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Heldreichia Boiss., *Hussonia* Boiss. (= *Erucaria* Gaertn.), *Iberidella* Boiss. (= *Noccea*), *Moriera* Boiss. (= *Aethionema*), *Nasturtiopsis* Boiss., *Parlatoria* Boiss., *Physoptychis* Boiss., *Pyramidium* Boiss. (= *Veselskya* Opiz), *Strigosella* Boiss., *Strophades* Boiss. (= *Erysimum* L.), *Tchihatchewia* Boiss. (= *Hesperis* L.), and *Zerdana* Boiss. (= *Sterigmostemum* M. Bieb.).

Typification

As shown throughout the text, many authors of various floras often artificially typified the *Brassicaceae* taxa described by Boissier based on material they did not examine and currently housed in herbaria other than those in Geneva. By contrast, for taxa typified here, the first step was checking the holdings in G-BOIS and the original protogues to find out if Boissier indicated that he examined such material in other herbaria. In typifying taxa described by Boissier in *Flora Orientalis*, Boissier clearly stated that first he examined the specimens in his own herbarium (G-BOIS) and then, if necessary he completed with specimens deposited in other herbaria, most of all B, LE and W as loans and the herbaria of Paris and London that he visited (BOISSIER, 1867b). Likewise, we consider for the typification of the taxa described in the *Diagnoses* that Boissier consulted specimens of the same herbaria.

In typifying taxa described by Boissier in the *Annales*, almost all authors overlooked BOISSIER (1841a) and the footnote by the editor of that publication. Boissier clearly stated that he based that series on Aucher-Eloy's collections in his own herbarium (now in G-BOIS) and that of Candolle. As Aucher-Eloy's collections were received by Candolle in 1837, *i.e.* after the publication of volume 1 of the *Prodromus* in which the *Cruciferae* are treated (CANDOLLE, 1824), these collections are not in the *Prodromus* herbarium (G-DC), but have been incorporated in the general collection G. All duplicates in these herbaria were checked because of their importance in the typification of taxa described by BOISSIER (1842a, 1842b, 1842c). Boissier did not examine the rich Aucher-Eloy collections in the Moricand or Delessert herbaria because they were not available in G on 1842, but he checked and annotated numerous duplicates at P. Some novelties were based on Aucher-Eloy unicates at P sent to Boissier by A. Brongniart, and these are recognized here as holotypes. He always annotated the specimens examined from other herbaria, and those unannotated (including those in P, or G with a label of Candolle's herbarium) are interpreted here as not examined. Boissier's unique handwriting easily distinguish his annotations from those of other botanists of his time.

If Boissier did not annotate or mention the source of material he studied, it is a definite rule that he based his descriptions *solely* on the material in his herbarium, and in the majority of cases he cited a single collection for a given taxon. Therefore, there is no justification to list a holotype or designate a lectotype based on material not studied by Boissier from any other herbarium. This matter is clearly indicated in the Code

(Article 9.1, note 1; TURLAND et al., 2018): "If the author used only one specimen or illustration, either cited or uncited, when preparing the account of the new taxon, it must be accepted as the holotype". This important note is enforced in identifying a given holotype, as well as in designating a lectotype, in a herbarium other than G-BOIS if it lacks Boissier's annotation or citation in the protologue. Such erroneous designations are either ignored or corrected by a second-step lectotypification throughout this work.

As for GAY's (1842) species novelties of *Erysimum*, it is clear that their names have priority because his account was published on 20 January 1842, whereas Boissier's (1842a) names in *Annales* were published in March of that year. Two of Gay's species, *E. purpureum* and *E. pycnophyllum*, are lectotypified in this work, and they are based on the same type collections of Boissier's illegitimate later homonym *E. purpureum* and name superfluous *E. thyrsoides* respectively.

Sequence of the text

BOISSIER (1867a) partially adopted CANDOLLE (1821a, 1821b, 1824) classification system of the *Cruciferae* by recognizing only three of the five major "subordo". He united the *Pleurorhizeae* DC. and *Notorhizeae* DC. into *Platylobeae* Boiss., maintained *Orthoploceae* DC. and *Spirolobeae* DC., and did not include *Diplocolobae* DC. because it is an exclusively South African group. Furthermore, he did not recognize any of the 21 tribes of Candolle, of which many were recognized by subsequent botanists to the present. Boissier divided the three *subordo* into informal groups based on descriptive terms applied to fruit length/width ratio (e.g., *Siliquosae*, *Siliculosae*), type of fruit flattening (*Angustiseptae*, *Latisepae*), and cotyledonary position (*Notorhizeae*, *Pleurorhizeae*). These descriptive fruit and embryo types were originally introduced by CANDOLLE (1821a, 1821b). For a comparison of the two systems and generic arrangements of Candolle and Boissier, the reader is advised to consult HAYEK (1911).

Except for the present work, not a single other author followed BOISSIER's (1867a) generic sequence. However, the main reason for doing so here is to link the present typification with the *Flora Orientalis* sequence to facilitate easy reference and future updates. Regardless to whether or not a given genus is currently recognized, the generic sequence follows the *Flora Orientalis*. Unless otherwise indicated, under each genus the species number and current tribal affiliation follow the latest estimates by AL-SHEHBAZ (2012) and/or the continuously updated *Brassicaceae* database or BRASSIBASE (2019). The aim is to aid the reader in linking the past and present knowledge of taxa.



