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Clarifications about the identity of the names *Sagina alexandrae* and *S. hawaiensis* (Caryophyllaceae)

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ABSTRACT:
The names *Sagina alexandrae* and *S. hawaiensis* are currently considered heterotypic synonyms. A detailed analysis of the protologues and other pertinent literature, as well as the study of the original material and other specimens, reveals that these two names do not represent the same taxon. Based on Pax's original description and Hillebrand's linked account published in *Flora of the Hawaiian Islands*, we noted that *S. hawaiensis* was described as having petals half as long as the sepals ("petalis quam calyx dimidio brevioribus" in the protologue), whereas the petals of *S. alexandrae* are longer than the sepals. Notably, *S. hawaiensis* was described with an uncommon combination of characters, specifically regarding the flowers which are 5-merous, with corollas shorter than the calyx, and 10 stamens. Among the few *Sagina* taxa with 10 stamens (*S. caespitosa*, *S. maxima*, *S. nivalis*, *S. nodosa*, and *S. saginoides*), only *S. maxima* s.s. exhibits a morphology matching that of *S. hawaiensis*. The nomenclature of these two names is clarified as follows. According to Arts. 9.3, 9.6, and 9.10 of the *Madrid Code*, the indication of "holotype" by Crow for *S. maxima* is corrected to "lectotype" (specimen at GH). Lacking any original material for *S. hawaiensis*, as well as useful specimens collected in Hawaii, the type of *S. maxima* was designated as the neotype (Art. 9.8) of *S. hawaiensis*, thus making the two names homotypic (new synonymy).

Keywords: nomenclature, *Sagina maxima*, synonymy, typification.

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INTRODUCTION

Sagina L. (Caryophyllaceae Juss.) is a genus of approximately 30 species mostly occurring in North-temperate and arctic regions, with only a few taxa growing on tropical mountains (Hernández-Ledesma *et al.* 2015). Although a detailed monograph on the genus is still lacking, molecular data have demonstrated that *Sagina* is monophyletic (see e.g. Fior *et al.* 2006; Greenberg & Donoghue 2011; Dillenberger & Kadereit 2022). However, the taxonomy and nomenclature of the genus still require further investigations (see e.g. Dillenberger & Kadereit 2022; Iamonico *et al.* 2022).

Iamonico (2016) correctly proposed a new name (*Sagina alexandrae* Iamonico) for *S. subulata* (Sw.) C.Presl, a later homonym (illegitimate according to Art. 53.1 of the *Madrid Code*; Turland *et al.* 2018) of *S. subulata* D'Urv. [≡ *Colobanthus subulatus* (d'Urv.) Hook.]. *Sagina alexandrae* is recognised as a distinct species in the Euro+Med Plantbase (Marhold 2011+), whereas it was synonymised with *S. hawaiensis* Pax in *Plants of the World Online* (POWO 2025) where *Spergularia nobreana* Samp. is also reported. While the identity of Sampaio's name (Sampaio 1906) was recently clarified by Iamonico & Dillenberger (2023), who considered it a heterotypic synonym of *Spergularia*

media (L.) C.Presl., Pax's *S. hawaiensis* has not yet been investigated from the nomenclatural point of view. Hence, as part of ongoing research on the genus *Sagina* (e.g. Iamonico 2016; Dillenberger & Kadereit 2022; Iamonico *et al.* 2022), Pax's name is investigated here in detail.

MATERIAL AND METHODS

This research is based on an analysis of the relevant literature (the protologues of the studied names included) and a search for and examination of the specimens deposited in the herbaria B, BISH, GH, K, NDG, RO, SBT, US, and YU (abbreviations according to Thiers 2025+).

The articles of the *International Code of Nomenclature for algae, fungi, and plants* cited in the text (e.g. "Art. 38.1") follow the current edition, i.e. the *Madrid Code* (hereafter as "ICN"; Turland *et al.* 2025).

