a 130 g charred sample contained four gladiolus seeds. The storage stored naked wheat (*Triticum aestivum* L. s.l.) and had a relatively low weed infestation level. Only the large-seeded corncockle and cleavers (*Galium aparine* L.) were present in more than 100 finds. This suggests that finely sifted grain was stored. In a naked wheat sample from the first half of the 6th century (early Byzantine settlement), impurities, including grains of rye (*Secale cereale* L.), *G. aparine* L., and *Agrostemma githago* L. were present, with one *G.* cf. *italicus* seed. During the second half of the 6th century, a period marked by fortification restorations, the number of gladiolus findings increased to eight across three samples containing a grain mixture of *Triticum monococcum* L., *T. aeastivum* L., *Hordeum vulgare* L. subsp. *vulgare*, *Avena*, *Secale cereale* L., and *Panicum miliaceum* L. Among the three earliest occupation layers, no *G.* cf. *italicus* seeds were identified. These layers also contained the fewest plant remains.

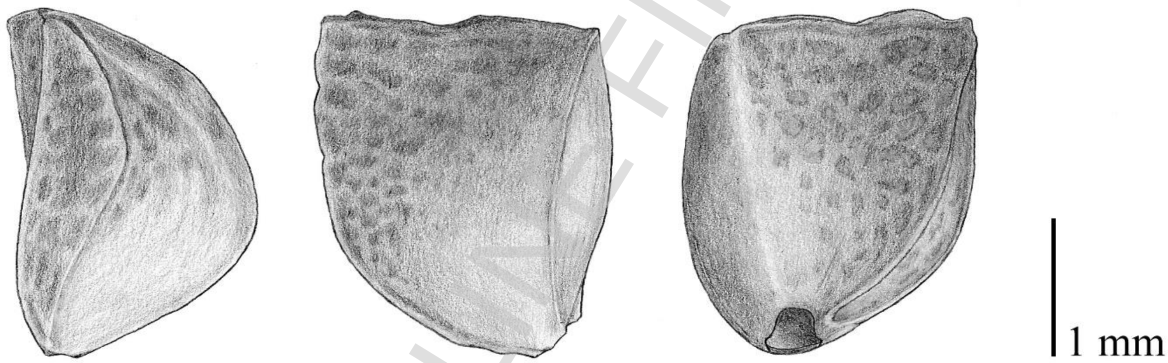

Figure 4. Charred *Gladiolus* cf. *italicus* seed from Felix Romuliana, 6th cent. (Medović, 2008). Drawing: A. Medović.

Justiniana Prima

Justinina Prima was a late antique city founded in the early 6th century in northern Illyricum, in the western part of the province of Dacia Mediterranea, near the border with Dardania. It is situated in the Lebane district (south Serbia), about 45 km from Niš (ancient Naissus) (Fig. 1). Located away from major transit routes, the city was built in fertile valleys along the Pusta, Jablanica, and southern Morava rivers (Baron et al., 2019; Ivanišević, 2010; Reuter, 2023). Justiniana Prima was designed as the new episcopal and administrative center of the Illyricum prefecture (Sarantis, 2016). However, this plan was likely hindered by ongoing invasions from barbarian groups, leading to the city's abandonment after less than 100 years of existence at the start of the 7th century. The abandonment should not be seen as a pause; instead, change is indicated by structural modifications from the mid-6th century onward, including simpler construction, renovations, and secondary use of buildings, suggesting that the city's decline began then (Ivanišević, 2010).

