



## A Research on Type Specimens and Herbarium Sheets of the Species *Arabis aucheri* Boiss. and *Arabis montbretiana* Boiss.

### *Arabis aucheri* Boiss. ve *Arabis montbretiana* Boiss Türlerine Ait Tip Örnekleri ve Herbaryum Kartonları Üzerinde Bir Araştırma

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#### ABSTRACT

The confusion in type specimens and herbarium sheets of *Arabis aucheri* and *Arabis aucheri* species, identified by Pierre Edmond Boissier in 1842, was organized in this study. The different species included in the type specimens was marked on the herbarium sheets.

#### Key Words

*Arabis*, Aucher-Éloy, Brassicaceae, herbarium, ICN, typification.

#### Öz

Bu çalışmada, Pierre Edmond Boissier tarafından 1842 yılında tanımlanan *Arabis aucheri* ve *Arabis aucheri* türlerine ait tip örnekleri ve herbaryum kartonlarındaki karışıklık düzenlendi. Tip örnekleri içinde yer alan farklı türler herbaryum kartonları üzerinde işaretlendi.

#### Anahtar Kelimeler

*Arabis*, Aucher-Éloy, Brassicaceae, herbaryum, ICN, tiplendirme.

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## INTRODUCTION

Pierre Martin Rémi Aucher-Éloy (1793–1838) was a French pharmacist and botanist who collected type specimens of the species of *Arabis aucheri* Boiss. and *Arabis montbretiana* Boiss. [1-3]. Aucher-Éloy settled in Istanbul in 1830 and collected plant and insect specimens from the countries of the Near East. This researcher's travel notes and letters from journeys in 1830–31, 1832, 1834, 1835, and 1837–38 were published in two volumes as "*Relations de Voyages en Orient de 1830 à 1838, par Aucher-Éloy*" [1, 2, 4].

As we learn from Aucher-Éloy's travel book, he began his journey between 1830 and 1831 in Istanbul, Türkiye, on 16 November 1830, and initially visited Egypt. He worked in Alexandria, Rashid, Cairo, Thebes, Minufiya, and the Sinai Peninsula during his journey to Egypt. He subsequently worked in Gaza and Jenin in Palestine, Jerusalem and Safed in Israel, Damascus in Syria, and Beirut in Lebanon. He travelled to Cyprus from Lebanon and returned to Istanbul after visiting Larnaca and Limassol in Cyprus [1, 2].

He began his brief journey in 1832 in Istanbul, Türkiye, and after visiting Izmir, Rhodes (Greece), Muğla and Aydın, respectively, he returned to Istanbul from Izmir. He began his travels in 1834 in Istanbul, Türkiye, and after working in İznik, Sakarya, Ankara, Yozgat, Kayseri, Mersin, Adana, Iskenderun, and Antakya, he moved to Aleppo, Syria (13–23 May 1834). When he returned to Türkiye from Aleppo, he finalized his journey by studying in Kilis, Gaziantep, Besni, Akdağ (08 June 1834), Malatya, Elazığ, Tunceli, Sivas, Erzincan, Bayburt, and Erzurum [1, 2].

In 1835, he started to travel from Istanbul, Türkiye, and respectively go up to Afyonkarahisar, Akşehir, Konya, Adana, and Iskenderun, Türkiye, and then moved to Aleppo, Syria (18 March–4 April) from Antakya. After Syria, he returned to Türkiye again and visited Mosul, Baghdad, Hillah, Babylon, and Karbala cities in Iraq through Urfa and Mardin, as well as Kermanshah, Hamedan, Isfahan, Tehran, Kashan, and Tabriz in Iran to study. After Iran, he travelled to Azerbaijan and then to Armenia, but he was unable to study since he became sick there [1, 2].

During his journey in 1836, he travelled from Istanbul, Türkiye, to Izmir, Türkiye, and then to Greece. After vi-

siting Syros, Athens, Thebes, Eğriboz Island, Thessaly and Western Macedonia in Greece, he travelled back to Türkiye and returned to Istanbul from Çanakkale [1, 2].

He began his travels in Istanbul, Türkiye, in 1837, and after visiting İzmit, Sakarya, Ankara, Kırıkkale, Çorum, Tokat, Giresun, Bayburt, and Erzurum, respectively, he moved to Iran. On the other hand, he studied at Tabriz, Ardebil, Qazvin, Gilan, Tehran, Qom, and Isfahan in Iran. Beginning his journey in Jolfa, Azerbaijan, in 1838, he worked in Kermanshah, Fars, Bushehr, and Hormozgan regions of Iran before moving to Oman. He held trips to Sahar and Muscat in Oman and went back to Iran. He worked in Saveh, Tabriz, South Khorasan, Fars and Isfahan in Iran and finalized his travels on 9 July 1838. Pierre Martin Rémi Aucher-Éloy died on 06 October 1838 in Jolfa (Azerbaijan) at the age of 45 [1, 2].

During his travels in 1834–35, P.M.R. Aucher-Éloy collected specimens from the species *Arabis aucheri* with the collector number "97" from Aleppo (Syria) and from the species *Arabis montbretiana* with the collector number "98" from Akdağ (Türkiye) [1, 3, 4-7]. Herbarium sheets that were organized with these specimens collected by P.M.R. Aucher-Éloy are currently preserved in different herbariums in Europe [7]. P.E. Boissier was the first researcher to taxonomically assess the specimens on some of these sheets. As a consequence of this researcher's study, some of the specimens numbered "97" that were named *Arabis aucheri* and some specimens numbered "97" and the specimens numbered "98" that were named *Arabis montbretiana* were assessed as 2 different new species [3]. The researcher labels on the herbarium sheets indicate that the type specimens of these species were studied by various researchers at different periods. However, one of these studies was published, and in this taxonomic study, type sheets of the species were organized [7].

