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RESEARCH ARTICLE

## Notice of a new *Crataegus* 'Kokhno' and +*Crataegomespilus*

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### Abstract

*Crataegus* (+*Crataegomespilus*) 'Kokhno' is a new graft chimera originated from the junction where *Crataegus germanica* (= *Mespilus germanica*) scion was top-grafted onto a stock *Crataegus* sp. In 1993, in the arboretum of one of the forestry-division offices in the Volhynia region, Vladyslav Oleshko found a putative hybrid between hawthorn and medlar, which was named in honor of well-known Ukrainian dendrologist Mykola Kokhno. He believed this plant was the result of a crossing between *Mespilus germanica* and *Crataegus ucrainica* because it was characterized by heterophylly having a mixture of both medlar and hawthorn leaves. The flowers of this plant are not solitary but placed in corymbs. The fruits are not aligned in size and range from 0.5–5.0 cm in diameter. The study of this hawthorn-medlar in the dendrological collection of the M.M. Hryshko National Botanical Garden (Kyiv, Ukraine) led to the conclusion that it is a graft chimera, not a hawthorn-medlar sexual hybrid. This hawthorn-medlar cultivar is morphologically similar to medlar but differs in the arrangement of flowers and fruits. The fruits typical for varietal medlar develop from solitary flowers, whereas atypical small fruits are located in groups. Both types of fruits have no germs in the stones. The cultivar 'Kokhno' is adapted to the Forest-Steppe of Ukraine and performs well as an ornamental and fruit plant. An outline of the history and nomenclature of graft hybrids (chimeras) between *Crataegus* and *Mespilus* is given.

**Keywords:** *Crataegus*, *Mespilus*, +*Crataegomespilus*, ×*Crataemespilus*, chimera, ICN, ICNCP, introduction, taxonomy

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### Introduction

Plant chimeras are organisms composed of cells of more than one plant genotype. In the middle of the XVII century, the first plant

chimera was discovered from the graft junction between sour orange and citron. This sectorial chimera was fittingly named the 'Bizzaria' (Frank & Chitwood, 2016). Later, plant chimeras of similar origin were found in other taxonomic

groups. In particular, there are two taxonomic groups of plants that are intermediate between *Crataegus* L. and *Mespilus* L.:  $\times$ *Crataemespilus* E.G. Camus, a sexual intergeneric hybrid, and  $+Crataegomespilus$  Simon-Louis ex Bellair, which is a graft chimera (Byatt et al., 1977).

In the Mr. Dardar's garden at Bronvaux near Metz (France), there was century-old tree medlar (*Mespilus germanica* L.) that most likely had been grafted on a stock of common hawthorn (*Crataegus monogyna* L.). The remarkable branches on this Bronvaux medlar were noticed originating from just beneath the graft about 1885 (Daniel, 1898; Simon-Louis, 1899; Jouin, 1899; Elwes & Henry, 2013). French nurseryman Leon Simon-Louis from Plantières near Metz propagated these unusual shoots that resulted from grafting medlar on hawthorn. The name  $+Crataegomespilus dardari$  Simon-Louis was proposed for the part of the plant with leaves and fruit like a medlar but with inflorescence and thorns like a hawthorn. Other abnormal shoots are more reminiscent of hawthorn; its leaves are almost lobed (a few, however, are not at all), and frankly stipulated; the flowers form a corymb (Bellair, 1899). It was named 'Jules d'Asnieres' by Simon-Louis or botanically  $+C. dardari$  f. *asnieresii* Koehne (Koehne, 1901; here and below, the rank of this taxon is indicated following the opinion of the cited authors). These graft-hybrids are periclinal chimeras with the outer tissues of the shoot produced by grafting belong to one parent while the inner tissue is those of the other (von Baur, 1910; Bean, 1911; von Meyer, 1915; Haberlandt, 1930; Byatt et al., 1977). There are cultivars of Bronvaux medlar, depending on the number of epidermal layers. These are 'Dardari' like medlar and also 'Jules d'Asnieres' and 'Jouinii' resembling hawthorn. The derivative varieties gave other chimeras with intermediate signs between medlar and hawthorn, including one named  $+Crataegomespilus langei$  Seeliger. It was discovered at Anzig, also near Metz, in 1913 by Ludwig Lange (Seeliger, 1926).

