

Supplementary material 02

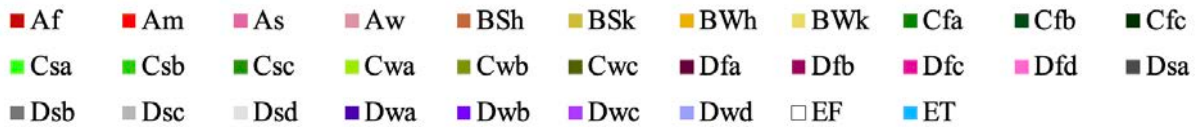
Distribution and climate of Hydrocharitaceae

1. Köppen-Geiger climate symbols and defining criteria (Peel et al. 2007, Kottke et al. 2006, Rubel et al. 2017, Cui et al. 2021)

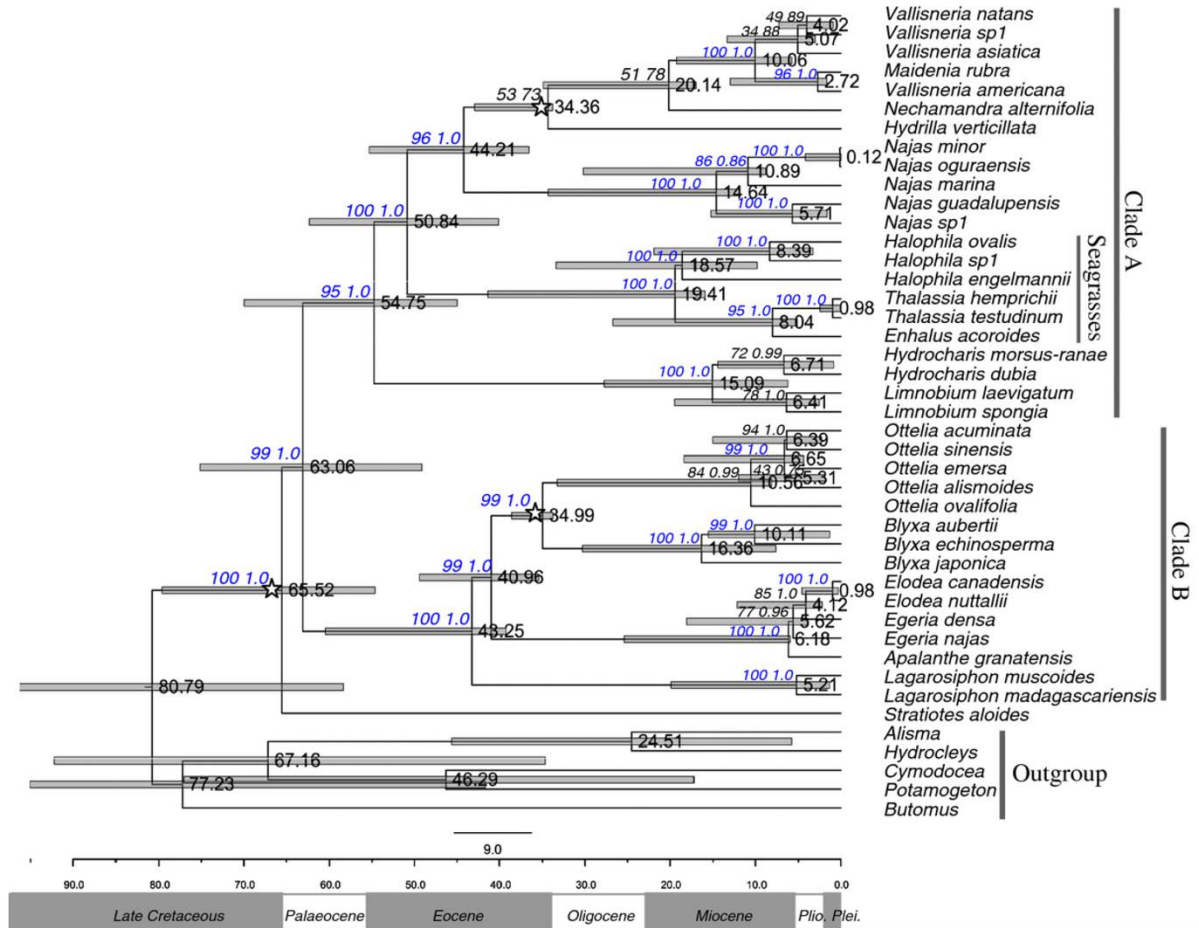
1st	2nd	3rd	Description and criteria
<i>A</i>			Equatorial/tropical — $\text{MTCM} \geq 18\text{ }^{\circ}\text{C}$
	<i>f</i>		Rainforest, fully humid— $\text{P}_{\text{dry}} \geq 60\text{ mm}$
	<i>m</i>		Monsoonal—not <i>Af</i> & $\text{P}_{\text{dry}} \geq 100 - \text{MAP}/25$
	<i>s</i>		Savannah with dry summer— $\text{P}_{\text{sdry}} < 60\text{ mm}$
	<i>w</i>		Savannah with dry winter— $\text{P}_{\text{wdry}} < 60\text{ mm}$
<i>B</i>			Arid — $\text{MAP} < 10 \times \text{P}_{\text{threshold}}$
	<i>W</i>		Desert— $\text{MAP} < 5 \times \text{P}_{\text{threshold}}$
	<i>S</i>		Steppe— $\text{MAP} \geq 5 \times \text{P}_{\text{threshold}}$
		<i>h</i>	Hot arid— $\text{MAT} \geq 18\text{ }^{\circ}\text{C}$
		<i>k</i>	Cold arid— $\text{MAT} < 18\text{ }^{\circ}\text{C}$
<i>C</i>			Warm temperate (subtropical to temperate)— $\text{T}_{\text{hot}} > 10\text{ }^{\circ}\text{C}$ & $0\text{ }^{\circ}\text{C} < \text{MTCM} < 18\text{ }^{\circ}\text{C}$
<i>D</i>			Snow (cold-temperate to boreal)— $\text{T}_{\text{hot}} > 10\text{ }^{\circ}\text{C}$ & $\text{MTCM} \leq 0\text{ }^{\circ}\text{C}$
	<i>s</i>		Summer dry— $\text{P}_{\text{sdry}} < 40\text{ mm}$ & $\text{P}_{\text{sdry}} < \text{P}_{\text{wwet}}/3$
	<i>w</i>		Winter dry— $\text{P}_{\text{wdry}} < \text{P}_{\text{swet}}/10$
	<i>f</i>		Fully humid, without a dry season, i.e. not <i>s</i> or <i>w</i>
		<i>a</i>	Hot summer— $\text{T}_{\text{hot}} \geq 22\text{ }^{\circ}\text{C}$
		<i>b</i>	Warm summer—not <i>a</i> & $\text{T}_{\text{mon10}} \geq 4$
		<i>c</i>	Cool/cold and short summer—not <i>a/b</i> & $1 \leq \text{T}_{\text{mon10}} < 4$
		<i>d</i>	Extremely continental: cold/very short or no summer & very cold winter—not <i>a/b</i> & $\text{MTCM} < -38\text{ }^{\circ}\text{C}$
<i>E</i>			Polar — $\text{T}_{\text{hot}} < 10\text{ }^{\circ}\text{C}$
	<i>T</i>		Tundra—($\text{T}_{\text{hot}} > 0$)
	<i>F</i>		Ice, permanent frost ('frost desert')—($\text{T}_{\text{hot}} \leq 0$)

MAP = mean annual precipitation, MAT = mean annual temperature, T_{hot} = mean temperature of the hottest month, T_{cold} = mean temperature of the coldest month, T_{mon10} = number of months where the temperature is above $10\text{ }^{\circ}\text{C}$, P_{dry} = precipitation of the driest month, P_{sdry} = precipitation of the driest month in summer, P_{wdry} = precipitation of the driest month in winter, P_{swet} = precipitation of the wettest month in summer, P_{wwet} = precipitation of the wettest month in winter, $\text{P}_{\text{threshold}}$ = varies according to the following rules: if 70% of MAP occurs in winter then $\text{P}_{\text{threshold}} = 2 \times \text{MAT}$, if 70% of MAP occurs in summer then $\text{P}_{\text{threshold}} = 2 \times \text{MAT} + 28$, otherwise $\text{P}_{\text{threshold}} = 2 \times \text{MAT} + 14$. Summer (winter) is defined as the warmer (cooler) six months period of October to March and April to September.

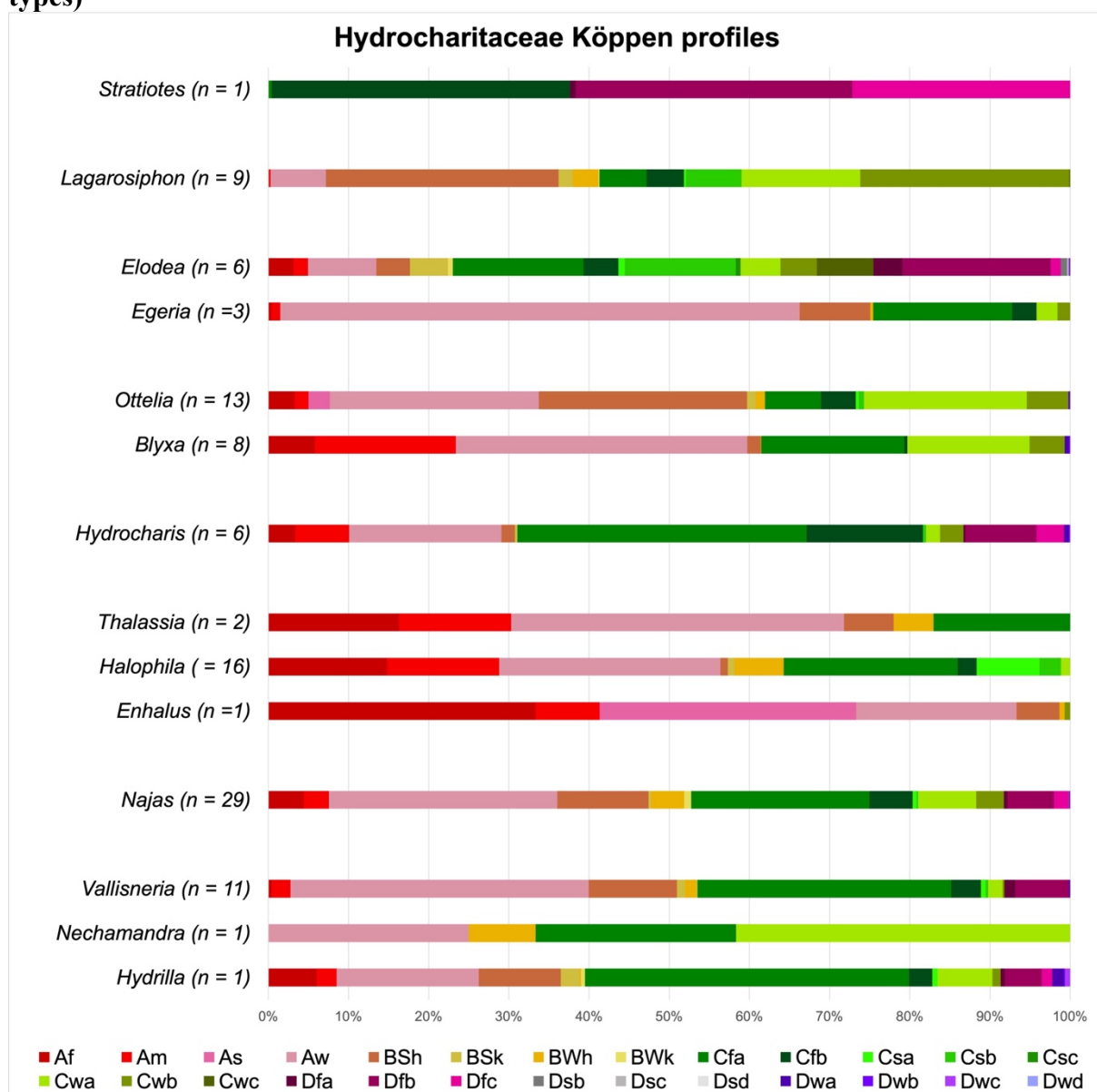
2. Köppen-Geiger climate map colour coding



3. Phylogenetic relationships within Hydrocharitaceae from Chen et al. (2012, fig. 1)



4. 1. Summarized Hydrocharitaceae genera Köppen profiles (incl. all Köppen climate types)



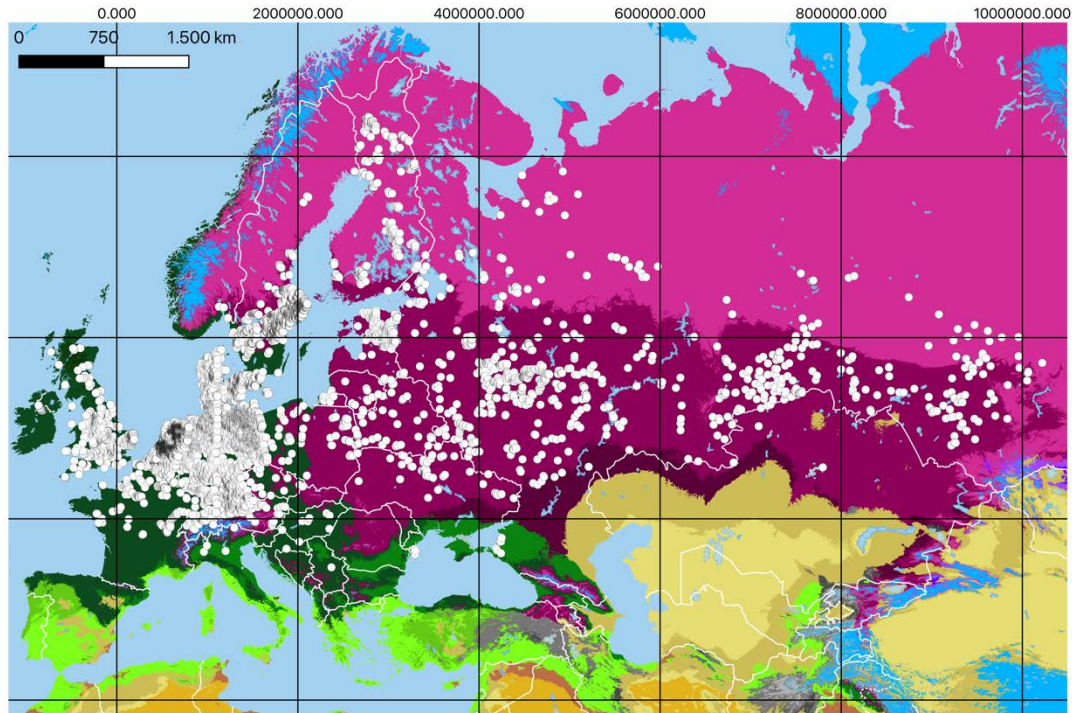
[illegible]

5. Hydrocharitaceae species Köppen Profiles

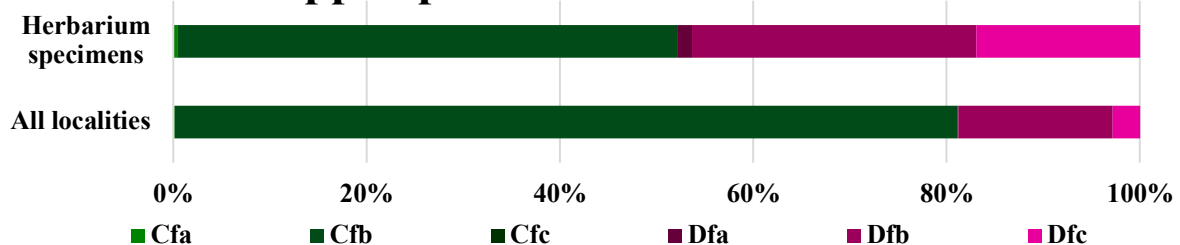
5.1. First diverging genus within Hydrocharitaceae cf. Chen et. al (2012)

5.1.1. Genus *Stratiotes* L., 1753.

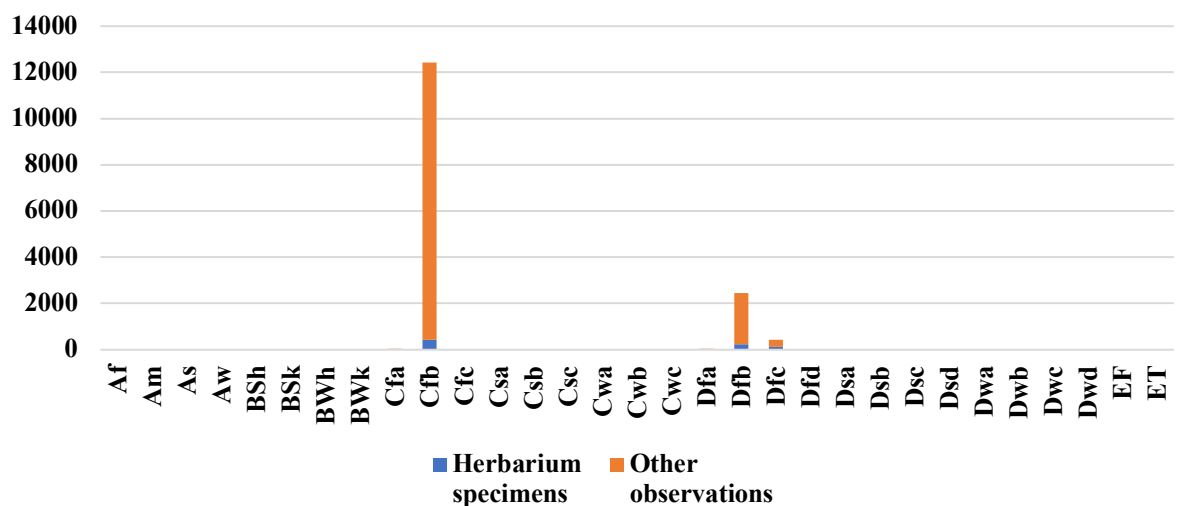
5.1.1.1. Köppen profile, distribution and climate map– GBIF all occurrences of *Stratiotes aloides* L. 1753; all localities (n = 28431), unique localities (n = 15341), herbarium specimens excluding duplicate occurrences (n = 820), other observations (n = 14537).



Köppen profile of *Stratiotes aloides*



Köppen profile of *Stratiotes aloides*

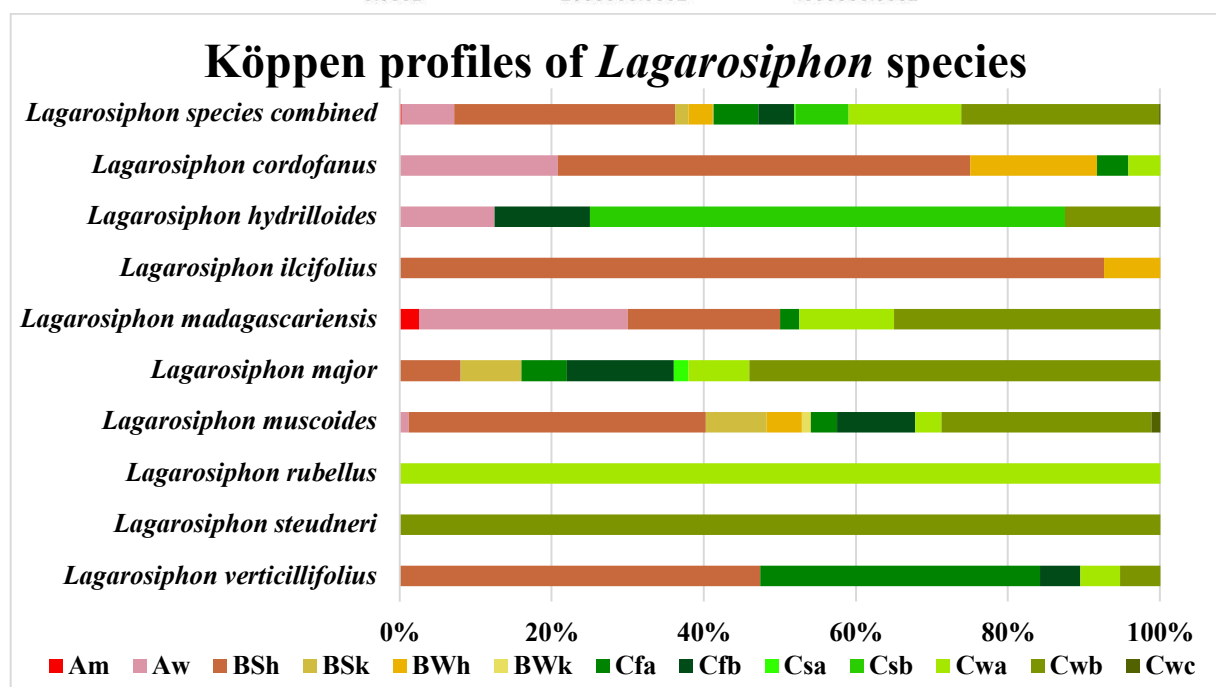
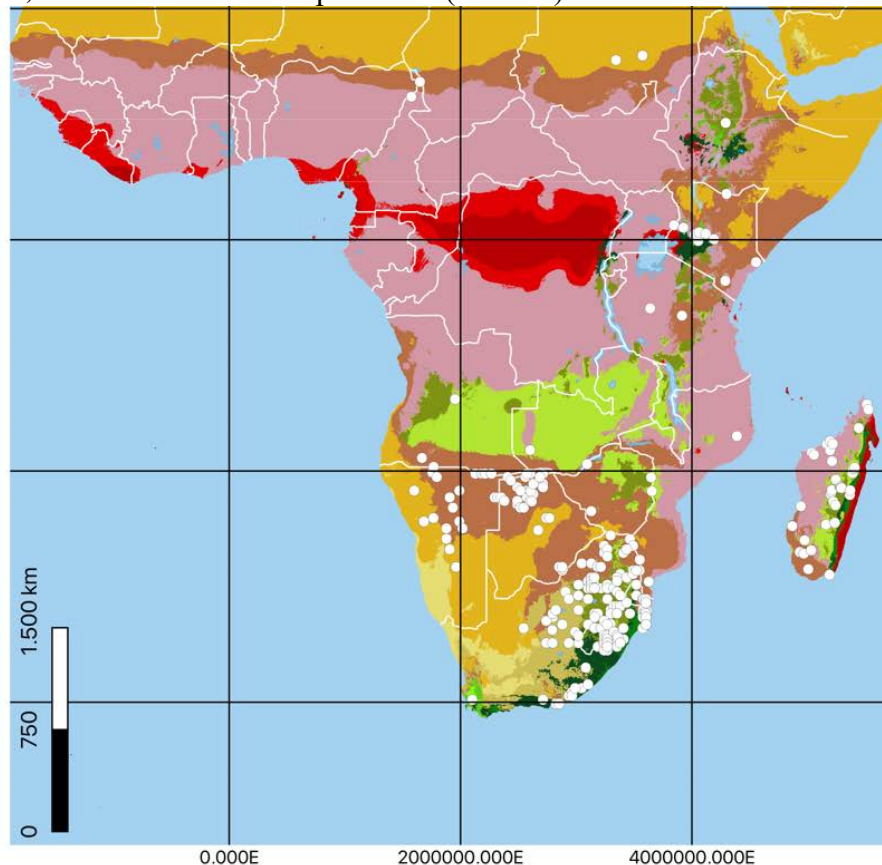


5.2 Clade B

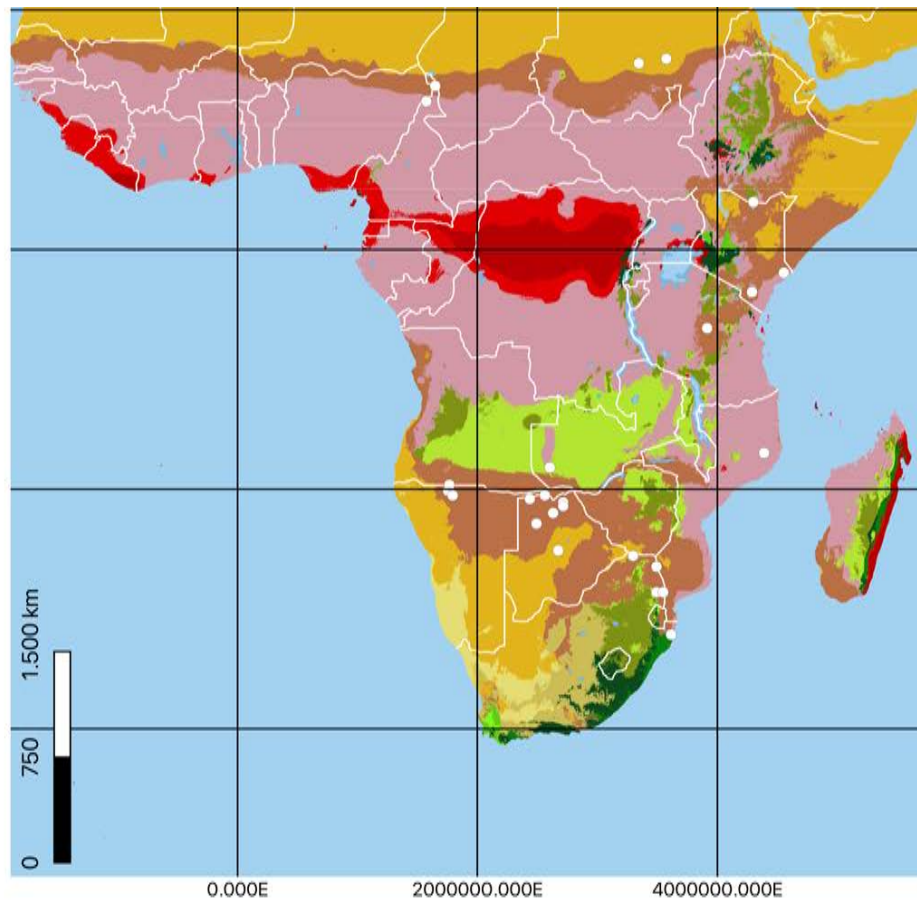
5.2.1. First diverging genera within Clade B of Hydrocharitaceae cf. Chen et. al (2012), comprising *Lagarosiphon* Harv., 1841 and *Appertiella* C.D.K.Cook & Triest, 1982 (GBIF database did not contain data sets of *Appertiella* including geographic occurrence data).

5.2.1.1. Genus *Lagarosiphon* Harv., 1841

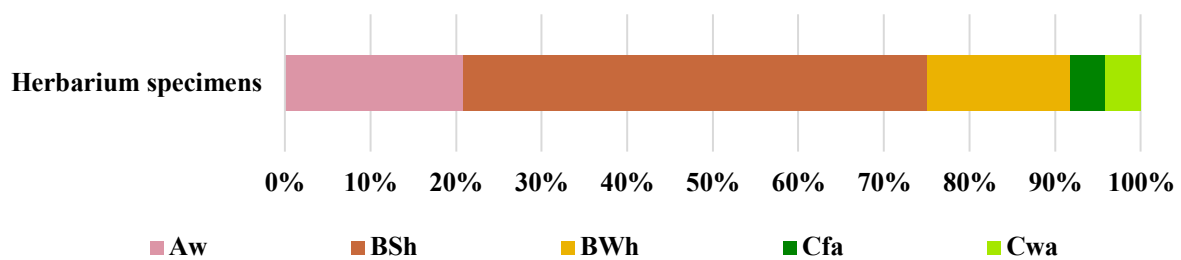
Distribution and Köppen profiles for *Lagarosiphon* incl. *L. cordofanus*, *L. hydrilloides*, *L. ilicifolius*, *L. madagascariensis*, *L. major*, *L. muscoides*, *L. rubellus*, *L. steudneri*, and *L. verticillifolius*, based on herbarium specimens (n = 445).



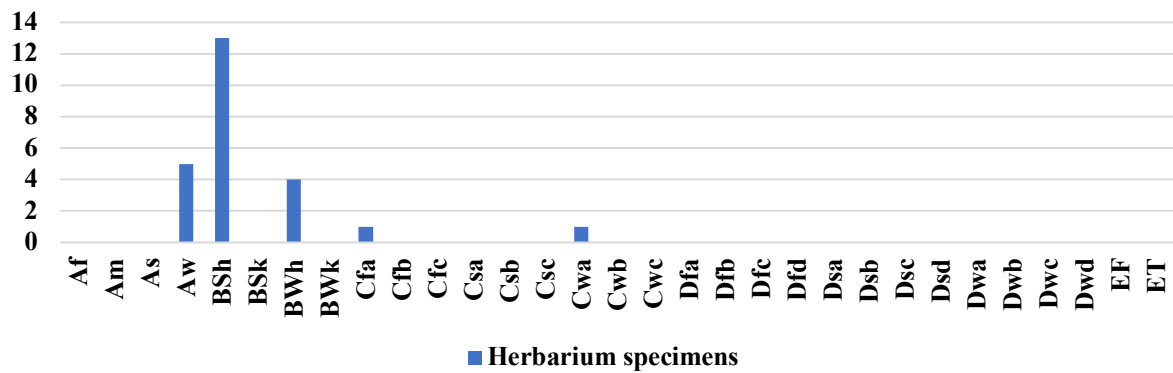
5.2.1.1.1. Köppen profile, distribution and climate map– GBIF occurrences of *Lagarosiphon cordofanus* Casp. 1858; herbarium specimens excluding duplicate occurrences (n = 24).



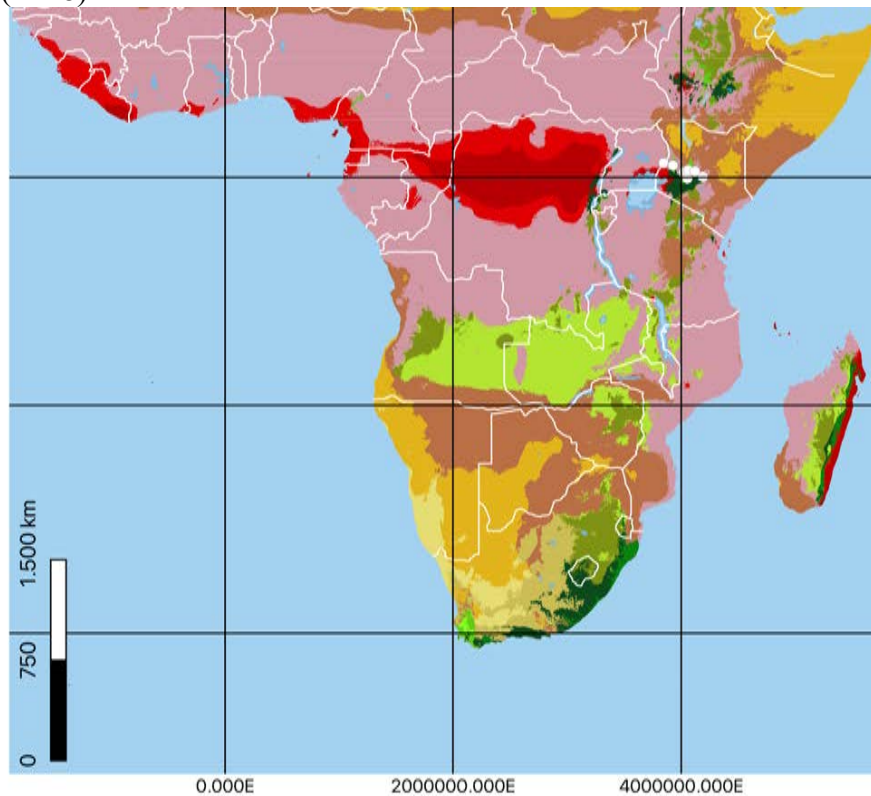
Köppen profile of *Lagarosiphon cordofanus*



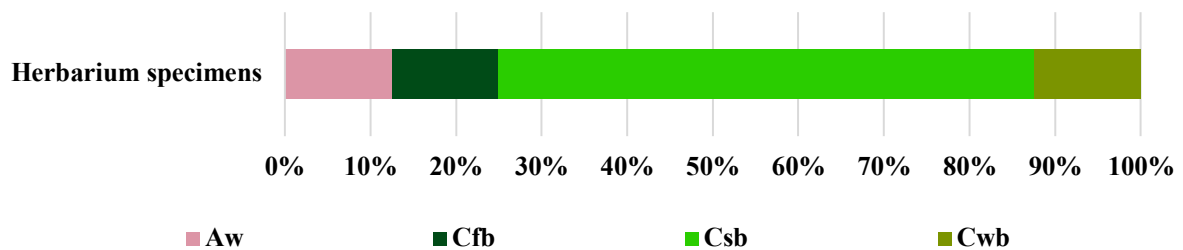
Köppen signatures of *Lagarosiphon cordofanus*



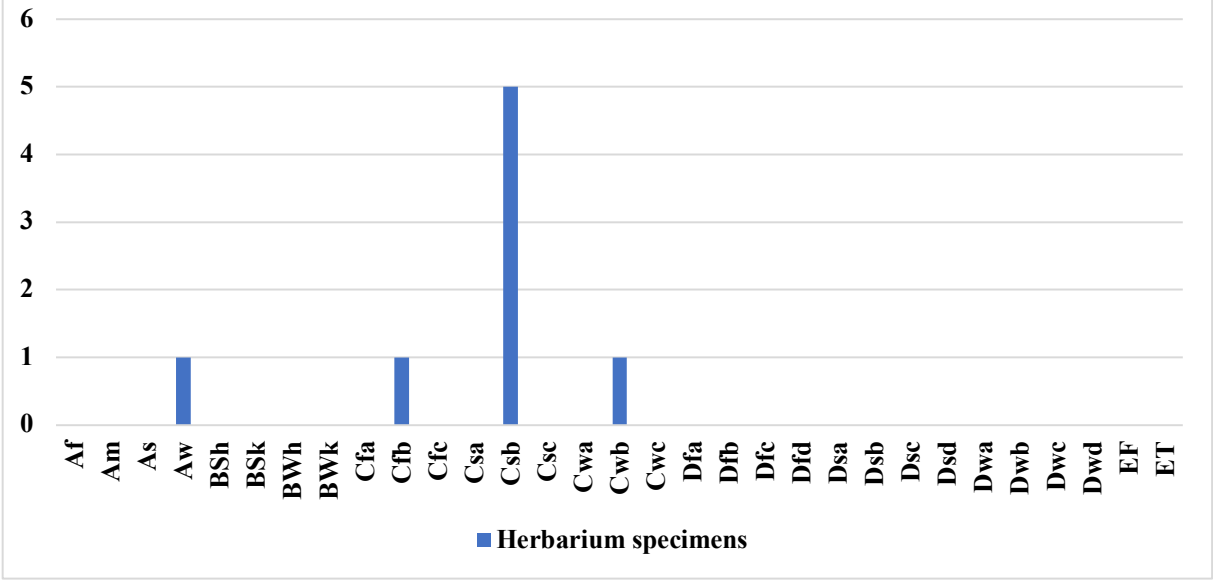
5.2.1.1.2. Köppen profile, distribution and climate map– GBIF occurrences of *Lagarosiphon hydrilloides* Rendle 1895; herbarium specimens excluding duplicate occurrences (n = 8).