When the type sheets of both species as well as the specimen on the sheets were examined again within the scope of the "Illustrated Flora of Türkiye," it was determined that specimens of *Arabis montbretiana*, *Arabis sagittata* (Bertol.) DC. and *Arabis alpina* L. species were mixed in some of the herbarium sheets numbered "AucherÉloy 97" that belonged to the species *Arabis aucheri* [8-10]. To avoid taxonomic confusion caused by the current situation, type sheets of *Arabis aucheri* and *Arabis montbretiana* species were organized again in this study.

## MATERIALS and METHODS

The materials of the study consisted of fourteen herbarium sheets in total; six in the Geneva (G-BOIS and G) herbarium, four in the Paris herbarium (P), two in the British Museum herbarium (BM), and two in the Kew herbarium (K) that were organized by Al-Shehbaz and Barriera in 2019. Figure 1 and 2 shows ten herbarium sheets and labels of *Arabis aucheri* species and Figure 3 and 4 shows four herbarium sheets and labels of *Arabis montbretiana* species among those.

In this study, 60 previously identified plant specimens on 14 herbarium sheets were identified one by one, and the collector numbers, collection locations, collection dates, and remarks made by other researchers on type sheet labels were reviewed, and the accuracy of this information was discussed.

## RESULTS

As a result of all the studies carried out with the specimens on the type sheets of the species *Arabis aucheri* and *Arabis montbretiana*, the information on the type specimens of these species has been reorganized as follows.

### Typification of names

***Arabis aucheri*** Boiss., Ann. Sci. Nat. Bot. ser. 2, (17):52 (1842).

**Type:** “[Aucher Éloy] N.97, Alep”. Holotype: SYRIA: Alep, [1834 (1835?)], Aucher-Éloy 97 (G-BOIS [G00332065]!); isotype: BM000583663 [digital image!], BM000583662 [digital image!] mixed with the specimens of *Arabis montbretiana*, three specimens on the top row (the second, third and fourth from left to right), and three specimens on the bottom row (the first, fourth and fifth from left to right), G00389096! mixed with the specimens of *Arabis montbretiana*, four specimens from left to right (the first, second, fifth, and eighth), P00747456 [digital image!] mixed with the specimen of *Arabis alpina*, three specimens on the top row (the first, second and third).

**Turkish name:** The Turkish name of *Arabis aucheri* is “ciliztere” [11].

**Notes:** The type specimens of the species *Arabis aucheri*

were collected from Syria (Aleppo) with the collector number “Aucher-Éloy 97.” As determined by Al-Shehbaz and Barriera (2019), there were ten herbarium sheets made from the collected specimens, and these sheets (Figure 1) are available in the herbariums of Geneva (G-BOIS and G), Paris (P), Kew (K), and the British Museum (BM) [7].

When the holotype sheet with the herbarium number G-BOIS [G00332065] in the collection of Boissier in the Geneva herbarium of the species *Arabis aucheri* was examined, it was determined that there were five specimens on this sheet (Figure 1.1), and there were 47 specimens in the other 9 isotype herbarium sheets [five specimens on the sheet number BM000583663 (Figure 1.2), ten specimens on the sheet numbered G00389096 (Figure 1.3), four specimens on the sheet numbered P00747456 (Figure 1.4), thirteen specimens on the sheet numbered BM00583662 (Figure 1.5), three specimens on the sheet numbered G00389095 (Figure 1.6), two specimens on the sheet numbered G00389097 (Figure 1.7), five specimens on the sheet numbered K000693235 (Figure 1.8), three specimens on the sheet numbered P00747457 (Figure 1.9), and two specimens on the sheet numbered P00747458 (Figure 1.10)] and 52 specimens in total on the type sheets.

When the specimens on the “Aucher-Éloy 97” type sheets (Figure 1) of the species *Arabis aucheri* were examined one by one, it was determined that the specimens in some types of sheets belonged only to *Arabis aucheri* (Figures 1.1 and 1.2), the specimens of *Arabis montbretiana* (Figures 1.3 and 1.5) and *Arabis alpina* (Figure 1.4) species were mixed with the specimens in some sheets, only the specimens of the species *Arabis montbretiana* were found in some sheets (Figures 1.6, 1.8, 1.9 and 1.10), and only the specimens of *Arabis montbretiana* and *Arabis sagittata* species were found in one sheet (Figure 1.7).

The label information on ten different types of sheets from the *Arabis aucheri* species was examined. Figure 2 displays the type sheets with different label information. When the information about collection locations of the specimens and the collector number on the label information was examined, it was determined that some labels contained *Aucher-Eloy Herbar d'Orient No:97*” and “*Alep*” (Figures 1.1, 1.2, 1.3, 1.5, 1.8, 2.2 and 2.5), some contained “*Asie occidentale*”, “97” and “*Alep*” (Figures 1.4, 1.9, 2.4 and 2.9), some contained

"*Plantes d'Orient.*", "97" ve "*Alep*" (Figures 1.6, 2.6 and 2.11) and one of them included "97" and "*Alep*" (Figures 1.7 and 2.8). A label (Figure 2.8) on the sheet numbered G00389097 (Figure 1.7) in the Geneva herbarium bears "*Donné en 1921 à la Ville de Genève par M<sup>me</sup> Augustin de Candolle et ses enfants*". According to this notation, A.P. De Candolle's children donated this sheet to the Geneva Herbarium in 1921. When examining the collection dates noted on the labels, it was observed that six of them (Figures 1.1, 1.2, 1.3, 1.5, 1.8, and 1.10) lacked a collection date, while four of them (Figures 1.4, 1.5, 1.6, 1.7, 2.4, 2.6, 2.8, and 2.9) put "1837" as the collection date.