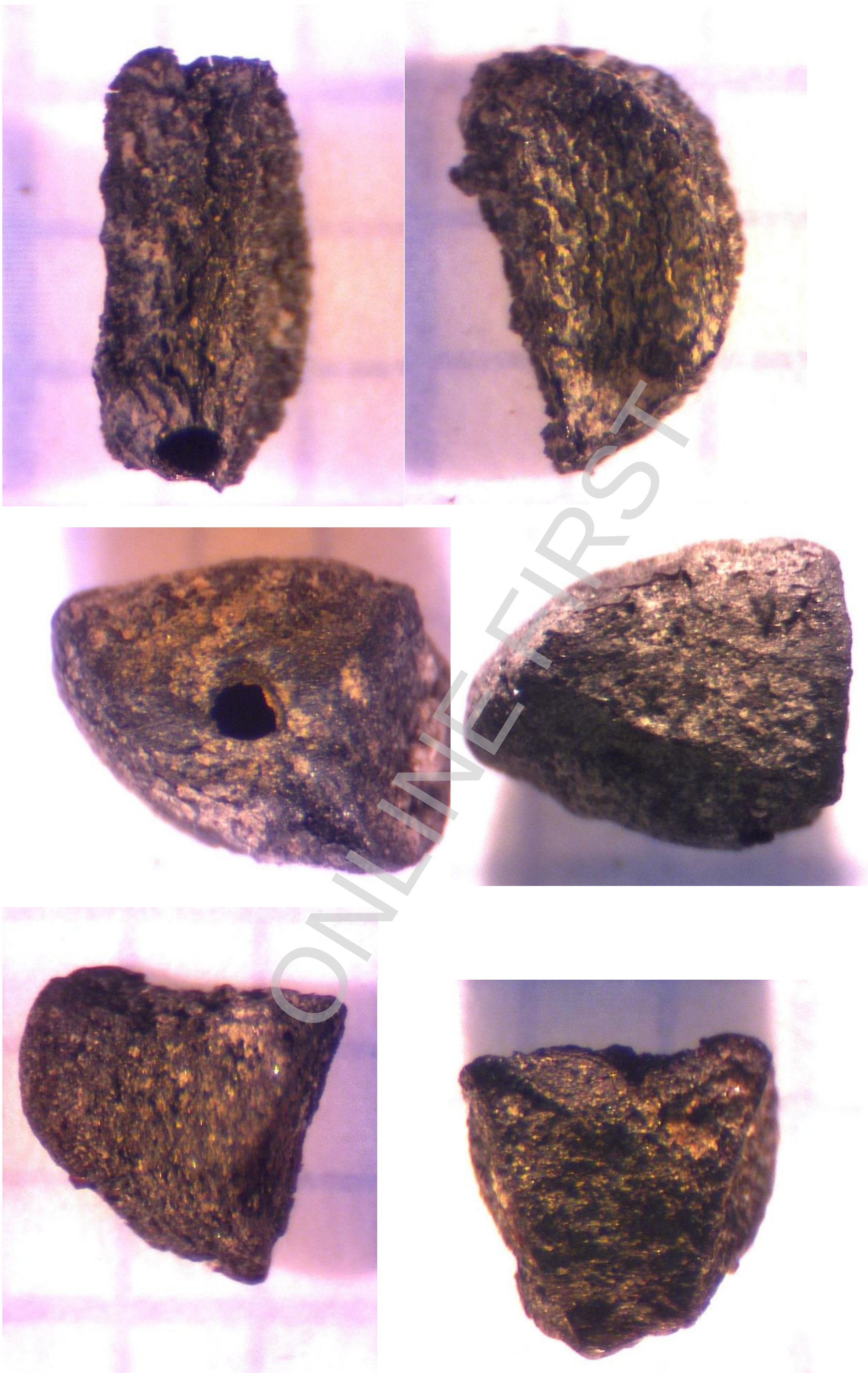

Figure 5. Two charred *Gladiolus* cf. *italicus* angular seeds with distinct hilar-end-hole and one seed without a visible hilar-end-hole from Felix Romuliana. Photo: A. Medović.