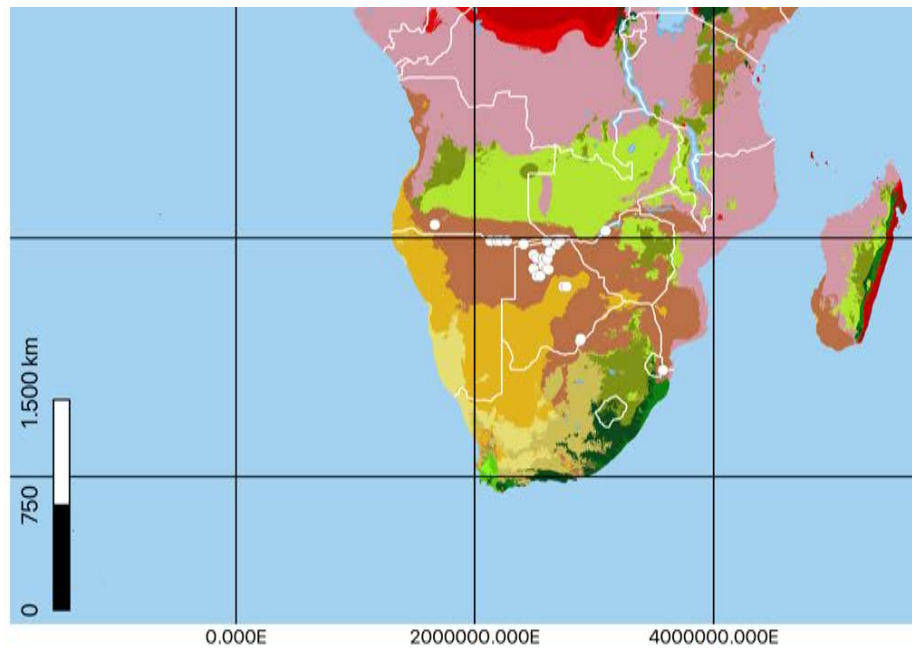
Köppen profile of *Lagarosiphon hydrilloides*



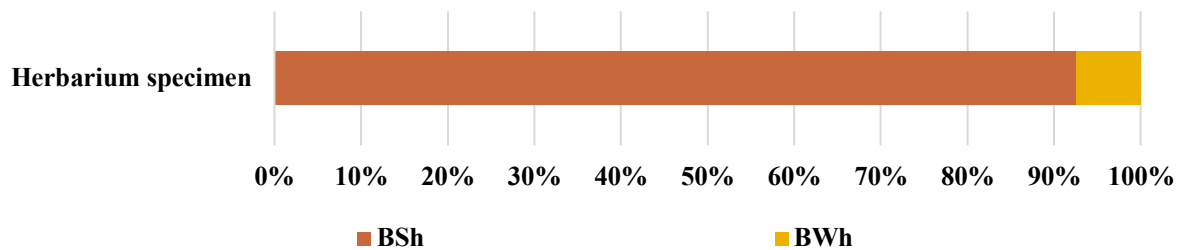
Köppen profile of *Lagarosiphon hydrilloides*



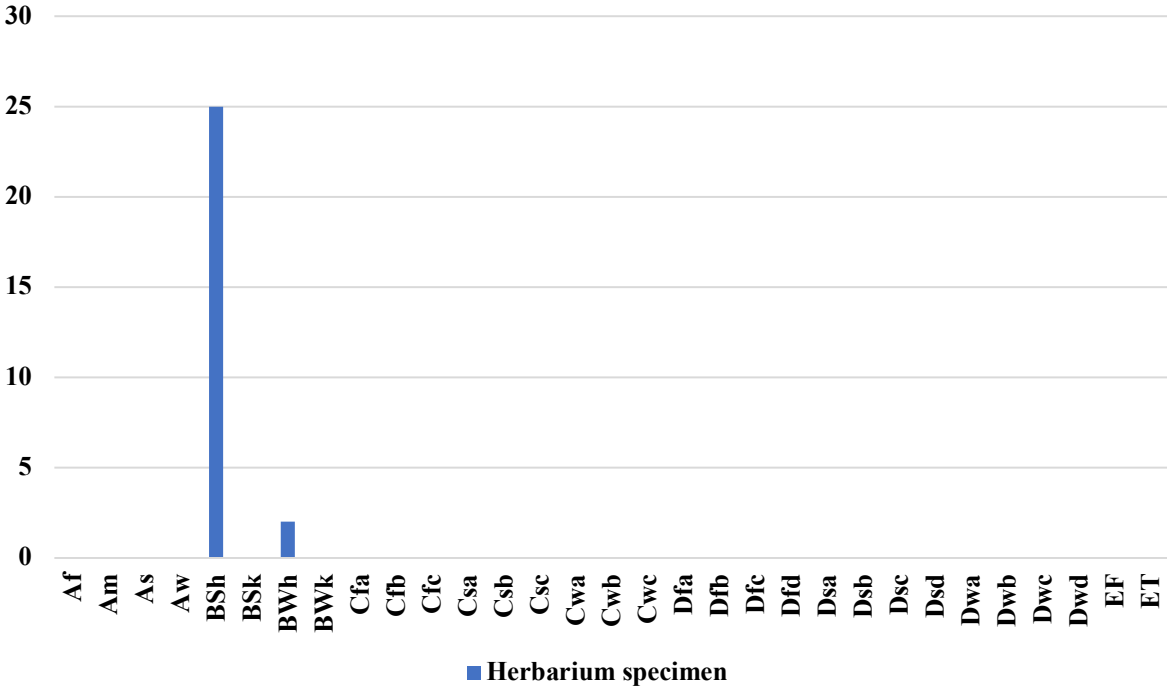
5.2.1.1.3. Köppen profile, distribution and climate map—GBIF occurrences of *Lagarosiphon ilicifolius* Oberm. 1964; herbarium specimens excluding duplicate occurrences (n = 27).



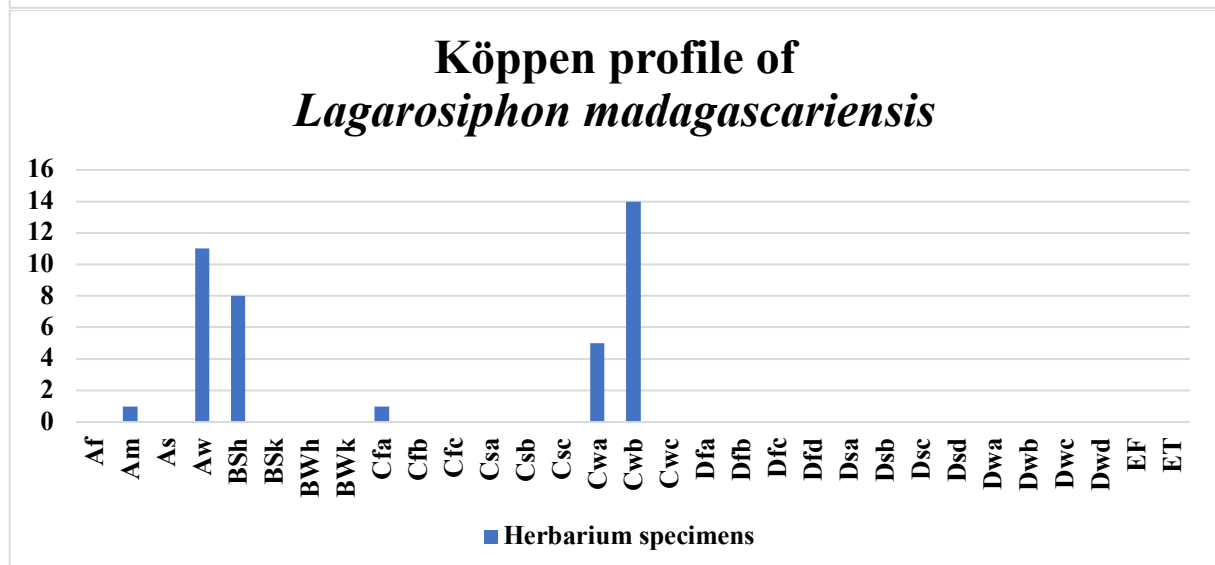
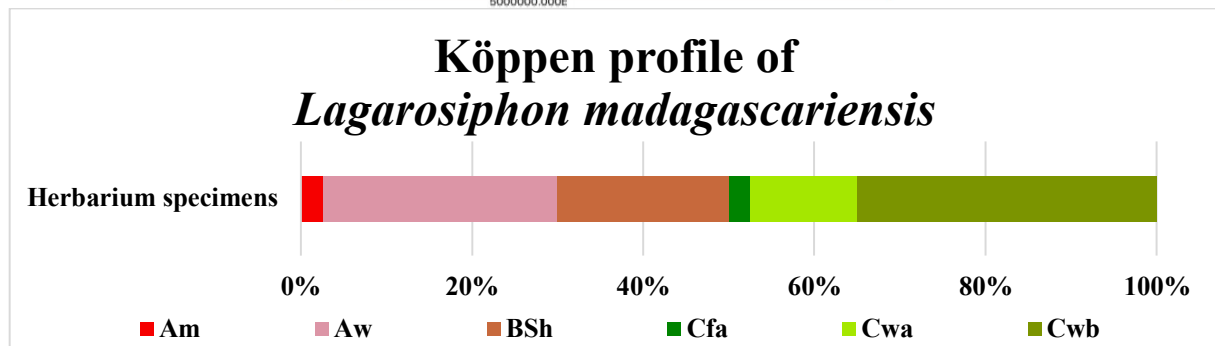
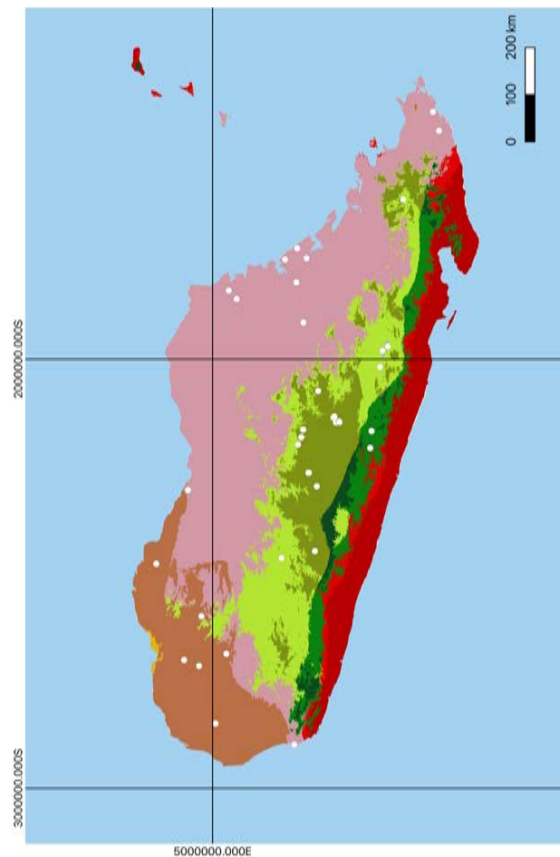
Köppen profile of *Lagarosiphon ilicifolius*



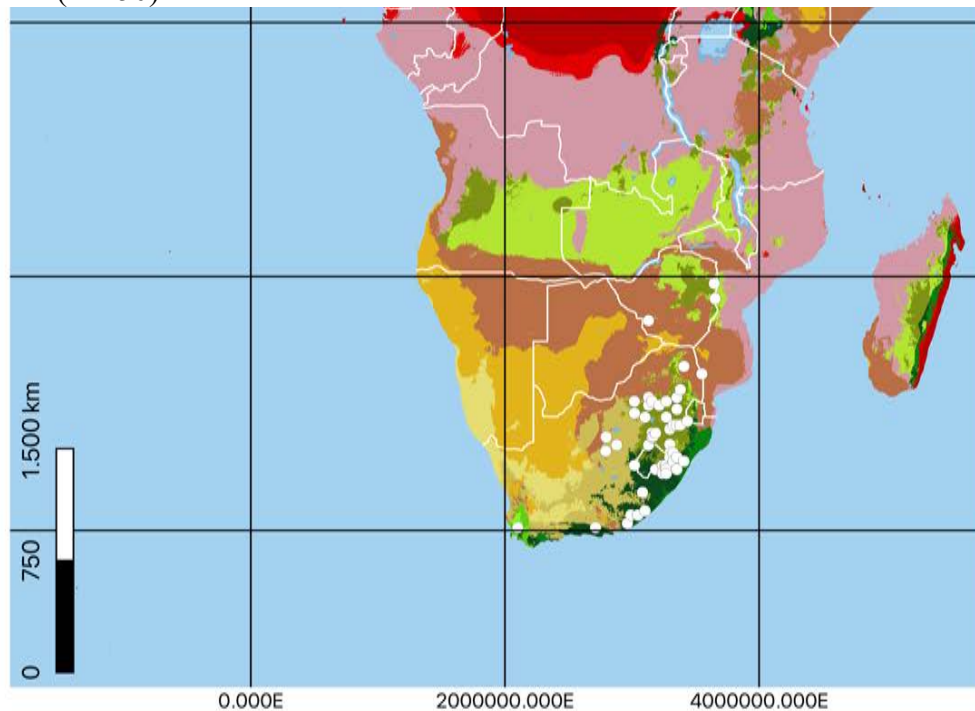
Köppen profile of *Lagarosiphon ilicifolius*



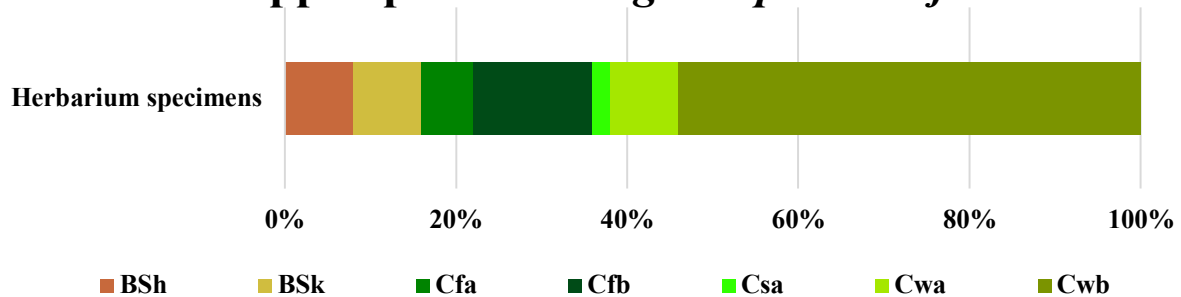
5.2.1.1.3. Köppen profile, distribution and climate map—GBIF occurrences of *Lagarosiphon madagascariensis* Harv. 1841; herbarium specimens excluding duplicate occurrences (n = 40).



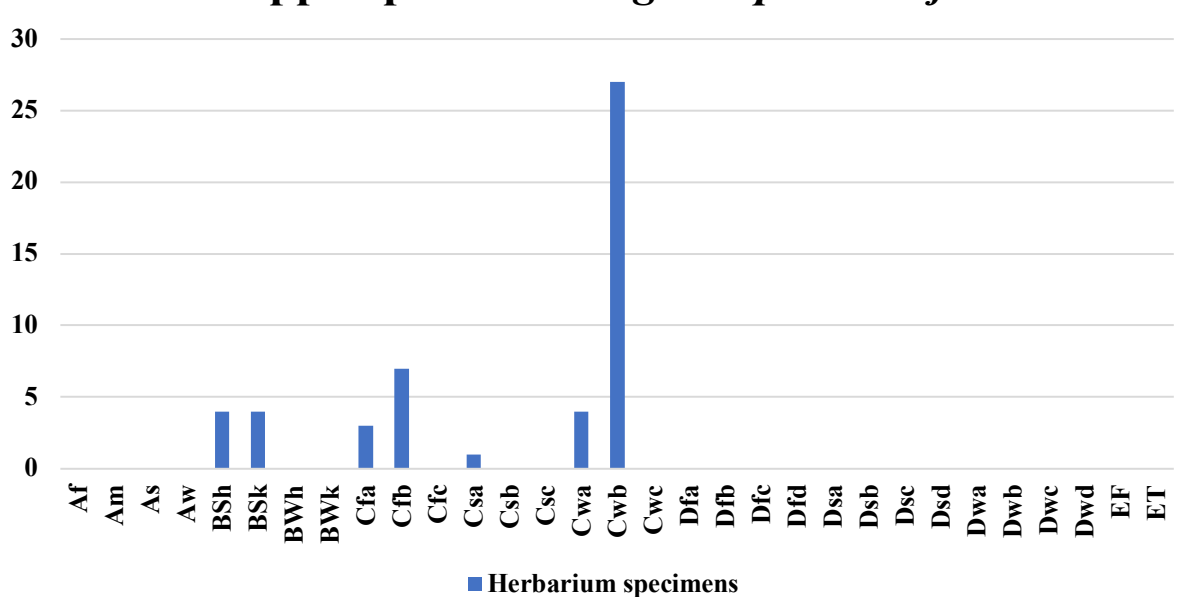
5.2.1.1.4. Köppen profile, distribution and climate map—GBIF occurrences of *Lagarosiphon major* (Ridl. 1886) Moss 1928; herbarium specimens excluding duplicate occurrences (n = 50).



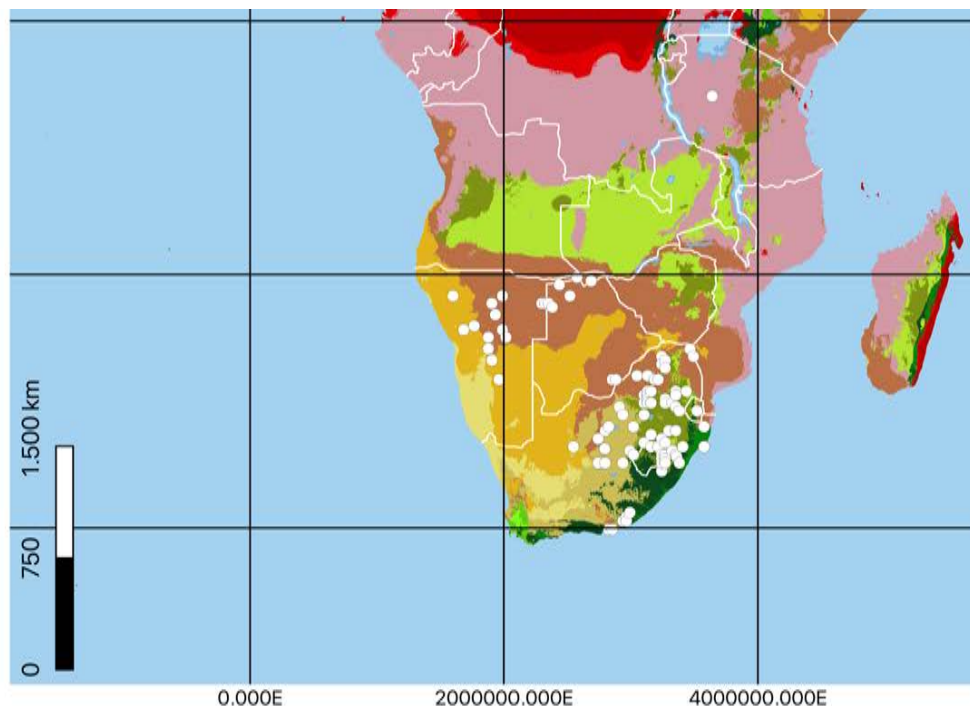
Köppen profile of *Lagarosiphon major*



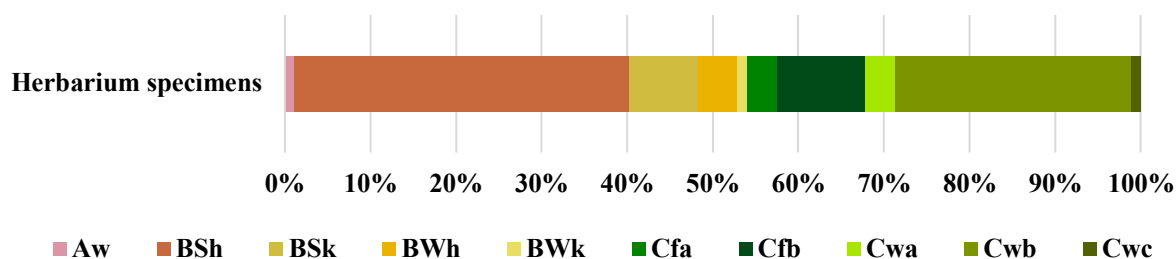
Köppen profile of *Lagarosiphon major*



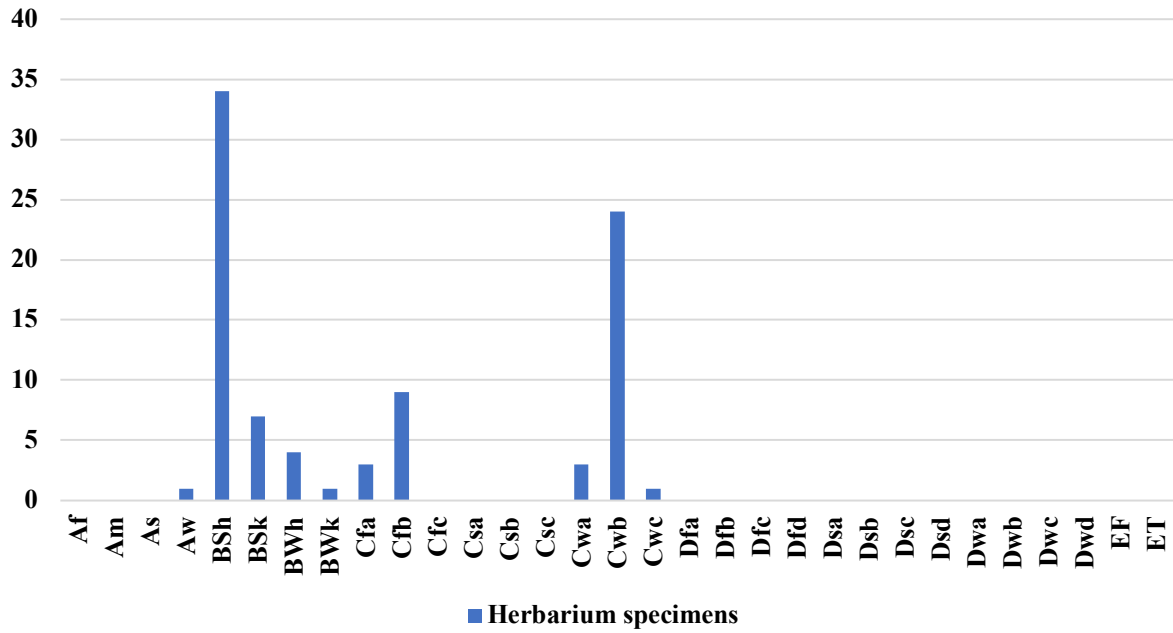
5.2.1.1.5. Köppen profile, distribution and climate map– GBIF occurrences of *Lagarosiphon muscoides* Harv. 1841; herbarium specimens excluding duplicate occurrences (n = 87).



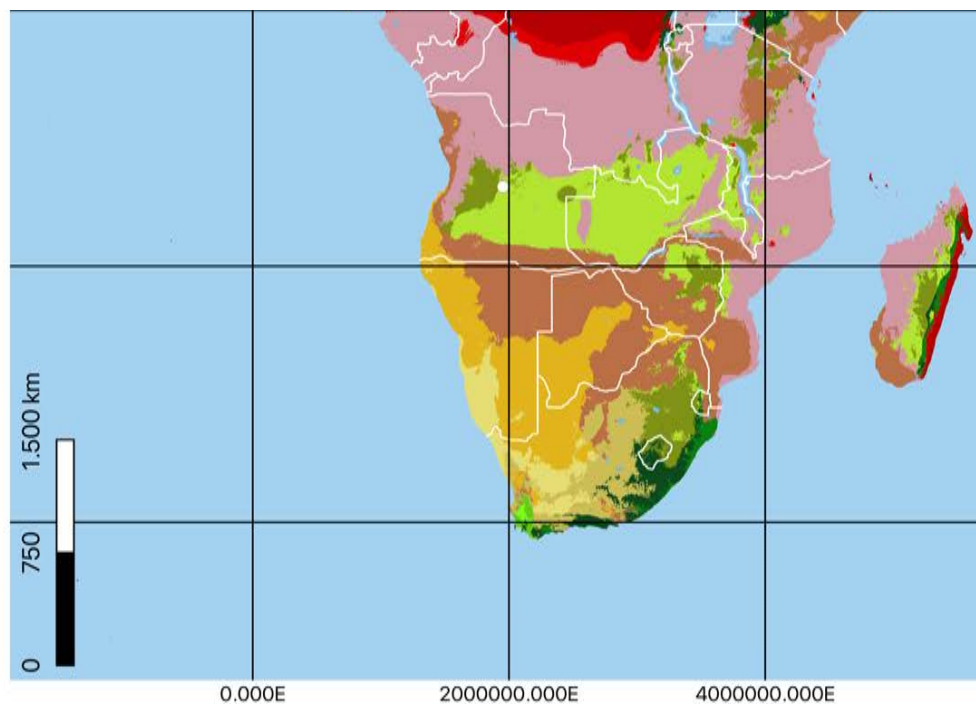
Köppen profile of *Lagarosiphon muscoides*



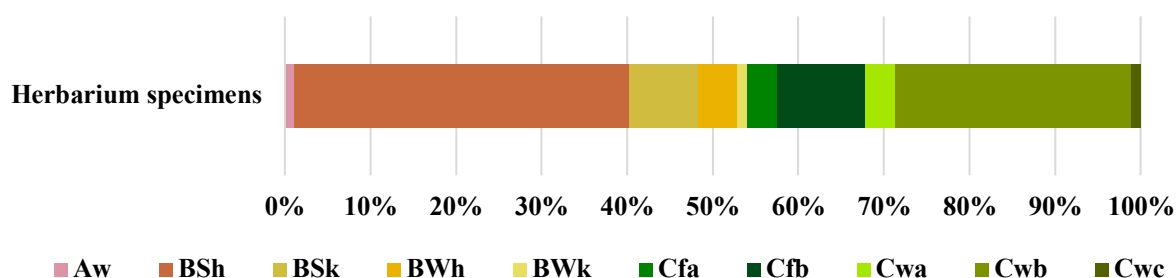
Köppen profile of *Lagarosiphon muscoides*



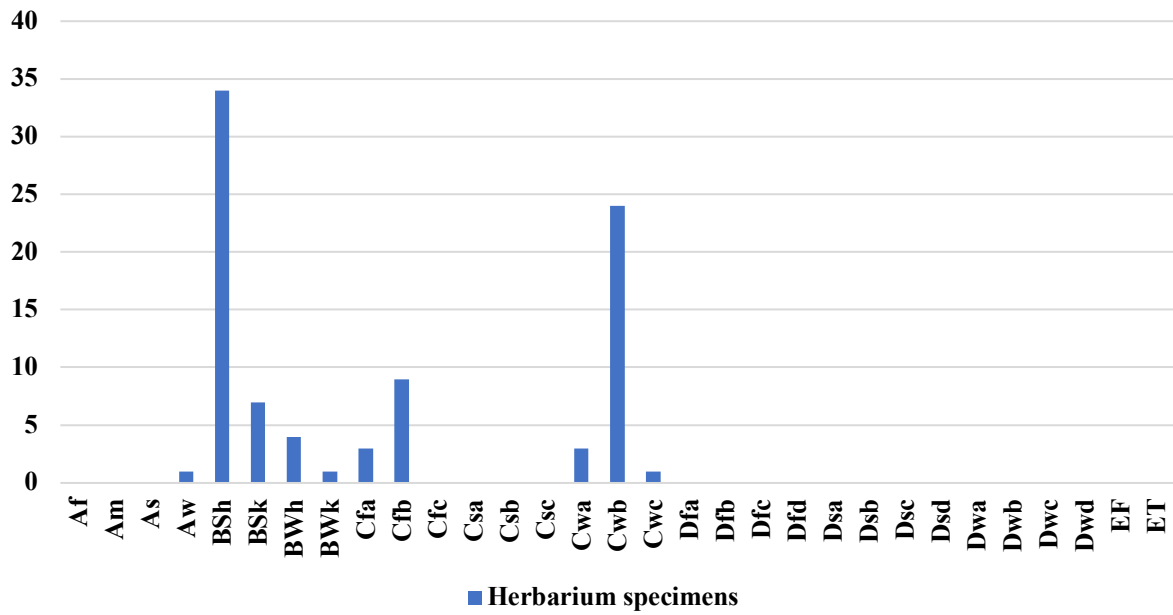
5.2.1.1.6. Köppen profile, distribution and climate map—GBIF occurrences of *Lagarosiphon rubellus* Ridl. 1886; herbarium specimens excluding duplicate occurrences (n = 1).



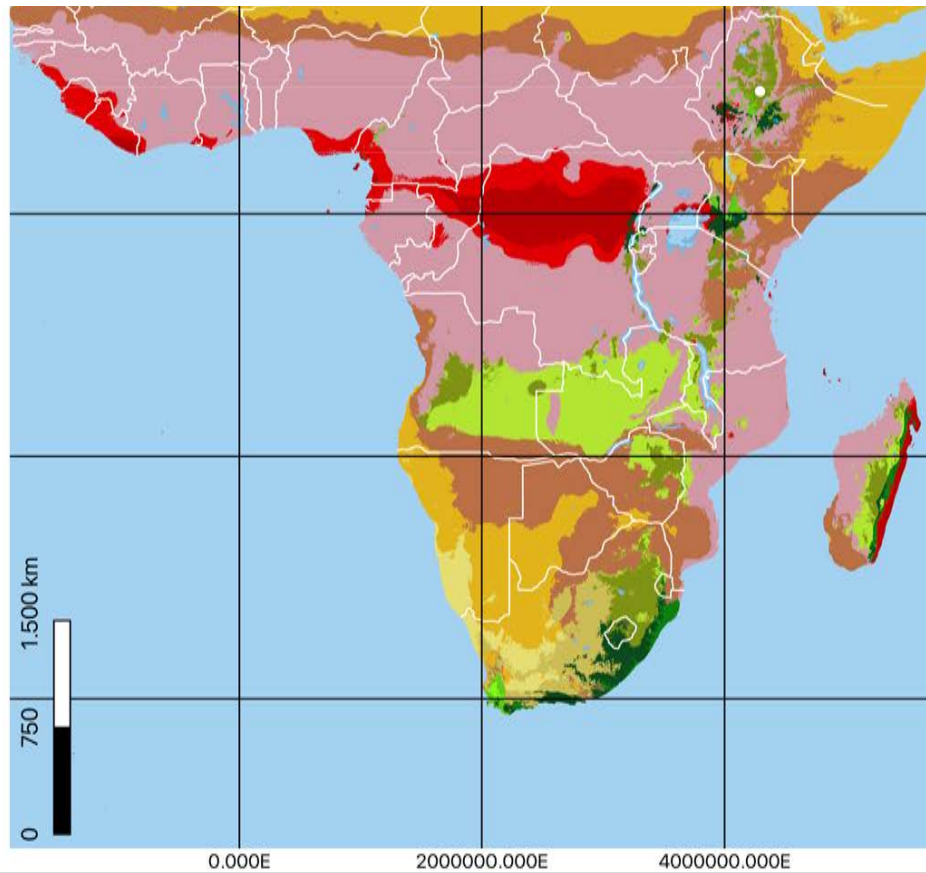
Köppen profile of *Lagarosiphon muscoides*



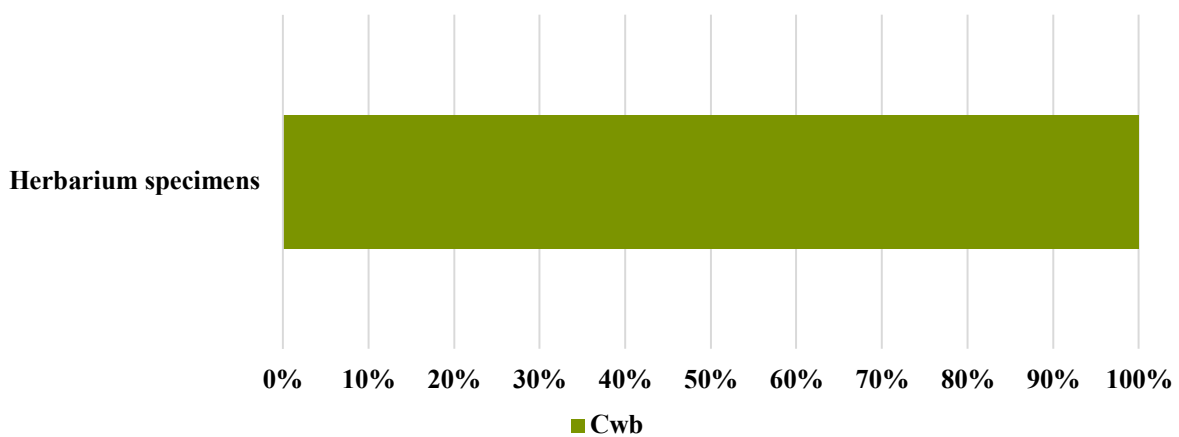
Köppen profile of *Lagarosiphon muscoides*



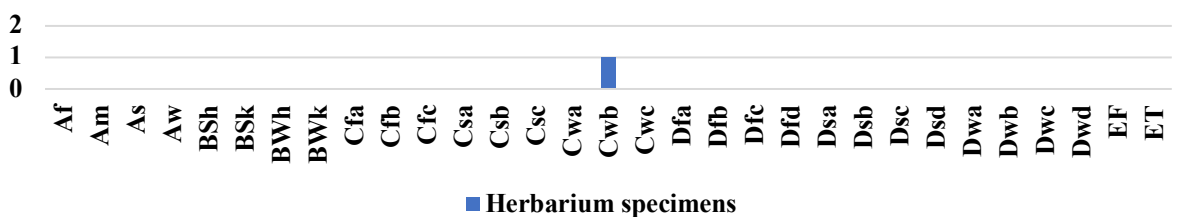
5.2.1.1.6. Köppen profile, distribution and climate map– GBIF occurrences of *Lagarosiphon steudneri* Casp. 1858; herbarium specimens excluding duplicate occurrences (n = 1).



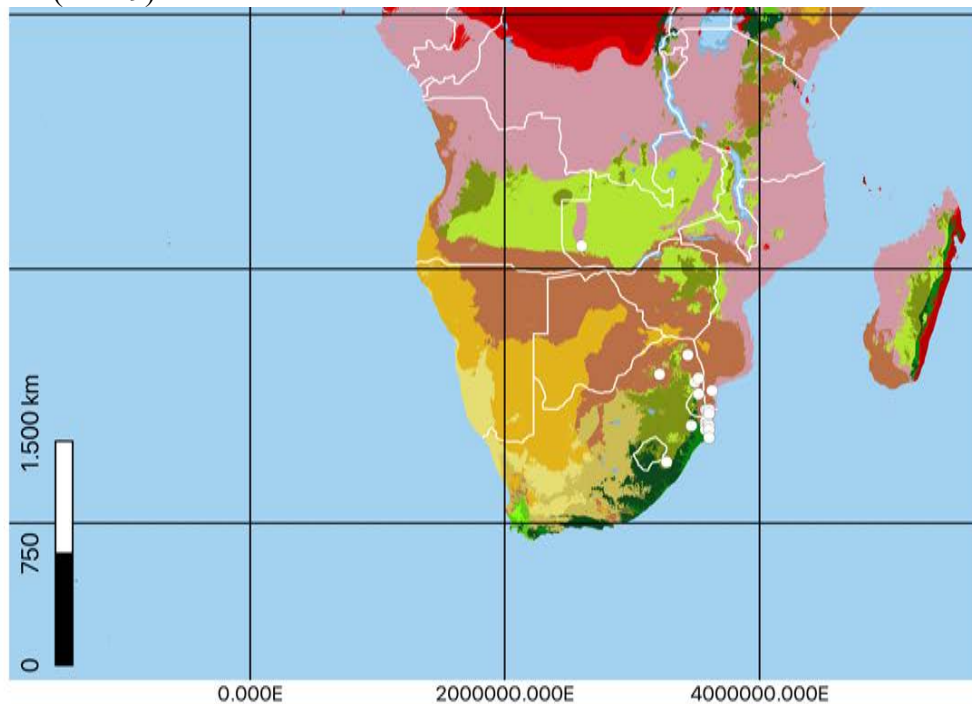
Köppen profile of *Lagarosiphon steudneri*



Köppen signatures of *Lagarosiphon steudneri*

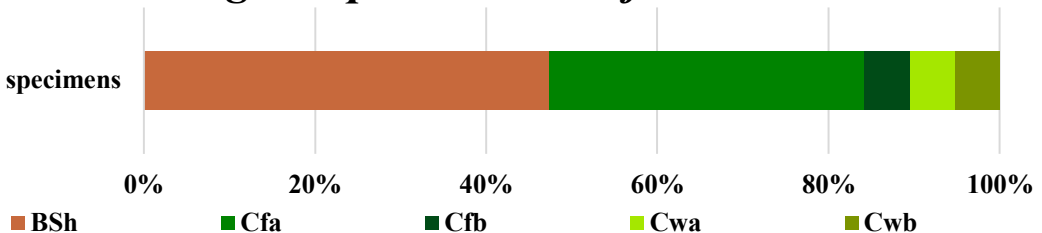


5.2.1.1.6. Köppen profile, distribution and climate map– GBIF occurrences of *Lagarosiphon verticillifolius* Oberm. 1964; herbarium specimens excluding duplicate occurrences (n = 19).