There were notes written by different researchers on the type sheets of the species *Arabis aucheri*. These notes were written by I. Al-Shehbaz in 2016 [G-BOIS (G00332065) (Figure 1.1)], by W. Greuter in 1971 [G00389096 (Figure 1.3) G00389095 (Figure 1.6) and G00389097 (Figure 2.7)], by V. Bourguignon in 2010 [P00747456 (Figure 1.4)], and W. Titz in 1971 [G00389097 (Figure 1.7)]. Among these notes, the label written by Al-Shehbaz (Figure 2.1) on the sheet (Figure 1.1) with the number G-BOIS (G00332065) in the Geneva herbarium bears "*Arabis aucheri* Boiss.", "*lectotype*" and "*holotype*", the label written by Greuter (Figure 2.3) on sheet numbered G00389096 (Figure 1.3) bears "*Arabis montbretiana* Boiss. (*isotype*)" and "*\* Arabis aucheri* Boiss. (*isosyntype*)", the label written by Greuter (Figure 2.6) on sheet numbered G00389095 (Figure 1.6) bears "*Arabis montbretiana* Boiss." and "*isosyntype*", the label written by Greuter (Figure 2.7) on sheet numbered G00389097 (Figure 1.7) bears "*Arabis montbretiana* (*syntype*)", and also the label written by Titz (Figure 2.8) on the same sheet bears "*Arabis aucheri*" and "*holotypus?*". The label written by an anonymous person (Figure 2.4) on the sheet (Figure 1.4) with the number P00747456 in the Paris herbarium bears "*holotype*" while the label written by Bourguignon (Figure 2.4) on the same sheet bears "*isotype*", and label written by an anonymous person (Figure 2.11) on the sheet (Figure 1.10) with the number P00747458 bears "*isotype*". The label written by an anonymous person (Figure 2.9) on the sheet (Figure 1.8) with the number K000693235 in the Kew herbarium bears "*Arabis aucheri*" and "*isotype*".

***Arabis montbretiana*** Boiss., Ann. Sci. Nat. Bot. ser.2, (17):53–54 (1842).

**Type:** "[Aucher- Éloy] N. 98, Ak-Dag et in h. DC. ex Alepo". Lectotype: TÜRKİYE, Adıyaman, Ak-Dağ, [08 vi

1834], Aucher-Éloy 98, (G-BOIS [G00332061!]); isolecotype: K000693257 [digital image!], P00747415 [digital image!]. Syntype: SYRIA, [1834 (1835?)], Aucher-Éloy [97?] G(s.n.) [digital image!].

**Turkish name:** The Turkish name of *Arabis montbretiana* is "ovakazteresi" [11].

**Notes:** The specimens of the species *Arabis montbretiana* were collected from Türkiye (Akdağ) with the collector number "Aucher-Éloy 98". As determined by Al-Shehbaz and Barriera (2019), there were four herbarium sheets made from those specimens, and these sheets (Figure 3) are accessible in the herbariums of Geneva (G-BOIS and G), Paris (P), and Kew (K) [7].

When lectotype sheet with herbarium number G-BOIS (G00332061) belonging to the species *Arabis montbretiana* in the Geneva herbarium (Figure 3.1), isolecotype sheets with the herbarium number K000693257 (Figure 3.2) in the Kew herbarium and P00747415 (Figure 3.3) in the Paris herbarium, and syntype herbarium sheet with no G (s.n.) number and no locality in the Geneva herbarium (Figure 3.4) were analyzed, it was determined that there were two specimens in each sheet. When a total of eight specimens on these sheets were examined one by one, it was determined that all specimens belonged to *Arabis montbretiana* species.

The label information on ten different type sheets from the species *Arabis montbretiana* was examined. Figure 4 displays the type sheets with different label information. When the information about collection locations of the specimens and the collector number noted on the label information was investigated, it was determined that some labels contained "*Aucher-Eloy Herbar d'Orient No:98*" and "*Ak-Dag*" (Figures 3.1, 3.2, 4.2 and 4.3), one contained "*Asie occidentale*", "*M. Aucher-Eloy*", "98", and "*Ak-Dag*" (Figures 3.3 and 4.6), and one only contained "*Aucher-Eloy*" (Figures 3.4 and 4.7). A label (Figure 4.8) on the sheet with no G (s.n.) number (Figure 3.4) in the Geneva herbarium bears "*Donné en 1921 à la Ville de Genève par M<sup>me</sup> Augustin de Candolle et ses enfants*". According to this notation, A.P. de Candolle's children donated this sheet to the Geneva Herbarium in 1921. Given the collection dates noted on the labels, it was observed that two labels on one of the sheets contained two different dates (Figure 3.3). One of these labels (Figure 4.5) bears "1834" as the collection date and "1837" is written on the other label (Figure 4.6). The la-

bel (Figure 4.7) on another sheet (Figure 3.4) shows the collection date as “1837”.

There are notes written by different researchers on the type sheets of the species *Arabis montbretiana*. While those on the sheets [G-BOIS (G00332061) (Figure 4.1) and G (s.n.) (Figure 4.8)] in the Geneva herbarium were written by W. Titz in 1971 and by Al-Shehbaz in 2016, the authors of the labels (Figure 4.6) on the sheet (Figure 3.3) in the Paris (P00747415) herbarium are anonymous. Among these notes, the label written by Titz (Figure 4.1) on the sheet (Figure 3.1) with the number G-BOIS (G00332061) in the Geneva herbarium bears “*A. recta* Vill”, “*Syntypus!* von. *A. montbretiana* Boiss.”, and also another label written by Al-Shehbaz (Figure 4.1) on the same sheet bears “*A. montbretiana* Boiss.” and “*lectotype*”. While the label (Figure 4.6) on the sheet (Figure 3.3) with the number P00747415 in the Paris herbarium bears “*Arabis montbretiana* Boiss.” and “*isotype*”, another label (Figure 4.6) bears “*syntype*”.

It was found in the type sheets of the *Arabis montbretiana* that there is a note “*Arabis pellucida*,” on the label (Figure 4.4) on the herbarium sheet (Figure 3.2) with the number K000693257 in the Kew herbarium and another label (Figure 4.5) on the herbarium sheet (Figure 3.3) with the number P00747415 in the Paris herbarium, the author of which is anonymous.

## DISCUSSION

The species *Arabis aucheri* and *Arabis montbretiana* are included in the section of *Turritina* (Wallr.) Rchb. in the genus *Arabis* [12-14]. The species in this section are distinguished from other species in the genus *Arabis* by being annual [5, 15].