In 1902, a similar case of a medlar grafted on hawthorn was found at La Grange in Saujon (France). The Saujon medlar, like the Bronvaux medlar, gave an extensive range of morphologically different chimeras (Guillaumin, 1949). The chimeras obtained on this tree were described as  $+Crataegomespilus bonnierii$  Daniel,  $+C. brunii$  Daniel,  $+C. lotsyi$

Daniel, and  $+C. rivieri$  Daniel (Daniel, 1909, 1914). A new form that grew up as  $+C. dardari$  sport was named  $+C. batesonii$  Daniel (Daniel, 1924). Unfortunately, not all of them have survived our times (Bourlès, 2022).

Angelo Manaresi (1915) reported about a new hawthorn-medlar graft hybrid in Tomba (Italy). It is known as  $+Crataegomespilus manaresii$  Lopriore. Its entirely pubescent leaves are similar to  $+C. dardari$  var. *asnieresii* (C.K. Schneid.) Rehder, and the flowers are similar to hawthorn, but the fruits are large and brown (Hjelmqvist, 1937; Guillaumin, 1949).

Original hawthorn-medlar chimeras were developed by Friedrich von Bergann (Bergann & Bergann, 1984; von Bergann, 1989) in Hamburg (Germany). *Crataegus*  $\times$  *media* Bechst. took part in forming these chimeras named  $+Crataegomespilus potsdamiensis$  Bergann & L. Bergann 'Diekto' and 'Monekto'.

## Material and methods

The study was conducted in collection sites of the Department of Dendrology of the M.M. Hryshko National Botanical Garden in Kyiv in 2021–2022. Two adult hawthorn-medlar trees, grafted on a hawthorn probably by V. Oleshko, as well as their shoots, leaves, flowers, and fruits were examined. The repositories of the Biodiversity Heritage Library (BHL, 2023) and the Digital Library of the National Library of France (Gallica, 2023) were used to access old papers. Both nomenclature codes: the International Code of Nomenclature for algae, fungi, and plants (ICN – Turland et al., 2018) and the International Code of Nomenclature for Cultivated Plants (ICNCP – Brickell et al., 2016) were used as rulebooks for nomenclature of sex hybrids and chimeras between hawthorn and medlar.

## Results and discussion

### Origin of 'Kokhno'

According to Kokhno & Kurdyuk (1994) and Kokhno & Trofimenko (2005), the only sexual hybrid between *Crataegus* and *Mespilus* ( $\times$ *Crataemespilus grandiflora* (Sm.) E.G. Camus) is hosted at the dendrological collections of V.I. Lipsky Botanical Garden of I.I. Mechnikov Odesa National University, but there is no

known +*Crataegomespilus* in Ukraine. This is not totally true because +*Crataegomespilus dardari* 'Asnieresii' was introduced in 1991 in the former Donetsk Experimental Station of Horticulture by one of the authors of this paper. The scions of +*C. dardari* 'Asnieresii' were obtained from the Central Botanical Garden of the Academy of Sciences of Belarus (Mezhenskyj, 2006; Mezhenska & Mezhenskyj, 2013). No other cases of +*Crataegomespilus* introduction in Ukraine have been recorded.

At the site of M.M. Hryshko National Botanical Garden, where the collection of hawthorn species is located, there are two hawthorn trees grafted by a medlar (Fig. 1 A). Our attention was attracted by the unusual appearance of these plants due to heterocarpy – the single large fruits (like in ordinary medlar) occurred alternately with small and very small medlar-like fruits. We believe these grafts were made by Vladyslav Oleshko, using found a new plant intermediate between medlar and hawthorn.

Vladyslav Oleshko worked in the Department of Dendrology of the M.M. Gryshko National Botanical Garden in 2005–2015. He had earlier written his Ph.D. thesis on medlar. Later he described a putative hybrid between hawthorn and medlar in one of his works (Oleshko, 2009). Here we provide the corresponding paragraph from his article: “During expeditions to the Volhynia, we repeatedly had to encounter hybrid woody plants. In 1993, on the territory of the arboretum of one of the forestry-division offices, we selected a new hybrid species not described in the literature, which had signs of two genera: *Crataegus* L. and *Mespilus* L. This is a tree with weeping branches up to 5 m high. Trunks (2) rustling, dirty-brown. The branches are thick, dirty gray. Young shoots are densely pubescent. Thorns are few. These plants are characterized by pronounced heterophylly. A mixture of both medlar and hawthorn leaves (*Crataegus ucrainica* Pojark.) are found in the crowns. The latter, in size, approaches the cultural forms of the medlar (14 cm long and 5.6 cm wide). The flowers are not solitary (at the ends of the shoots), like in the common medlar (*Mespilus germanica* L.), but they are placed in racemes, and they are much larger (6 cm). The same goes for the fruits. They are not aligned in size and range from 0.5 to 5 cm in diameter. The seeds are

sterile. Hybrid plants we called Kokhno's hawthorn-medlar (*Crataegomespilus ×kochnovii* Oleshko)”.