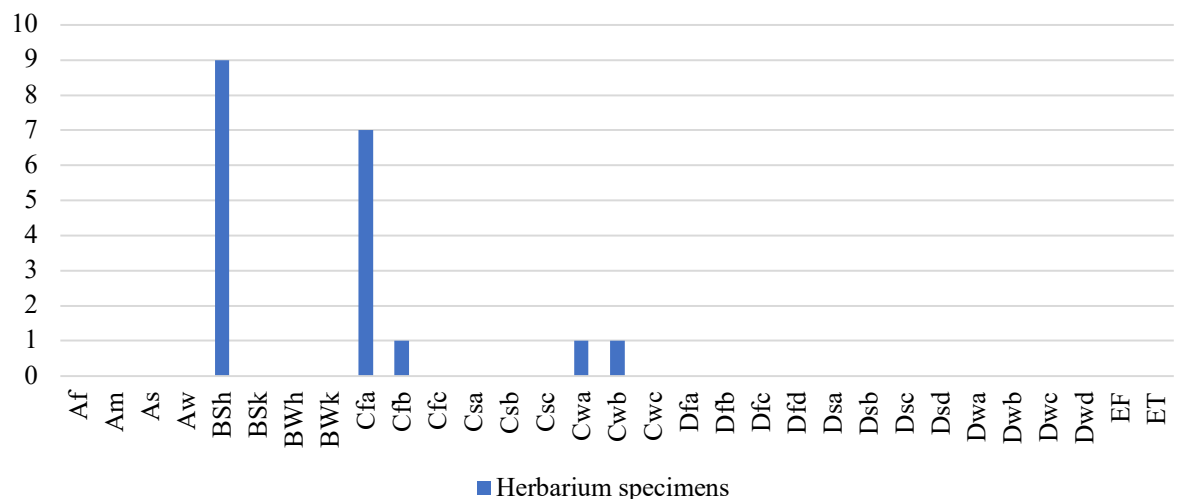


**Köppen profile of
*Lagarosiphon verticillifolius***

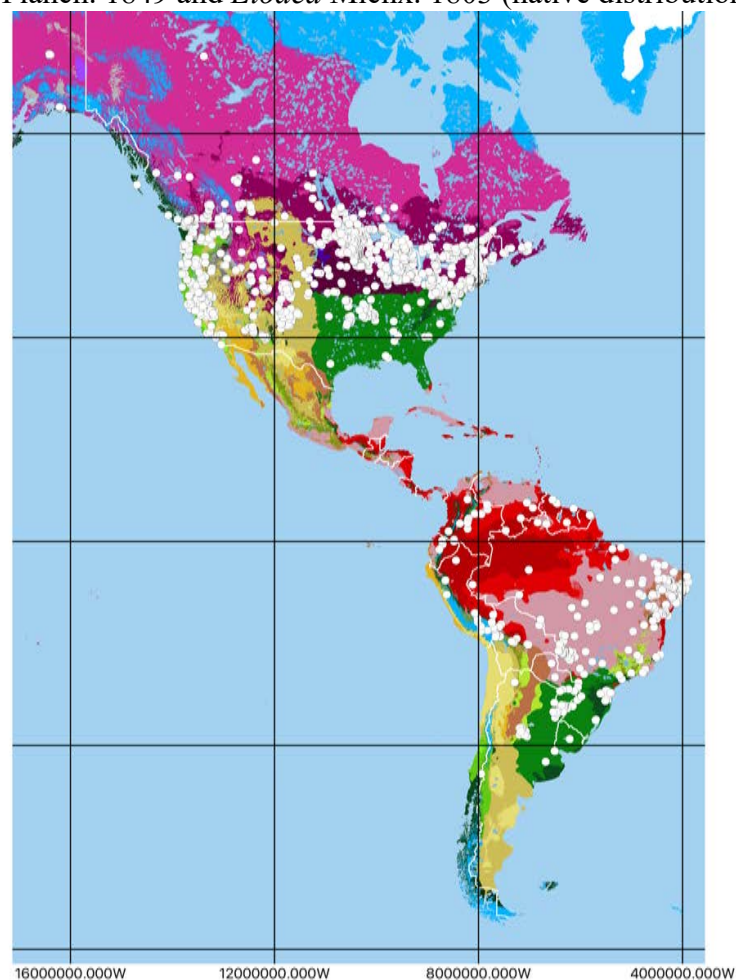
Herbarium specimens



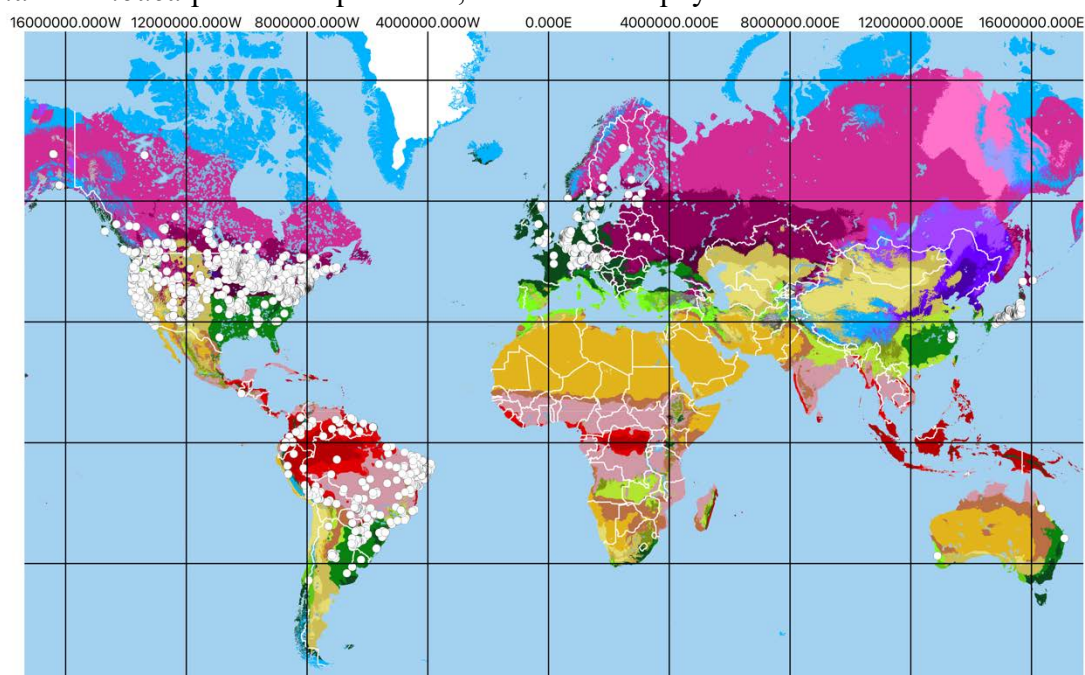
**Köppen profile of
*Lagarosiphon verticillifolius***



5.2.2. Second diverging genera within Clade B of Hydrocharitaceae cf. Chen et. al (2012), comprising *Egeria* Planch. 1849 and *Elodea* Michx. 1803 (native distribution)

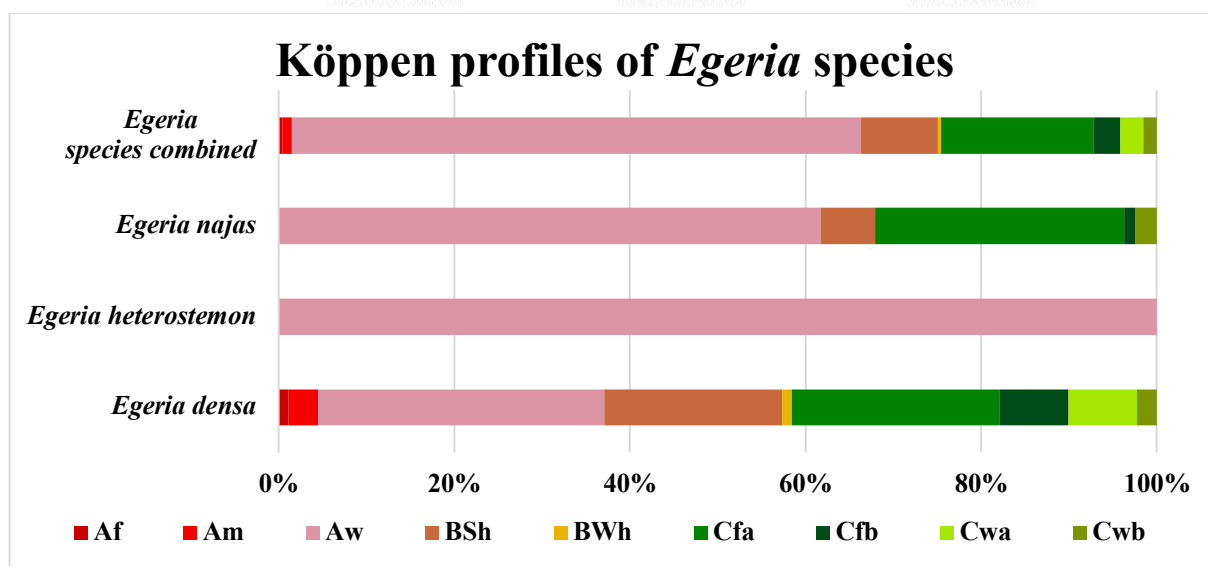
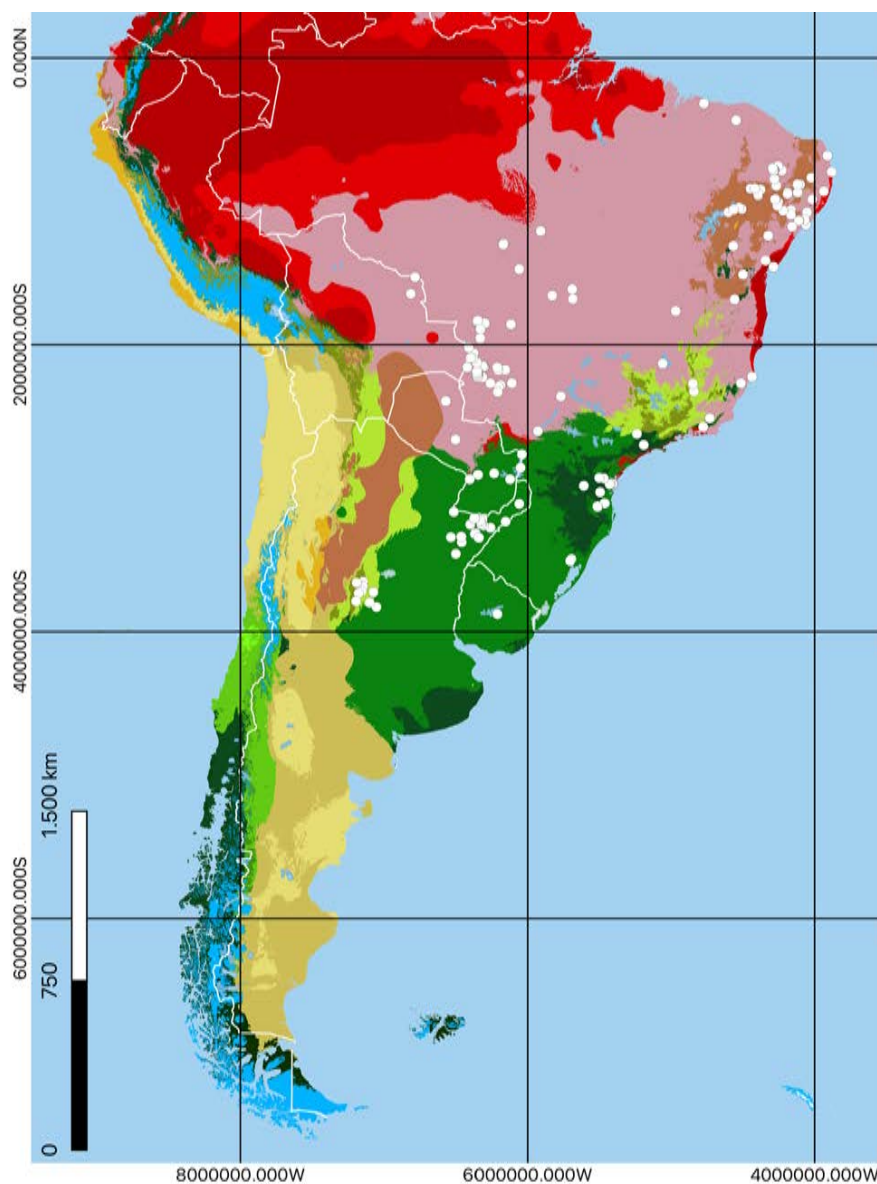


Egeria and *Elodea* preserved specimens, native and neophyte distribution.

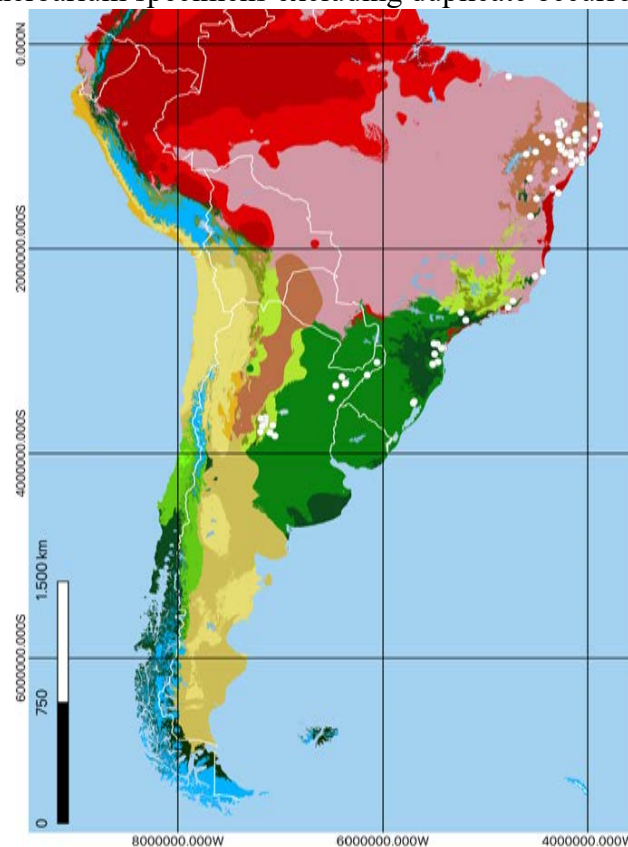


5.2.2.1 Genus *Egeria* Planch. 1849.

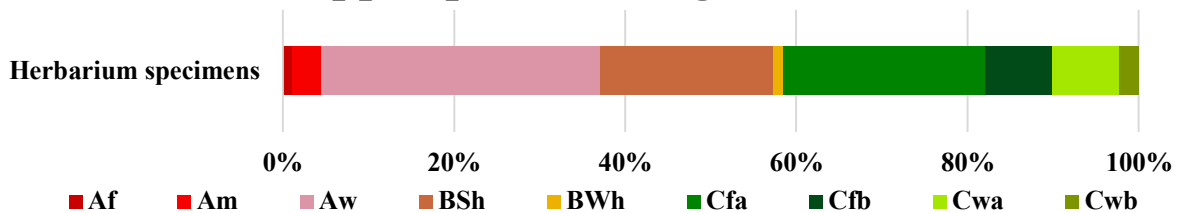
Distribution and climate map and Köppen profiles for *Egeria* incl. *Egeria densa*, *E. heterostemon*, and *E. najas*, based on herbarium specimens excluding duplicate occurrences (n = 241).



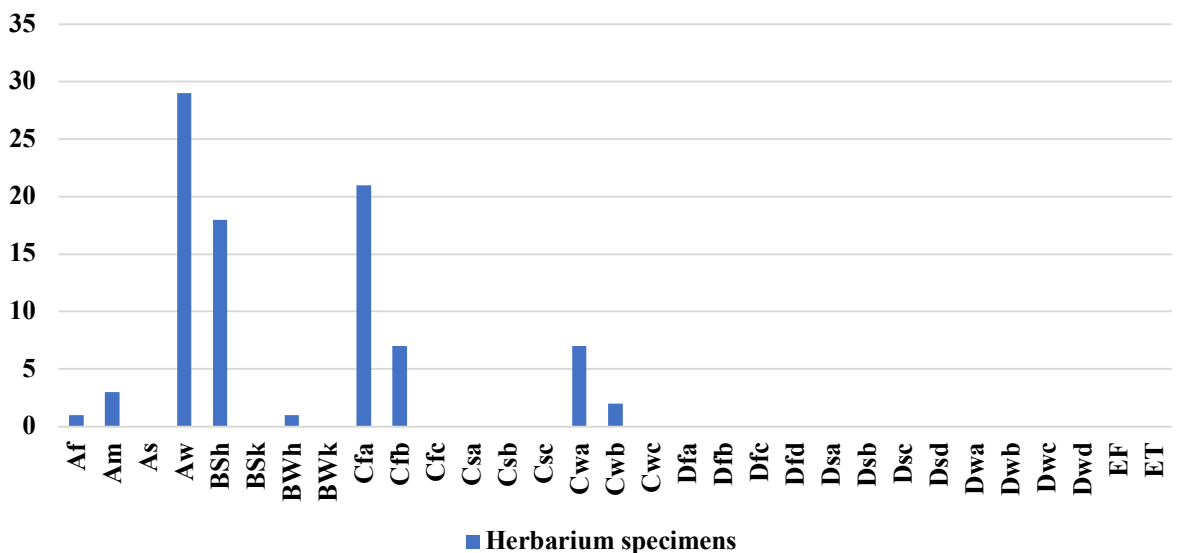
5.2.2.1.1. Köppen profile, distribution and climate map– GBIF occurrences of *Egeria densa* Planch. 1949; herbarium specimens excluding duplicate occurrences (n = 89).



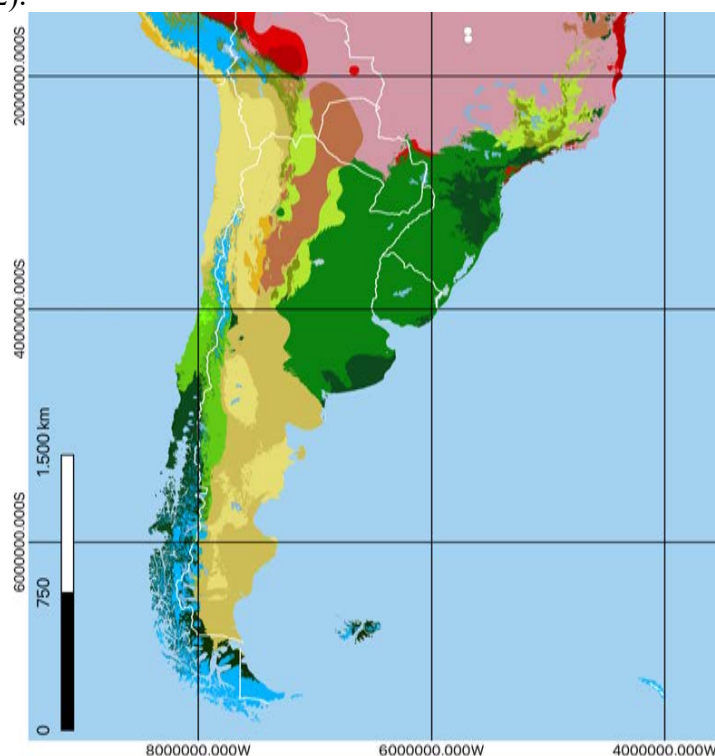
Köppen profiles of *Egeria densa*



Köppen profiles of *Egeria densa*

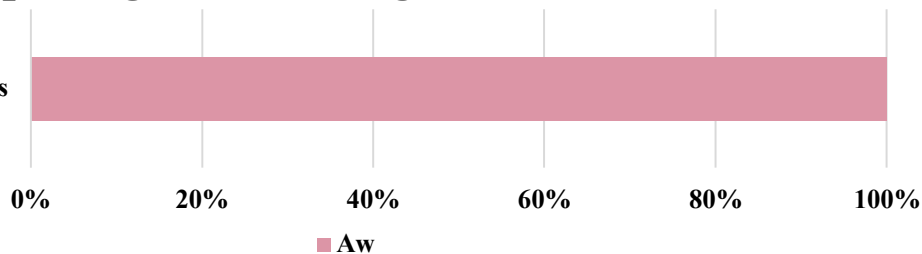


5.2.2.1.2. Köppen profile, distribution and climate map– GBIF occurrences of *Egeria heterostemon* S.Koehler & C.P.Bove 2001; herbarium specimens excluding duplicate occurrences (n = 2).

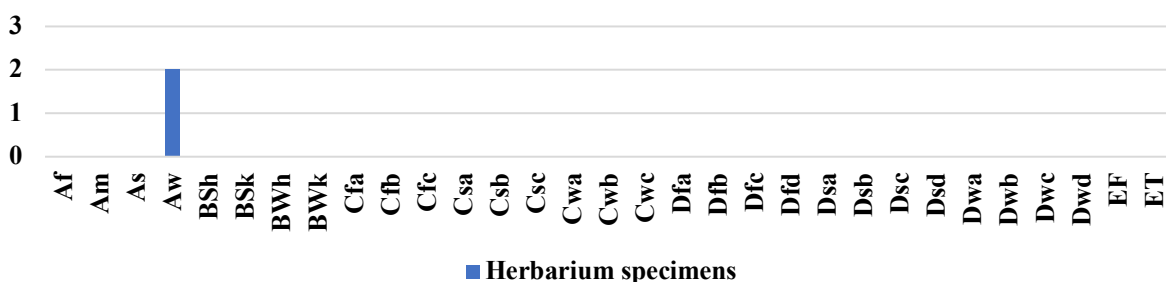


Köppen signatures of *Egeria heterostemon*

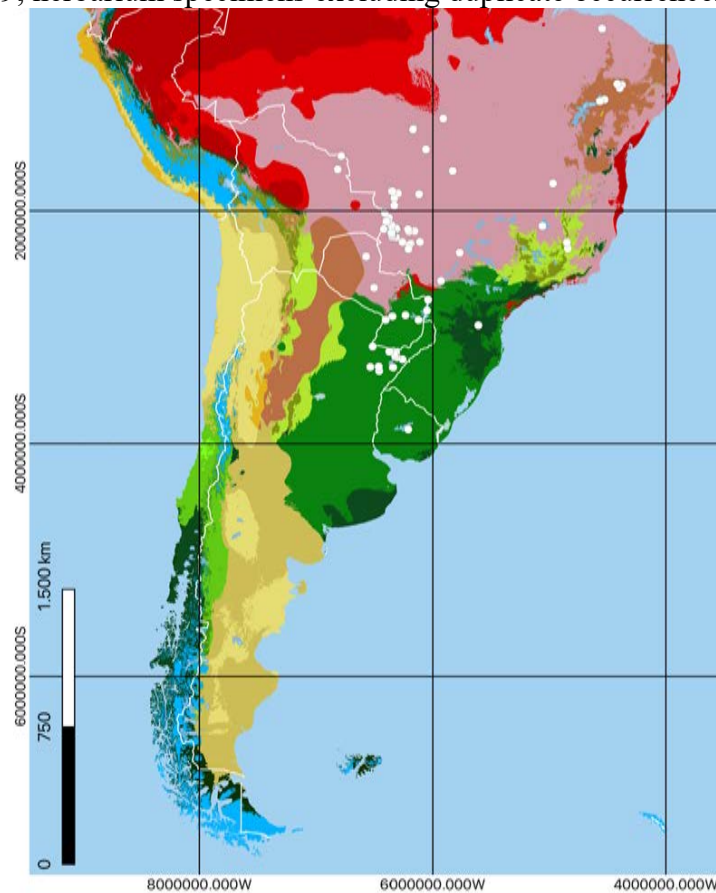
Herbarium specimens



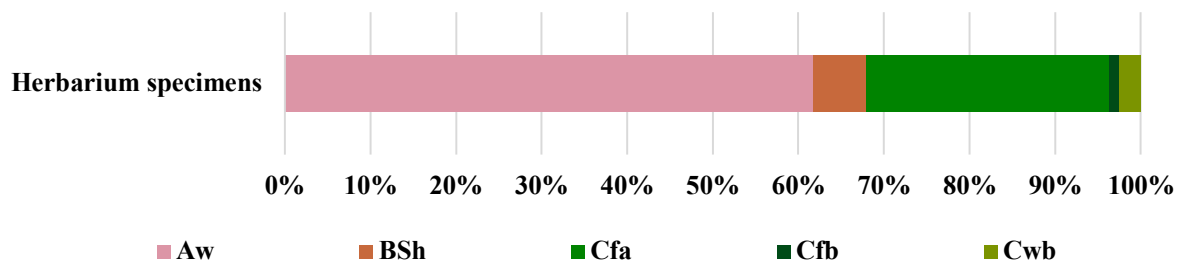
Köppen signatures of *Egeria heterostemon*



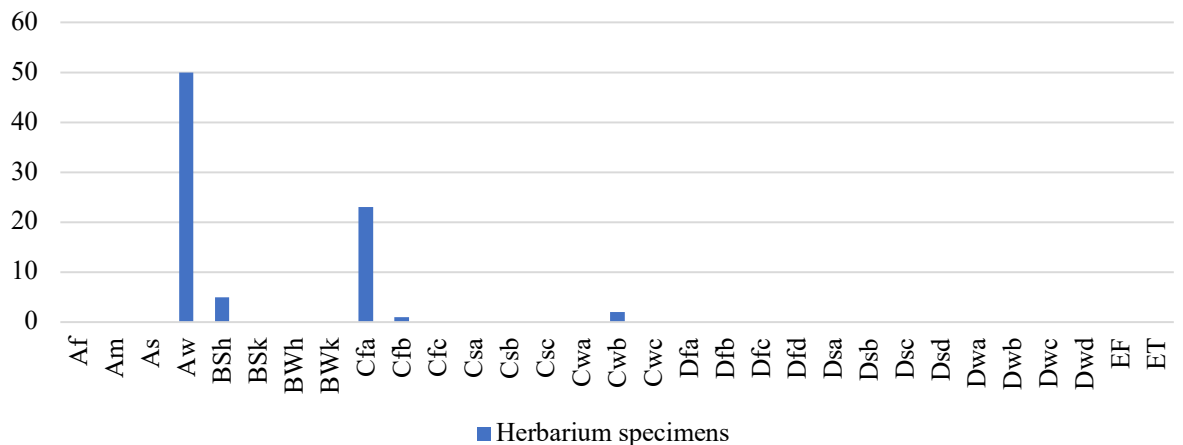
5.2.2.1.3. Köppen profile, distribution and climate map– GBIF occurrences of *Egeria najas* Planch. 1849; herbarium specimens excluding duplicate occurrences (n = 81).



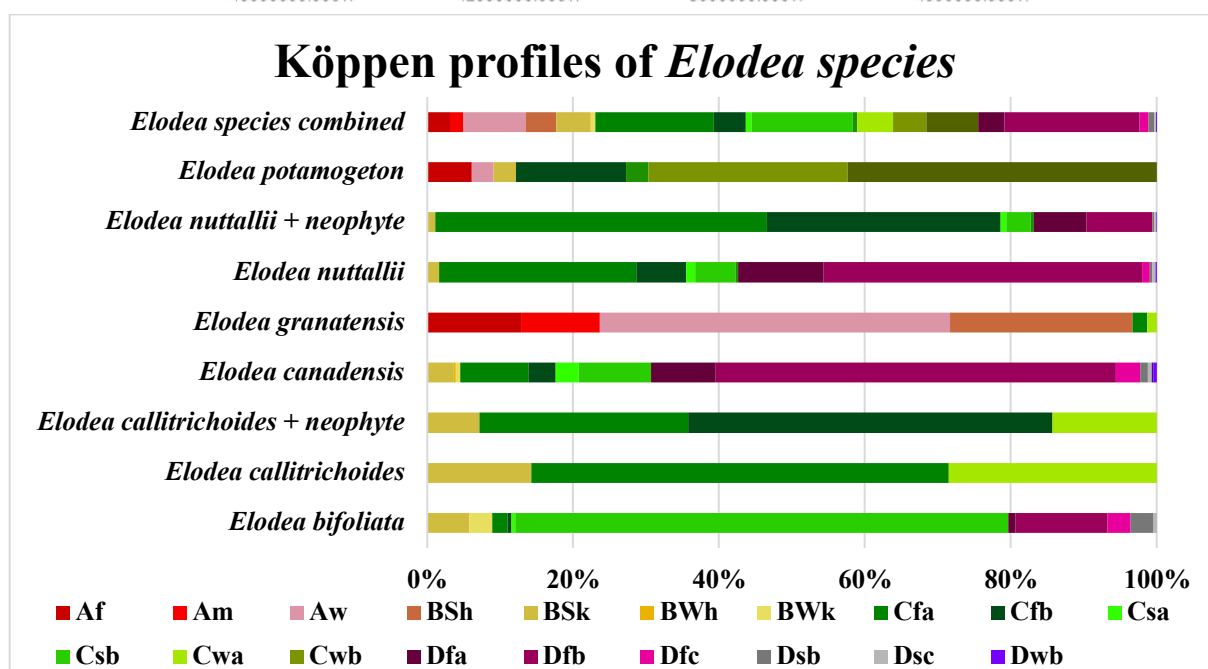
Köppen profile of *Egeria najas*



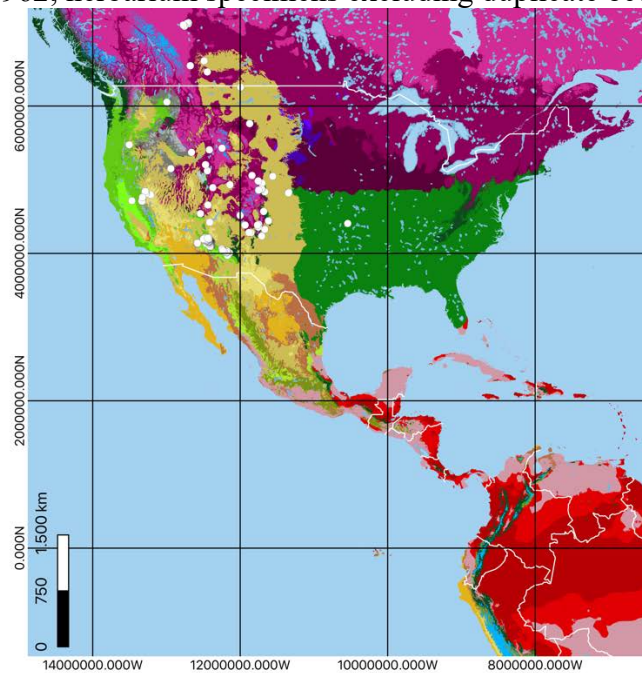
Köppen profile of *Egeria najas*



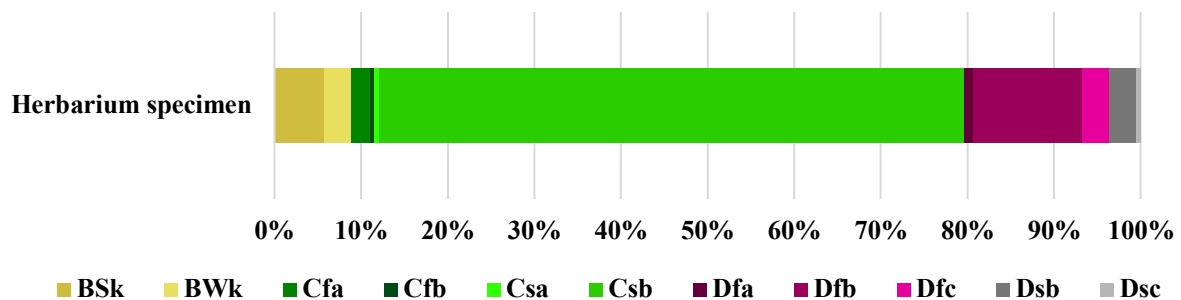
Distribution and Köppen profiles of genus *Elodea* incl. *E. bifoliata*, *E. callitrichoides*, *E. canadensis*, *E. granatensis*, *E. nuttalli*, and *E. potamogeton*, based on herbarium specimens (n = 2458).



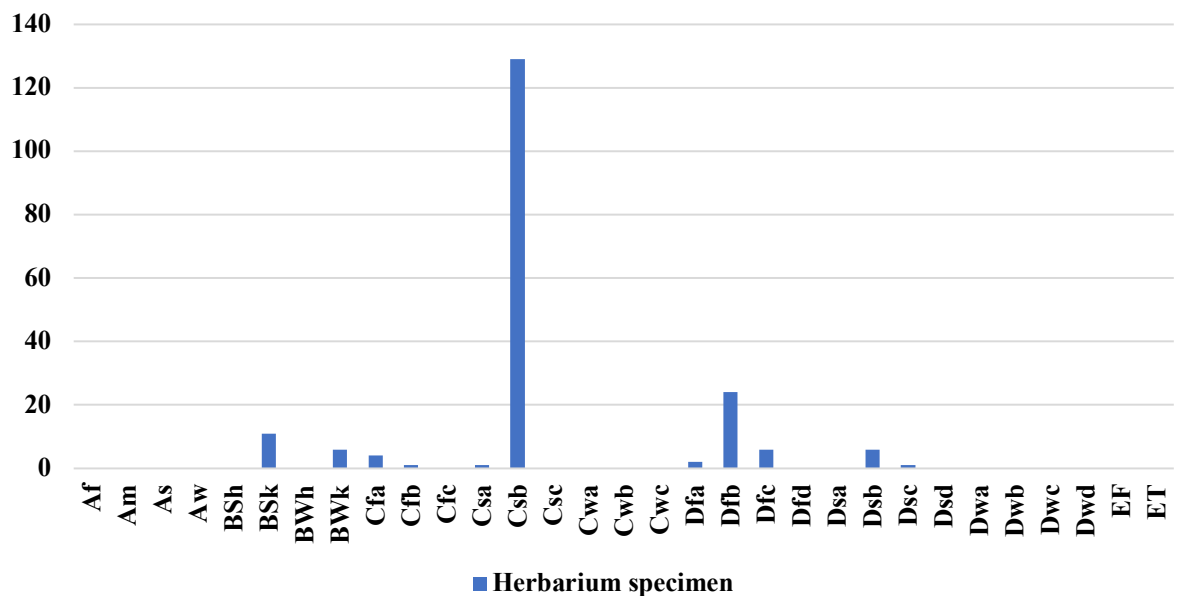
5.2.2.2.1. Köppen profile, distribution and climate map– GBIF occurrences of *Elodea bifoliata* H.St.John 1962; herbarium specimens excluding duplicate occurrences (n = 191).



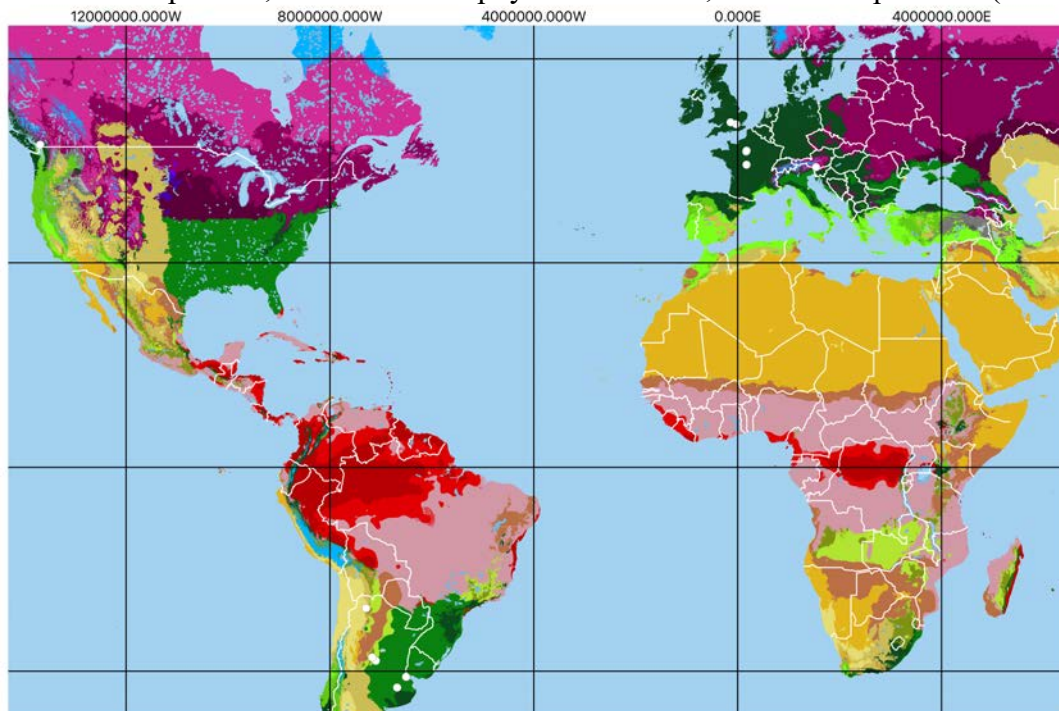
Köppen profile of *Elodea bifoliata*



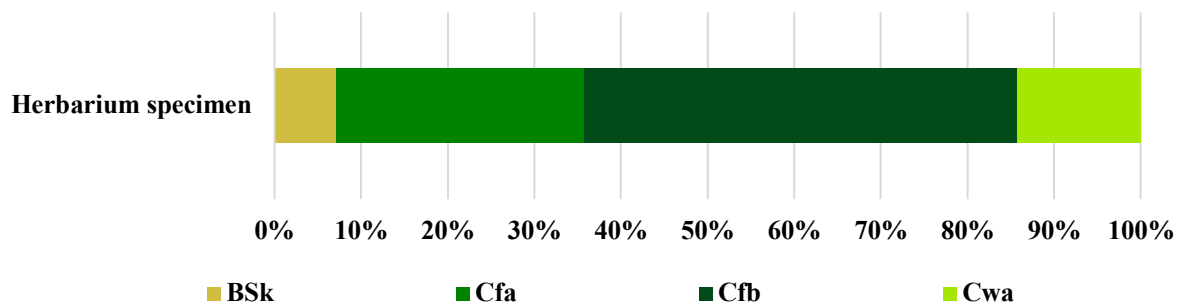
Köppen profile of *Elodea bifoliata*



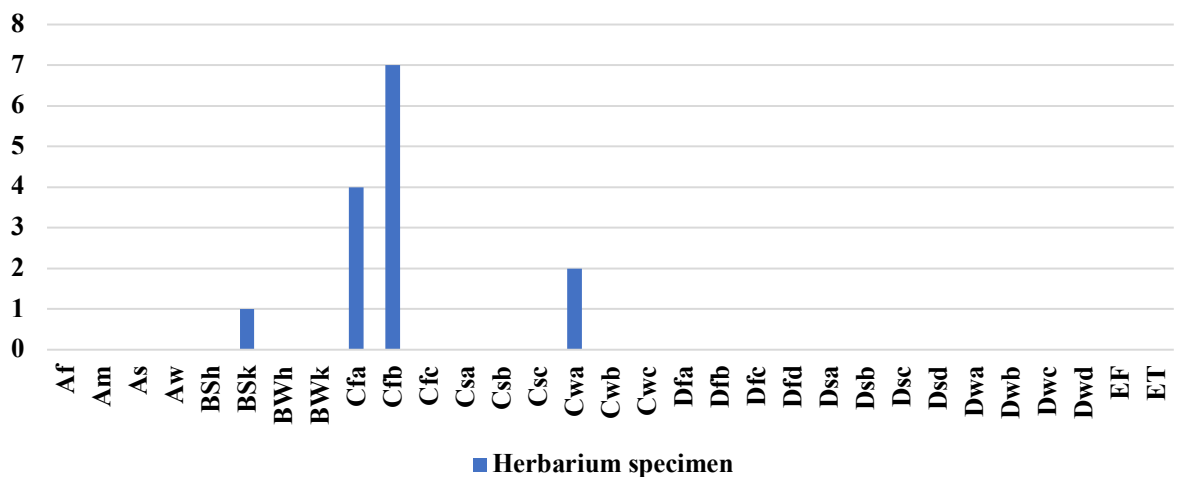
5.2.2.2. Köppen profile, distribution and climate map– GBIF occurrences of *Elodea callitrichoides* Casp. 1857, natural and neophyte distribution; herbarium specimen (n = 14).