RESULTS AND DISCUSSION

Pax (1894: 27–28) published the name *Sagina hawaiensis,* reporting in synonymy "*S. subulata* Hillebr., Fl. Hawaiian Islands 38, nec aut. germ.". This citation refers to *Flora of the Hawaiian Islands* by Hillebrand (1888: 38) who, in turn, cited " '**S.** [Sagina] **subulata**, *Wimm.—Koch, Synops. Fl. Germ.*' ", thereby referring to Wimmer's (1844: 76) *Flora von Schlesien preussischen und österreichischen Antheils* and Koch's (Koch 1843: 119) *Synopsis florae Germanicae et Helveticae.* It should be noted that although Wimmer (1844: 76) proposed a new combination under *Sagina* for *Spergula subulata* Sw., this binomial is an isonym of the previous *S. subulata* (Sw.) J.Presl and, therefore, not valid from the nomenclatural point of view (Art. 6.3 Note 2 of ICN)]. However, as clearly stated by Pax (1894: 27, "…nec aut. germ."), his concept of *S. hawaiensis* excludes those of the German authors (Wimmer 1844 and Koch 1843). All things considered, Pax's *Sagina hawaiensis* must be studied within the context of Hillebrand's concept and work.

Pax (1894: 27–28) provided a detailed description of *Sagina hawaiensis*, as well as its provenance and collector ("Sandwich Inseln, Maui, Weideplätze bei Ulupalakua (Hillebrand)"; which represents a syntype according to ICN Art. 9.6. According to Stafleu & Cowan (1979) and the HUH Index of botanists (2013), Hillebrand's herbarium and the types of his Hawaiian flora were preserved at B where, however, no specimens were traced since Hillebrand's collection (as well as most of the B herbarium) was destroyed during World War II as highlighted by several authors (e.g. Eggli & Leuenberger 2008; Iamonico *et al.* 2017; Montesinos-Tubée & Iamonico 2023). Consequently, a neotypification would be required under the rules of the *Madrid Code* (Art. 9.8 of ICN). In selecting a useful specimen for neotypification purposes, both the protologue by Pax (1894: 27–28) and the description by Hillebrand (1888: 38) ought to be considered. First, it is to be noted that the genus *Sagina* is actually considered allochthonous in Hawaii, with only the following three taxa recorded: *S. decumbens* (Elliott) Torr. & A.Gray subsp. *occidentalis* (S.Watson) C.E.Crow, *S. japonica* (Sw.) Ohwi, and *S. procumbens* L. (Wagner *et al.* 2025+). A comparison of the descriptions provided by Pax and Hillebrand with the current ones for these three species (see e.g. Crow 1978: 68–70), clearly shows that none of them can be ascribed to *S. hawaiensis* since:

- *Sagina decumbens* and *S. japonica* have petals which are slightly longer and equal to slightly shorter than the sepals [*vs.* petals half as long as the sepals ("petalis quam calyx dimidio brevioribus" in the protologue) in *S. hawaiensis*];
- *Sagina procumbens* has flowers which are usually 4-merous with 4 to 8 stamens (flowers always 5-merous and 10 stamens in *S. hawaiensis*);

The putative synonymy of *Sagina hawaiensis* with *S. alexandrae* by some authors and databases (see e.g. Portal to the Flora of Italy 2024; POWO 2025) can be excluded based on the petal/sepal ratio which is, respectively, about 0.5 and > 1 (Clapham & Jardin 1993: 147; Pignatti 2018).

The occurrence of 10 stamens in *Sagina hawaiensis* is not a common feature in the genus, whose members usually exhibit 4 or 5 stamens. Species with 10 stamens include: *S. caespitosa* Lange, *S. maxima* (A.Gray) s.l., *S. nivalis* (Lindblom) Fr., *S. nodosa* (L. Fenzl), and *S. saginoides* (L.) H.Karst. Due to the petal/sepal ratio in *S. hawaiensis* (about 0.5), *S. caespitosa* (ratio > 1), *S. nivalis* (ratio about 1; also, the flowers do not match, being 4-merous against 5-merous in *S. hawaiensis*), and *S. nodosa* (ratio about 2) can be excluded. *Sagina saginoides* has glabrous peduncles, whereas those of *S. hawaiensis* are glandular-pubescent. *S. maxima* s.s. exhibits a morphology consistent with *S. hawaiensis* with the following diagnostic features (Crow 1978, 2005): succulent leaves, 5-merous flowers, glandular-pubescent peduncles, and a corolla shorter than the calyx.