The discovery of regrafted trees in the depths of the forest plantations became a little sensation due to the unusualness of the case. Since their appearance coincides with Oleshko's description, they can be assumed to be the respective plant.

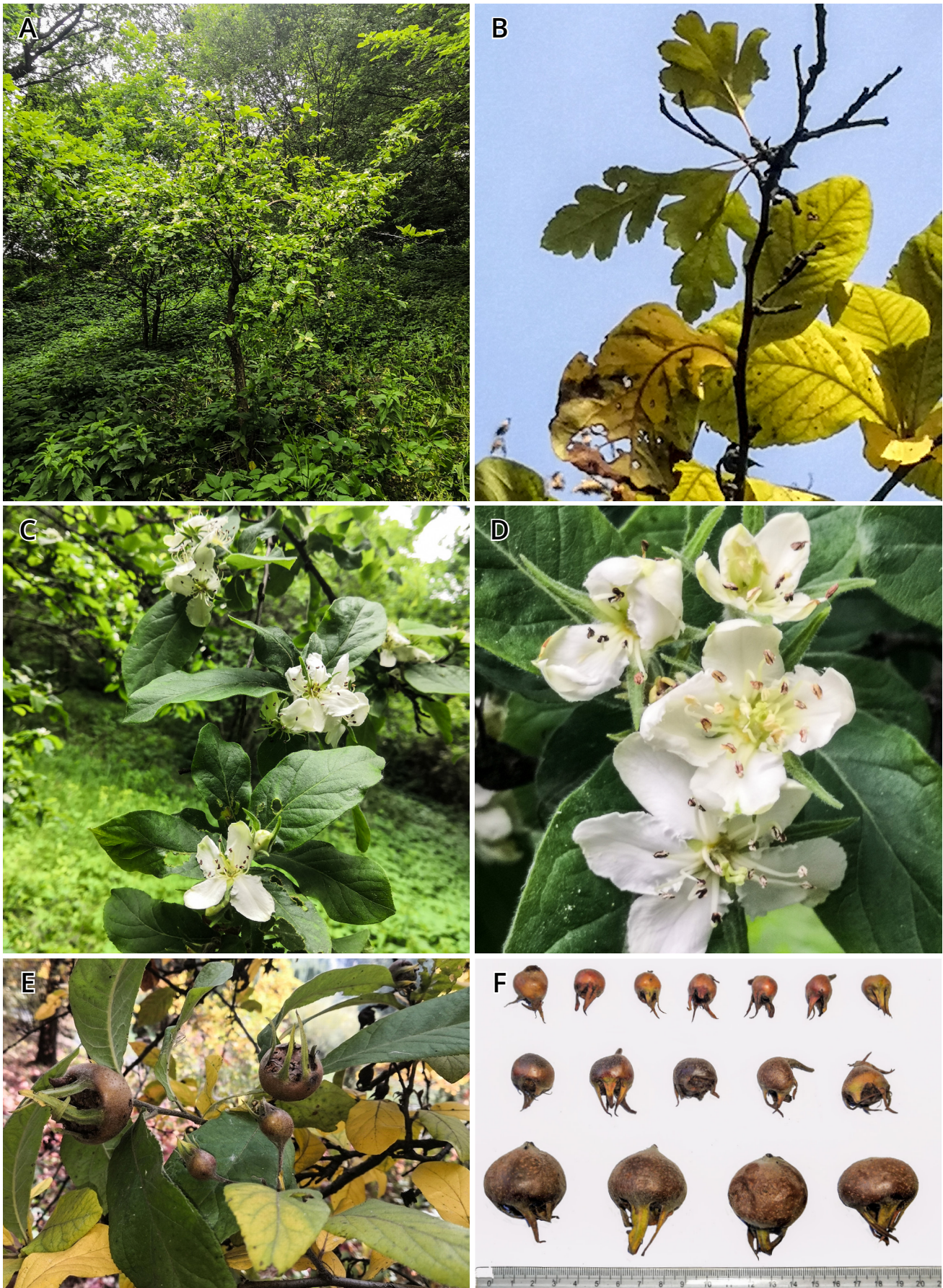
### Morphology

A deciduous tree, 3 m high. Shoots are sometimes thorny, with thorns 1–2 cm long. Leaves simple, usually elliptic or oblong, up to 12 cm long, 3.5–4.5 cm wide, entire or finely serrate, softly pubescent on both surfaces; stalk 5 mm long, hairy. Remarkably, the leaves of most branches in the crowns are like in medlar, and only one branch on the top of the tree carried hawthorn-like leaves (Fig. 1 B). Inflorescences are terminal at the top of extension shoots and leafy short ones, one–two–flowered or three–five–flowered in corymb; axes canescent; flowers pentamerous, 4–5 cm across, pure white; styles five (Fig. 1 C & D). Flowering occurs in the first half of May, fruiting – at the end of October or in November. Fruits are pomes, globular, and brown. Fruits are of two types – large varietal medlar and medlar-like, but small or very small (Fig. 1 E & F). Pyrenes have neither seeds nor inner chambers.

Following our observations, the discovered plant is well adapted to the climatic conditions of Forest-Steppe of Ukraine and performs nicely as an ornamental and fruit cultivar.

### Taxonomy and nomenclature

Chimeras between hawthorn and medlar are known to have originated by grafting *Mespilus germanica* onto *Crataegus* ssp. Usually, *Crataegus oxyacantha* L. (épine blanche in French) is listed as a rootstock for both Bronvaux medlar (Bellair, 1899; Jouin, 1899; Simon-Louis, 1899; Koehne, 1901) and Saujon medlar (Daniel, 1909, 1914, 1924). Carl Linnaeus something confused subsequent generations of botanists regarding *C. oxyacantha* because under this name, he placed in his herbarium morphologically distinct plants (Dandy, 1943), which now are recognized as independent species – *C. rhipidohylla*