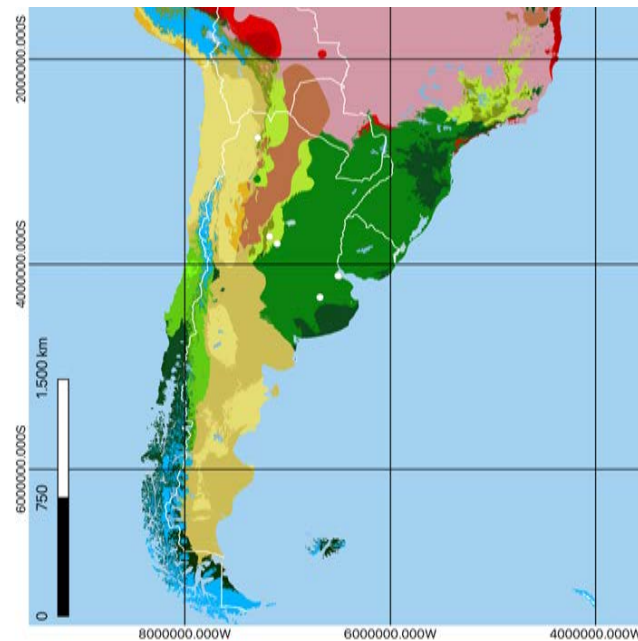
Köppen profiles of *Elodea callitrichoides* (+ neophyte localities)



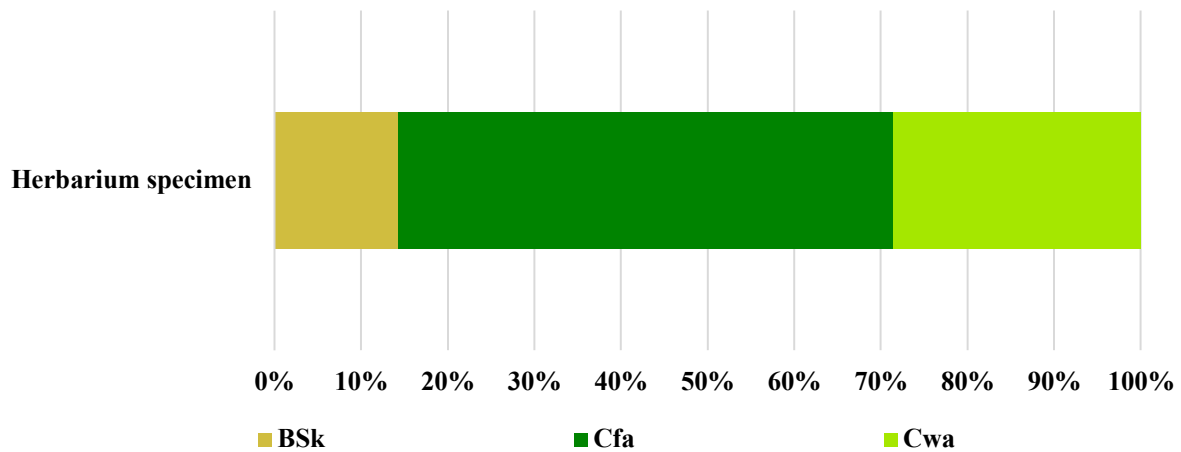
Köppen profiles of *Elodea callitrichoides* (+ neophyte localities)



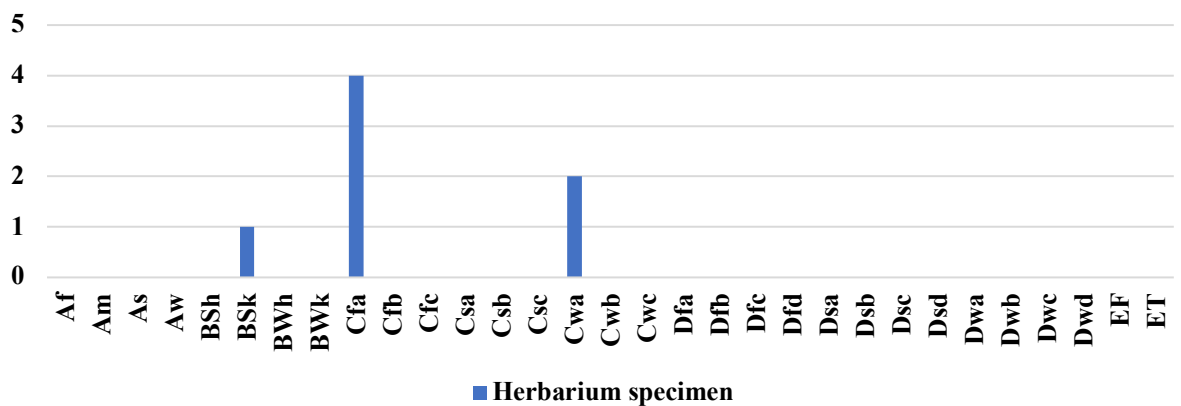
Köppen profile, distribution and climate map – GBIF occurrences of *Elodea callitrichoides*, natural distribution; herbarium specimens excluding duplicate occurrences (n = 7).



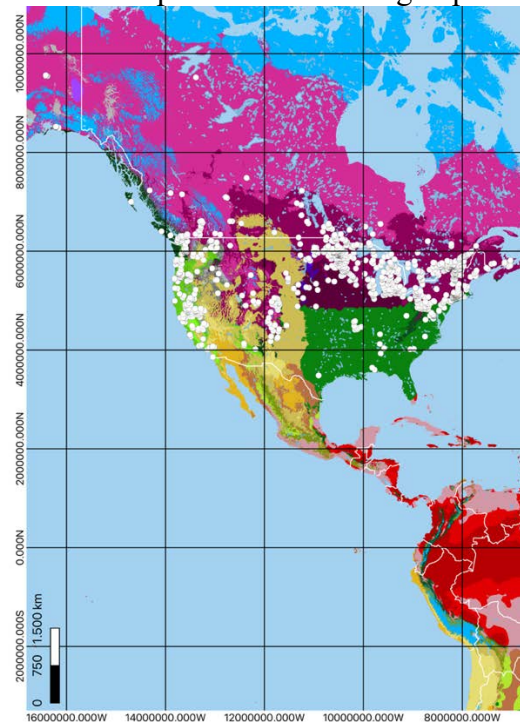
Köppen profile of *Elodea callitrichoides*



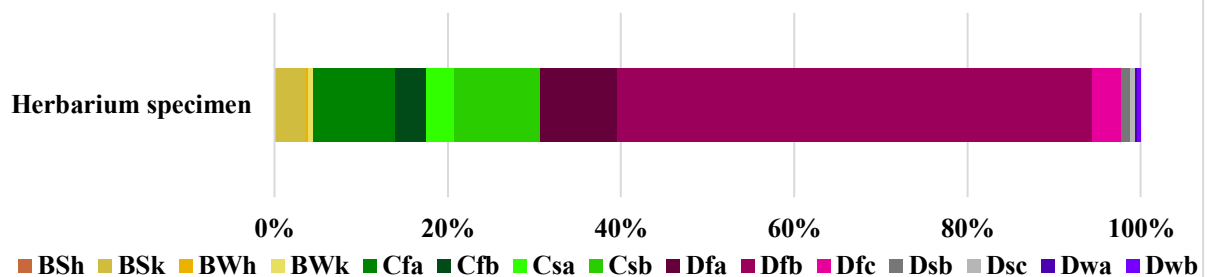
Köppen profile of *Elodea callitrichoides*



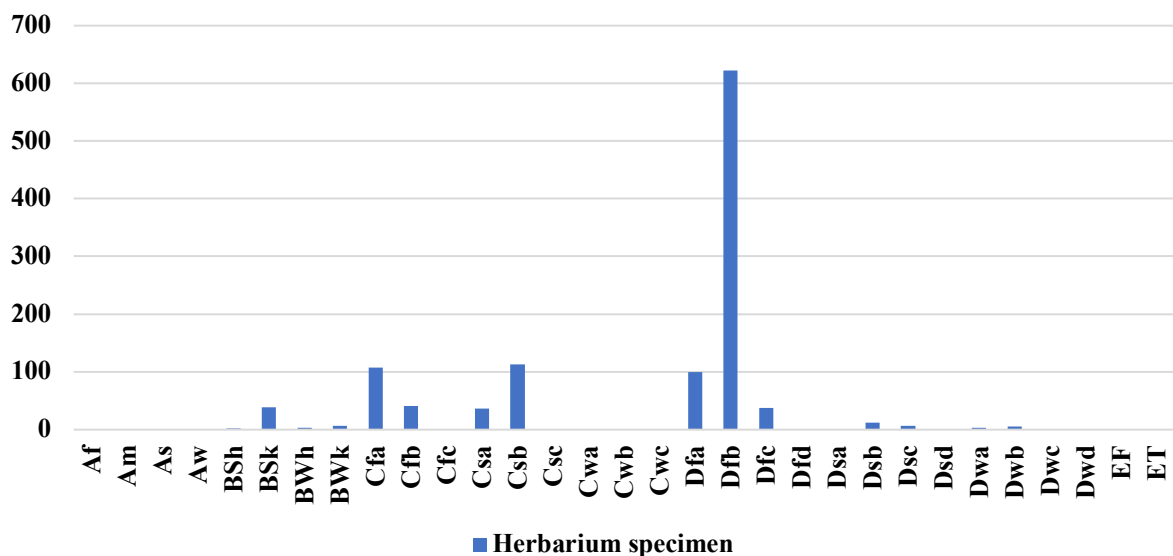
5.2.2.2.3. Köppen profile, distribution and climate map – GBIF occurrences of *Elodea canadensis* Michx. 1803; herbarium specimens excluding duplicate occurrences (n = 1134).



Köppen profile of *Elodea canadensis*



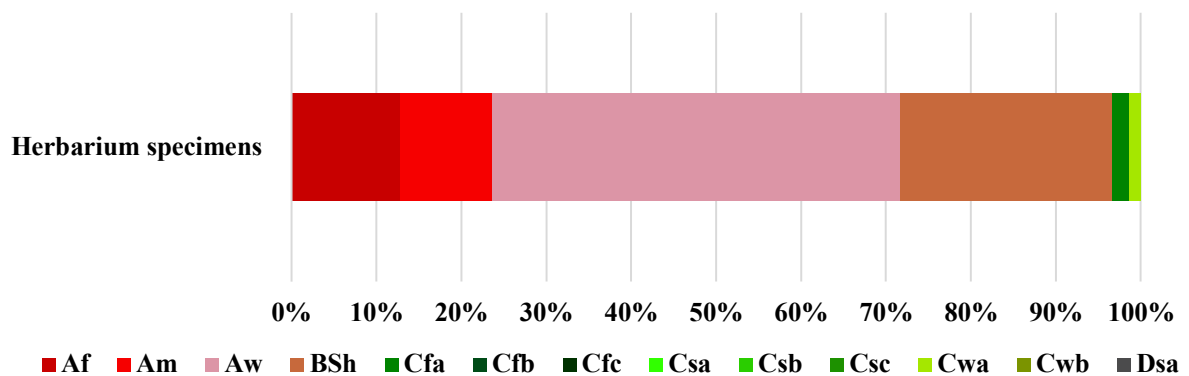
Köppen profile of *Elodea canadensis*



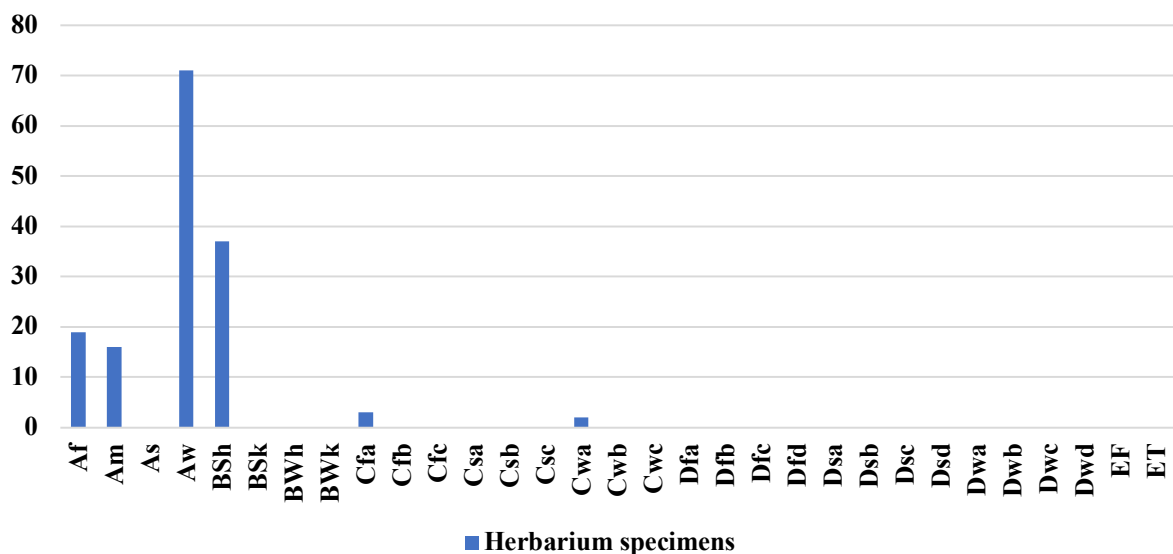
5.2.2.2.4. Köppen profile, distribution and climate map– GBIF occurrences of *Elodea granatensis* H.St.John 1962; herbarium specimens excluding duplicate occurrences (n = 148).



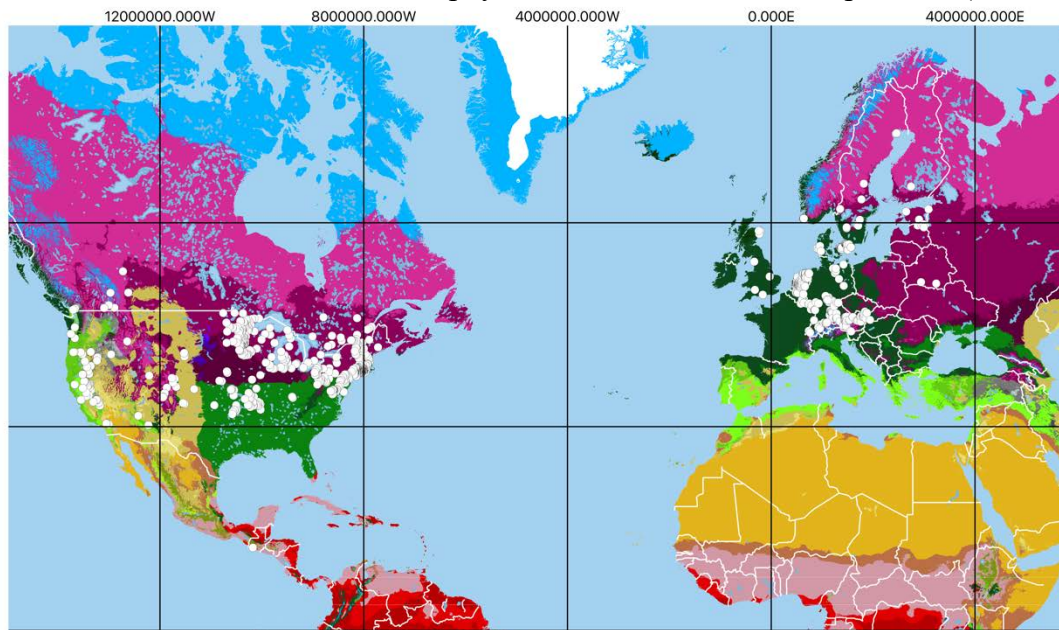
Köppen profile of *Elodea granatensis*



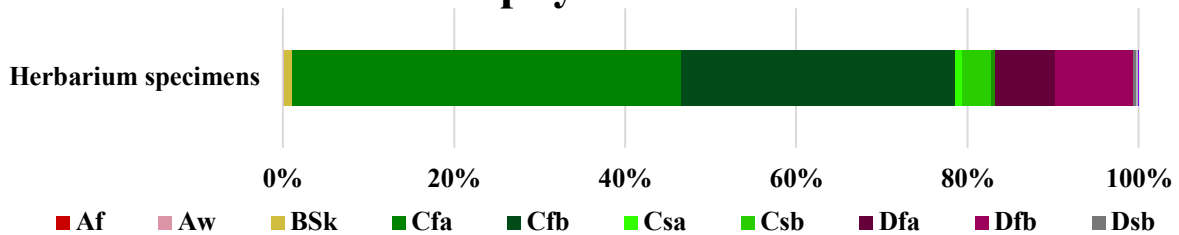
Köppen profile of *Elodea granatensis*



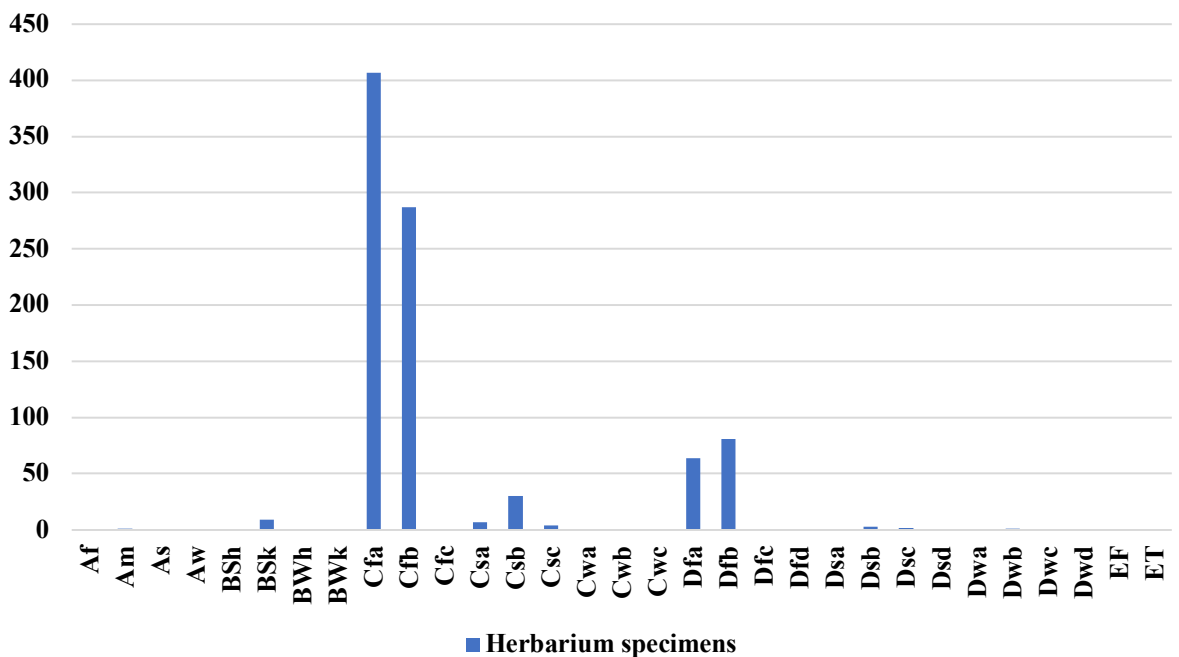
5.2.2.2.5. Köppen profile, distribution and climate map– GBIF occurrences of *Elodea nuttallii* H.St.John 1920; natural and neophyte distribution; herbarium specimen (n = 896).



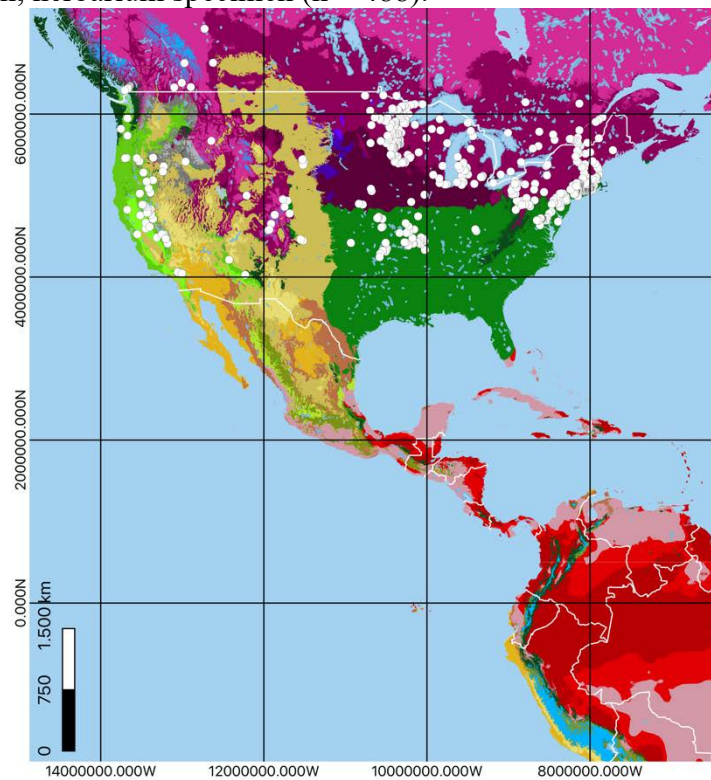
**Köppen profile of *Elodea nuttallii*
+ neophyte localities**



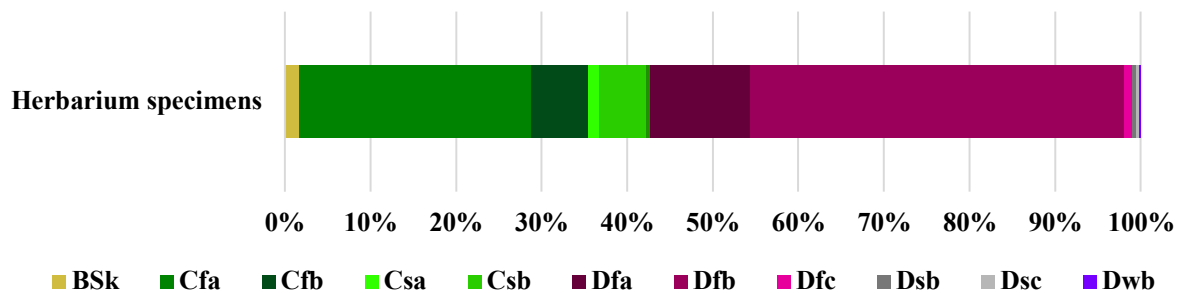
**Köppen profile of *Elodea nuttallii*
+ neophyte localities**



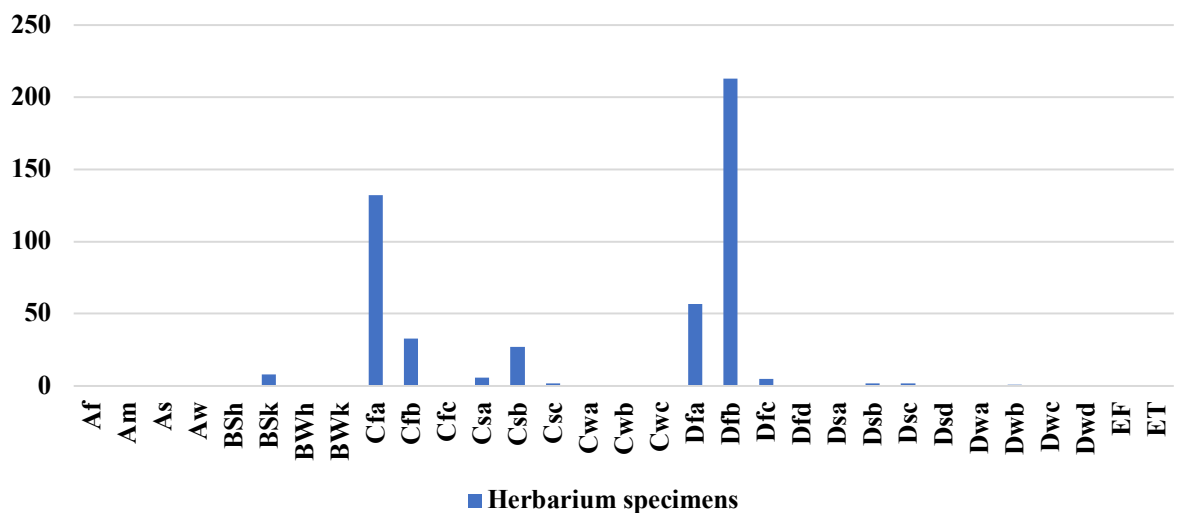
Köppen profile, distribution and climate map– GBIF occurrences of *Elodea nuttallii*; natural distribution; herbarium specimen (n = 488).



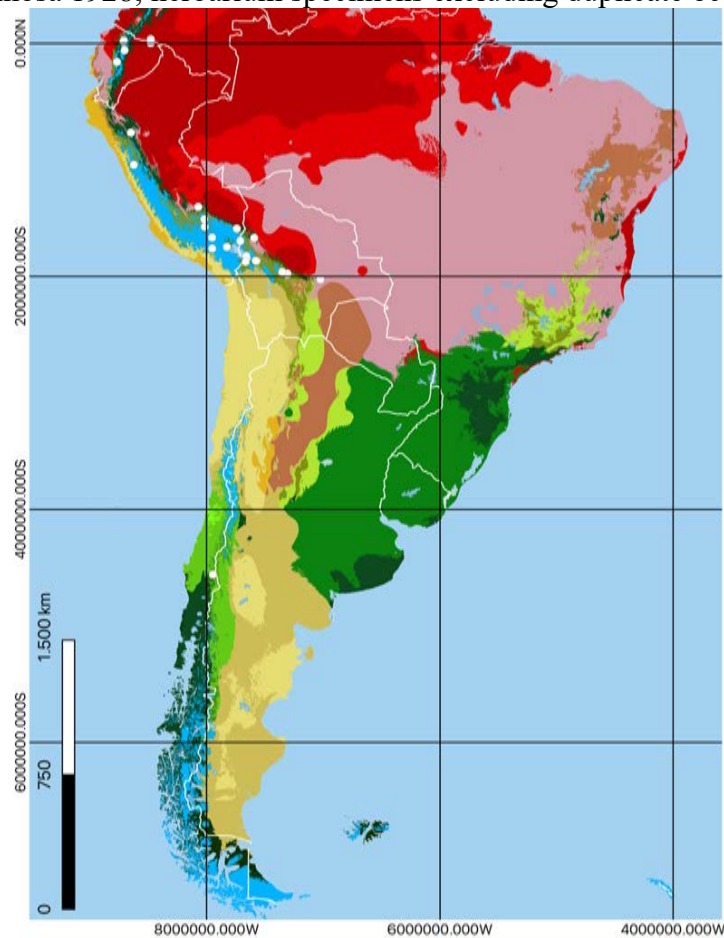
Köppen profile of *Elodea nuttallii*



Köppen profile of *Elodea nuttallii*

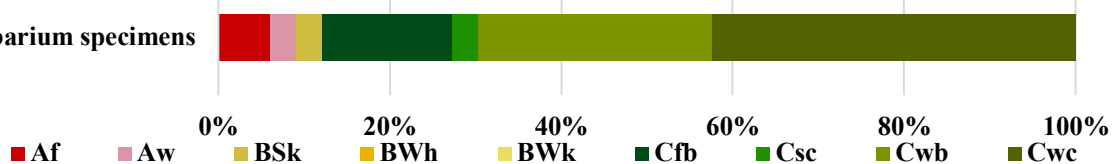


5.2.2.2.6. Köppen profile, distribution and climate map—GBIF occurrences of *Elodea potamogeton* Espinosa 1928; herbarium specimens excluding duplicate occurrences (n = 33).

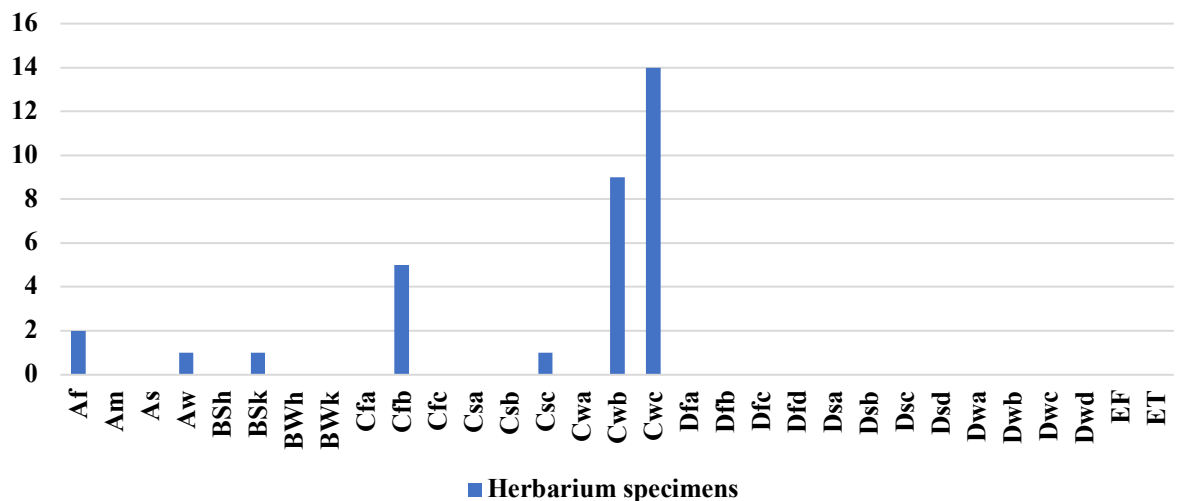


Köppen profile of *Elodea potamogeton*

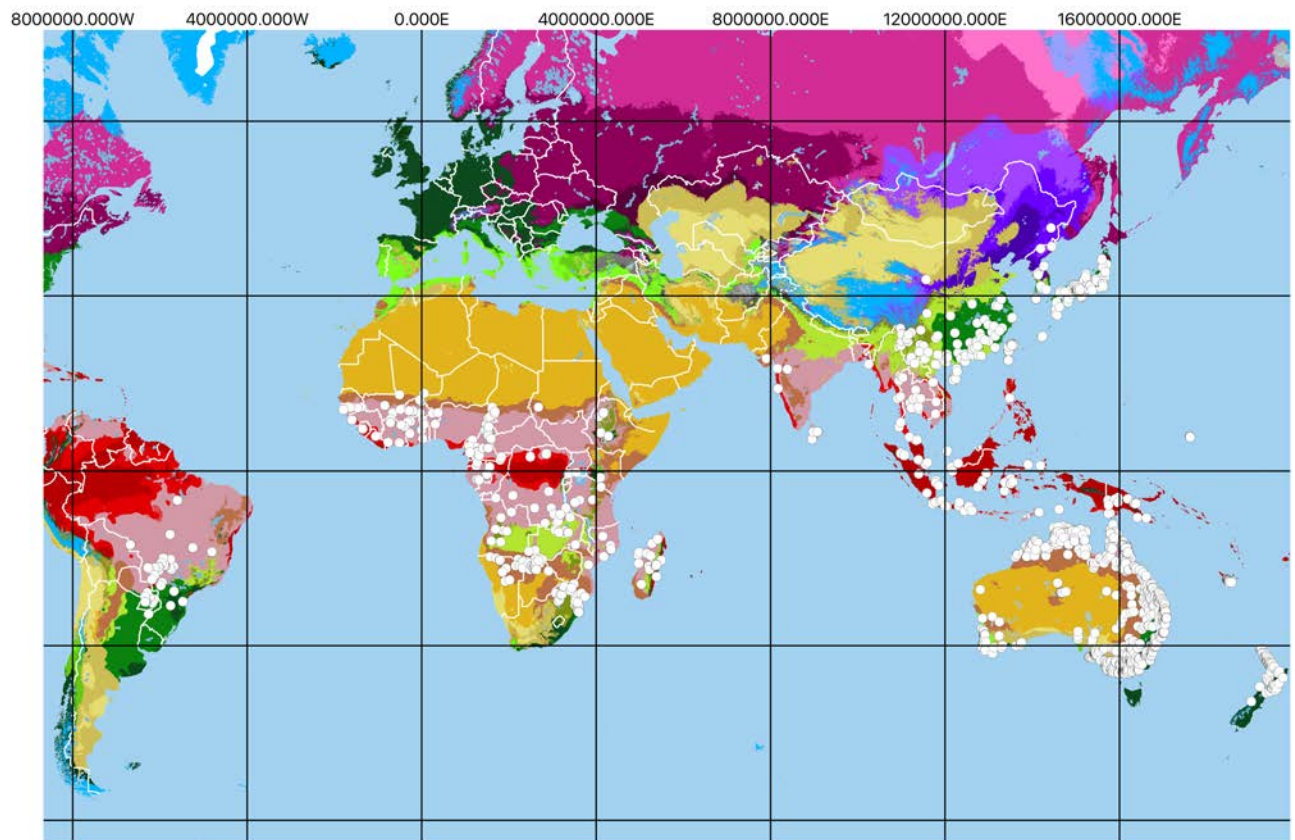
Herbarium specimens



Köppen profile of *Elodea potamogeton*

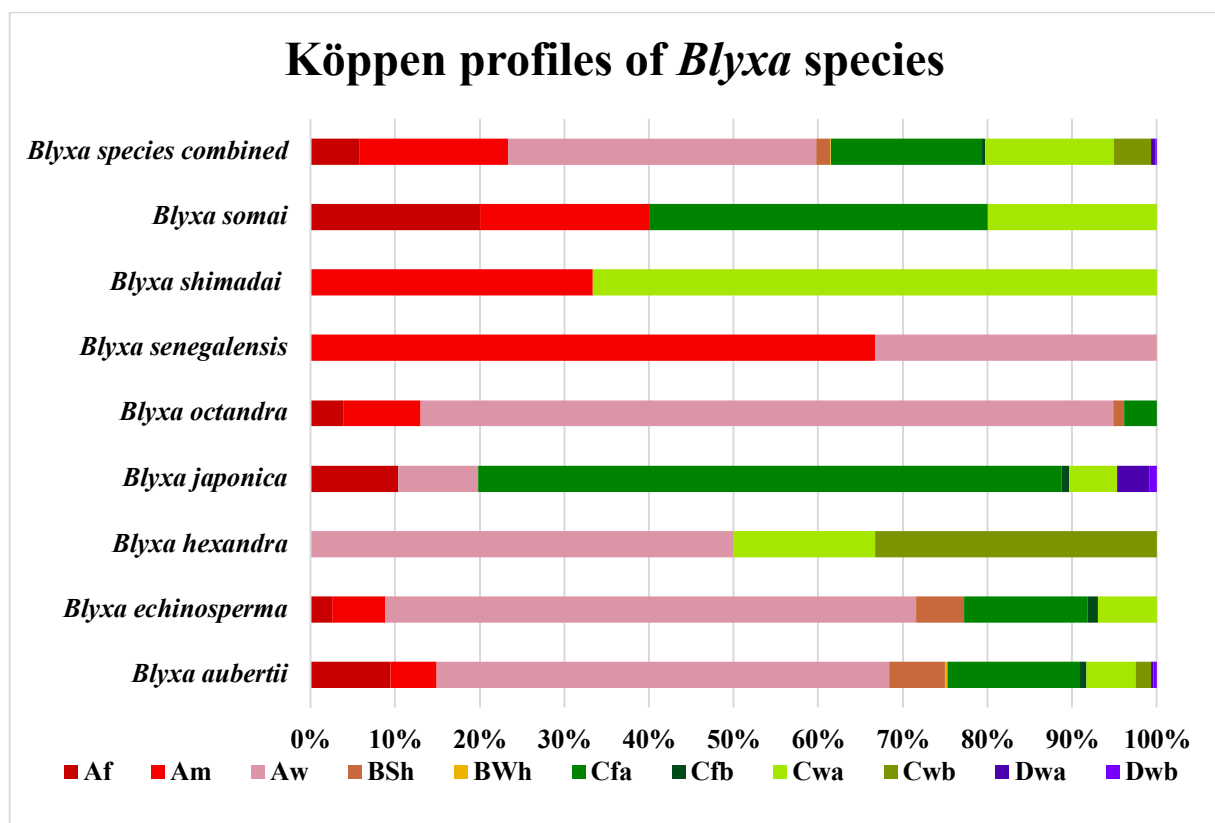
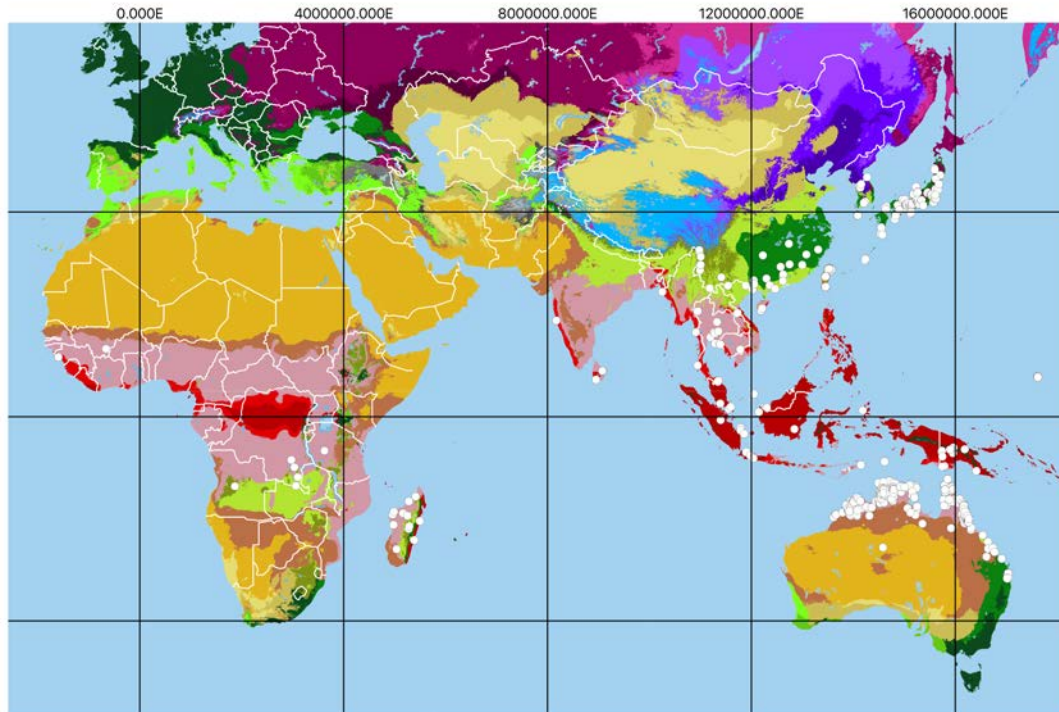