In Justiniana Prima, 202 *G.* cf. *italicus* seeds were found in different contexts (Fig. 6). Seventy-three seeds originated from four cereal-storage deposits, found in their original containers (pithoi), within three excavation areas of the lower town. The storage finds were mostly cleaned of weeds and cereal chaff and mostly contained *Triticum aestivum* L. (Reuter, 2023). Additionally, all storages contained small amounts of admixtures of other cereals (such as *Avena*, *Hordeum vulgare* L. subsp. *vulgare*, *Panicum miliaceum* L., *Triticum dicoccum* Schrank ex Schübl., *T. monococcum* L., and *Secale cereale* L.). Two of them contained somewhat higher levels of rye, suggesting residual material from a prior cultivation season or evidence of mixed cropping. Other crops, such as legumes and fruits, are only represented in small numbers. Among the weeds, *Agrostemma githago* L. is the dominant species. The other 126 *G.* cf. *italicus* seeds originate from the upper-town granary (*horreum*) north of the acropolis. The building had an entrance area, a vestibule, and a large adjoining storage room measuring 22 x 10 meters (Ivanišević et al., 2019). It is believed that the storage room had a wooden floor. The building was destroyed in a large fire at the end of the 6th century. By the early 7th century, small structures were erected on the debris. Several layers and specific features were extensively sampled. The analysis results suggest that the building was no longer used for storage at the time of the fire. The plant spectrum (n = 262,633) is mainly composed of weeds (37 %) and wild plants, primarily grassland vegetation (38 %) and to a lesser extent cereals (9 %). However, the structure's features indicate its use as a granary where grain was cleaned, potentially explaining the high proportion of weeds that likely collected beneath the wooden floor. The large number of species classified as grassland vegetation suggests that animal fodder may also have been stored.

The charring experiment

The charring experiment's findings can be summarized as follows:

1. The shape of the charred macrobotanical remains corresponds to that of modern seeds only when the membranous cover remains attached (Fig. 7).
2. Removal of the membranous cover reveals a circular hilum opening (Fig. 8).
3. Varying exposure durations of fresh seeds to fire significantly impact the morphology of the charred seeds. Prolonged exposure (15 minutes) caused the membrane to become brittle and easily removable.
4. Prolonged exposure of seeds to 200 °C produced a morphology identical to that of the antique seed findings. Undamaged membranes wrapped around the seeds give them a triquetrous, angular shape and wrinkled surface.
5. The wrinkled membrane cover could only be peeled off with additional rubbing by fingers. If this wrinkled cover is missing, the pyriform seeds have a „smooth" surface and edges (Fig. 8 and 9).

The charring experiment prompted a reexamination of a 5th-century Gamzigrad storage room sample (Table 2), which previously yielded four *G.* cf. *italicus* charred seeds with attached membranes. Seven seeds (Fig. 10) that match charred modern field gladiolus seeds without membranes were also recorded (Fig. 11). The seeds were previously described as *Allium* bulbils (Medović, 2008).

Figure 6. Charred *G.* cf. *italicus* seeds from Justiniana Prima. Photo: A. Reuter.

Figure 7. Charred triquetrous gladiolus seed from Justiniana Prima and the recent field gladiolus seed with membranous cover collected from natural populations in Portugal. Photo. A. Reuter.

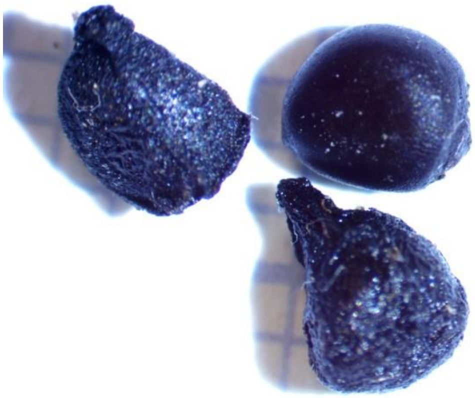

Figure 8. Experimental charring of recent *G. italicus* seeds with a membrane cover resulted in a distinct triquetrous shape of macrobotanical finds. Following a 60-minute charring process at 200°C in the oven, the seed's membrane could be removed by vigorously rubbing it between the fingers. Naked seeds exhibit a slightly reticulate surface. Photo: A. Medović.