**Figure 1.** *Crataegus* (+*Crataegomespilus*) 'Kokhno': **A** – trees of medlar-hawthorn chimera; **B** – hawthorn-like leaves at the top of the branch; **C** – branch in the blooming; **D** – multiflowered inflorescence; **E** – branch in the fruiting stage; **F** – variation of fruits.

Gand. (Christensen, 1992) and *C. monogyna* Jacq. Since the name *C. oxyacantha* became a source of confusion, it was rejected (Lambinon, 1981; Brummitt, 1986).

*Crataegus oxyacantha* was popular in horticulture as a rootstock for quince, medlar, pear, etc. This name has been used in historical times for two-styled *C. laevigata* (Poir.) DC., as well as for one-styled species (Byatt, 1974). Some botanists applied this name to *C. monogyna*. Many botanists believe that *C. monogyna* is a component of Bronvoux medlar (Jouin, 1899; Noll, 1905; Weiss, 1930; Phipps et al., 2003; Fichtner & Wissemann, 2021). Both Bronvoux medlar and Saujon medlar are unstable graft-chimeras forming shoots of various intermediate structures in different proportions between parental species and, by bud variation, may give rise to pure hawthorn or pure medlar branches (Koehne, 1901; Noll, 1905; Daniel, 1919, 1924; Swingle, 1927; Weiss, 1930; Guillaumin, 1949). Concerning +*Crataegomespilus langei*, there are references that initially medlar was grafted on *C. laevigata* (Weiss, 1930; Byatt et al., 1977) on the one hand or it is considered as a bud sport of 'Jules d'Asnières' (Guillaumin, 1949) on the other hand. The leaves of +*C. langei* have many more hairs than the medlar, while +*C. dardari* and +*C. asnieriesii* C.K. Schneid have approximately the same number of hairs (Weiss, 1930). There are events of dechimerization of 'Jules d'Asnières' with a return to the pure parental state of *C. monogyna*. In the case of +*C. langei*, shoot of *C. monogyna* var. *lanigera* Beck can develop (Guillaumin, 1949). It should be noted that misidentifications are possible for *C. monogyna* in horticultural practice due to numerous intermediate forms of hybrid origin, especially since there are many similar-looking one-styled species of *C. rhipidophylla* Gand. s.l. and *C. ×subphaerica* Gand. s.l. complexes (Fichtner & Wissemann, 2021).