5.2.3. Crown group Clade B of Hydrocharitaceae cf. Chen et. al (2012), comprising *Blyxa* Noronha ex Thouars, 1806 and *Ottelia* Pers., 1805

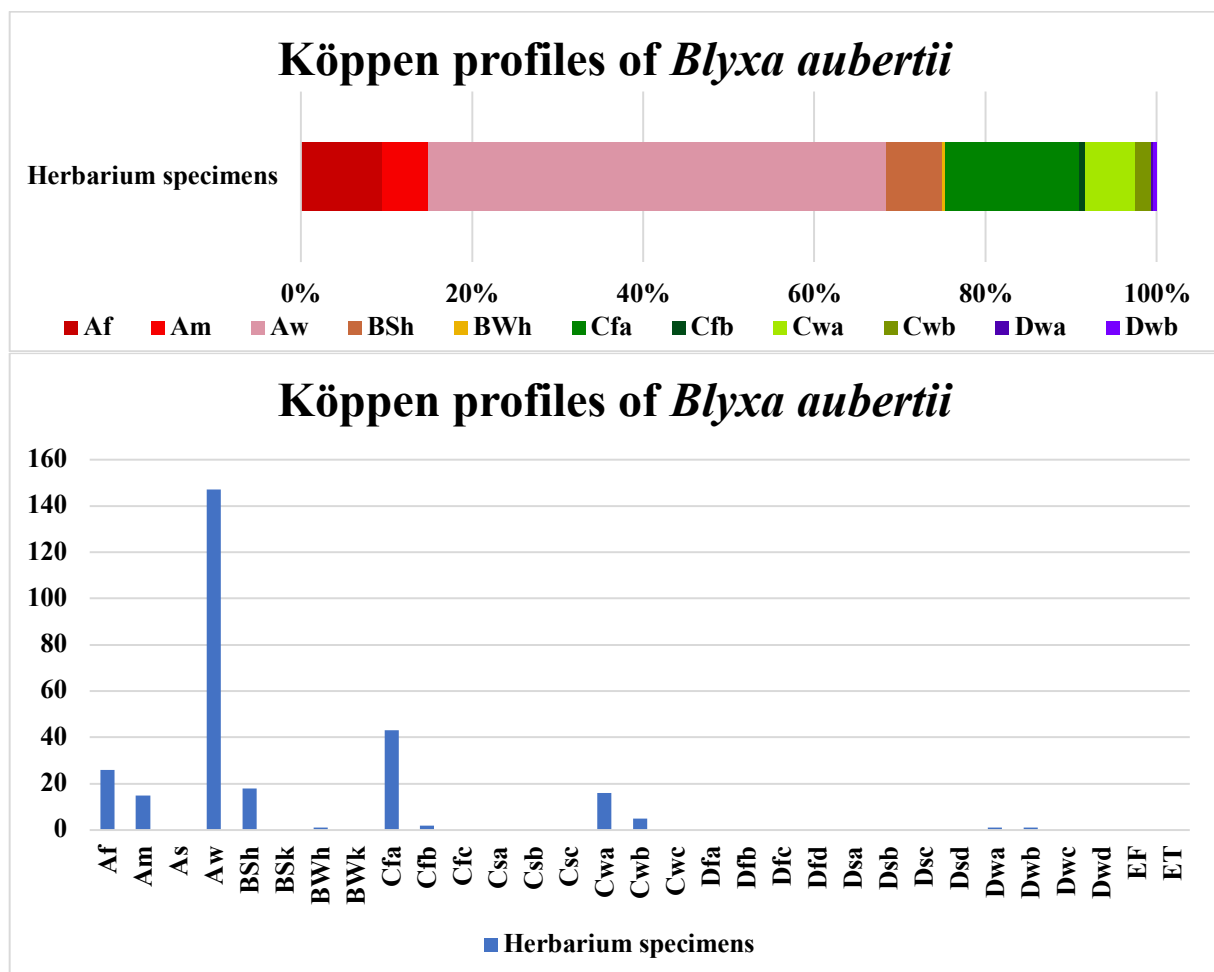
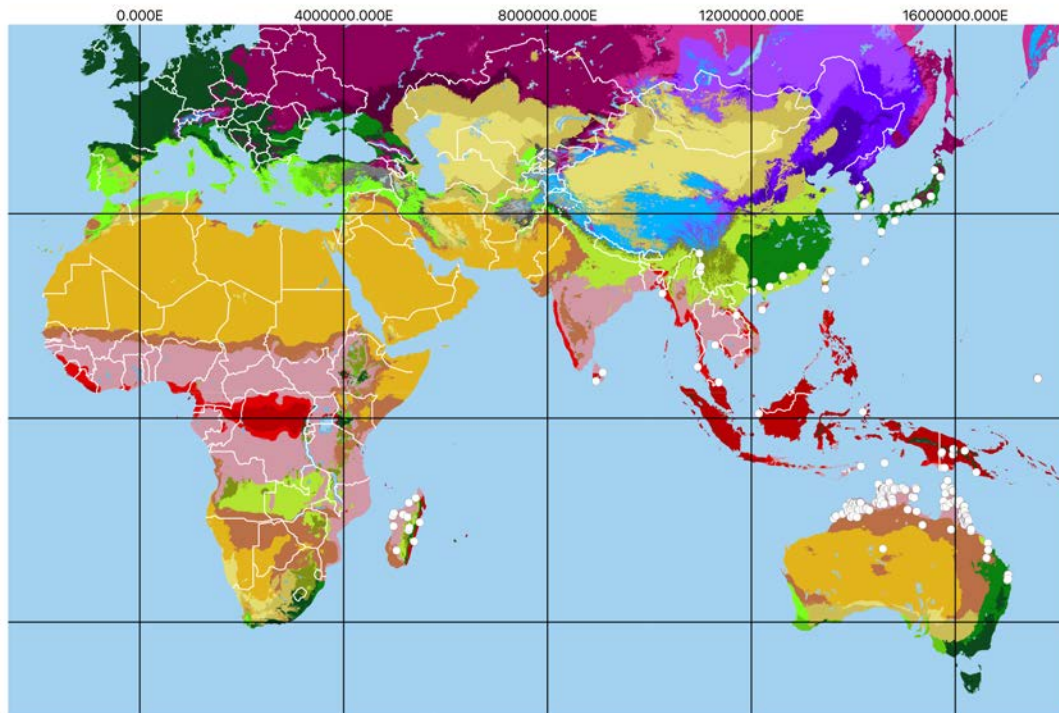


5.2.3.1 Genus *Blyxa* Noronha ex Thouars 1806.

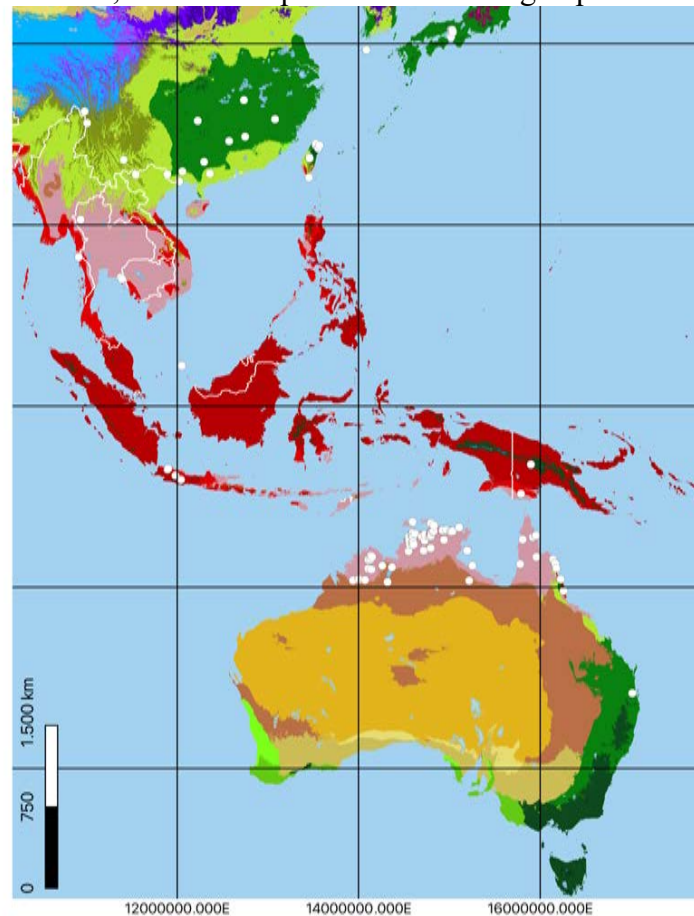
Distribution and Köppen profiles for genus *Blyxa* incl. *B. auberti*, *B. echinosperma*, *B. hexandra*, *B. japonica*, *B. octandra*, *B. senegalensis*, *B. shimadai*, and *B. somai*, based on preserved specimen (n = 926).



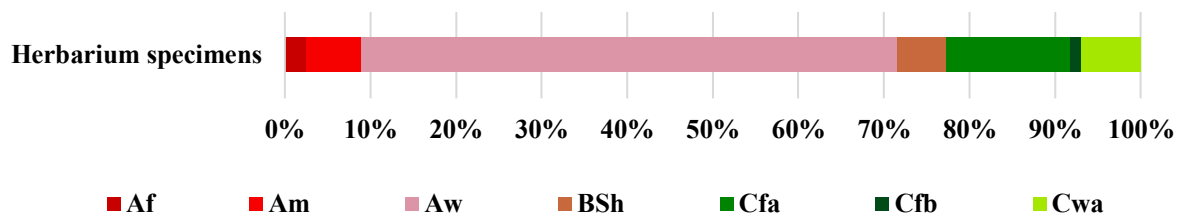
5.2.3.1.1. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa aubertii* Rich. 1814; herbarium specimens excluding duplicate occurrences (n = 275).



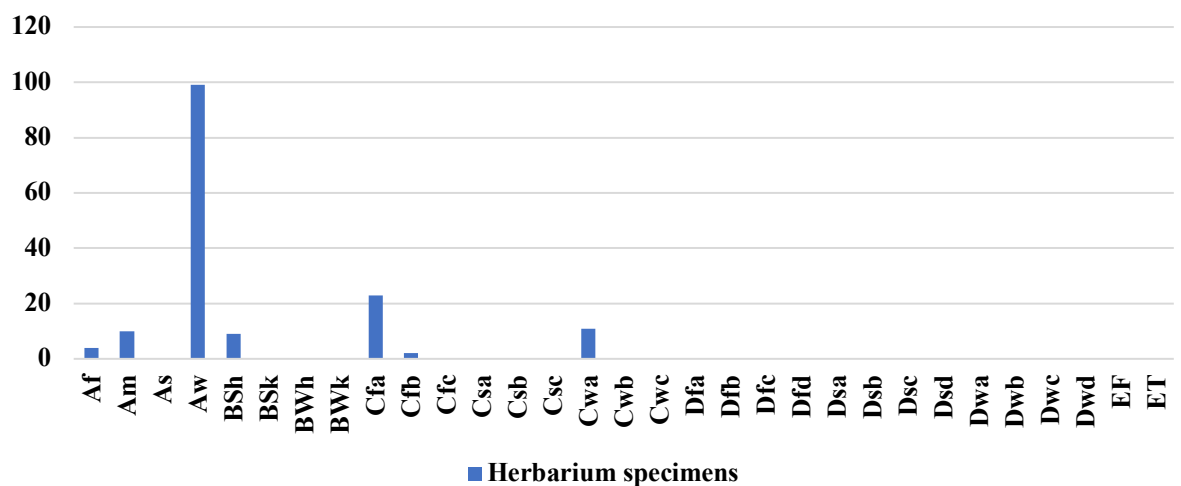
5.2.3.1.2. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa echinosperma* Hook f. 1888; herbarium specimens excluding duplicate occurrences (n = 158).



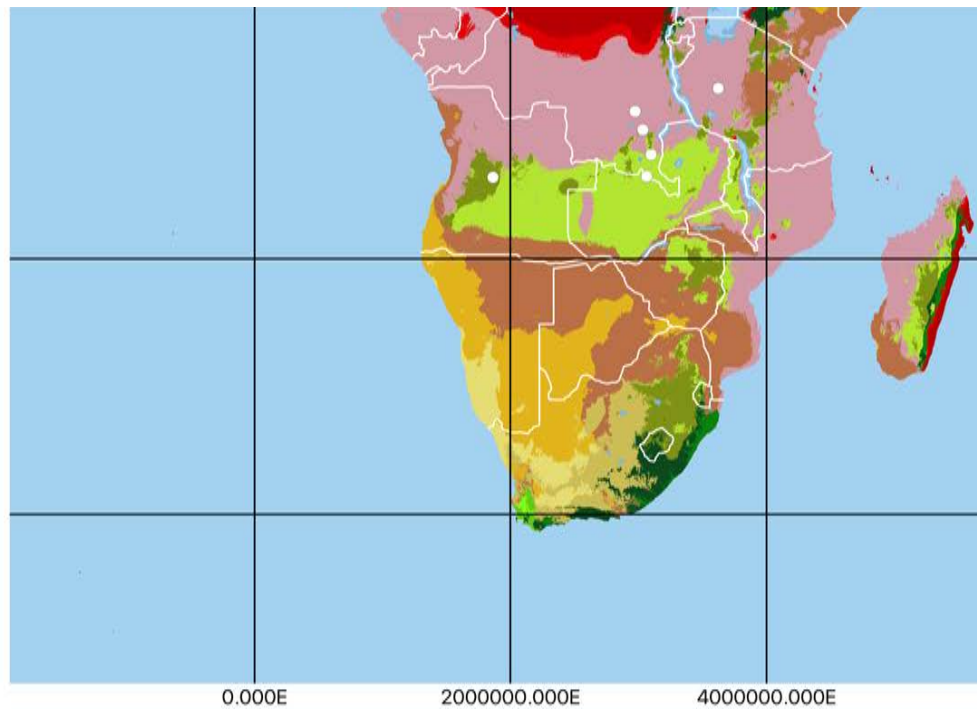
Köppen profile of *Blyxa echinosperma*



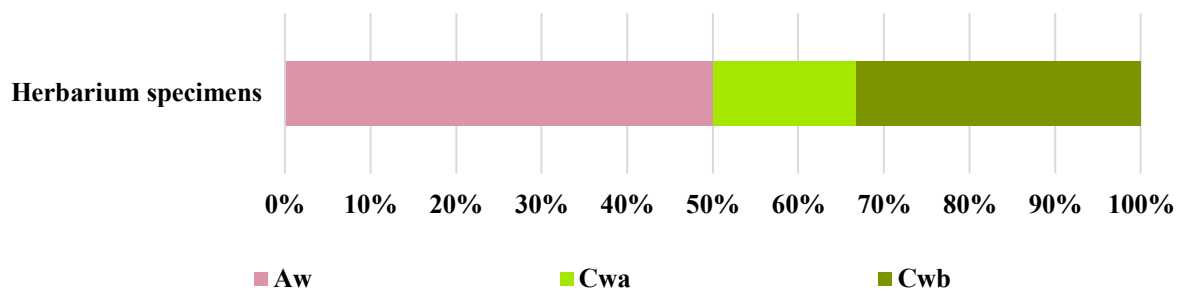
Köppen profile of *Blyxa echinosperma*



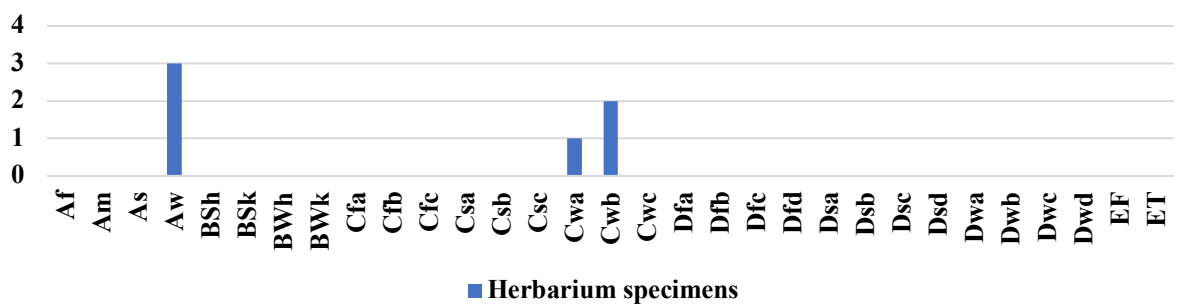
5.2.3.1.3. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa hexandra* C.D.K.Cook & Luond 1980; herbarium specimens excluding duplicate occurrences (n = 6).



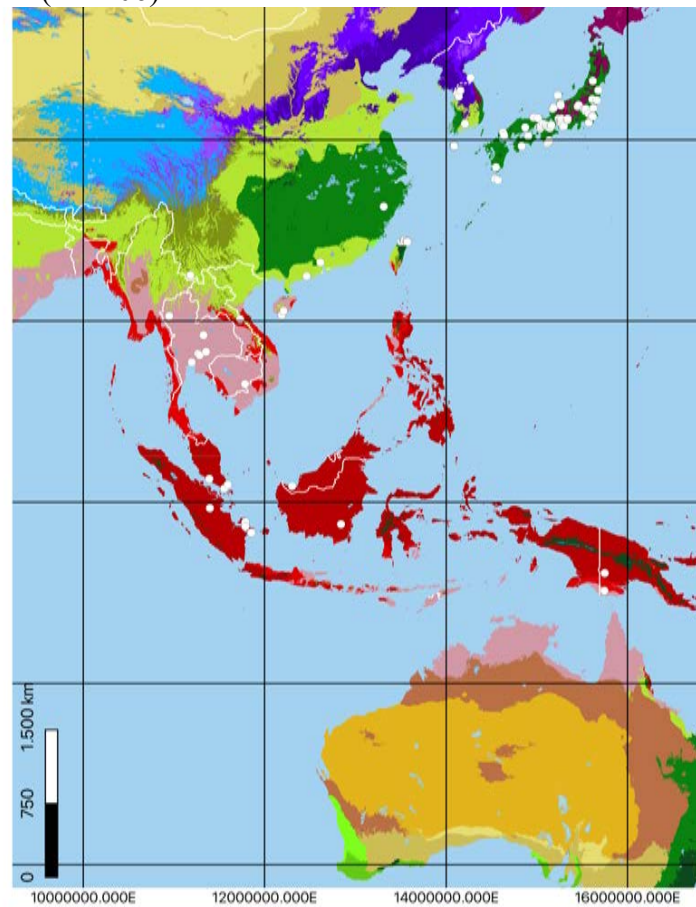
Köppen profile of *Blyxa hexandra*



Köppen profile of *Blyxa hexandra*

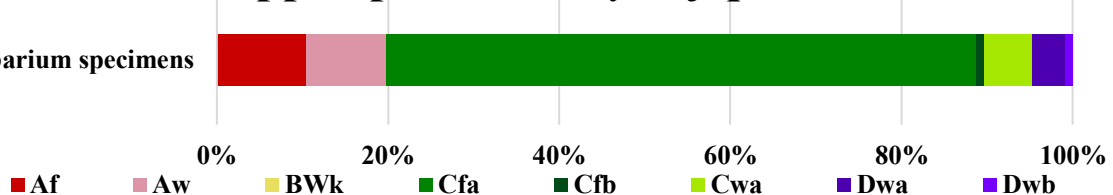


5.2.3.1.4. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa japonica* (Miq. 1866) Maxim. ex Asch & Gürke 1889; herbarium specimens excluding duplicate occurrences (n = 106).

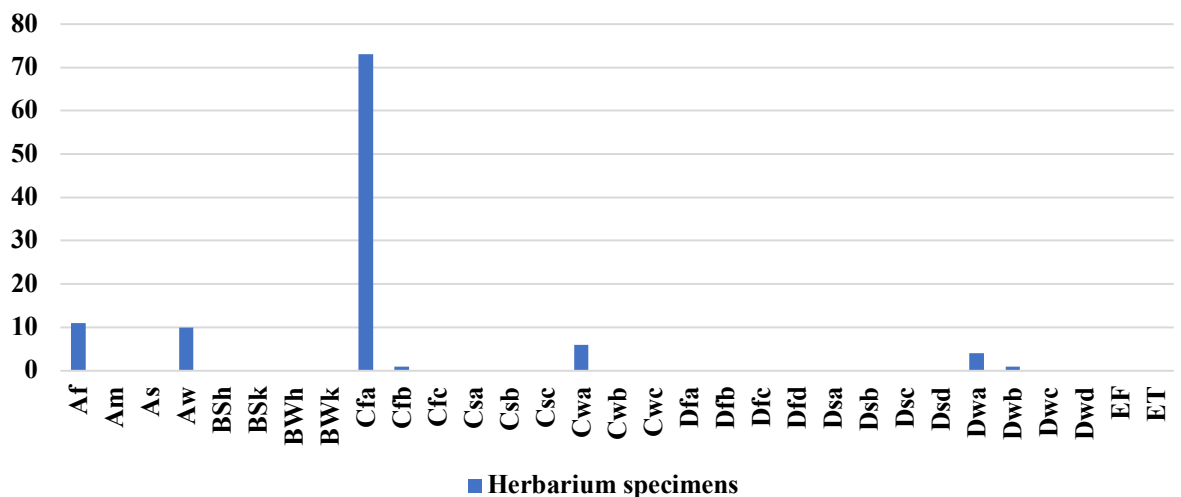


Köppen profile of *Blyxa japonica*

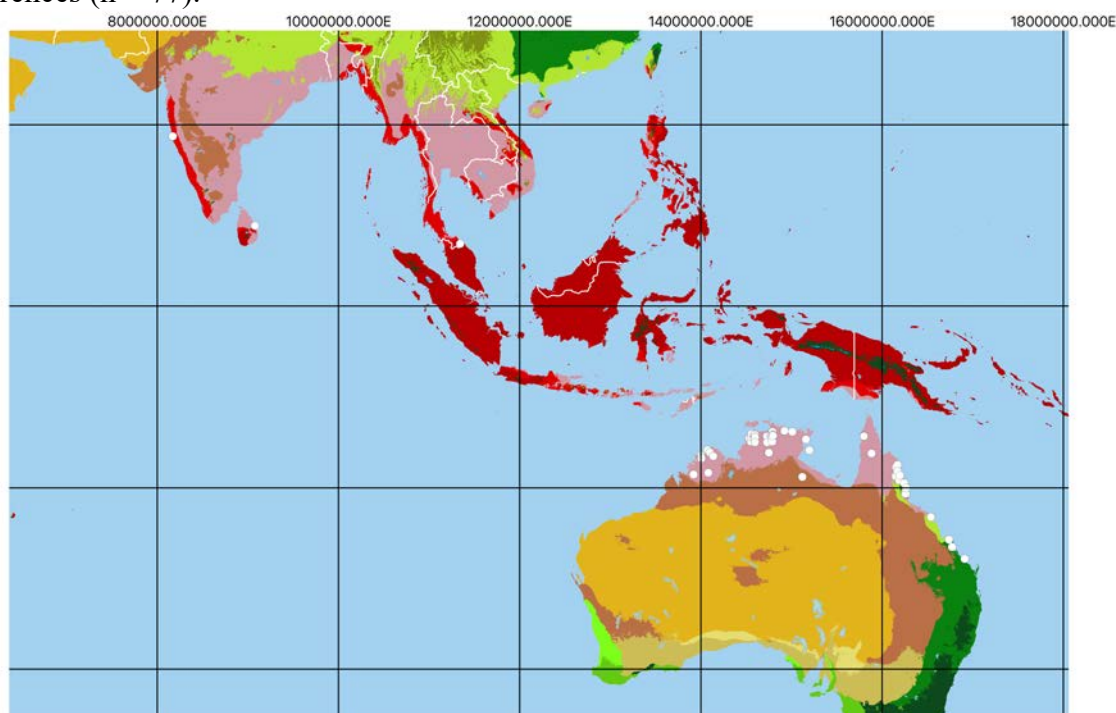
Herbarium specimens



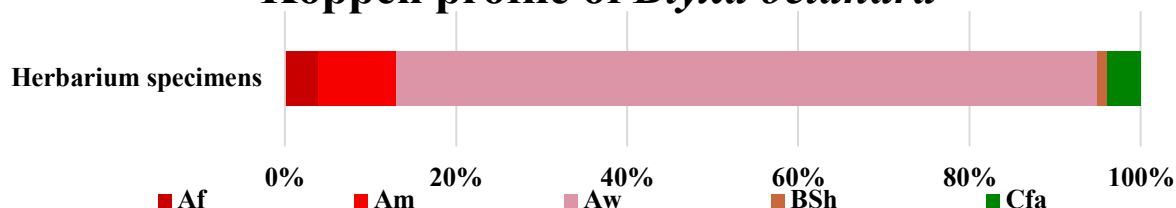
Köppen profile of *Blyxa japonica*



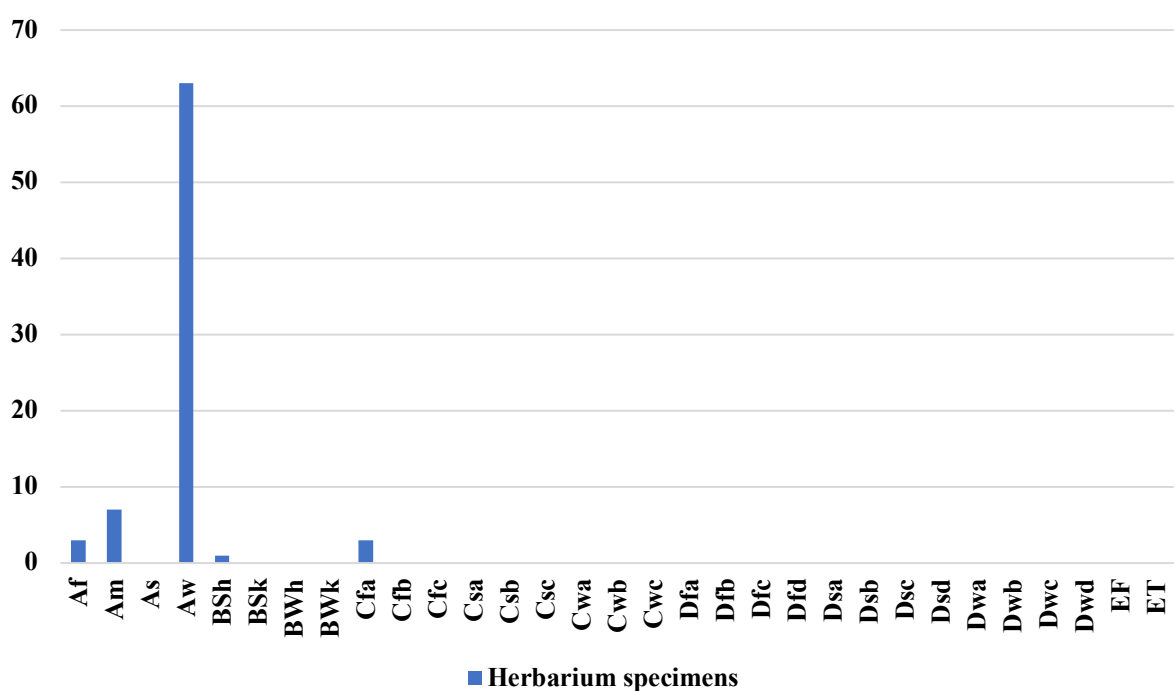
5.2.3.1.5. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa octandra* (Roxb. 1802) Planch. ex Thwaites 1864; herbarium specimens excluding duplicate occurrences (n = 77).



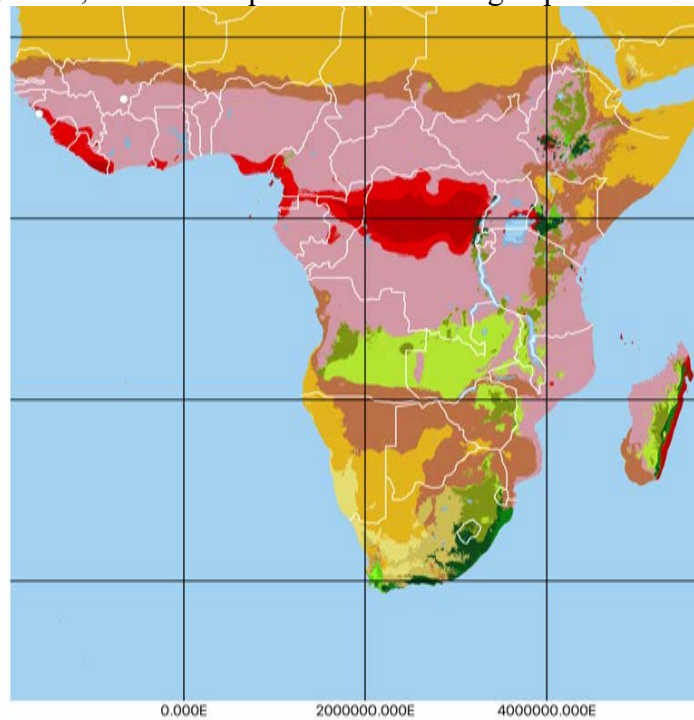
Köppen profile of *Blyxa octandra*



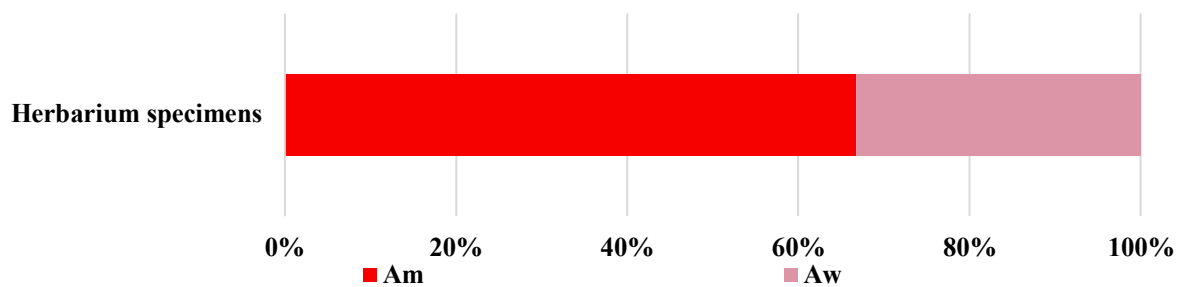
Köppen profile of *Blyxa octandra*



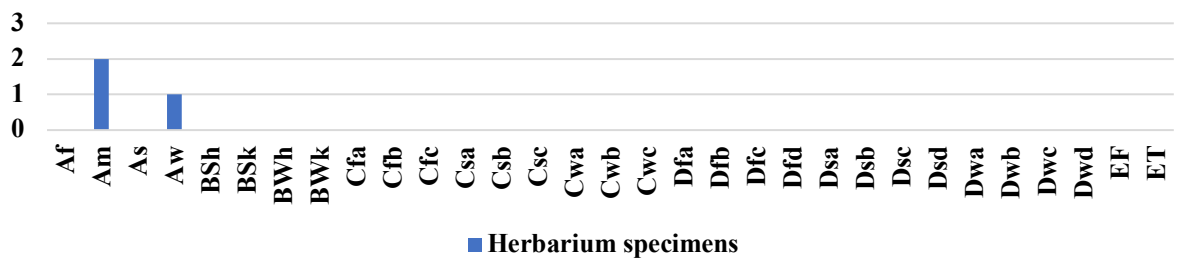
5.2.3.1.6. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa senegalensis* Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 3).