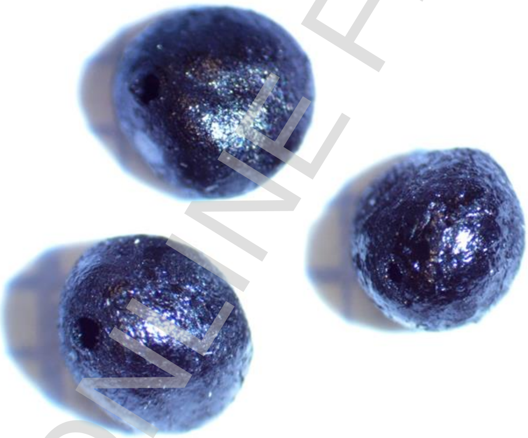

Figure 9. Experimental charring of *Gladiolus italicus* seeds underneath the fireplace (uncontrolled heat source) for 15 minutes. Thermal degradation of the membrane reveals the hilum, a distinguishing feature of ancient specimens. Seeds exhibit a slightly reticulate to a „smooth" surface. Photo: A. Medović.

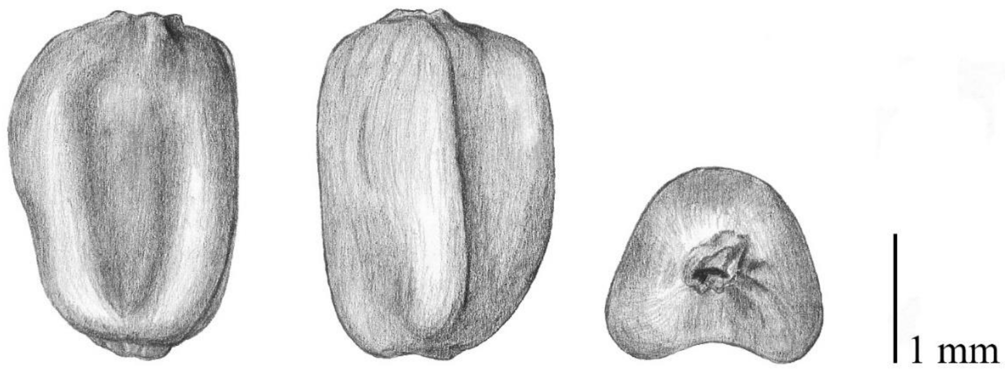

Figure 10. Charred seed of *G.* cf. *italicus* without membrane cover found in a storage room from Gamzigrad, 5th cent. Drawing: A. Medović.

Figure 11. Recent seed of *G. italicus* without membrane cover. Its surface is slightly reticulate. Photo: A. Medović.

Discussion

The archaeobotanical findings are presently limited in distribution to southeastern Serbia and in time to the antique period (Fig. 1). Charred field gladiolus seeds from Kale at Krševica are the oldest and southernmost in today's Serbia. Assessing its status or history is difficult due to the lack of finds from earlier or later periods in Serbia. At the archaeobotanically well-documented Bronze/Iron Age site of Hisar near Leskovac (Medović, 2012), located just 22 km east of Justiniana Prima, not a single seed corresponds to the new findings. During the Celtic and Roman period, such macrobotanical remains have not been found at archaeological sites in northern Serbia (Medović, 2010, 2014; Medović et al., 2021). Archaeobotanical research on periods associated with the Serbian Middle Ages remains limited (Medović, 2016), and consequently, the status of this plant is currently unknown.

The charred seeds *G.* cf. *italicus* are found in storage facilities where winter grains prevail – einkorn (*Triticum monococcum* L), wheat (*T. aestivum* L.), or rye (*Secale cereale* L.). At the Kale-Krševica site, the cereal crops were accompanied by weeds in the winter cereal fields – *Agrostemma githago* L., *Lolium temulentum* L., and *Bromus sterilis* L. (Tab. 1). In an ethnographic experiment of crop processing in Greece (G. E. M. Jones, 1984), *G. italicus* seeds were categorized into big, free, and heavy weeds. Together with big-seeded weeds in winter cereals, seeds of *Galium* species were the main weed impurities in the charred plant record at Kale- Krševica. The large, heavy, free seeds remain with the fine-sieved products after crop processing and are then stored.