A study by Mutlu in 2004 provided a current diagnostic key used to distinguish the species in Section *Turritina* in Türkiye. According to the results of this study, the species *Arabis aucheri* can be easily distinguished from *Arabis verna* W.T.Aiton by their white flowers and from other species with auriculate leaves (*Arabis montbretiana* Boiss., *Arabis nova* Vill., and *Arabis erikii* Mutlu by their cuneate leaf bases [15-17]. The study by Al-Shehbaz and Barriera [7] recognized the species *Arabis montbretiana* Boiss., as a synonym for the species *Arabis nova*. However, it was stated in the study by Mutlu [15] that the species *Arabis montbretiana* differentiated from *Arabis nova* species by having long, simple, and forked hairs on

the upper surface of the stem leaves [7, 15].

*Arabis aucheri* is an annual species with individual heights ranging from 6 to 30 cm. Due to their short height, they can fit into a large number of herbarium sheets. The type sheets of this species also contained specimens ranging from 2 to 13 (Figure 1). “Article 8.2” of the “International Code of Nomenclature for Algae, Fungi, and Plants” (ICN) states that a holotype sheet may be organized as a herbarium sheet consisting of several small specimens from the same collection. However, the holotype should only be in an herbarium sheet and kept in an herbarium [18].

Organizing a large number of specimens of small-sized annual or perennial species in a herbarium sheet brings some problems. One of these problems is that many specimens obtained in a single collection are affixed to more than one herbarium sheet and each of these sheets is organized as a holotype sheet [19]. Another problem is affixing specimens of different species similar to each other on the same herbarium sheet. The finally identified problem seems to have arisen during the preparation of some of type sheets (G00389096, BM00583662, and P00747456) numbered “Aucher-Éloy 97” of *Arabis aucheri* (Figures 1.3, 1.4 and 1.5). Totally four specimens, the first, second, fifth, and eighth from left to right, among the 11 specimens on the sheet numbered G00389096 (Figure 1.3) in the Geneva herbarium, and similarly only totally seven specimens, the second, third and fourth from left to right in the top row, and the first, fourth, fifth and sixth from left to right in the bottom row, among 13 specimens on the sheet numbered BM00583662 (Figure 1.5) in the herbarium of British Museum belong to the species *Arabis aucheri*, and other specimens belong to the species *Arabis montbretiana*. Greuter also noticed this disorder in the sheets in Geneva herbarium, and the individuals that belong to the species *Arabis aucheri* are marked on the herbarium sheet and this was indicated on the label (Figure 2.3) on the herbarium sheet. A total of three specimens only in the top row, among the four individuals on the sheet numbered P00747456 (Figure 1.4) in the Paris herbarium belong to the species *Arabis aucheri*, and the single specimen in the bottom row belongs to the species *Arabis alpina*. Although five sheets in the herbariums of Geneva [G00389095 (Figure 1.6) and G00389097 (Figure 1.7)], Kew [K000693235 (Figure 1.8)] and Paris [P00747457 (Figure 1.9) and P00747458 (Figure 1.10)] were type sheets of the species *Arabis*

*aucheri*, those sheets contain no specimens of the species *Arabis aucheri*. Greuter also noticed this disorder in the sheets in Geneva herbarium, and it was indicated on the label (Figures 2.6 and 2.7) affixed on the herbarium sheet. It was determined that there was a total of 24 specimens, only five of which belonged to the species *Arabis aucheri*, on the ten existing type sheets of the species *Arabis aucheri*. More than half of the previously identified type specimens (53 pcs.) of the species *Arabis aucheri* were from different species. To avoid confusion in species identifications, this situation should be indicated when organizing the type sheets of the species *Arabis aucheri*, and herbarium sheets that generate any confusion, as well as the specimens on them, should not be examined when reviewing type specimens of the species *Arabis aucheri*.

The labels of *Arabis aucheri* on two type sheets (Figures 1.1 and 1.7) in the Geneva herbarium and one type sheet (Figure 1.4) in the Paris herbarium (Figures 2.1, 2.4, and 2.8) bear "holotype". While those labels were written by Titz in 1971 (Figure 2.8) and by Al-Shehbaz in 2016 (Figure 2.1), the author of the other label (Figure 2.4) was anonymous. When a species is newly introduced to the scientific world, many specimens of that species are inserted in many herbarium sheets that contain the same label information, and the researchers who work on those type sheets may identify distinct sheets as holotypes when no separate numbers are utilized to differentiate them from one other.

The study by Al-Shehbaz and Barriera [7] determined which of the type sheets pertaining to the species *Arabis aucheri* would be the optimal herbarium sheet. According to this study, it was reported that this sheet should be "holotype" since only one carton was mentioned in the earliest publication (protologue) of the species description, and only the herbarium sheet numbered G-BOIS (G00332065) of this species is available in the Boissier collection at the Geneva Herbarium [3, 7].

The type locality of the species *Arabis aucheri* was reported as "N.97, Alep" in "Planta Aucherianæ Orientales" where the species was originally defined, and the type locality of the species *Arabis montbretiana* was reported as "N.98, Ak-Dag et in h. DC. ex Aleppo" [3]. The work "Flora Orientalis" written by Boissier in 1867 stated that the location of the species *Arabis aucheri* was "in rupestribus Syriæ ad Aleppo (Auch. 97! ex parte)", while the location of the species *Arabis montbre-*

*tiana* was "Syriâ (Auch. exs 97! ex parte), monte Akdagh Cappadociæ (Auch. exs. 98!)" . The work "Flora of Turkey" prepared by Cullen [6] stated that the location of the species *Arabis aucheri* was "Type: [Syria] Alep, Aucher 97", while the type location of the species *Arabis montbretiana* was "Type: [Türkiye B7 Malatya] in montis Akdagh Cappadociæ, Aucher 98 (K!)" .