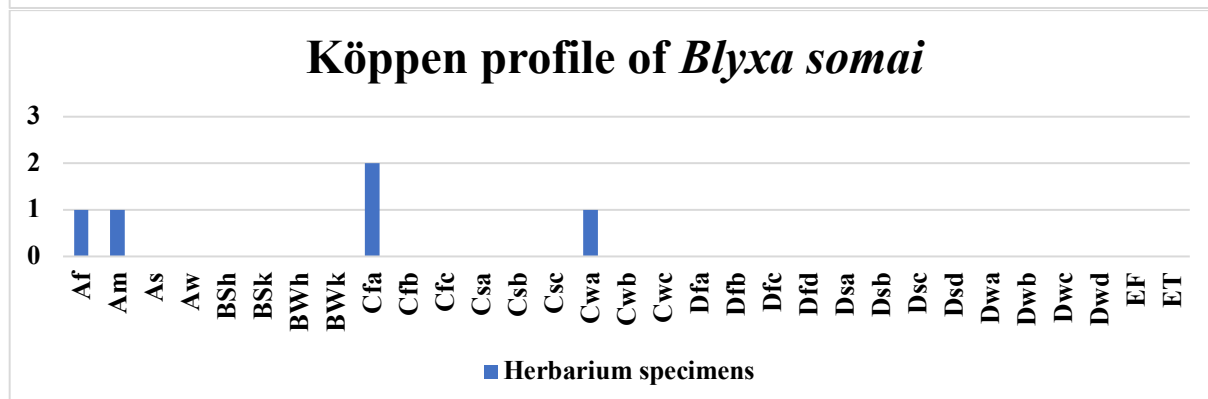
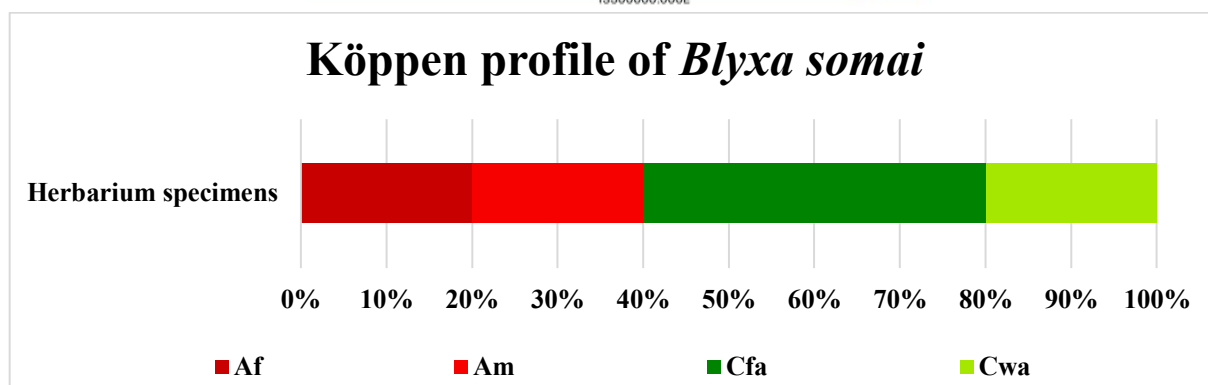
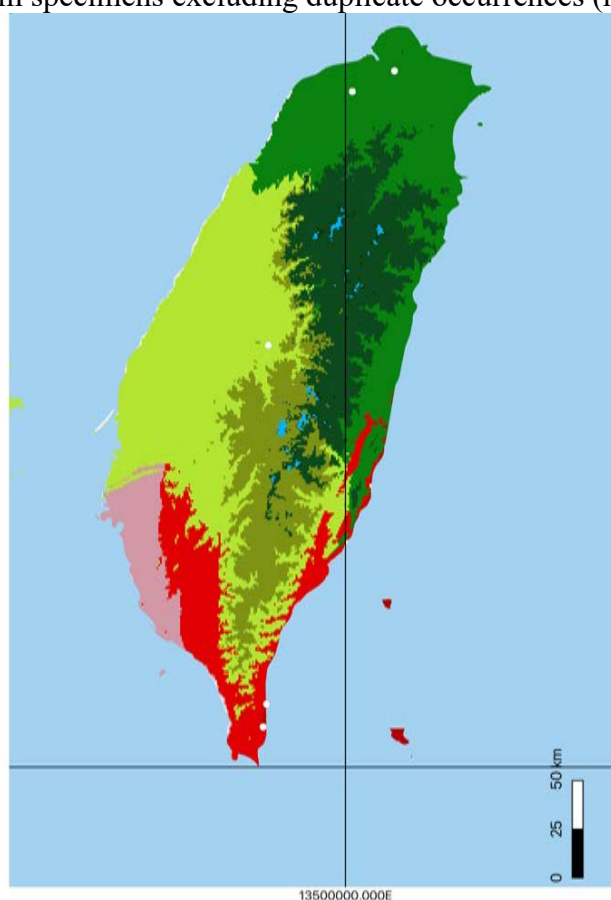
Köppen profile of *Blyxa senegalensis*



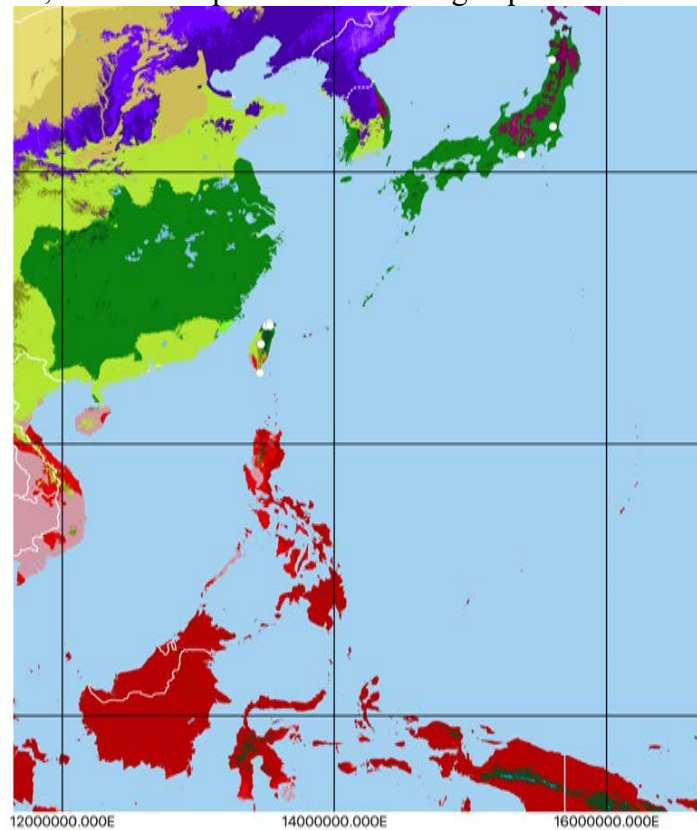
Köppen profile of *Blyxa senegalensis*



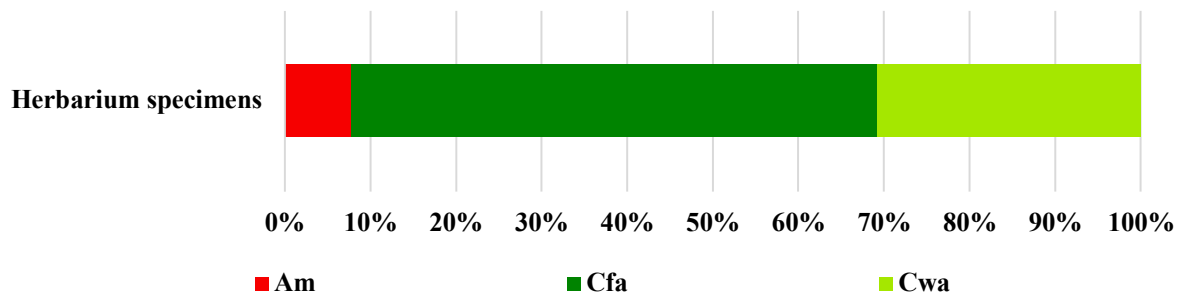
5.2.3.1.7. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa somai* Hayata 1915; herbarium specimens excluding duplicate occurrences (n = 5).



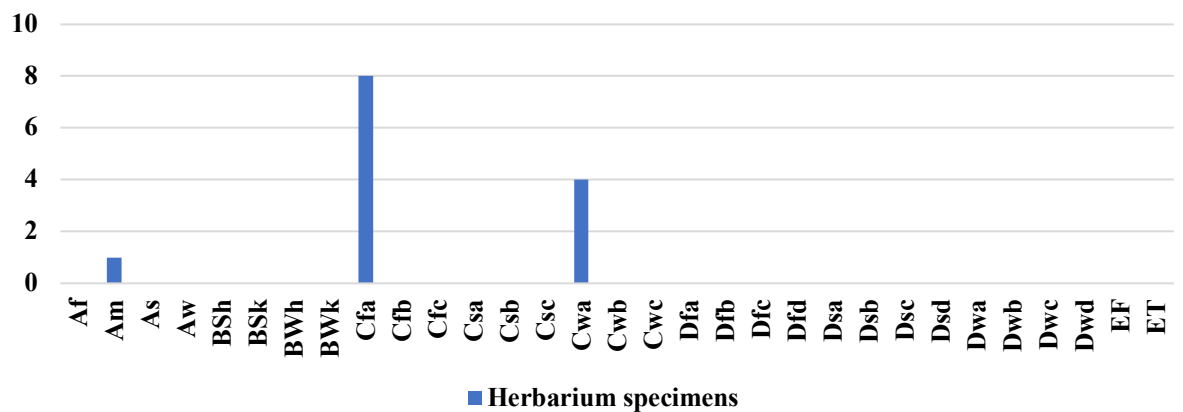
5.2.3.1.8. Köppen profile, distribution and climate map– GBIF occurrences of *Blyxa shimadai* Hayata 1915; herbarium specimens excluding duplicate occurrences (n = 13).



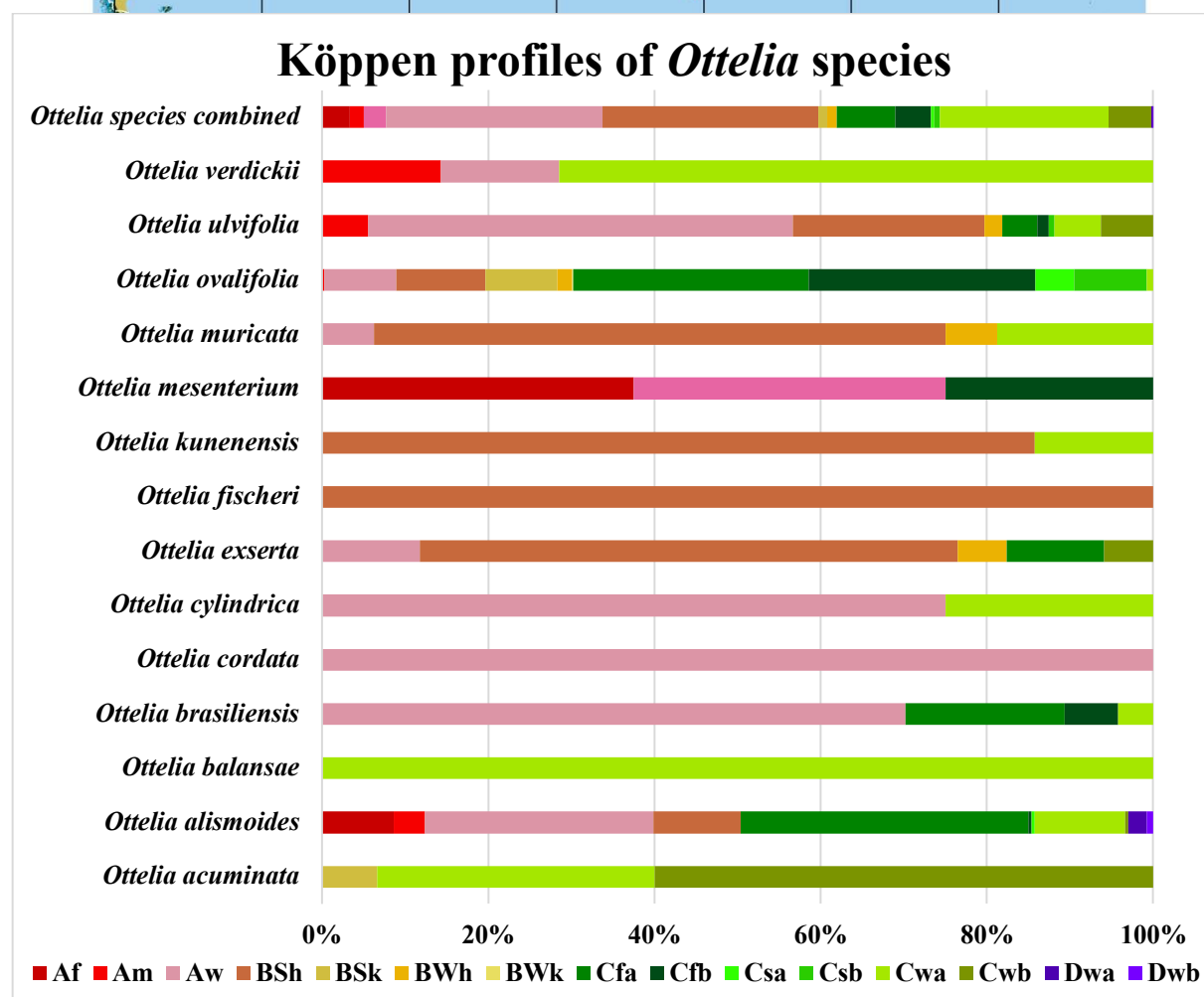
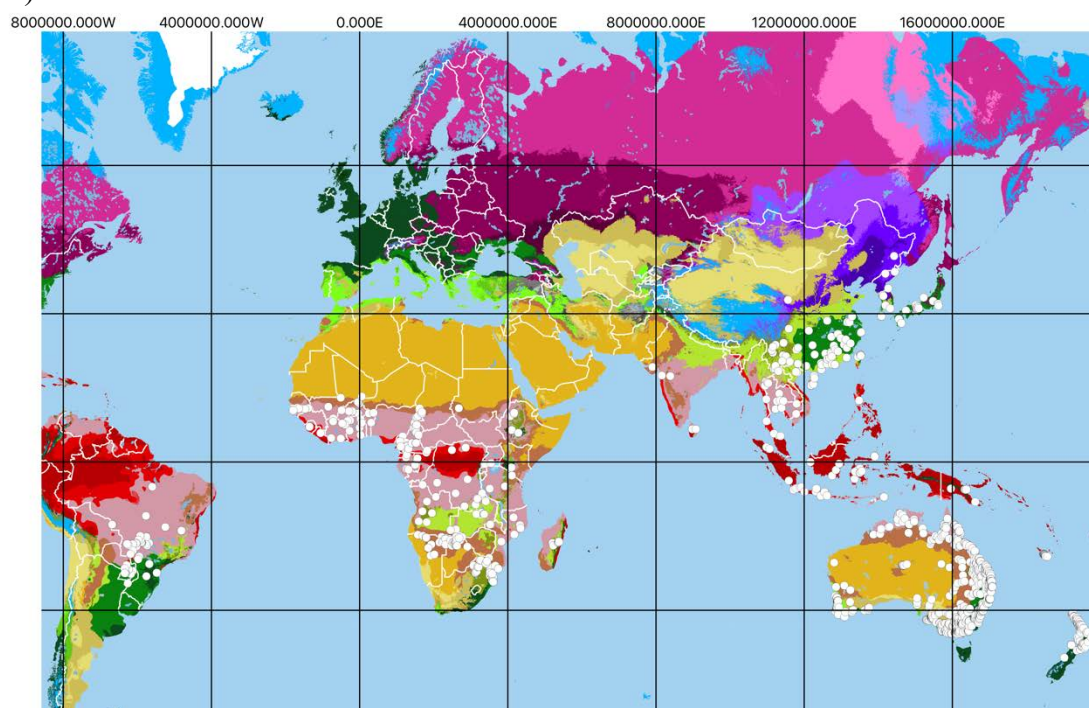
Köppen profile of *Blyxa shimadai*



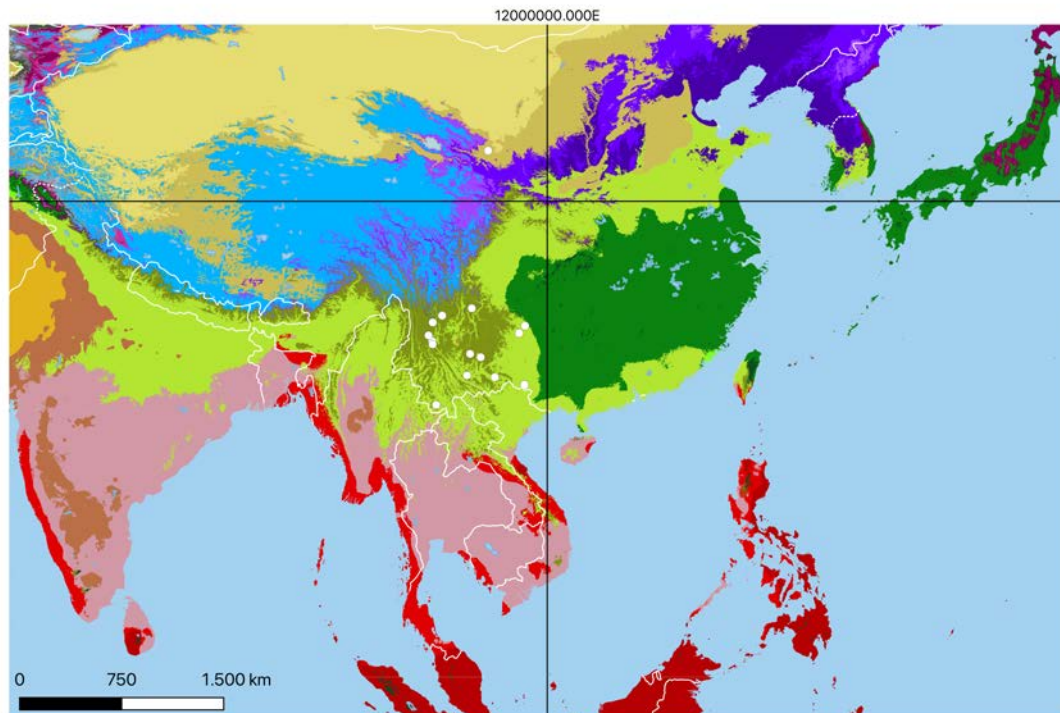
Köppen profile of *Blyxa shimadai*



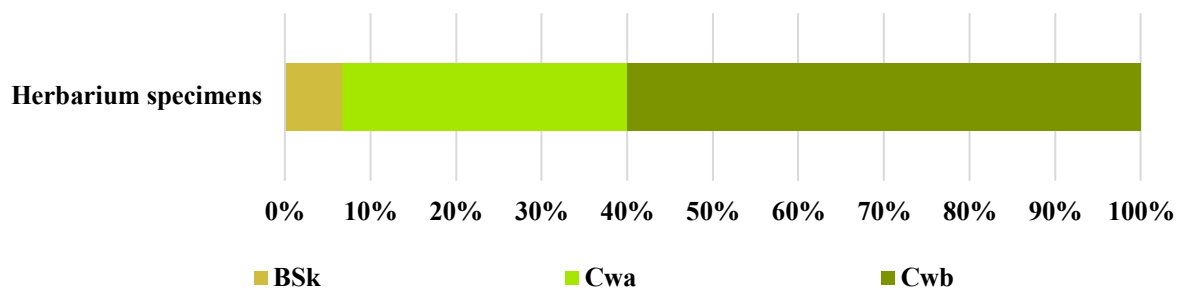
Distribution and Köppen profiles of genus *Ottelia* incl. *Ottelia acuminata*, *O. alismoides*, *O. balanesnsae*, *O. brasiliensis*, *O. cordata*, *O. exserta*, *O. kunenensis*, *O. mesenterium*, *O. muricata*, *O. ovalifolia*, *O. ulvifolia*, and *O. verdickii*, based on preserved specimen (n = 1670).



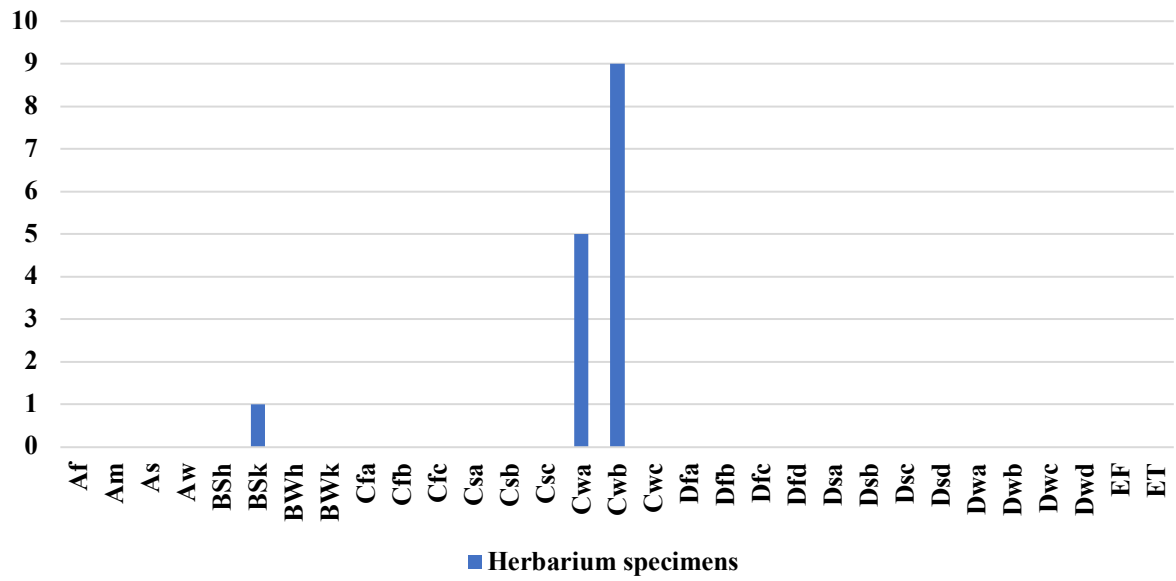
5.2.3.2.1. Köppen profile, distribution and climate map– GBIF occurrences of *Ottelia acuminata* (Gagnep. 1907) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 15).



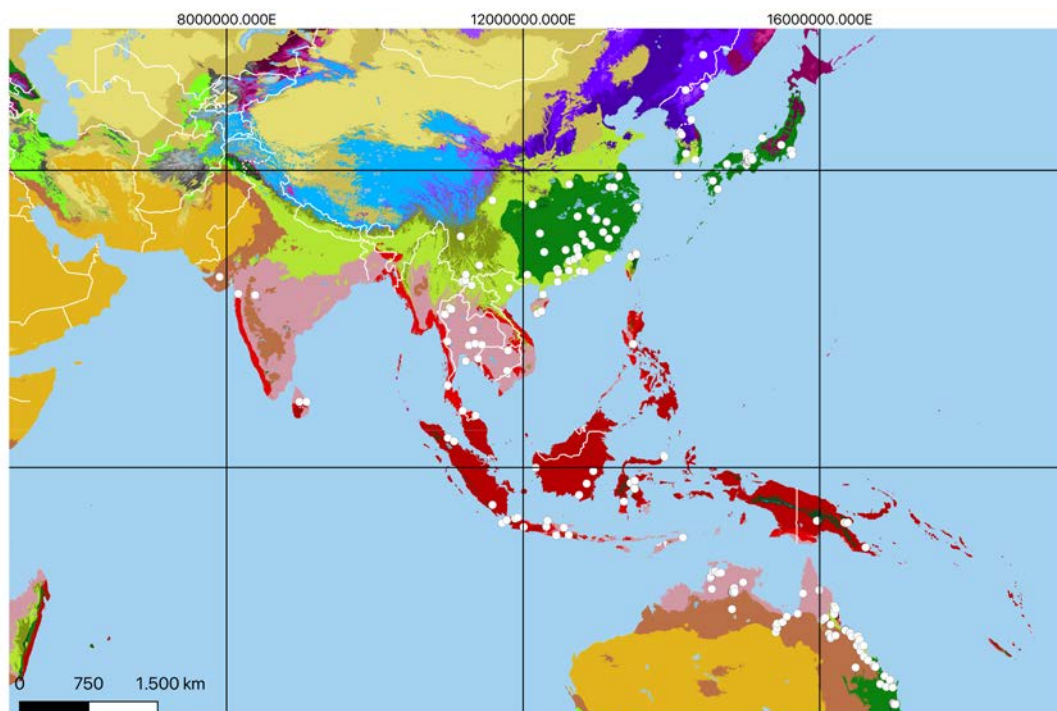
Köppen profile of *Ottelia acuminata*



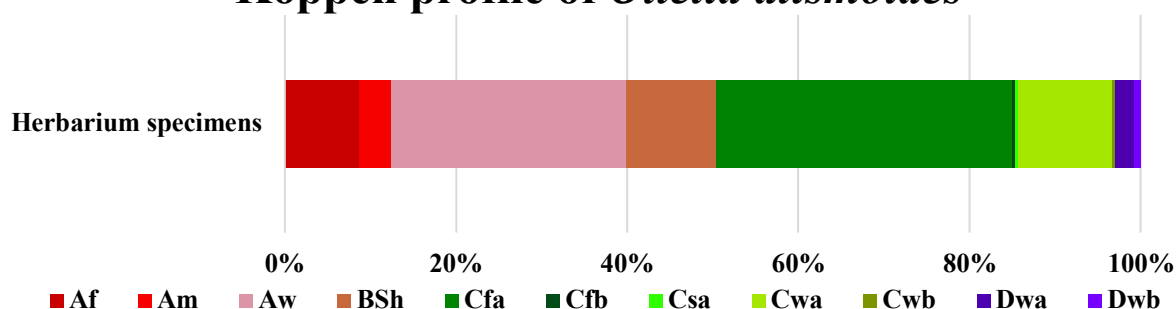
Köppen profile of *Ottelia acuminata*



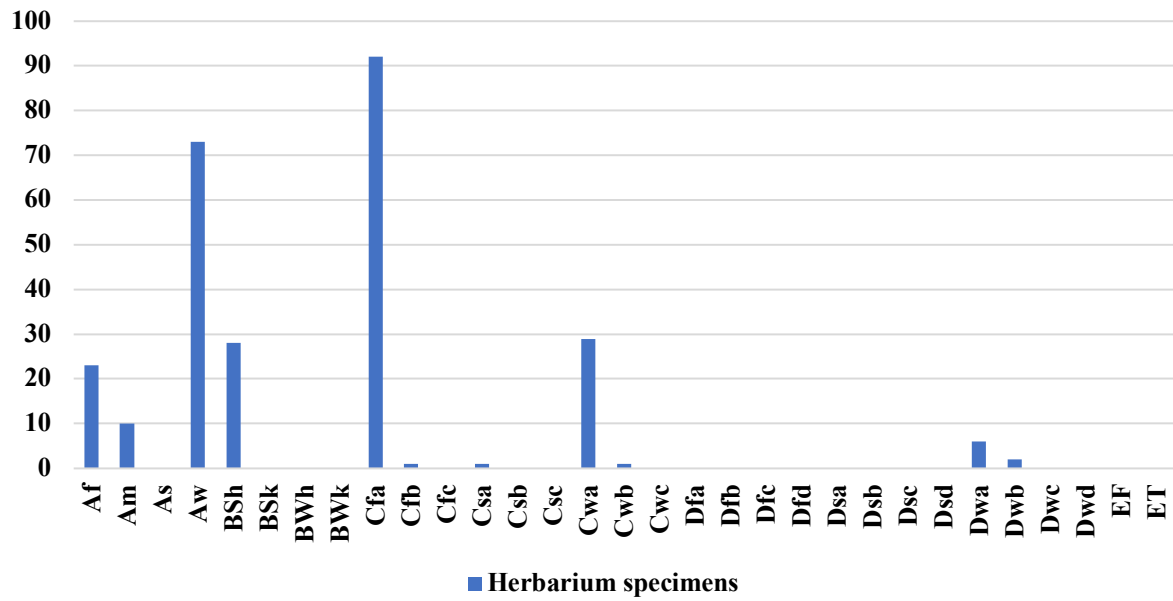
5.2.3.2.2. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia alismoides* (L. 1753) Pers. 1805; herbarium specimens excluding duplicate occurrences (n = 266).



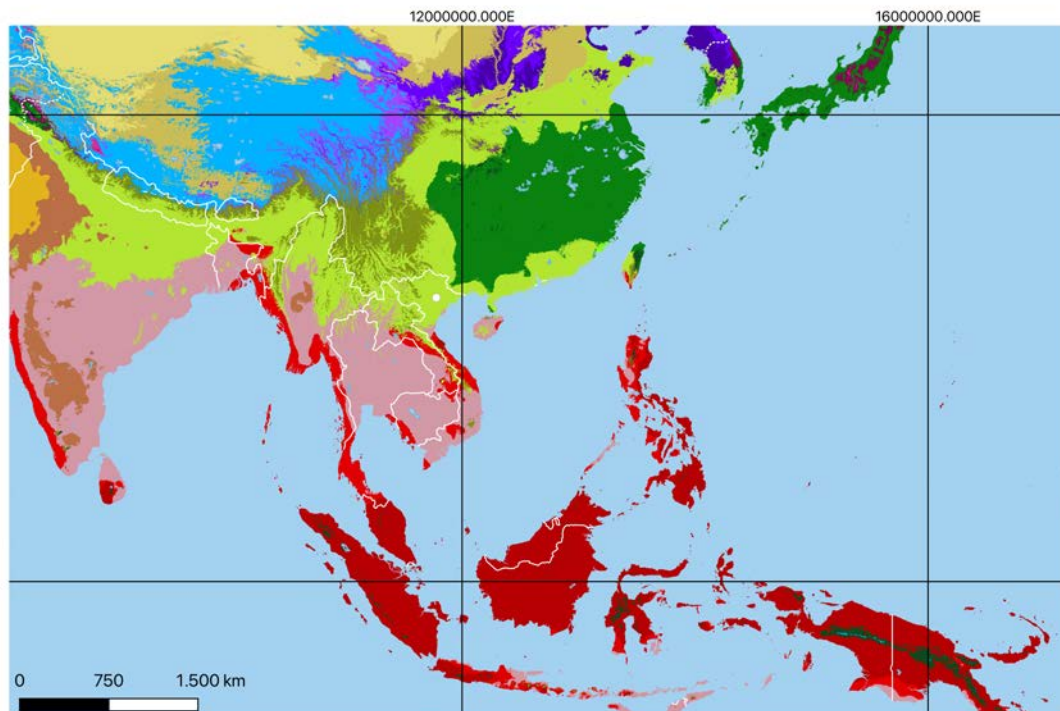
Köppen profile of *Ottelia alismoides*



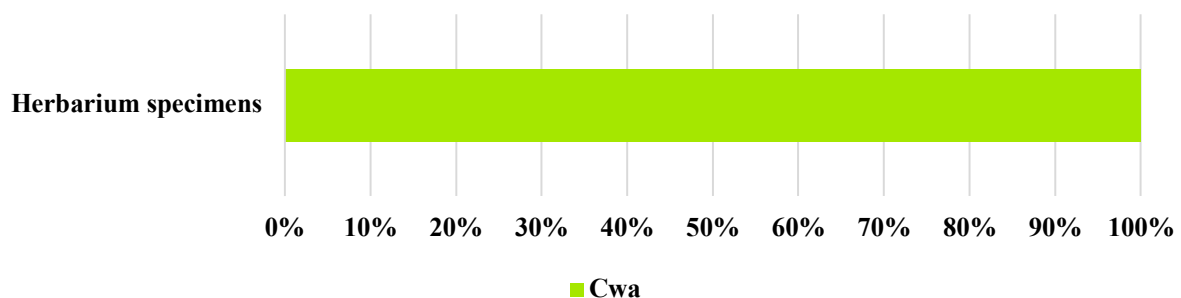
Köppen profile of *Ottelia alismoides*



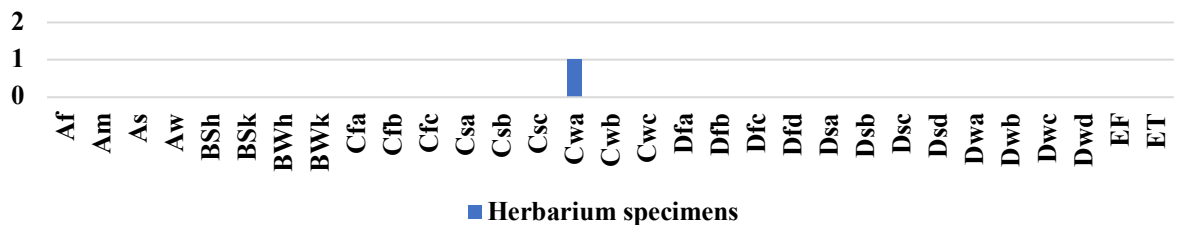
5.2.3.2.3. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia balansae* (Gagnep. 1907) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 1).



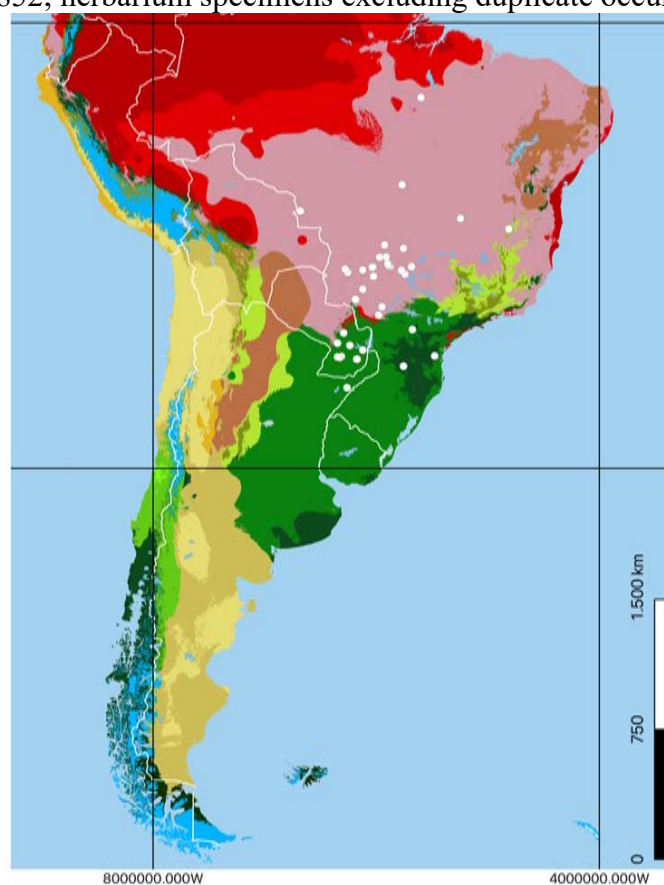
Köppen profile of *Ottelia balansae*



Köppen profile of *Ottelia balansae*

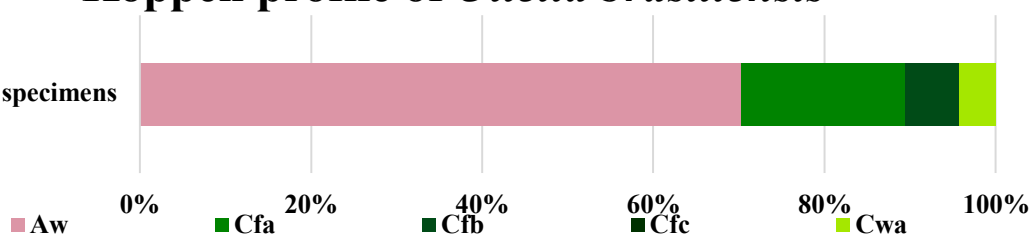


5.2.3.2.4. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia brasiliensis* Walp. 1852; herbarium specimens excluding duplicate occurrences (n = 47).

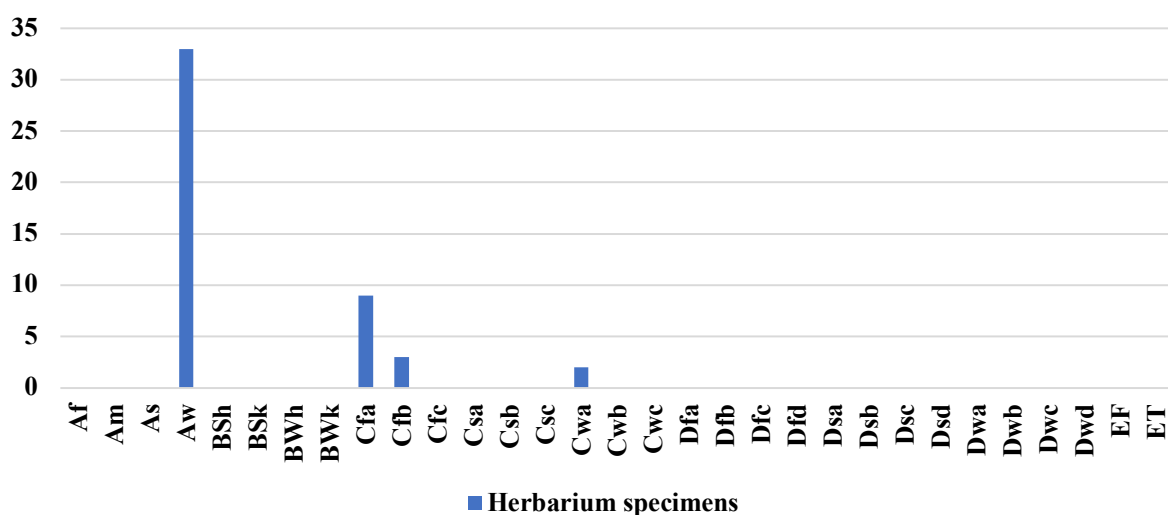


Köppen profile of *Ottelia brasiliensis*

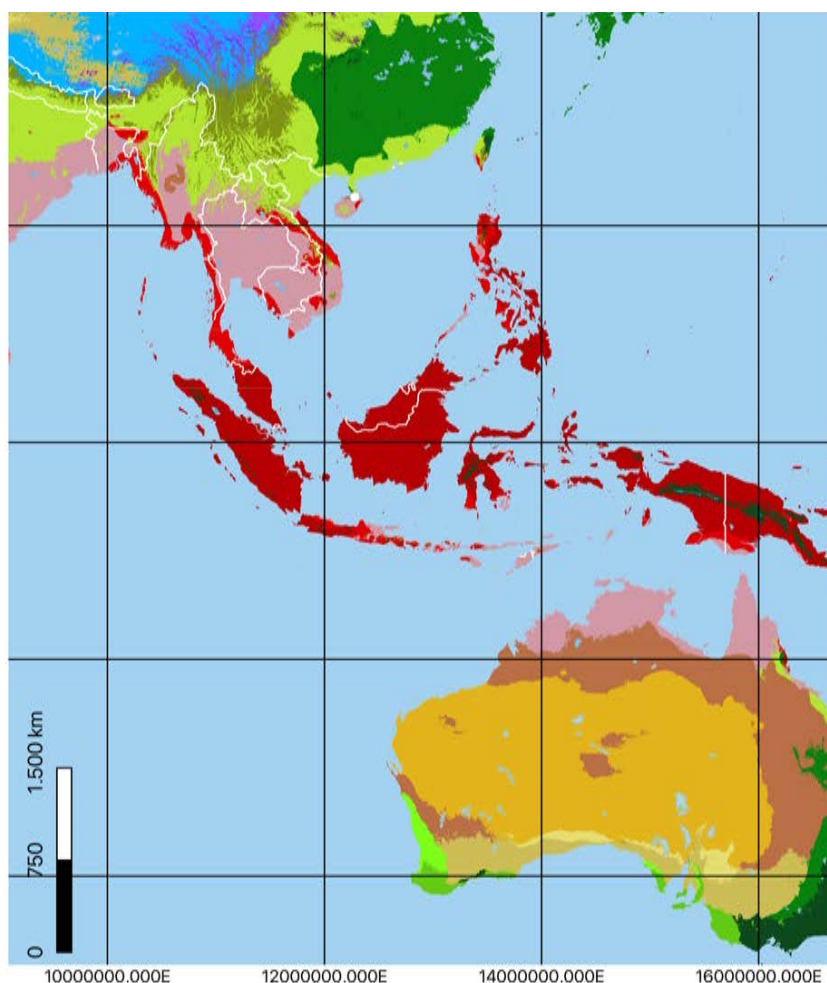
Herbarium specimens



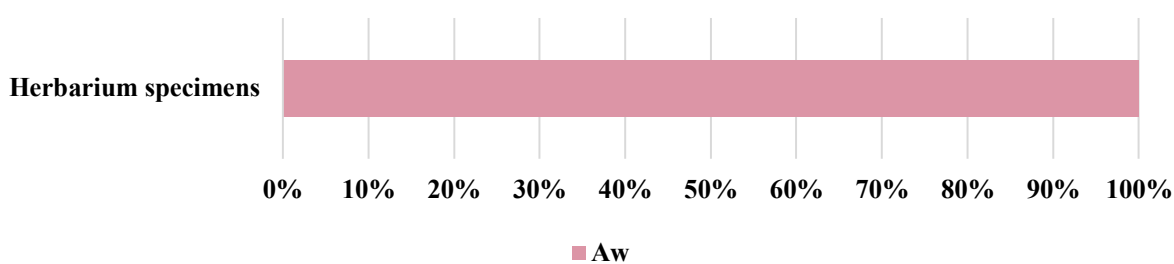
Köppen profile of *Ottelia brasiliensis*



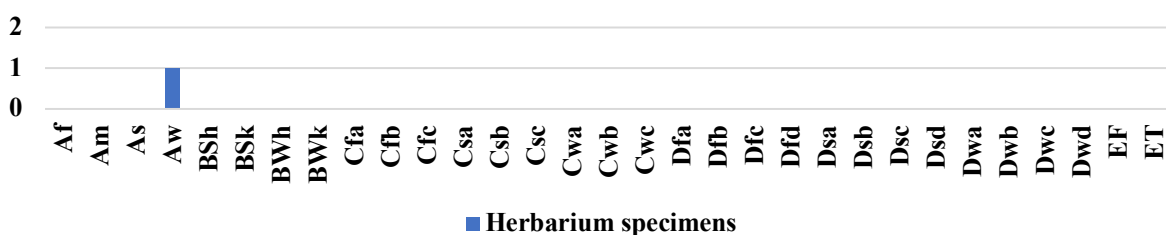
5.2.3.2.5. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia cordata* (Wall. 1830) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 1).