Despite its Latin name indicating an Italian origin, the field gladiolus likely originates from farther east—Syria, Turkey, and Lebanon. It is believed that *Gladiolus antakiensis* A.P. Ham. is the progenitor of the field gladiolus (Mifsud & Hamilton, 2013). Unlike most *Gladiolus* species that produce winged seeds, the seeds of the field gladiolus are wingless. Although the absence of wings might seem like a disadvantage for the plants, it has been observed that wingless seeds can better survive the threshing process of food grains than winged seeds. Humans have unintentionally favored these species with wingless seeds and helped disperse them with crops across the Mediterranean. *G. italicus* is found in Serbian (Niketić et al., 2018), Italian (Fanfarillo et al., 2020), Croatian (Istria and Dalmatia) (Hallier, 1880), Albanian (Susaj et al., 2012), Greek (Dimopoulos et al., 2018), and Bulgarian weed flora (Assyov, 2012; Raycheva et al., 2021). It is often called the field gladiolus because it commonly appears in wheat fields throughout the Mediterranean (Mifsud & Hamilton, 2013). In Albania, it is known as the gladiolus of winter crops (Susaj et al., 2012). This perennial herb has uneven bilateral symmetrical flowers, arranged in a unilateral or distichous spike. The field gladiolus has a shorter reproductive cycle than wheat, so it can withstand harvesting and deep plowing, which helps it spread more effectively. It is regarded as an agricultural pest (Colasante et al., 1999). It blooms from April to May (Susaj et al., 2012). *G. italicus* stems measure 25-70 cm in height (Tan & Edmondson, 1984). The capsules of *G. italicus* are globose-ovoid, up to 1 cm long, with an umbilicate top featuring three grooves, and are bluntly three-angled (Komarov, 1968). The seeds ripen between June and July.

Gladiolus italicus, a weed characteristic of the Mediterranean region, must have reached today's territory of Serbia through the well-developed trade and communication networks that operated during antiquity. Its occurrence in regions where it was not previously recorded suggests human-mediated dispersal, most likely as a contaminant of transported agricultural products such as grain. The recovery of this species at an archaeological site in Serbia provides tangible evidence of these long-distance interactions and supports the idea that ancient trade routes played a direct role in the movement of both cultivated plants and their associated weed flora.

The carbonization processes of different plant species and plant components can be affected by a variety of factors, such as moisture content, weather, temperature, fuel, and duration of heating, even when the conditions in the laboratory (oven experiments) and field (experiments with open fire) are very similar (Guarino & Sciarrillo, 2004; Valamoti et al., 2021). Consequently, there may be notable differences between results obtained in the controlled laboratory setting and those in real-world field conditions. Additionally, cereals are particularly sensitive to high temperatures, typically between 200 and 400°C (Braadbaart, 2004). The well-preserved charred seed assemblage recovered from the Kale site at Krševica (Tab. 1) suggests that most plant material was not exposed to high temperatures during the charring process. The membranous seed cover of gladiolus may have remained intact and tightly wrapped around the seeds, imparting a triquetrous to angular shape and wrinkled surface. The protruding, thinnest region of the membrane (Figs. 7 and 8) may have easily broken off, revealing the distinctive "holes" characteristic of antique seed specimens (Figs. 2-7 and 9). Nevertheless, the emergence of a „naked" field gladiolus seed in one sample suggests that the membranous cover is brittle and may break under heat influence. The coexistence of carbonized seeds with and without seed membrane within a single sample at Gamzigrad (Tab. 2) suggests that the plant material experienced uneven heating during the carbonization process.