Crow (1978: 77) indicated a GH specimen as the holotype of Gray's binomial *Sagina maxima,* and an isotype at NY was also reported. However, Gray (1858: 382) did not designate any holotype since the protologue includes just the provenance ("Cape Sangar") and the title of the work highlights the collector ("… collected in Japan by Charles Wright …"). In other words, Gray (1858) cited a syntype (ICN Art. 9.6). We traced one specimen at GH (barcode GH00037841) which is annotated as a holotype by Crow (label on the bottom-centre of the sheet). According to Arts. 9.3, 9.6, and 9.10 Crow's term holotype should be corrected to lectotype.

Concerning the typification of *Sagina hawaiensis*, the herbarium BISH (*Herbarium Pacificum* at the Hawaiian Bishop Museum), where numerous Hawaiian collections are preserved, was also examined but, unfortunately, no useful specimen was found. A solution is to use the lectotype of *S. maxima* (GH00037841) as the neotype of Pax's binomial. The two names thus become homotypic synonyms.

TAXONOMIC TREATMENT

Sagina maxima A.Gray, Mem. Amer. Acad. Arts n.s., 6: 382. 1858. – **Lectotype (designated by Crow 1978: 77 as "holotype" here corrected according to ICN Art. 9.10)**: Japan, Cape Sangar, 1853-1856, *Wright s.n.* (GH00037841!, image available at https://plants.jstor.org/stable/viewer/10.5555/al.ap.specimen.gh00037841).

≡ *Sagina hawaiensis* Pax, Bot. Jahrb. Syst. 18: 27. 1893, *syn. nov.* – **Neotype (designated here)**: Japan, Cape Sangar, 1853-1856, *Wright s.n.* (GH00037841!, image available at https://plants.jstor.org/stable/viewer/10.5555/al.ap.specimen.gh00037841).

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REZIME

Pojašnjenja o identitetu imena vrsta *Sagina alexandrae* i *S. hawaiensis* (Caryophyllaceae)

Duilio Iamonico

Imena *Sagina alexandrae* i *S. hawaiensis* se trenutno smatraju heterotipskim sinonimima. Detaljna analiza protologa i relevantne literature, kao i originalnog materijala i drugih specimena otkrivaju da se ova dva imena ne odnose na isti takson. Na osnovu Paxovog originalnog opisa i Hillebrandovog opisa publikovanog u Flori Havajskih ostrva, primetili smo da kruničnilistići *S. hawaiensis* predstavljaju 1/2 dužine kruničnih listića ("petalis quam calyx dimidio brevioribus" u protologu), dok su kod *S. alexandrae* čašični i kruničnilistići iste dužine. Zapravo, kod *S. hawaiensis* je opisan set neuobičajenih karaktera, posebno u vezi cvetova koji su petočlani, sa krunicom koja je kraća od čašice, kao i 10 prašnika. Medju nekoliko *Sagina* sa 10 prašnika (*S. caespitosa*, *S. maxima*, *S. nivalis*, *S. nodosa* i *S. saginoides*), jedino *S. maxima* s.s. pokazuje morfologiju identičnu *S. hawaiensis*. Nomenklatura ova dva imena je razjašnjena. Prema članu s. 9.3, 9.6, i 9.10 Madrid koda, indikacija "holotipa" od strane Crow-a za *S. maxima* je korigovana u "lektotip" (specimen u GH). Zbog nedostatka originalnog materijala *S. hawaiensis*, kao i specimena sakupljenog na Havajima, tipski material *S. maxima* je označen kao neotip (*Član* 9.8), što čini ova dva imena homotipskim sinonimima (novim sinonimima).

Ključne reči: nomenklatura, *Sagina maxima*, sinonimija, tipifikacija