Fig. 3. Boissier and Barbey herbaria at the University of Geneva with their curator, Gustave Beauverd in c. 1925.
[Bibliothèque des Conservatoire et Jardin botaniques, Genève]



Fig. 4. Historical herbarium G-BOIS at the Conservatoire et Jardin botaniques in Geneva (2019).
[Picture: F. Golay]

Concluding remarks

The *Cruciferae* in *Flora Orientalis* and its *Supplementum* are represented by a total of 118 genera, 784 species, and 155 varieties, of which 20 genera, 411 species, and 121 varieties were described as new by Boissier there or previously in the *Annales* and *Diagnoses*. Thirty two out of a total of 532 novelties described by Boissier did not necessitate any typification (19 renamings of taxa and 13 superfluous names). They are excluded from typifications statistics throughout the text and in Table 1. The status of only 7 out of the 500 remaining novelties are undetermined because their type collections were not located in any of the major herbaria consulted. It is not known if they were misplaced in those herbaria or housed in smaller ones not visited for this study. They include three species (*Clypeola glabra* Boiss., *Lepidium setosum* Boiss., and *Sisymbrium hesperidiflorum* Boiss. & Buhse) and four varieties (*Berteroa ascendens* var. *microcarpa* Boiss., *Cardamine uliginosa* var. *amethystina* Boiss., *Matthiola humilis* var. *ecornuta* Boiss., and *M. incana* var. *glabra* Boiss.).

Holotypes or lectotypes of 457 out of 500 novelties (91.4%) described by Boissier are definitely housed in his herbarium in G-BOIS. The remaining specimens (for 34 novelties) are housed in various herbaria: 25 at P, 7 at G, and one each at K and W. For those, Boissier often took fragments that he deposited in his herbarium, and they are considered as isotypes or isolectotypes.

Only 20 out of the 500 novelties (4%) that are dealt with in this work are illegitimate names, and they include 11 later homonyms and 9 superfluous names. In cases where Boissier's superfluous names were based on the same type collection that the correct name, e.g. in J. Gay's novelties of *Erysimum*, the holotypes or lectotypes were based on specimens available to Gay.

In summary, the present study deals with the typification of 500 names (395 species and 105 varieties). Fifty-one (51) have previously been correctly typified by earlier authors. Holotypes are considered for 280 names, lectotypes are designated herein for 161 taxa (including 28 second-step lectotypifications) and one neotype is designated (see Table 1). None of the 121 varieties described by Boissier is currently recognized, 156 out of 411 species (38%) described are recognized (147 in the original

genus and 9 in another genus). Finally, 376 novelties out of 532 taxa are currently synonymized (see Table 2).

Table 2. Number of accepted and synonymized Boissier's names

Taxa	Accepted Boissier's names		Synonymized Boissier's names	Total Boissier's names	Total
	in original genus	in other genera			
species	147	9	255	411	
varieties	0	0	121	121	
Total	156 (29.3%)		376 (70.7%)		532

Names typification

All currently accepted taxa (genera, species, varieties) in the text are listed in boldface, and those synonymized are in italics. No additional homotypic or heterotypic synonyms are given because it is beyond the scope of this work to do that. Following the bibliographic citation of the basionym of each taxon, the word "Type", the localities, and collectors are listed exactly as they appeared in the original work. For each entry, following the word "Holotypus" or "Lectotypus", exact data of the type locality is given in quotation marks based on the G-BOIS material, or rarely elsewhere if Boissier based his taxon description on such material, followed by the elevation, date, and collector indicated according to an established standard. And where appropriate, "Syntypus" is indicated with the same sequence as for the holo- or lectotypus.

Herbarium acronyms are arranged alphabetically, and whenever available, the barcode numbers are given. For herbaria with more than one duplicate, the barcode numbers are listed in an ascending order. The entire holdings, including types, of A, B, BM, E, G, G-BOIS, G-DC, GH, JE, K, KW, MO, P, PR, PRC, S, US, W, WU, Z, and ZT were examined for every species and variety described by Boissier. Therefore, there is no need to place an exclamation mark "!" following the acronyms and barcodes of these herbaria. All specimen images in the VIRTUAL HERBARIA (2019) were verified. For all other cited herbarium acronyms with barcode numbers, their images were examined on JSTOR Global Plants website [<https://plants.jstor.org>]. Finally, acronyms without barcodes were based on the literature.

Notes are provided about the typification of each species or variety, particularly if the lectotype is designated here for the first time, or if earlier lectotypifications were incomplete, controversial, or erroneous. Status of the holo- or lectotype material in G-BOIS is presented, especially when more than one sheet exists. Whenever necessary, taxonomic information is also given here.

Table 1. Summary of the number of typifications

Status	Number of types
Holotypes	280 (56.0%)
Lectotypes here designated	133 (26.6%)
2nd step designation	28 (5.6%)
Neotypus	1 (0.2%)
Previous typifications	51 (10.2%)
Types not found	7 (1.4%)
Total	500