Table 1. Charred plant items (seeds and one-seeded fruits, unless otherwise stated) from a macro-botanical sample from Kale – Krševica, 4th/3rd cent. BC., 4 liters of soil, 220,32 g of charred plant material analyzed. n: quantity; n (%): quantity percentage; mg: mass in milligrams; mg (%): mass percentage; r: < 0.5 %; +: > 0.5 % < 1.0 %.

	n	n (%)	mg	mg (%)
Cereals:				
Triticum monococcum	3481	32	38536	33
T. monococcum , spikelet forks/glume bases	335	3	154	r
Hordeum vulgare vulgare	2743	25	37333	32
Triticum spelta	1514	14	20315	17
T. spelta , spikelet forks/glume bases	156	1	82	r
Triticum dicoccon	251	2	3140	3
T. dicoccon , spikelet forks/glume bases	2	r	0	r
cf. *Triticum aestivum* s.l.	18	r	187	r
Avena	15	r	62	r
Cerealia indeterminata	1086	10	13746	12
Millets:				
Panicum miliaceum	10	r	11	r
Pulses:				
Lathyrus (sativus)	6	r	70	r
Lens culinaris	2	r	10	r
Vicia ervilia	2	r	20	r
cf. *Pisum sativum*	1	r	5	r
Leguminosae sativae indeterminatae	5	r	27	r
Oil plants:				
Camelina sativa	6	r	1	r
Papaver somniferum	1	r	0	r
Fruits:				
cf. *Vitis vinifera*	1	r	1	r
Possible medicinal and aromatic plants:				
Carum carvi	4	r	9	r
Coriandrum sativum	1	r	2	r
Possible dyeing plants:				
Rubia tinctorum	10	r	46	r
Weeds and ruderals:				
Agrostemma githago	966	9	2361	2
A. githago, capsule fragments	1	r	0	r
Lolium temulentum	201	2	545	r
Galium spurium	127	1	135	r
Galium aparine	26	r	61	r
Gladiolus cf. *italicus*	16	r	42	r
Fallopia convolvulus	13	r	12	r
Bromus sterilis- type	10	r	15	r
Dasypyrum villosum	9	r	24	r
Vicia -type	8	r	32	r
Bromus secalinus	6	r	13	r
Bromus arvensis	5	r	5	r
Chenopodium album	3	r	1	r
Echinochloa crus-galli	3	r	1	r
Adonis	2	r	3	r
Anthemis- type	2	r	0	r
Asperula arvensis	2	r	3	r
Chenopodium hybridum	2	r	0	r
Galium tricornutum	2	r	4	r
Trifoilum -type	2	r	0	r
Medicago	1	r	0	r
Medicago cf. *minima*	1	r	0	r
Rorippa -type	1	r	0	r
Rumex crispus -type	1	r	0	r
Plant Families:				
Poaceae	3	r	0	r
Asteraceae	2	r	0	r
Polygonaceae	2	r	0	r
Fungi				
Claviceps purpurea , sclerotium	1	r	5	r
Sum:	**11068**	**100**	**117019**	**100**

Table 2. Charred plant items (seeds and one-seeded fruits, unless otherwise stated) from a macro-botanical sample from Gamzigrad, 5th cent., 10 liters of soil, 130 g of charred plant material analyzed. n: quantity; n (%): quantity percentage; mg: mass in milligrams; mg (%): mass percentage; r: < 0.5 %; +: > 0.5 % < 1.0 %.

	n	n (%)	mg	mg (%)
Cereals:				
Triticum aestivum s.l.	5576	92.62	82419	97.97
Secale cereale	32	+	273	r
Hordeum vulgare vulgare	6	r	78	r
Avena	3	r	24	r
T. monococcum	2	r	3	r
Millets:				
Panicum miliaceum	21	r	27	r
Pulses:				
Lens culinaris	1	r	3	r
Vicia faba	1	r	46	r
Fruits:				
Malus/Pyrus	1	r	3	r
Possible medicinal and aromatic plants:				
Althaea officinalis	1	r	1	r
Malva	1	r	1	r
Weeds and ruderals:				
Agrostemma githago	194	3.22	831	+
Galium aparine	66	1.10	205	r
Bromus arvensis	26	r	28	r
Bromus secalinus	21	r	76	r
Galium spurium	14	r	18	r
Bupleurum rotundifolium	10	r	10	r
Gladiolus cf. *italicus* , seeds without membrane	7	r	13	r
Gladiolus cf. *italicus* , seeds with membrane	4	r	11	r
Lolium temulentum	5	r	14	r
Fallopia convolvulus	4	r	7	r
Trifolium -type	3	r	2	r
Chenopodium album	2	r	0	r
Convolvulus arvensis	2	r	3	r
Lapsana communis	2	r	0	r
Torilis arvensis	2	r	1	r
Bromus sterilis -type	1	r	3	r
Centaurea	1	r	1	r
Melampyrum arvense/pratense	1	r	6	r
Picris hieracioides	1	r	0	r
Sambucus ebulus	1	r	1	r
Setaria glauca	1	r	1	r
Silene -type	1	r	0	r
Vicia sativa	1	r	9	r
Vicia -type	1	r	2	r
Plant Families:				
Lamiaceae	2	r	2	r
Apiaceae	1	r	1	r
Asteraceae	1	r	0	r
Sum:	**6020**	**100**	**84123**	**100**