When the studies on the species *Arabis aucheri* were examined, the location where the type specimens were collected was observed to be "Alep" (Aleppo) in Syria (today) and the collector number was "97" [3, 5, 6]. This information is also available on the ten different type sheets seen in Figure 1. The collection dates of type specimens within the location information were not mentioned in the studies by Boissier and Cullen [3, 5, 6]. When the holotype (Figure 1.1) and the five isotype sheets (Figures 1.2, 1.3, 1.5, 1.8, and 1.10) were examined, it was observed that the sheets lacked the collection year, but the other four isotype sheets were dated "1837" (Figures 1.4, 1.6, 1.7 and 1.9). When the travel book published by Jaubert [1, 2] was examined, it was observed that Aucher-Éloy arrived in Aleppo in Syria during his journey in 1834, and then travelled to Aleppo again in 1835. As these data show, the collection years listed on the type sheets do not correspond to the years in the travel book by Aucher-Éloy.

While the label of *Arabis montbretiana* on one type sheet (Figures 3.1 and 4.1) in the Geneva herbarium bears "lectotype", one type sheet (Figures 3.3 and 4.6) in the Paris herbarium (Figures 2.1, 2.4 and 2.8) indicates "isotype". There is no type sheet for this species that indicates holotype. The organization of type sheets of this species was determined in the study by Al-Shehbaz and Barriera [7]. According to this study, Boissier who originally identified the species in 1842 indicated in this publication (protologue) that he used a sheet collected by Aucher-Éloy but was available in his own collection (the specimen numbered 98 of Akdağ) and another sheet from the De Candolle collection (the unnumbered specimen of Aleppo). Due to the fact that there was only one herbarium sheet with the number G-BOIS (G00332061) collected from Akdağ belonging to this species in the Boissier collection in the Geneva herbarium, it was stated that the sheet containing the specimens of Akdağ should be "lectotype", and the other sheet with no number containing specimens G (s.n.) of Aleppo in the De Candolle collection and donated to the Geneva herbarium in 1921 should be "syntype".



The study in 2019 by Al-Shehbaz and Barriera, who organized the type specimens of *Arabis montbretiana* stated that they were unable to locate a “G (s.n.) syntype specimen” of this species at the Geneva herbarium, and this sheet was most likely lost. In the course of this study, it was found that two sheets were donated to the Geneva herbarium by the De Candolle herbarium in 1921 (Figures 1.7 and 3.4), and two labels (Figure 2.8) on one of these sheets (Figure 1.7) indicated “M. Aucher-Éloy, 97, *Arabis* sp. nov., Alep, 1837”. One of these labels should most likely belong to the unlabelled specimen.

Another unusual condition on the type sheets was that, while being declared to belong to the species *Arabis aucheri*, one of the two specimens on the type sheet with the number G00389097 (Figure 1.7) corresponded to the *Arabis montbretiana* species and the other to the *Arabis sagittata* species. This sheet was found among the type sheets of the *Arabis aucheri* species in the study by Al-Shehbaz and Barriera [7]. There are four more herbarium sheets numbered G00389095, K000963235, P00747457, and P00747458 (Figures 1.6, 1.8, 1.9 and 1.10) with the same condition in the study by these researchers. Although individuals belonging to the *Arabis montbretiana* and *Arabis alpina* species were mixed in the herbarium sheets with the numbers G00389096, P00747456 and BM00583662, which were shown in the type sheets of *Arabis aucheri* species in the same study, this condition was not stated in this study.

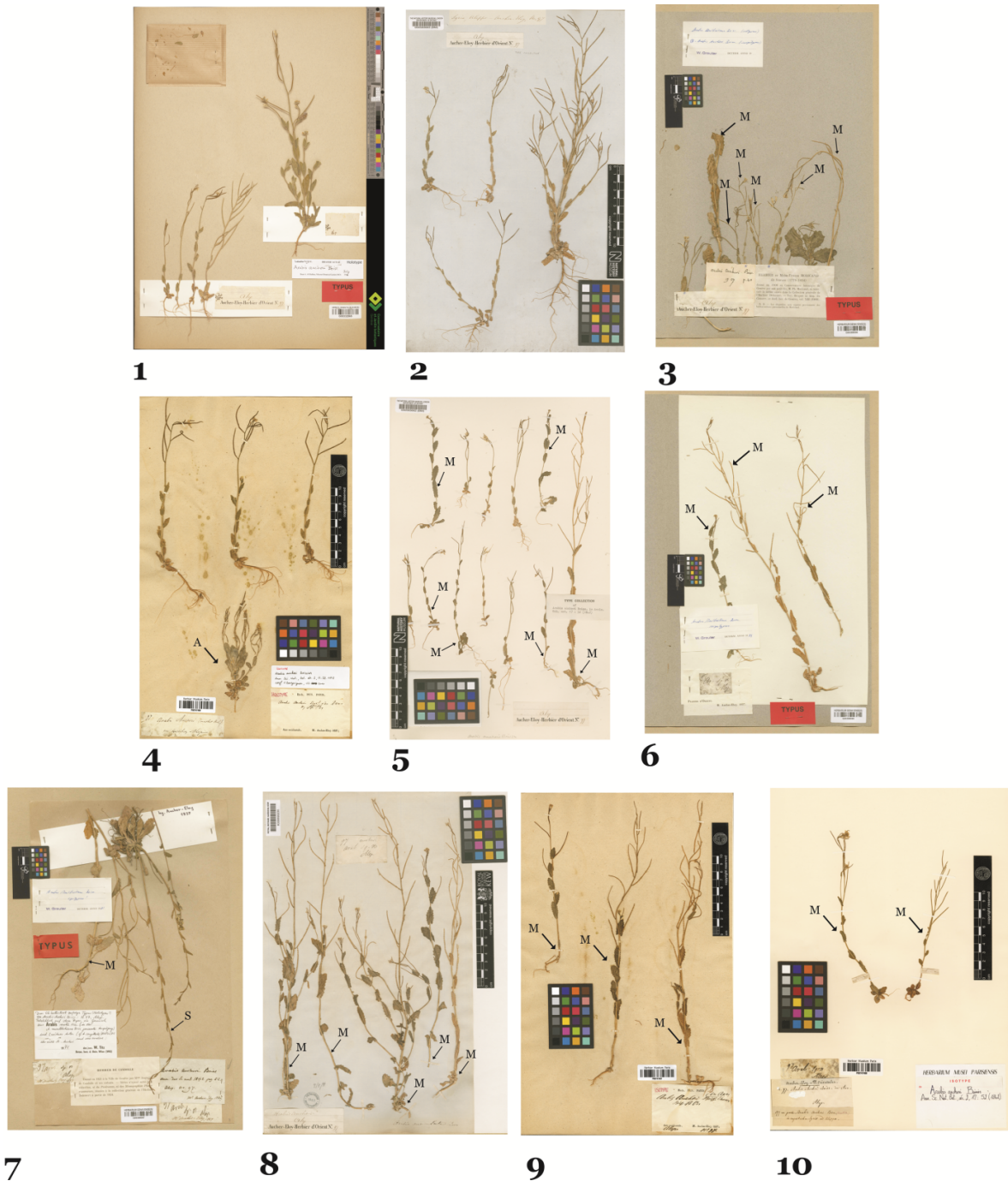
While the information on the country and province of the collection location of the type specimen was not noted in the information on the type location of the *Arabis montbretiana* species in the work produced by Boissier in 1842, the same researcher used the information on location together with the name of the region as “monte Akdagh Cappadociæ” in their work produced in 1867. Cullen [6] recorded in his work that the type specimens were collected in “[Türkiye B7 Malatya] in montis Akdagh Cappadociae” in the information on the type location of the species *Arabis montbretiana*. When the type sheets belonging to this species were examined, it was found that there was no information on province and region as the collection location on the sheets, but they indicated only “Akdağ” (Figure 3.1, 3.2 and 3.3). When the travel book published by Jaubert [1, 2] was examined, Aucher-Éloy appeared to have returned to Türkiye from Aleppo after studying in Aleppo in