A component of the chimera developed by Bergann is *Crataegus ×media* 'Paulii', which originated from the crossing between *C. monogyna* and *C. laevigata*. According to Oleshko (2009), *C. ucrainica* is one of the species that took part in forming the Volhynian medlar mentioned above. Considering that several species of hawthorn combined with medlar took part in chimeras' origin, different species names could be applied, not only +*Crataegomespilus dardari*. However,

according to current ideas, the species name +*C. dardari* is incorrect. Now it is written as +*Crataegomespilus* 'Dardari'. The graft chimeras cannot have species names because they simultaneously combine genotypes of two species (Brickell et al., 2016). However, if graft chimeras are intergeneric, they can be given the new genus name.

In the present work, the original spelling of the specific epithet, formed from the surname with the ending '-i' instead of '-ii' and with a capital letter, has been corrected following Art. 60.1, Rec. 60C.1, Rec. 60F.1, Ex. 24 of the ICN (Turland et al., 2018). The material studied by Oleshko and named *Crataegomespilus ×kochnovii*, nom. nudum is a graft-hybrid, but Oleshko believed it to be a sexual hybrid and, accordingly, he published it as a nothospecies.

In general, 13 +*Crataegomespilus* forms were named and reported by the date (Simon-Louis, 1899; Noll, 1905; Schneider, 1906; Daniel, 1914, 1919, 1924; Lopriore, 1921; Seeliger, 1926; Bergann & Bergann, 1984; Oleshko, 2009):

1. +*Crataegomespilus asnieriesii* C.K. Schneid. (syn.: +*C. dardari* var. *crataegoides* Zabel.; +*C. dardari* var. *asnieriesii* (C.K. Schneid.) Rehder; +*C. dardari* f. *asnieriesii* Koehne; +*Crataegomespilus* 'Asnieriesii'; +*Crataegomespilus* 'Jules d'Asnières')
2. +*Crataegomespilus batesonii* Daniel
3. +*Crataegomespilus bonnieri* Daniel
4. +*Crataegomespilus brunii* Daniel
5. +*Crataegomespilus dardari* Simon-Louis (syn.: +*C. dardari* var. *mespilioides* Zabel)
6. +*Crataegomespilus jouinii* Noll
7. +*Crataegomespilus kochnoi* Oleshko
8. +*Crataegomespilus langei* Seeliger
9. +*Crataegomespilus lotsyi* Daniel
10. +*Crataegomespilus manaresii* Lopriore
11. +*Crataegomespilus potsdamiensis* Bergann & L. Bergann 'Diekto'
12. +*Crataegomespilus potsdamiensis* Bergann & L. Bergann 'Monekto'
13. +*Crataegomespilus rivieri* Daniel

Regarding the spelling of the generic name, Simon-Louis gave the name *Crataego-Mespilus* through a hyphen. According to Art. 20.3 of the ICN (Turland et al., 2018), the name of a genus may not consist of two words unless a hyphen joins these words, and the hyphenated generic name should be retained (Art. 60, Note 6). However, following Art. 20.3, Note 3, the names

of intergeneric hybrids are formed according to the provisions of Art. H.6. Consequently, according to Art. H.6.2, Ex. 5, using a hyphen is treated as an error and should be corrected by deleting the hyphen. The formation of 'generic' names of grafts-chimeras is the same way as intergeneric hybrids; therefore, the correct spelling should be *Crataegomespilus* (McNeill et al., 2016).

Plants in cultivation may be named following the ICN (Turland et al., 2018), but there is an except for graft-chimeric genera, which are governed by the ICNCP (Brickell et al., 2016). According to Art. 24 of the ICNCP, a graft-chimera can be indicated by a formula with the names of both parents in alphabetical order, which are joined by a plus sign (+), e.g., *Crataegus* + *Mespilus* (Art. 24.2, Ex. 1) or by a combined name, e.g., +*Crataegomespilus* (Art. 24.3, Ex. 2). The name +*Crataegomespilus*, which is a graft chimera is different from ×*Crataemespilus*, which is a true hybrid between the same genera, *Crataegus* and *Mespilus*. However, for some reason, certain authors applied the name *Crataegomespilus* for both sexual hybrids and graft chimeras (Bean, 1914; Rehder, 1940; Kokhno & Trofimenko, 2005).

*Crataegus* and *Mespilus* were recognized as phylogenetically distinct genera in Maleae, showing *Mespilus* as a sister genus to *Crataegus* (Campbell et al., 1995, 2007; Potter et al., 2007). However, due to the lack of a single character by which *Mespilus germanica* can be distinguished from any species of *Crataegus*, it was proposed to combine these two genera (Lo et al., 2007). Uniting *Mespilus* with *Crataegus* was then facilitated by Talent et al. (2008), who proposed to conserve the name *Crataegus* for nomenclatural stability. *Mespilus* has been merged with *Crataegus* (Turland et al., 2018; Ufimov & Dickinson, 2020), and *M. germanica* obtained the new name *Crataegus germanica* (L.) O. Kuntze. However, Phipps (2014, 2016) argued the differences between *Mespilus* and *Crataegus* and regarded the merging of these two genera as optional or unnecessary.