Conclusion

Excavations at three Serbian sites—Kale-Krševica, Felix Romuliana, and Justiniana Prima—uncovered charred *Gladiolus italicus* seeds in two morphological forms. Charring experiments on modern seeds showed that semispherical, laterally compressed, angular seeds retain a wrinkled surface and circular hilum, while seeds losing their membranous cover become globose-pyriform with a smooth surface, confirming patterns seen in the archaeobotanical specimens. A single sample may contain both types. These seeds do not appear before the antique period in Serbia, suggesting human introduction. Their consistent association with winter cereals and storage or processing contexts indicates they originated near cultivated fields.

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Italijanska gladiola (*Gladiolus italicus* Mill.) – korovska primesa u skladištima žitarica u jugositočnoj Srbiji tokom antičkog perioda

Aleksandar Medović · Anna E. Reuter

Sažetak: Na osnovu arheoloških i arheobotaničkih istraživanja u jugoistočnoj Srbiji, otkrivena su do sada nedokumentovana ugljenisana semena iz ranog i kasnog antičkog perioda. Ova semena, polusferičnog, uglastog oblika, prvobitno su klasifikovana u porodicu Iridaceae. Međutim, detaljnom morfološkom analizom makrobotaničkih nalaza utvrđena je značajna sličnost sa semenima recentne italijanske gladiole (*Gladiolus italicus* Mill.), koja je poznata kao korovska vrsta rasprostranjena u južnoj Evropi i delovima Azije. Ugljenisana semena italijanske gladiole pronađena su na tri značajna antička lokaliteta: Kale kod Krševice (naselje izgrađeno u starogrčkom stilu), Gamzigrad kod Zaječara (kasnorimski i vizantijski lokalitet Feliks Romulijana) i Caričin grad kod Lebana (vizantijski lokalitet Justinijana Prima). Činjenica da su ovi nalazi isključivo prisutni uz žitarice ili objekte korišćene za preradu i skladištenje useva u antičkom periodu, sugeriše da je *G. italicus* rasla u blizini žitnih polja ili na oranicama. Eksperiment ugljenisanja recentnih semena italijanske gladiole pružio je vrednu studiju slučaja o tafonomskim procesima koji omogućavaju očuvanje mekih, membranskih omotača semena *G. italicus*. Dodatno, eksperiment je omogućio otkrivanje još jednog morfološkog oblika semena italijanske gladiole među makrobotaničkim nalazima. Utvrđeno je da ukoliko krhka membranska opna semena izgori usled izlaganja visokim temperaturama, površina semena postaje glatka i poprima zaobljen, kruškasti oblik. Prisustvo makroostataka italijanske gladiole na antičkim lokalitetima u jugoistočnoj Srbiji ukazuje da je ova vrsta verovatno ulazila u skladišta ozimih žitarica kao korovska primesa, uprkos prethodnom finom prosejavanju žitarica. Makrobotanički nalazi značajno doprinose razumevanju uvođenja ove biljne vrste u korovsku floru Srbije i podstiču na dalja istraživanja njenog rasprostiranja u prošlosti.
Ključne reči: arheobotanika, *Gladiolus italicus*, identifikacija semena, tafonomija, korovska flora, skladišta žita, jugoistočna Srbija, antički period