Syria between 13–23 May 1834. After studying in Kilis, Gaziantep and Besni (today’s Adıyaman) in Türkiye, he continued his studies in Ak-dağ (in the borders of Çelikhan, which is the district of Adıyaman today) on 08 June 1834. After studying in Akdağ, he finalized his journey by making investigations in Malatya, Elazığ, Tunceli, Sivas, Erzincan, Bayburt and Erzurum. Besni and Akdağ, which Aucher-Éloy travelled in 1834, are today within the borders of Adıyaman province. While Adıyaman was a district of Malatya province until 1954, it was recognized as a province with 9 districts: Besni, Çelikhan, Gölbaşı, Tut, Sincik, Samsat, Kahta, Gerger and Central after that date [20]. Since Akdağ, the place where this species is concentrated today falls inside the borders of Adıyaman province, the provincial information that should be corrected as Adıyaman in the location information of the type specimens belonging to the species. When the region map in the “Flora of Turkey” by Davis [21] was examined, it was observed that Akdağ within the Adıyaman province was situated in the “Mesopotamian region,” not the “Cappadocia region.”

The collection date of the type specimens in the studies by Boissier and Cullen was not indicated in the information on the type location of the species *Arabis montbretiana* [3, 5, 6]. The type sheets with the numbers G-BOIS (G00332061) (Figure 3.1) and K000693257 (Figure 3.2) lacked any collection year. However, while the label (Figure 4.5) on the sheet (Figure 3.3) with the number P00747415 bears 1834, the other label (Figure 4.6) on the same sheet bears 1837. The collection date on the G (s.n.) sheet (Figure 3.4) was observed to bear 1837.

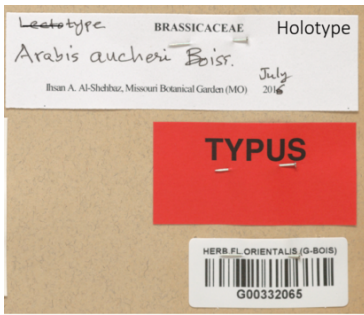
The presence of consecutive collector numbers “97” and “98” in the type information of the species *Arabis aucheri* and *Arabis montbretiana* indicates that those specimens were collected within the same year. When the travel book published by Jaubert [1, 2] was examined, it was observed that Aucher-Éloy arrived in Aleppo and Malatya during his journey in 1834, and then travelled to Aleppo again in 1835. He did not plan any journeys to these two locations in 1837. Specimens of both species should probably have been collected in 1834.

There may be a number of reasons why the specimens of the species *Arabis aucheri* and *Arabis montbretiana* were mixed in herbarium sheets. One of them is that consecutive collector numbers were assigned to each specimen collected in the same period. In the meanwhile, similar specimens may be mixed up with specimens

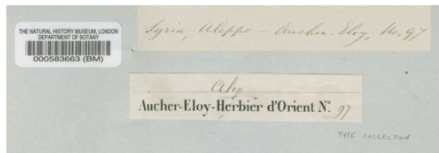


**Figure 1.** Holotype (1) and isotype (2–10) sheets of *Arabis aucheri* in different herbariums described by Al-Shehbaz and Barriera in 2019. 1- G-BOIS [G00332065]; 2- BM000583663; 3- G00389096; 4- P00747456; 5- BM000583662; 6- G00389095; 7- G00389097; 8- K000693235; 9- P00747457; 10- P00747458; (A; *Arabis alpina*, M; *A. montbretiana*, S; *A. sagittata*).