As a result, there are differences between the ICN (Turland et al., 2018) and ICNCP (Brickell et al., 2016) in treating these genera. According to the ICN, *Mespilus* is treated as a taxonomic synonym of *Crataegus*, while ICNCP considers them as separate genera and widely cites the name +*Crataegomespilus* in its

articles. Nonetheless, when the component taxa of a graft chimera belong to the same genus, the name of the graft chimera is the name of the genus followed by a cultivar epithet (ICNCP, Art. 24.5)

The graft chimera might be given a cultivar name if both 'parents' belong to the same genus. The cultivar is a basic category for plants used in agriculture, forestry, and horticulture, and epithets in names are retained as cultivar epithets (ICNCP, Art. 28, Note 2, Note 4). Therefore all +*Crataegomespilus* 'species' may be and must be treated as the cultivars, e.g., +*C. dardari* = +*Crataegomespilus* 'Dardari', +*C. rivieri* = +*Crataegomespilus* 'Rivieri', +*C. potsdamiensis* 'Diekto' = +*Crataegomespilus* 'Diekto', etc. The cultivar epithet 'Jules d'Asnières' is preferable for +*C. asnieresii*, not 'Asnieresii' (ICNCP, Art. 24. Ex. 5). Since the name *C. ×kochnovii* proposed by Oleshko for putative sexual hybrid without diagnosis is a *nomen nudum* and mistaken, there is no reason to use its specific epithet in the Latinized form for cultivar name. Therefore, we give this chimera a cultivar epithet 'Kokhno' under the original spelling of the name of famous Ukrainian dendrologist Mykola Kokhno. Considering *Mespilus* merging within the genus *Crataegus*, this chimera is named here *Crataegus* 'Kokhno'.

## Conclusions

The studied tree in the M.M. Hryshko National Botanical Garden dendrological collection with features intermediate between medlar and hawthorn species is a graft chimera. Since *Mespilus germanica* is transferred to *Crataegus* as *Crataegus germanica*, the graft chimera taxonomically belongs to the genus *Crataegus*, not +*Crataegomespilus* in the recommendation of ICNCP; therefore a name *Crataegus* 'Kokhno' for this chimera has been proposed. The new chimera is adapted to the climatic conditions of Forest-Steppe of Ukraine and performs well as an ornamental and fruit cultivar.

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## Повідомлення про новий сорт *Crataegus* 'Kokhno' та +*Crataegomespilus*

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*Crataegus* (+*Crataegomespilus*) 'Kokhno' – це нова прищеплена химера, що виникла з місця з'єднання *Crataegus germanica* (= *Mespilus germanica*) прищепленого на *Crataegus* sp. У 1993 році Владислав Олешко в дендропарку одного з лісгоспів Волинської області знайшов вірогідний гібрид глоду з мушмулою, який назвав на честь відомого українського дендролога Миколи Кохна. Він вважав, що ця рослина є результатом схрещування *Mespilus germanica* з *Crataegus ucrainica*, оскільки характеризується гетерофілією, маючи суміш листків мушмули та глоду; не поодинокі, а розташовані в щитках квітки; його плоди не вирівняні за розмірами й коливаються від 0,5 до 5,0 см в діаметрі. Вивчення цієї глодомушмули в дендрологічній колекції Національного ботанічного саду ім. М.М. Гришка дозволило зробити висновок, що вона є прищепленою химерою, а не статевим гібридом глоду з мушмулою. Цей сорт глодомушмули морфологічно схожий з мушмулою, але відрізняється розташуванням квіток і плодів. Плоди подібні до плодів сортової мушмули розвиваються з поодиноких квіток, тоді як нетипові дрібні плоди скупчені групами. Плоди обох типів не містять насінин у кісточках. Сорт 'Kokhno' адаптований до умов Лісостепу України і демонструє хороші показники як декоративна і плодова культура. Подано нарис історії та номенклатури прищеплених гібридів (химер) між *Crataegus* і *Mespilus*.

**Ключові слова:** *Crataegus*, *Mespilus*, +*Crataegomespilus*, ×*Crataemespilus*, химера, МКН, МКНКР, інтродукція, таксономія