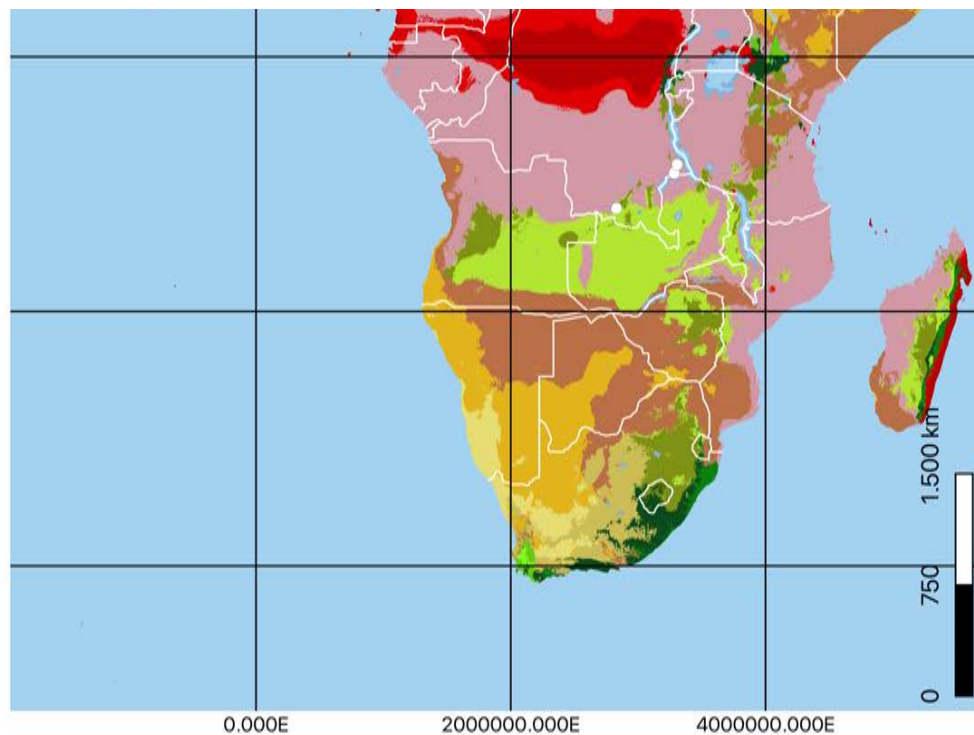
Köppen profile of *Ottelia cordata*



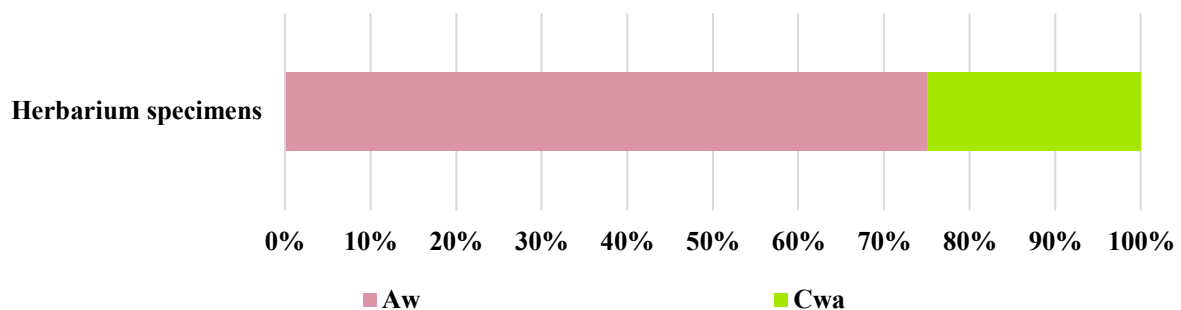
Köppen profile of *Ottelia cordata*



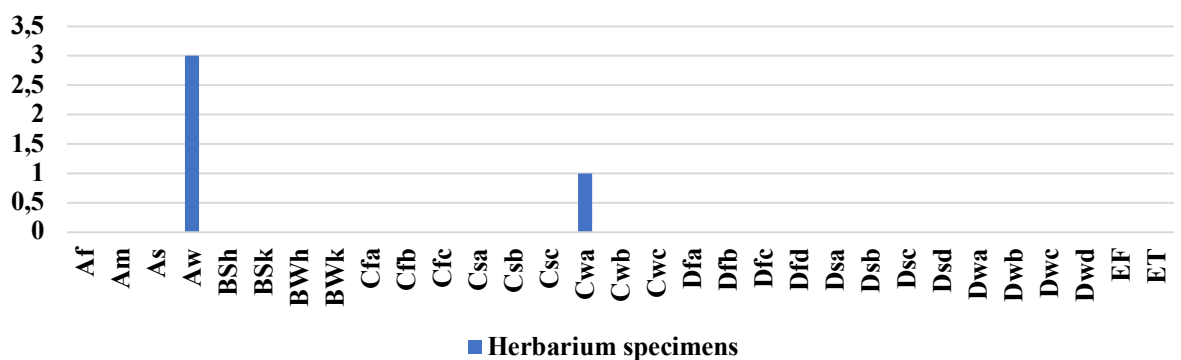
5.2.3.2.6. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia cylindrica* (T.C.E.Fr.) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 3).



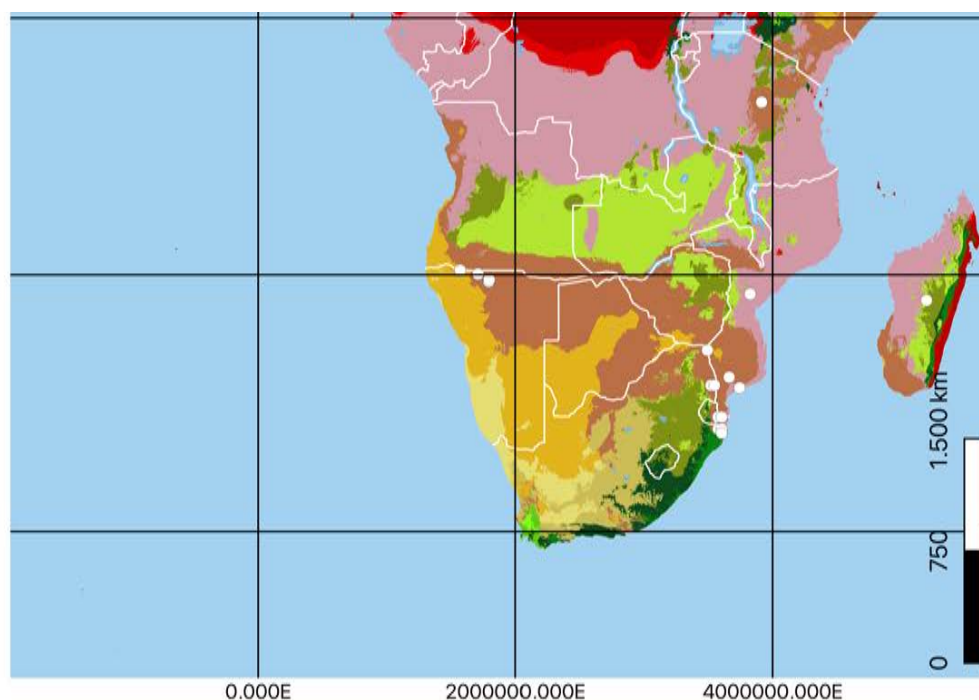
Köppen profile of *Ottelia cylindrica*



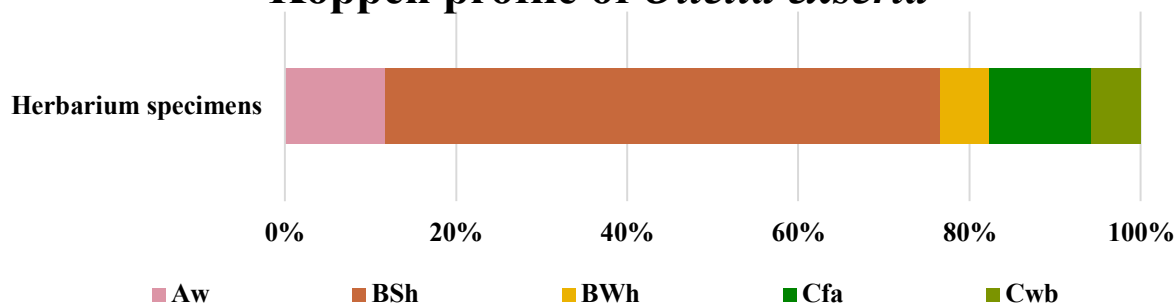
Köppen profile of *Ottelia cylindrica*



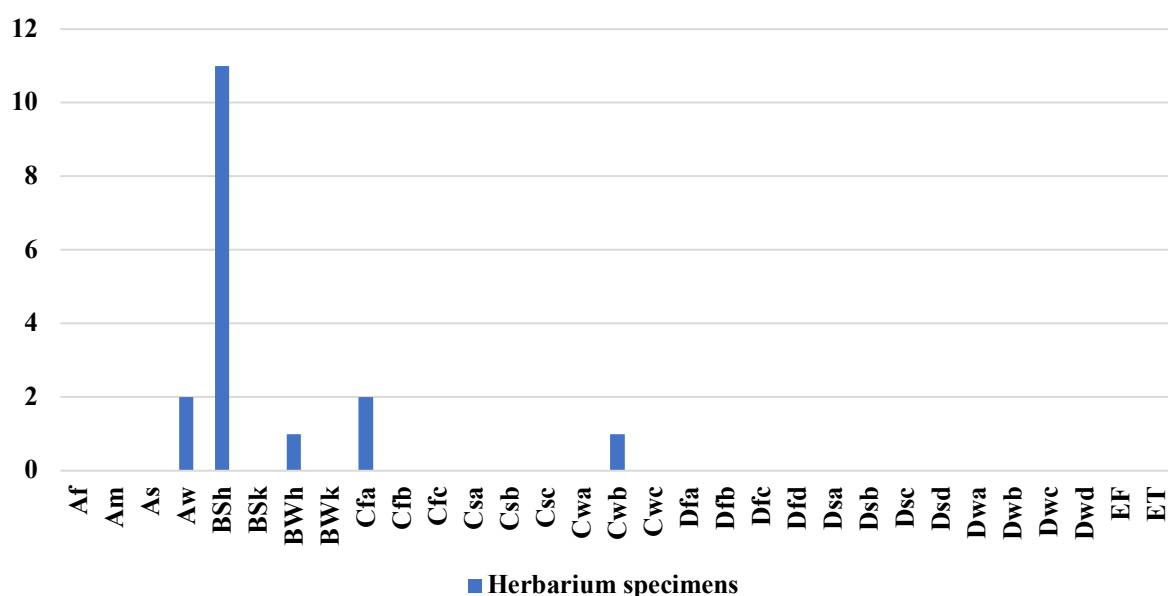
5.2.3.2.7. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia exserta* (Ridl. 1886) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 17).



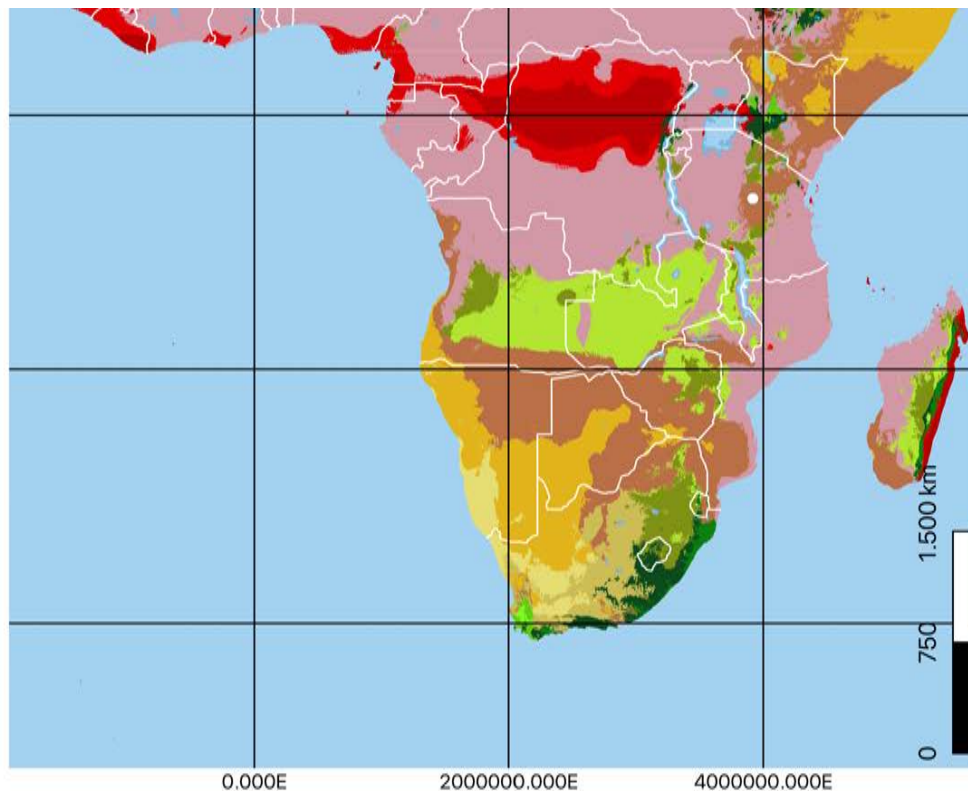
Köppen profile of *Ottelia exserta*



Köppen profile of *Ottelia exserta*



5.2.3.2.8. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia fischeri* (Gürke 1895) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 1).



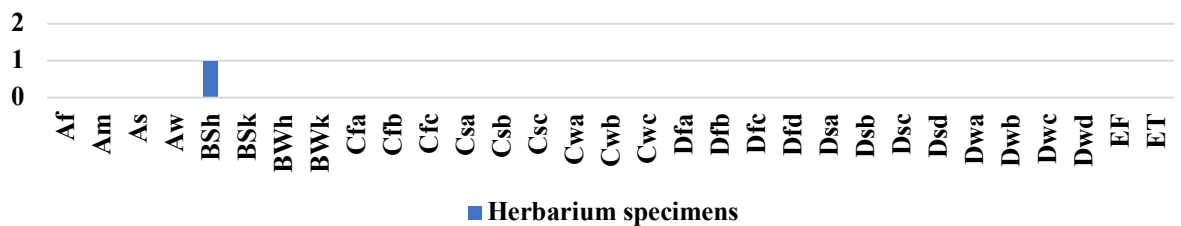
Köppen profile of *Ottelia fischeri*

Herbarium specimens

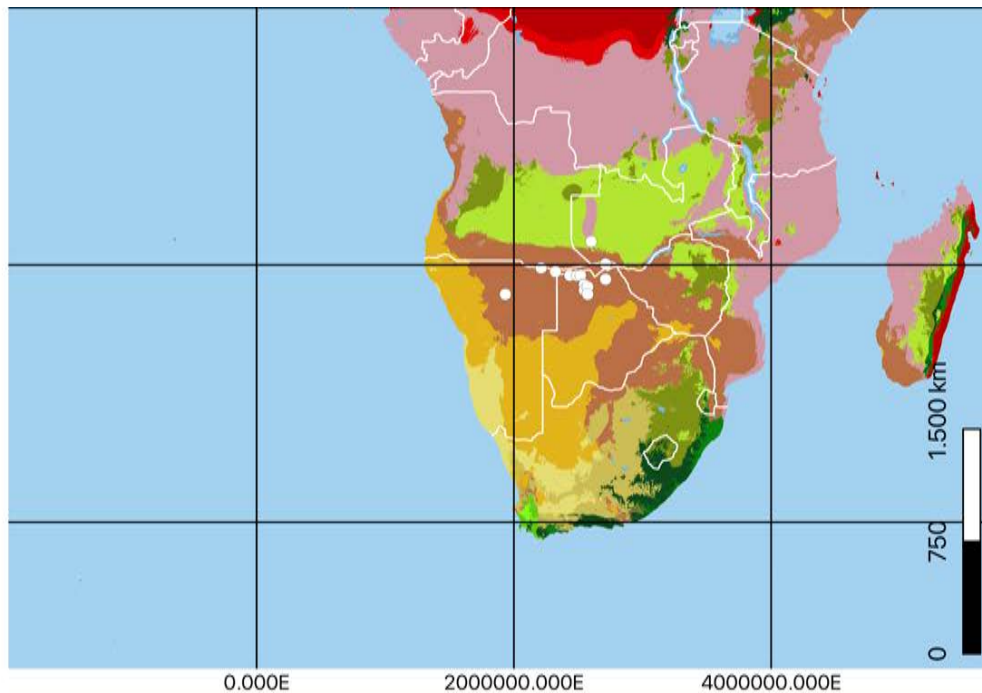
0% 20% 40% 60% 80% 100%

■ BSh

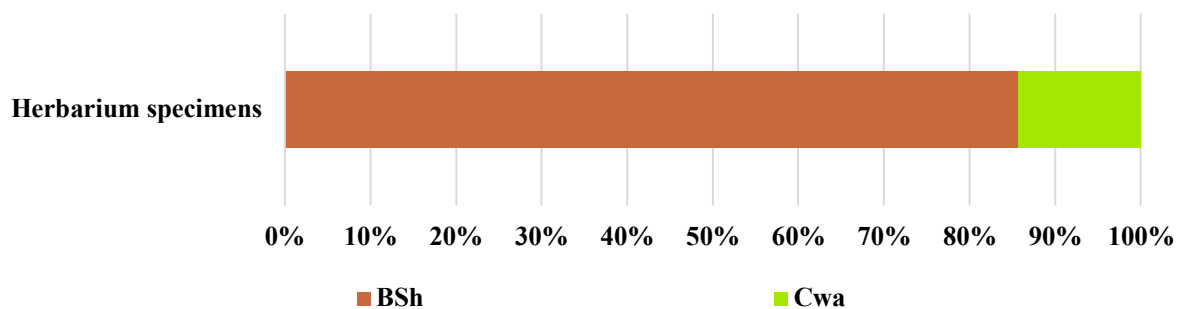
Köppen profile of *Ottelia fischeri*



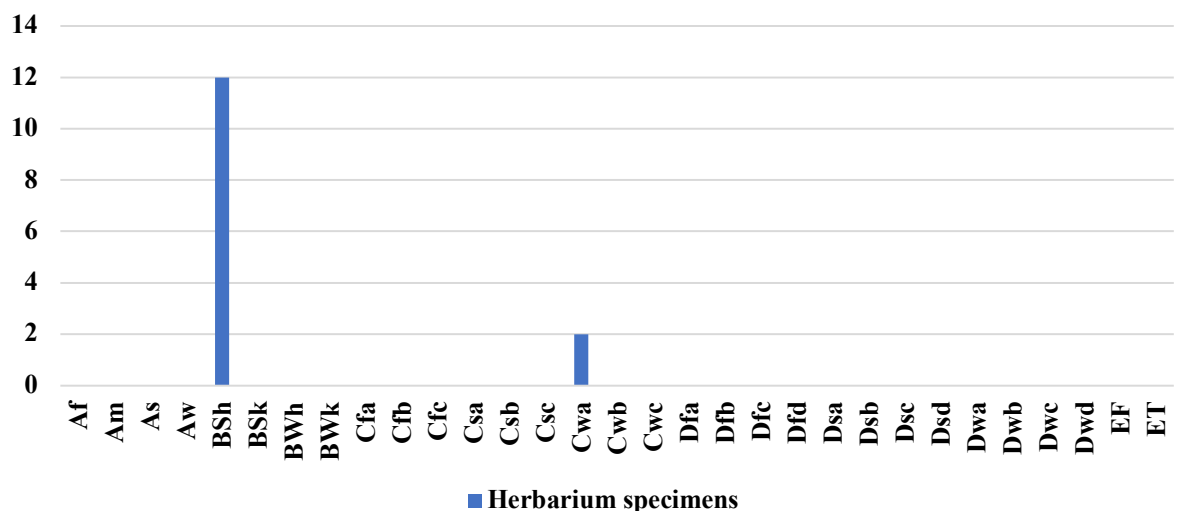
5.2.3.2.9. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia kunenensis* (Gürke 1895) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 14).



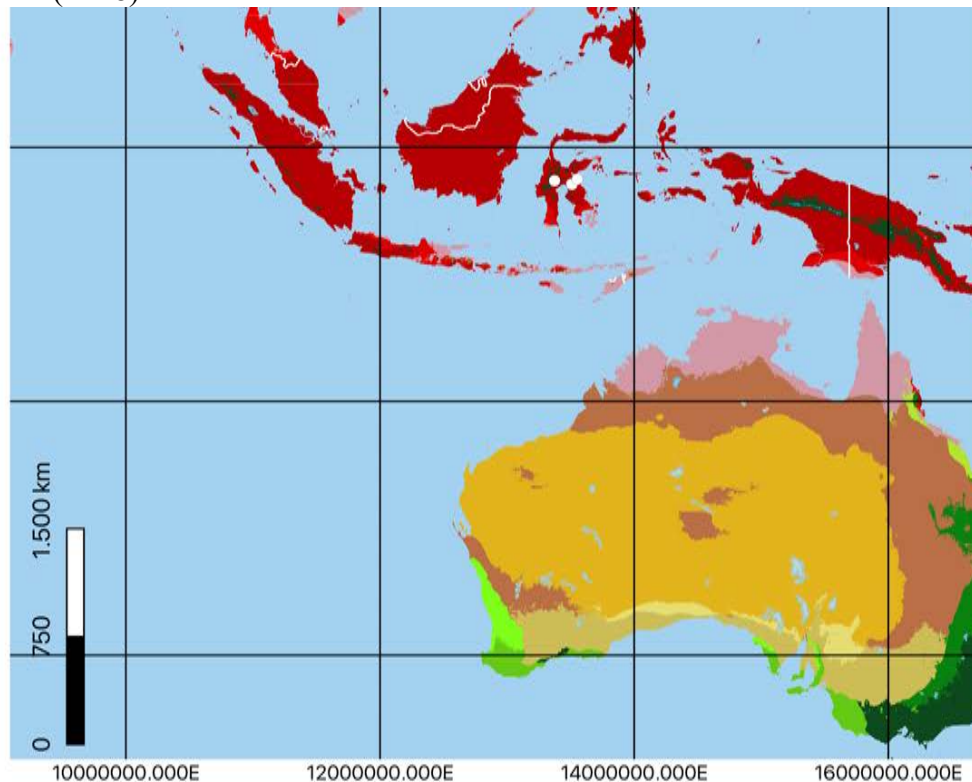
Köppen profile of *Ottelia kunenensis*



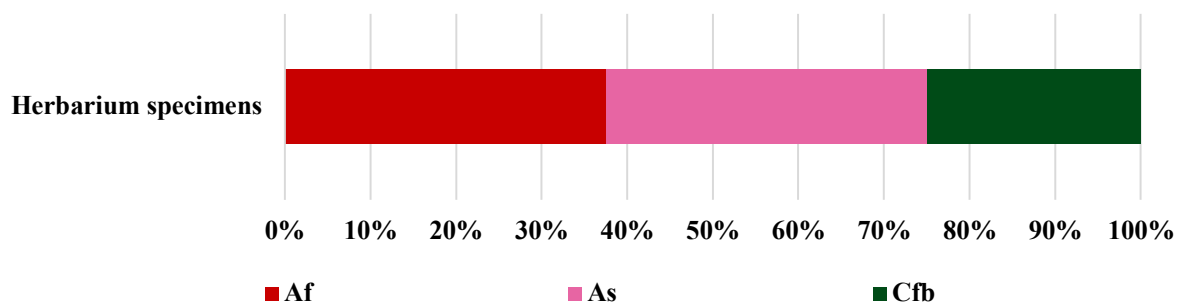
Köppen profile of *Ottelia kunenensis*



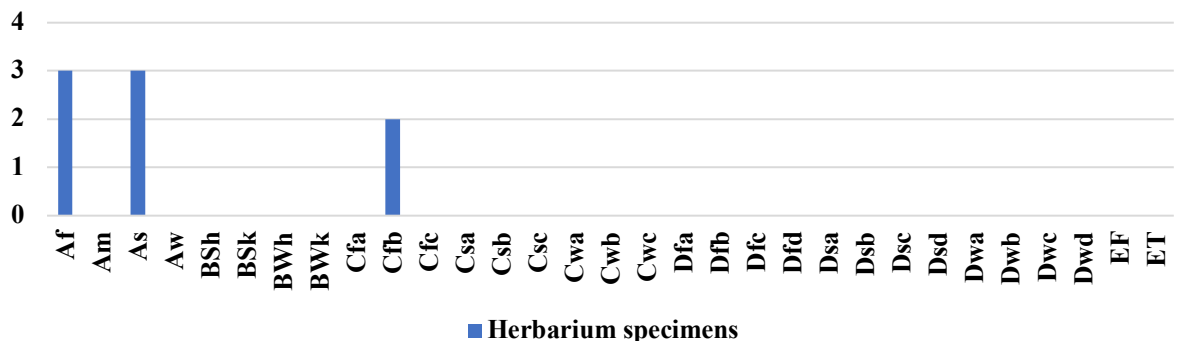
5.2.3.2.10. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia mesenterium* (Hallier f. 1915) Hartog 1957; herbarium specimens excluding duplicate occurrences (n = 8).



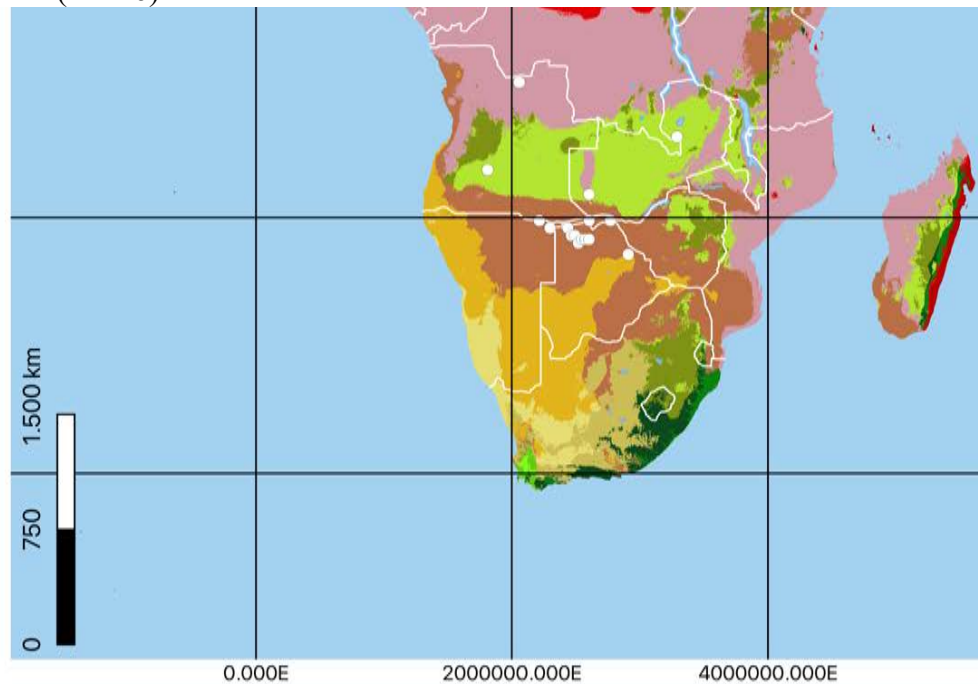
Köppen profile of *Ottelia mesenterium*



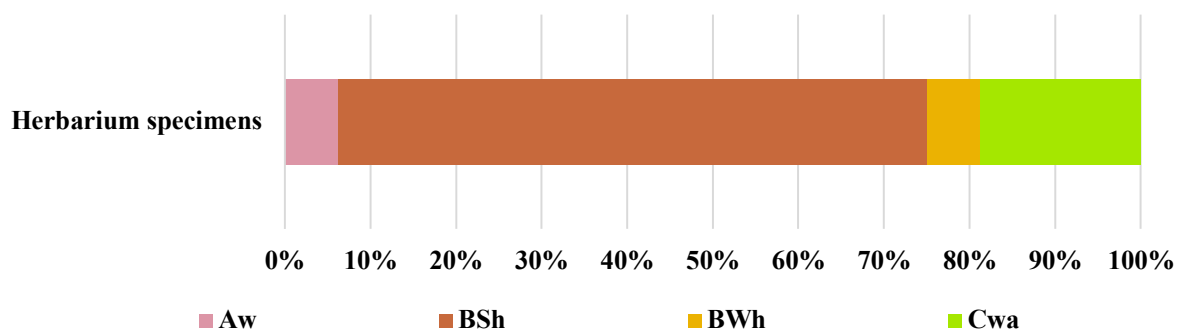
Köppen profile of *Ottelia mesenterium*



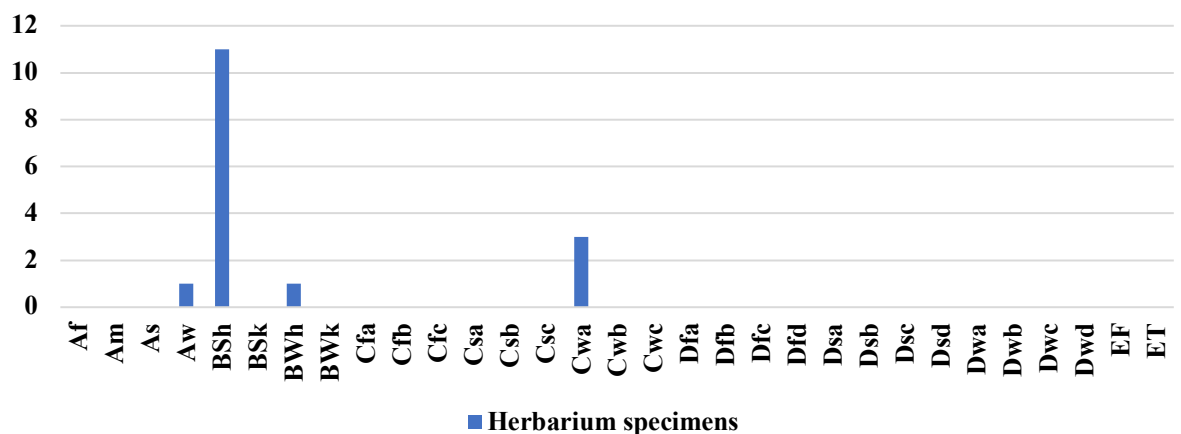
5.2.3.2.11. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia muricata* (C.H.Wright 1898) Dandy 1934; herbarium specimens excluding duplicate occurrences (n = 16).



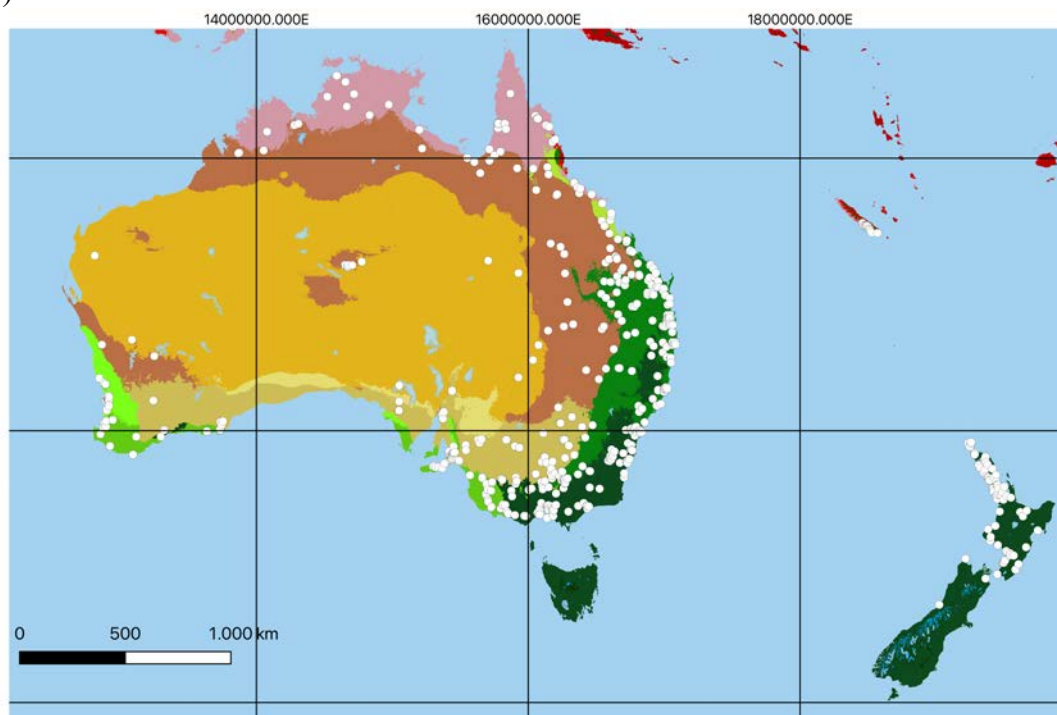
Köppen profile of *Ottelia muricata*



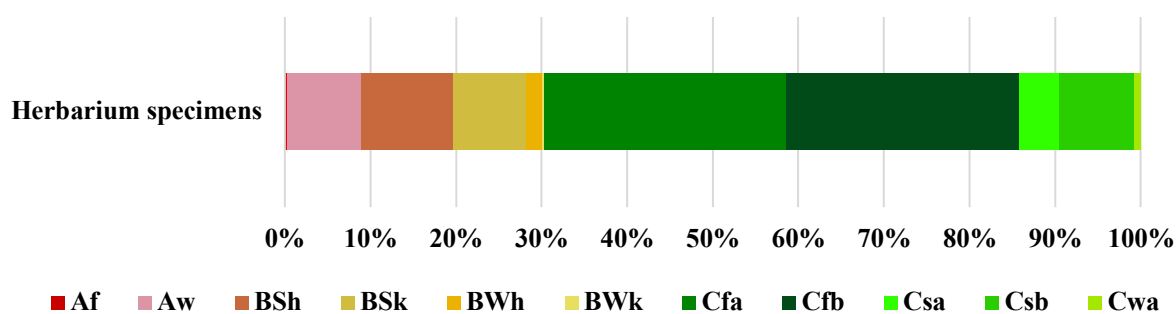
Köppen profile of *Ottelia muricata*



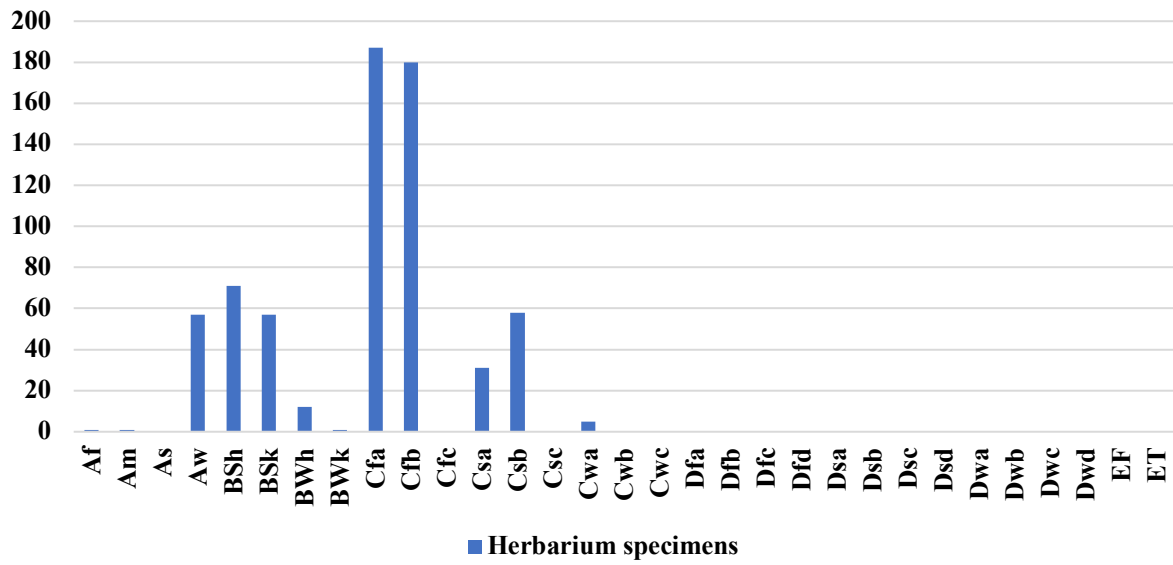
5.2.3.2.12. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia ovalifolia* (R.Br. 1810) Rich. 1814; herbarium specimens excluding duplicate occurrences (n = 661).