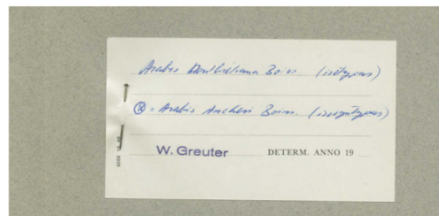




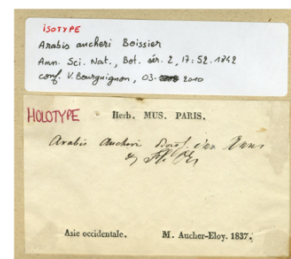
1



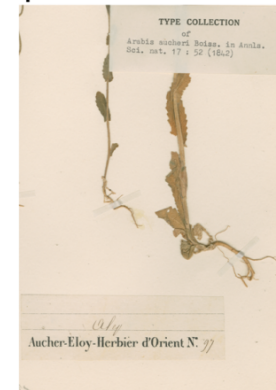
2



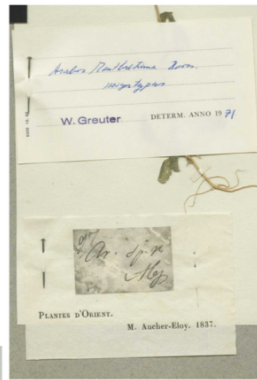
3



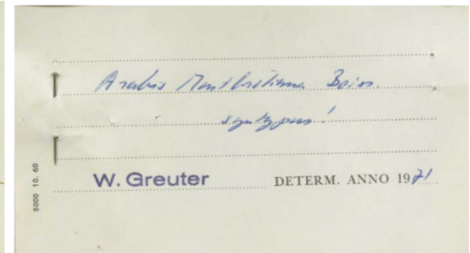
4



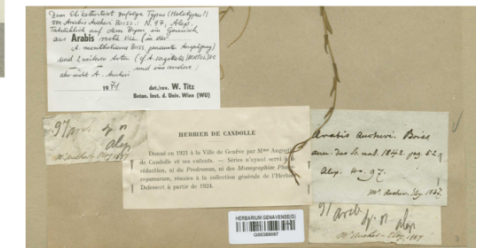
5



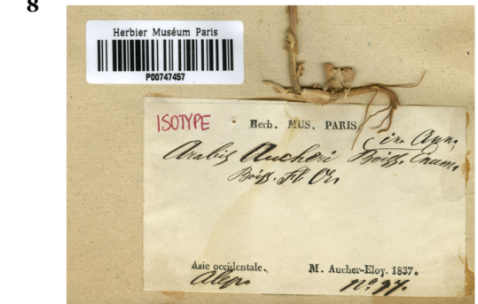
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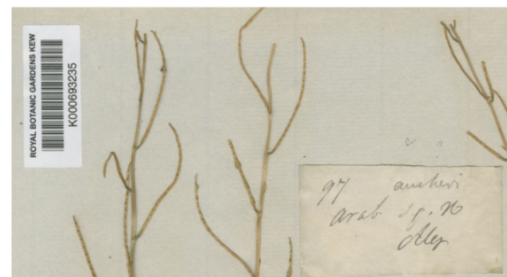
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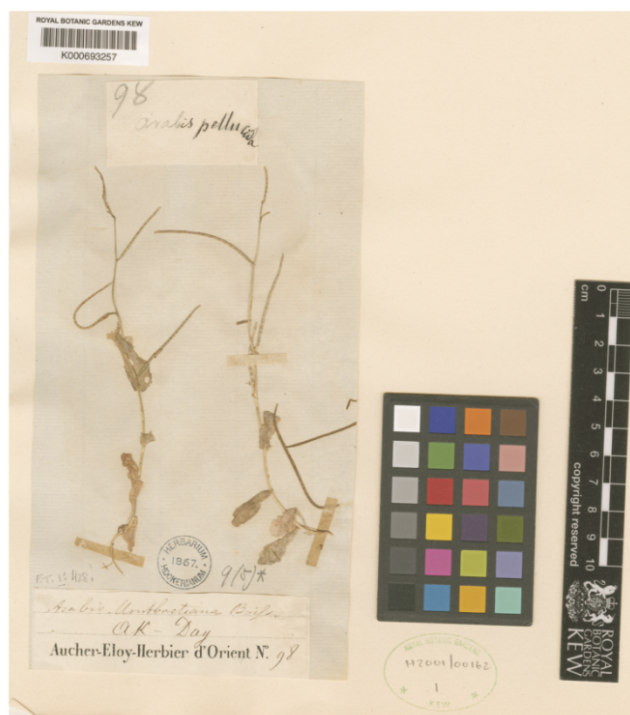


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**Figure 2.** Label information on some type cartons of *Arabis aucheri*. 1- G-BOIS [G00332065]; 2- BM000583663; 3- G00389096; 4- P00747456; 5- BM000583662; 6- G00389095; 7, 8- G00389097; 9- K000693235; 10- P00747457; 11- P00747458.



1



2



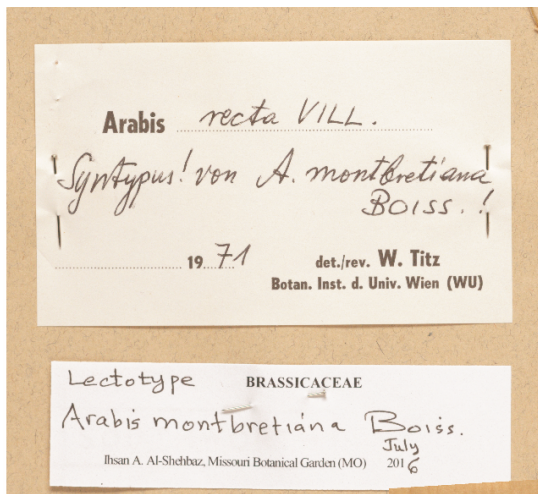
3



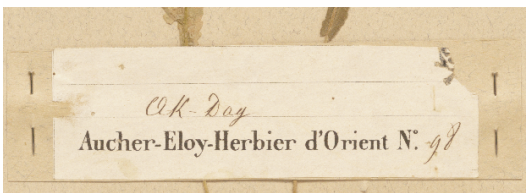
4

**Figure 3.** Lectotype (1), isolectotype (2–3) and syntype (4) sheets of *Arabis montbretiana* in different herbariums described by Al-Shehbaz and Barriera in 2019. 1- G-BOIS [G00332061]; 2- K000693257; 3- P00747415; 4- G [s.n.].





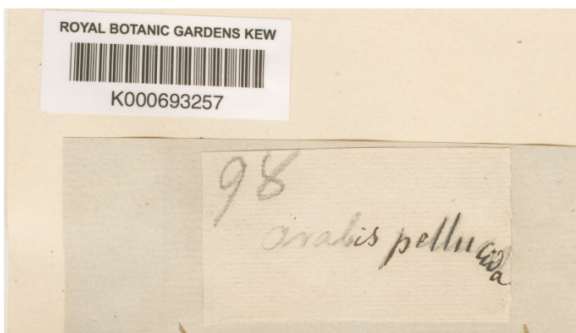
1



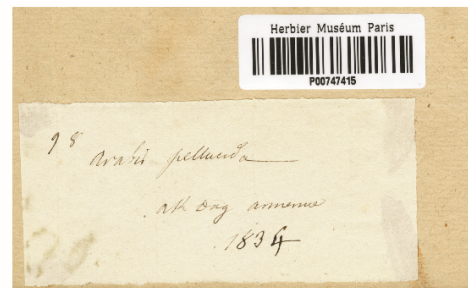
2



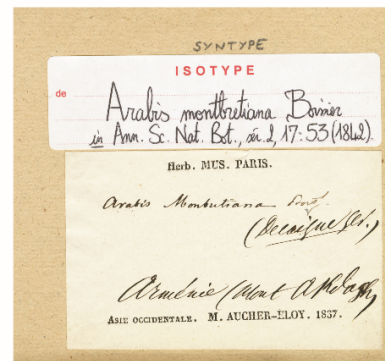
3



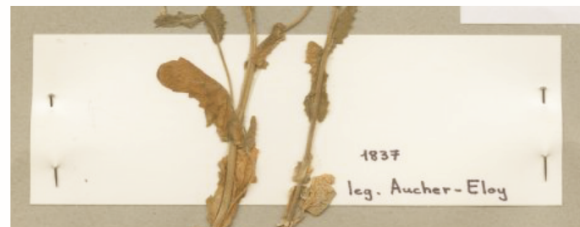
4



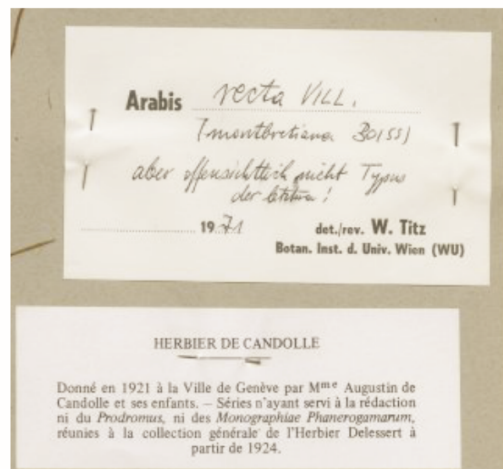
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7



8

**Figure 4.** Label information on some type cartons of *Arabis montbretiana*. 1, 2- G-BOIS [G00332061]; 3, 4- K000693257; 5, 6- P00747415; 7, 8- G [s.n.].

in different numbers. Or another reason is that similar species are found side by side at the collection place. So, the collector may have indicated and recorded similar species as the same species.

The reason for mixing up the specimens “97” and “98” mentioned in this study cannot be due to their simultaneous collection. In 1834, Aucher-Éloy’ collected specimens from Aleppo between the 13th and 23rd of May and then from Akdağ on the 8th of June in the same year. Therefore, specimens of two species were collected around one month apart.

There is a study that was conducted by Mutlu and Erik [23] on the distribution and threath categories of species belonging to the genus *Arabis* in Türkiye. When the Türkiye distribution maps of the species *Arabis aucheri* and *Arabis montbretiana* in this study were examined, it was observed that these species had a similar distribution in the Eastern Mediterranean, South-eastern Anatolia, and the Anatolian diagonal, and may have distributed in the same regions since *Arabis alpina* and *Arabis sagittata* are the most prevalent species in the genus. When the “Flora of Syria, Palestine and Sinai” written by Post in 1932 [23] was examined, the other three species that have been mixed up with the *Arabis aucheri* species were also noticed in Syria. Aucher Éloy might have collected specimens of the *Arabis aucheri*, *Arabis montbretiana*, *Arabis alpina* and *Arabis sagittata* species from the same place in Aleppo, Syria, and recorded them under the same collector number. Aucher-Eloy’s sample numbers do not always follow sequential localities [24]. For example, samples numbered “79 and 82” are registered in Elwed Persiae and Tehran (Iran) and sample numbered “80” in Akdağ (Turkey) [25].

The nomenclature “*Arabis pellucida*” on the labels (Figures 4.4 and 4.5) on type sheets (Figures 3.2 and 3.3) in the Kew and Paris herbariums was not a valid name for any species in the genus *Arabis* until today [26, 27]. Therefore, this nomenclature should be recognised as “*nomen nudum*” according to ICN (Divivion 2, Chapter 6, Section 2, Recommendation 50B.1; glossary) [18]. A description is available for this in Part 2, Chapter 3, Subsection 4, Article 23, Recommendation 23A3(i) of the ICN. According to the description in this recommendation, it is stated, “*Not adopt epithets from unpublished names found in correspondence, travellers’ notes, herbarium labels, or similar sources, attributing them to their authors, unless these authors have approved pub-*

*lication*” [18]. In accordance with this recommendation, this nomenclature should not be employed in species synonyms.

## CONCLUSION

As shown by this study, it is crucial to assign an accession number or barcode number to each of the herbarium sheets as an identifier in order to organize disorders during the placing of plant specimens on the herbarium sheets. In my studies on herbariums in Türkiye, I’ve observed that the identifier numbers of herbarium sheets have been not assigned regularly and more than one herbarium sheet with the same collector number has been assigned the same herbarium accession or barcode number. Also, this study demonstrates that it is crucial for researchers to write down their names and the date on which their remarks were recorded in the notes they left on herbarium specimens after inspection. Herbarium personnel will exercise due diligence in this subject and assist in resolving any taxonomic problems in future studies.

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