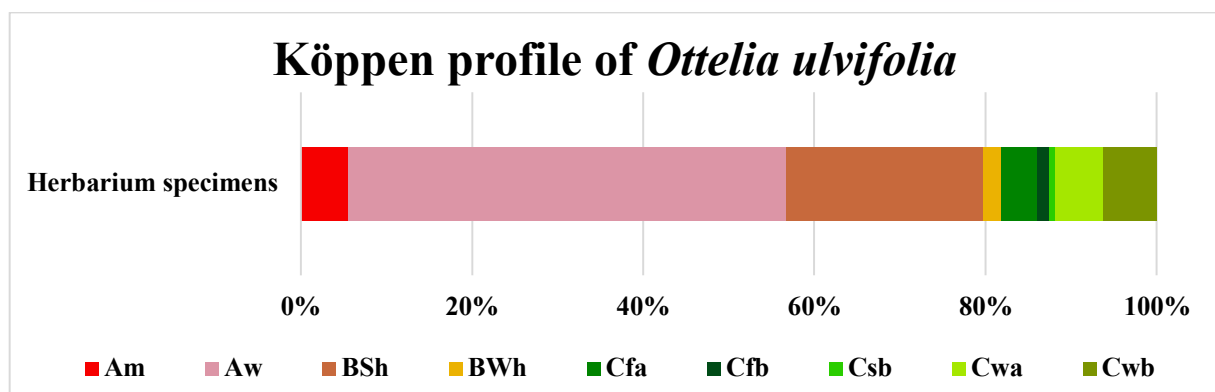
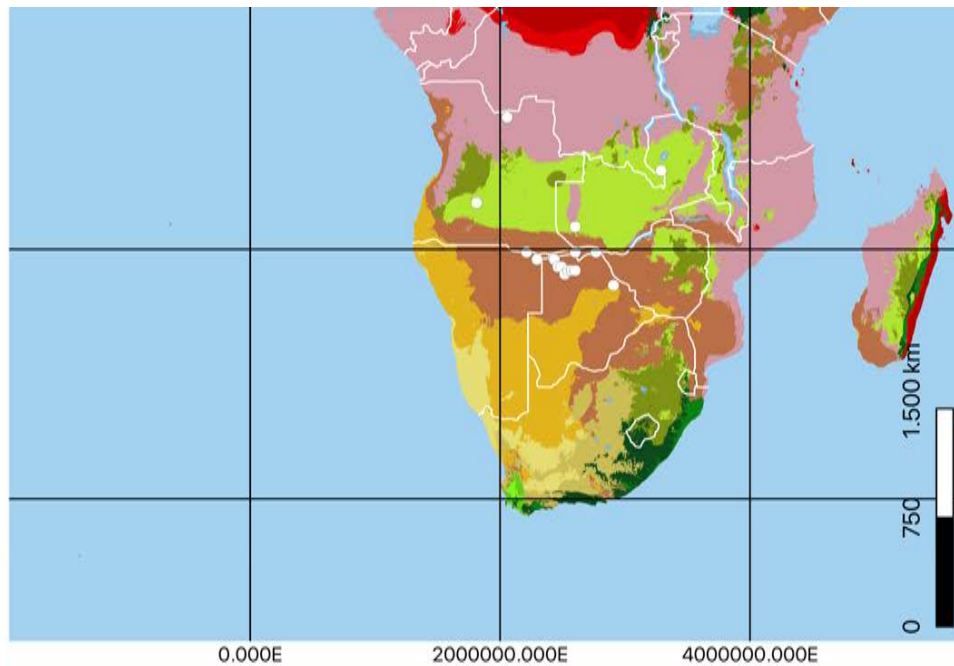
Köppen profile of *Ottelia ovalifolia*



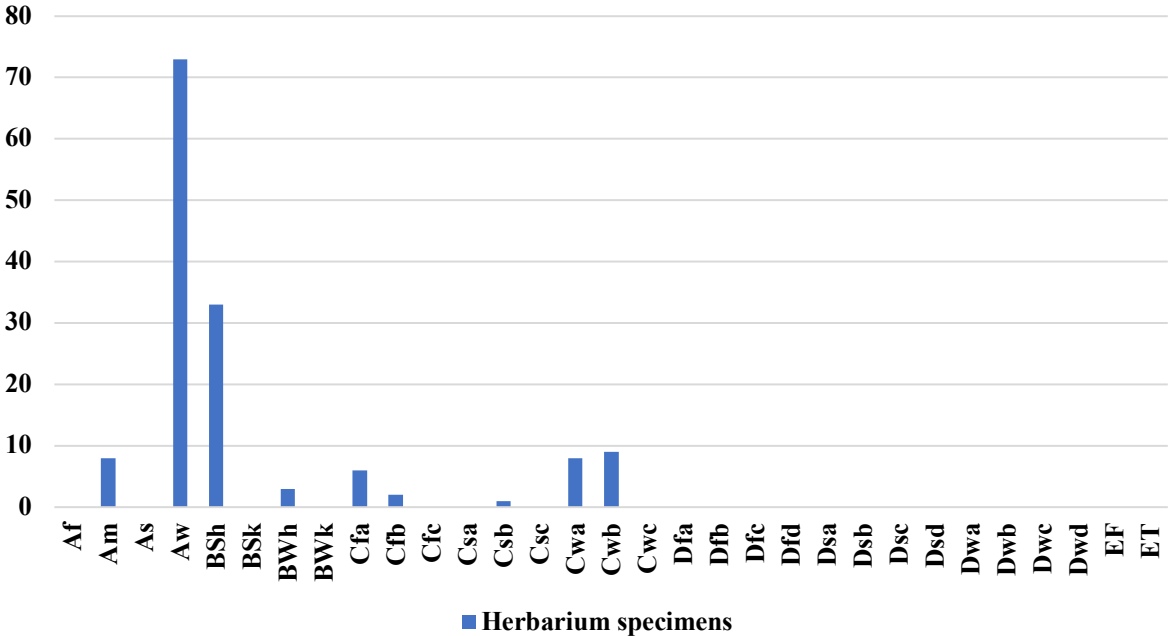
Köppen profile of *Ottelia ovalifolia*



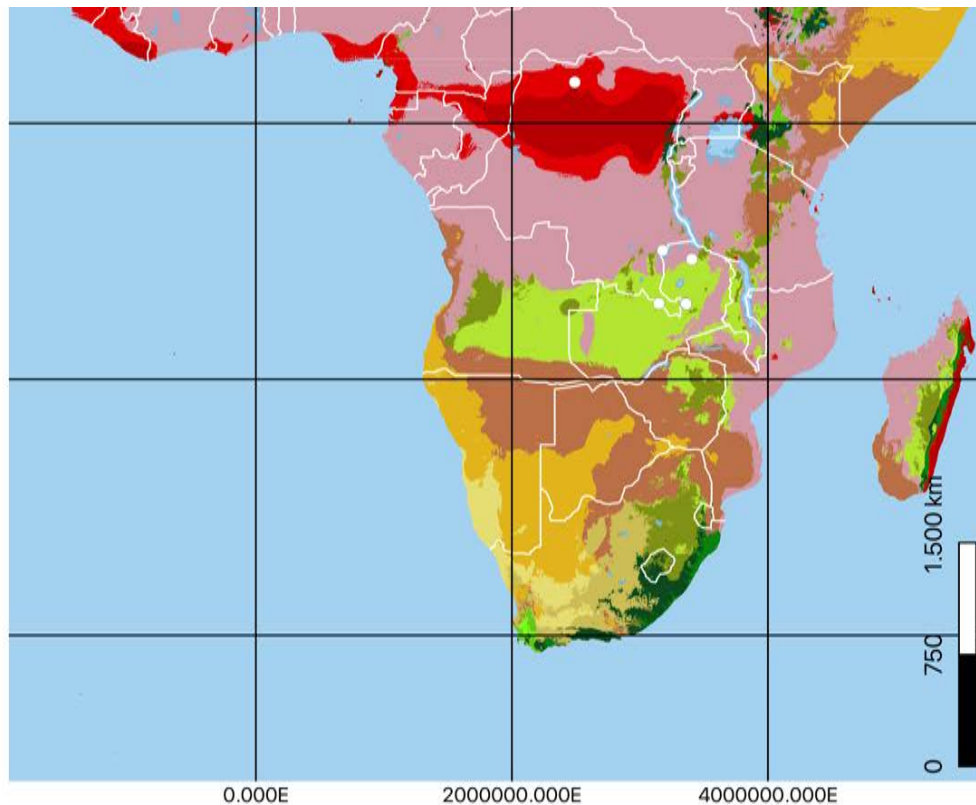
5.2.3.2.13. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia ulvifolia* (Planch. 1849) Walp. 1852; herbarium specimens excluding duplicate occurrences (n = 143).



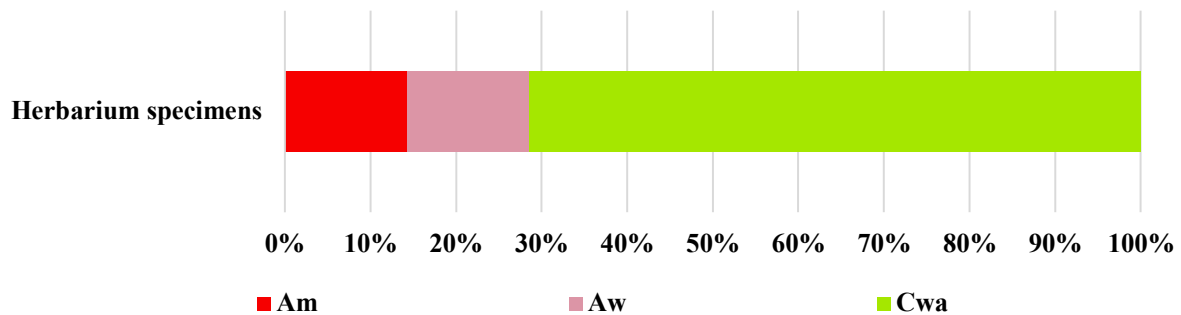
Köppen profile of *Ottelia ulvifolia*



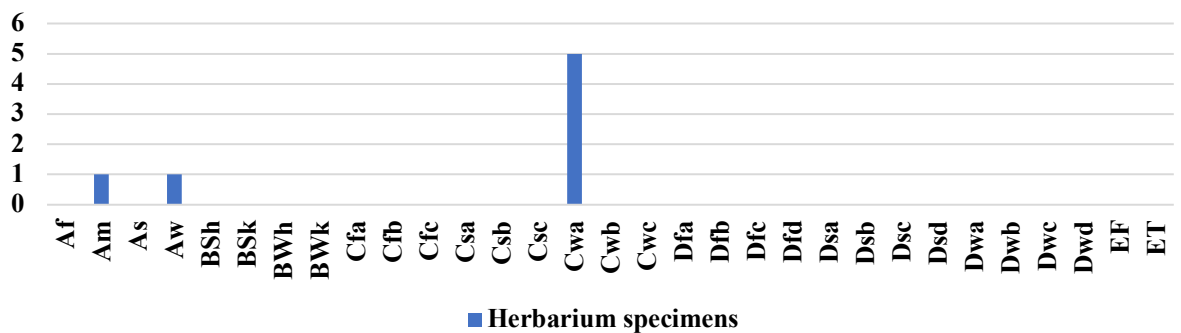
5.2.3.2.14. Köppen profile, distribution and climate map – GBIF occurrences of *Ottelia verdickii* Gürke ex De Wild., 1903; herbarium specimens excluding duplicate occurrences (n = 7).

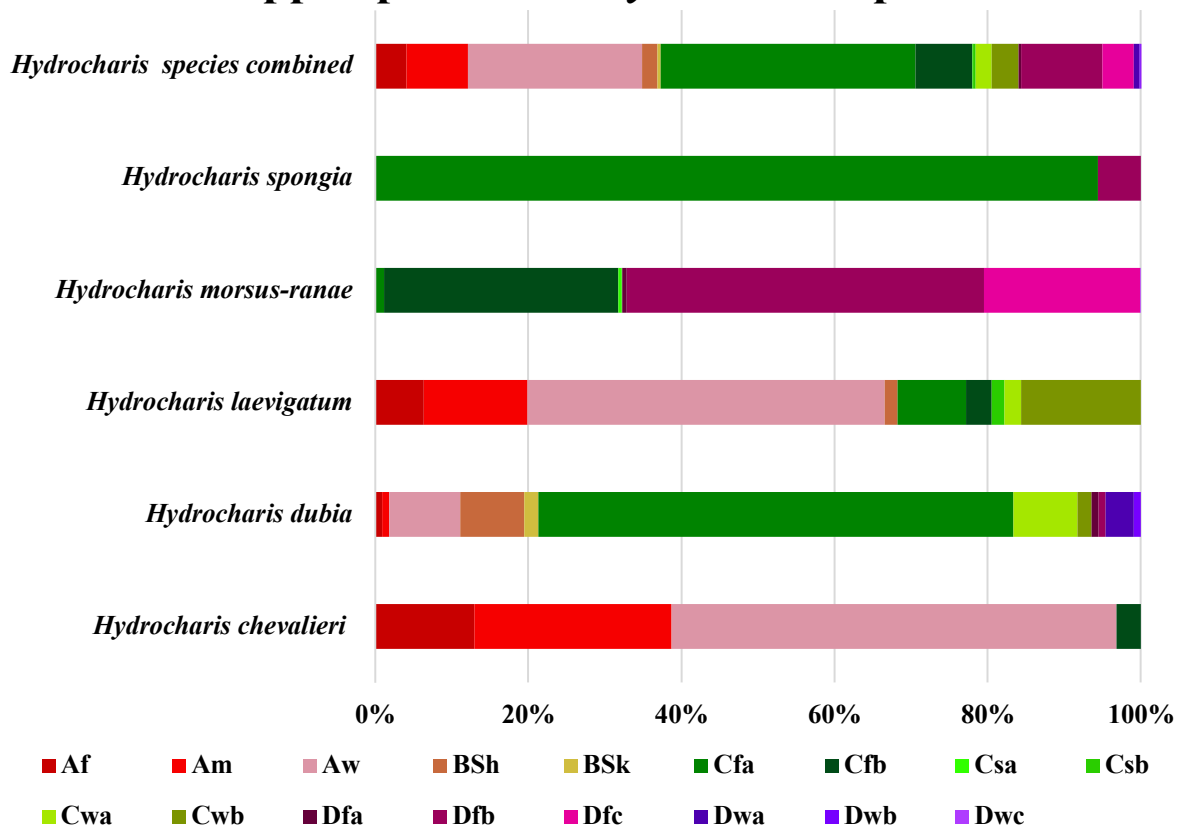


Köppen profile of *Ottelia verdickii*

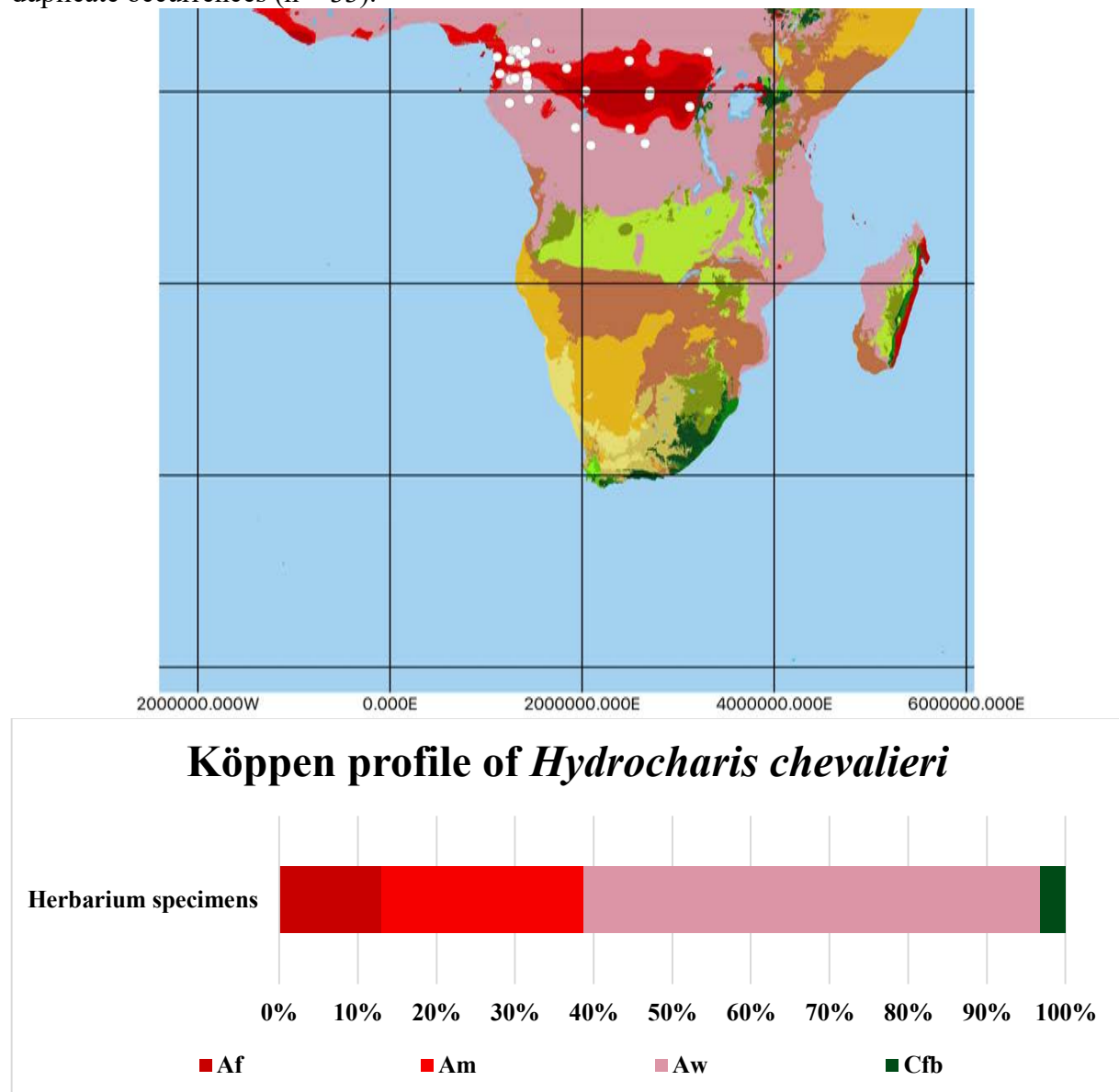


Köppen profile of *Ottelia verdickii*

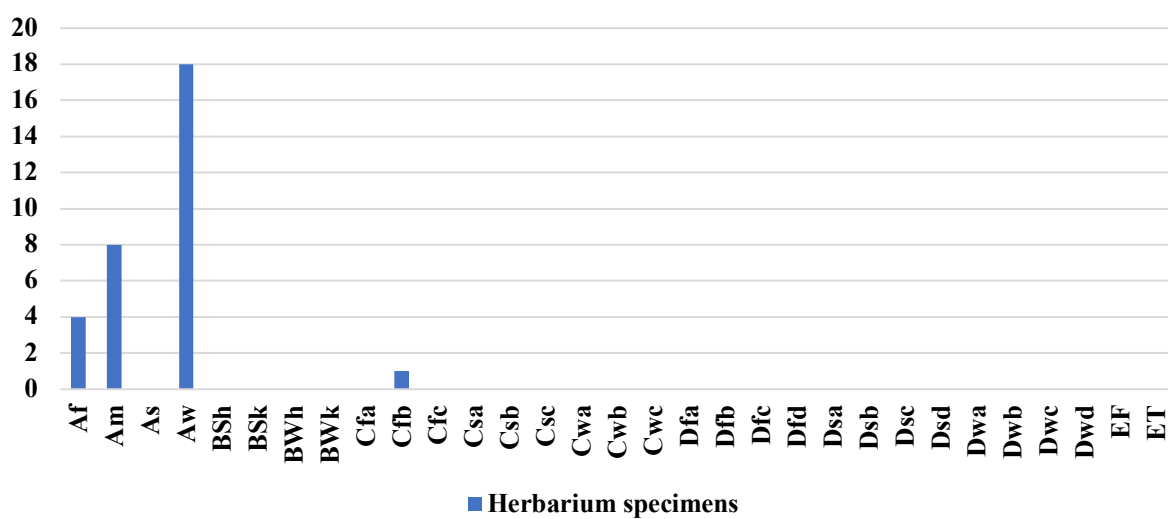




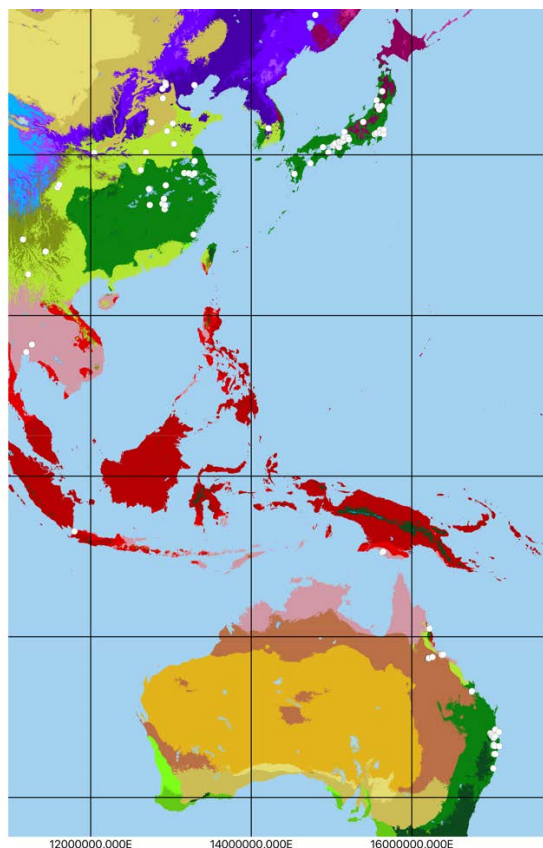
5.3.1.1.1. Köppen profile, distribution and climate map– GBIF occurrences of *Hydrocharis chevalieri* (De Wild. 1922) Dandy 1932; herbarium specimens excluding duplicate occurrences (n = 33).



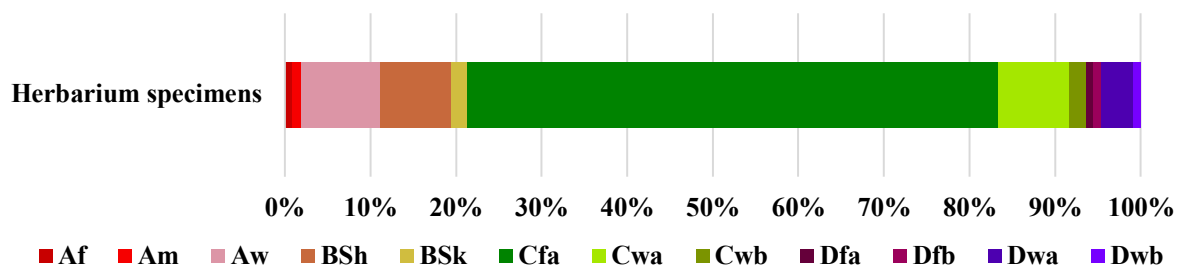
Köppen profile of *Hydrocharis chevalieri*



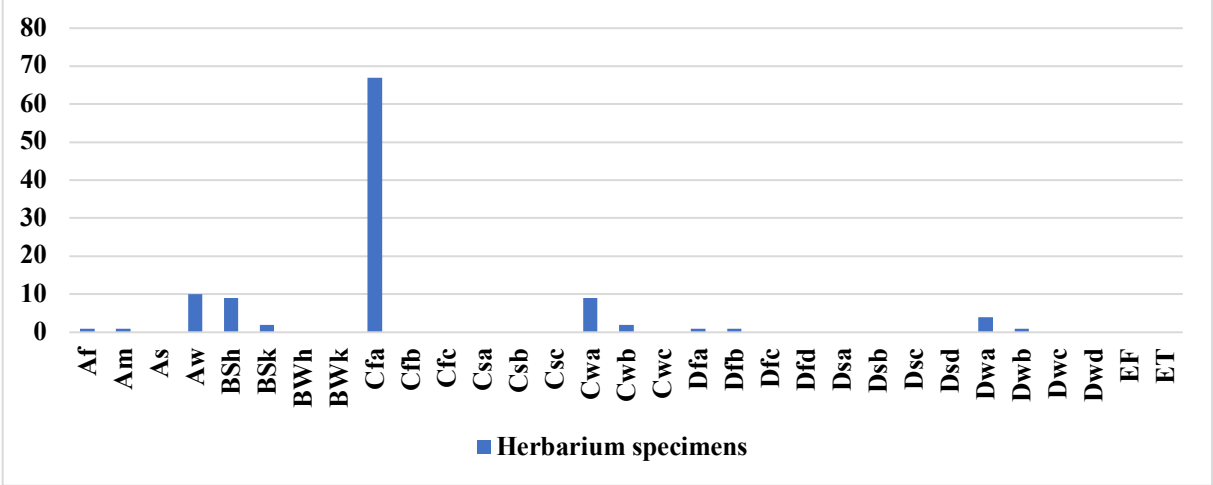
5.3.1.1.2. Köppen profile, distribution and climate map– GBIF occurrences of *Hydrocharis dubia* (Blume 1827) Backer 1925; herbarium specimens excluding duplicate occurrences (n = 108).



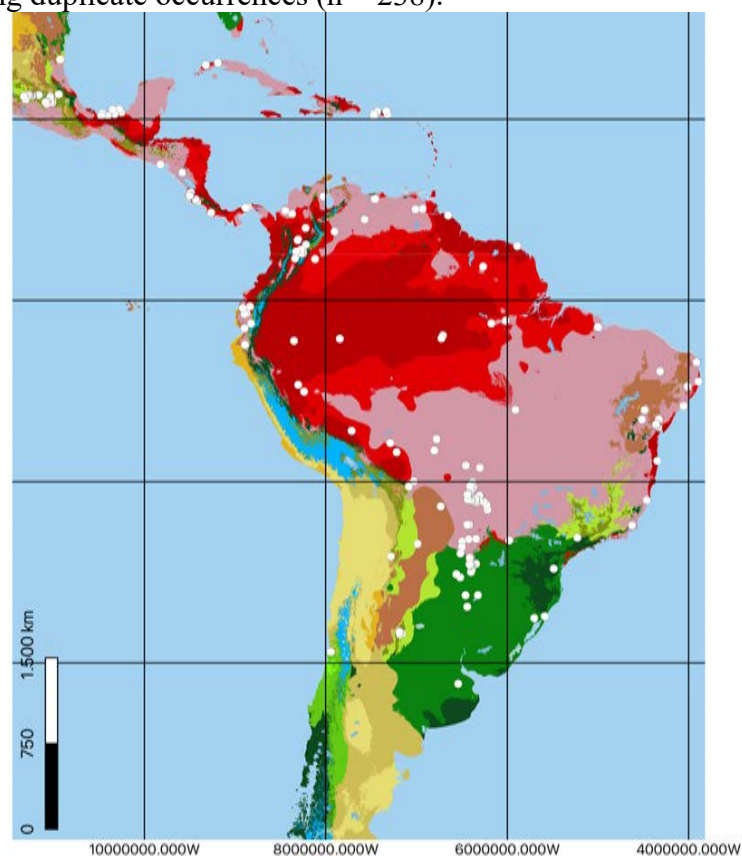
Köppen profile of *Hydrocharis dubia*



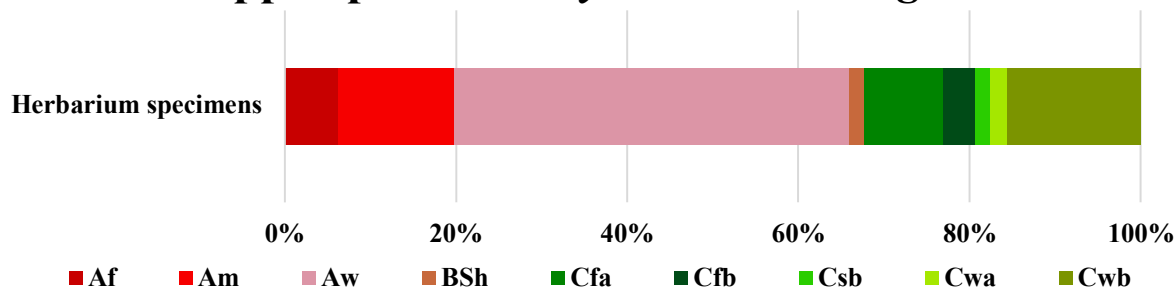
Köppen profile of *Hydrocharis dubia*



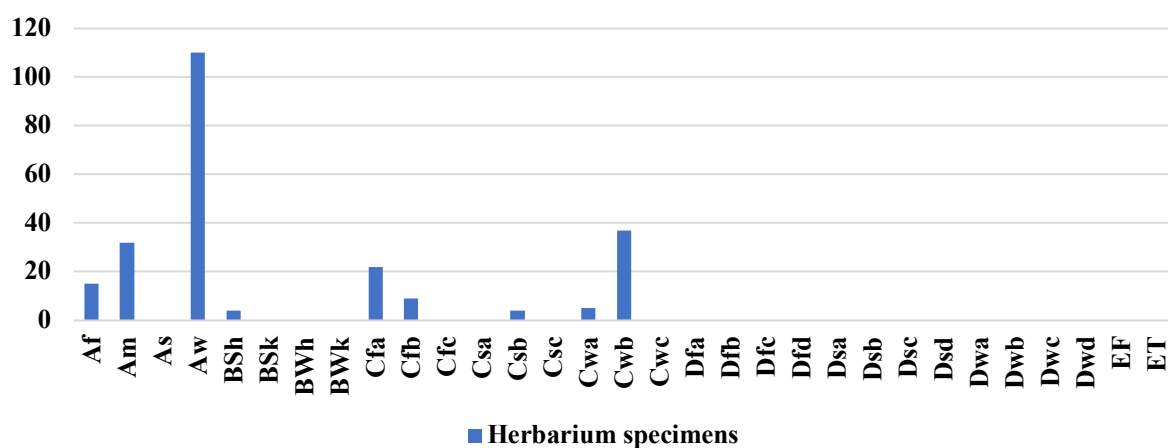
5.3.1.1.3. Köppen profile, distribution and climate map– GBIF occurrences of *Hydrocharis laevigata* (Humb. & Bonpl. ex Willd. 1810) Byng & Christenh. 2018; herbarium specimens excluding duplicate occurrences (n = 238).



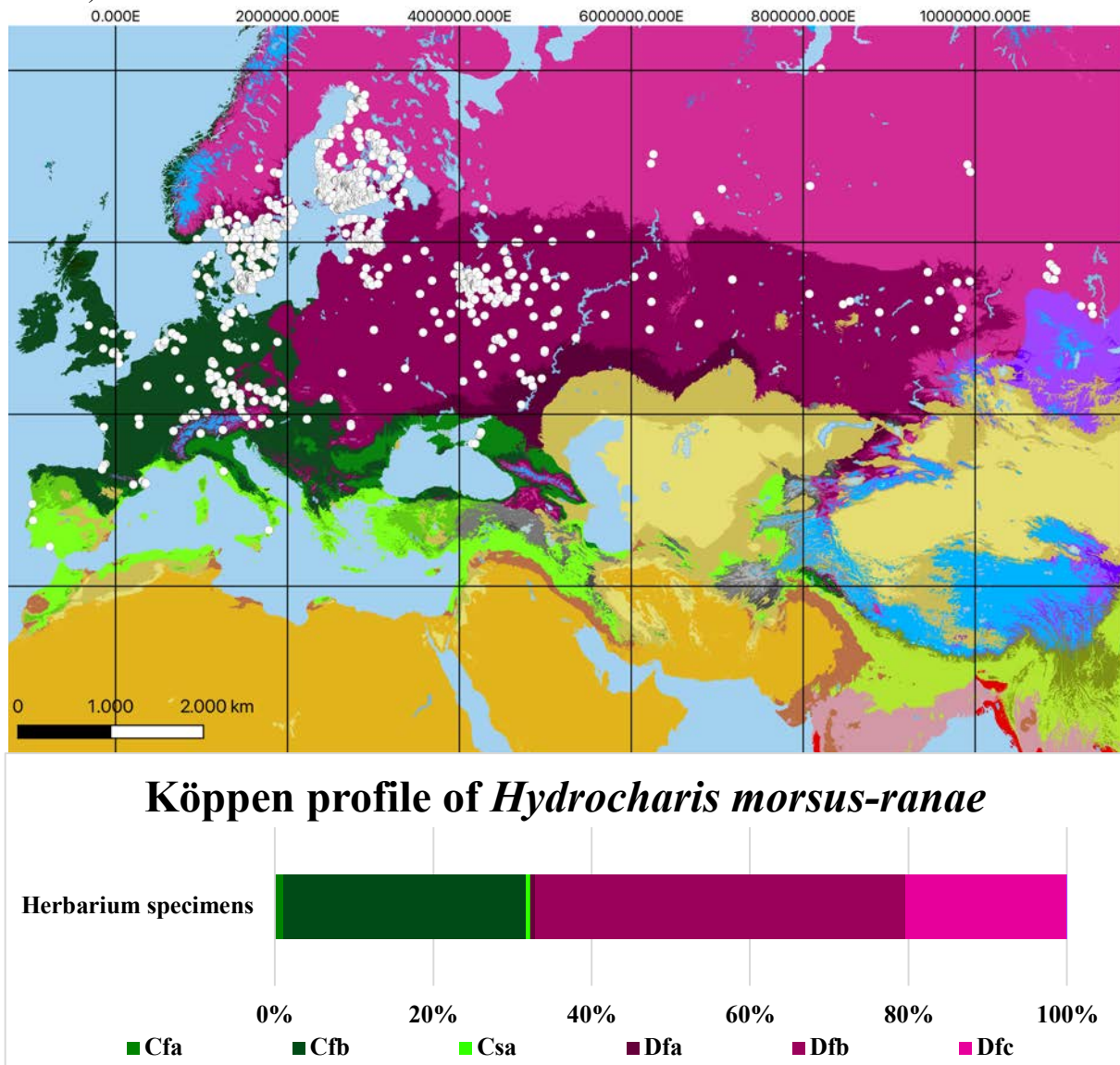
Köppen profile of *Hydrocharis laevigatum*



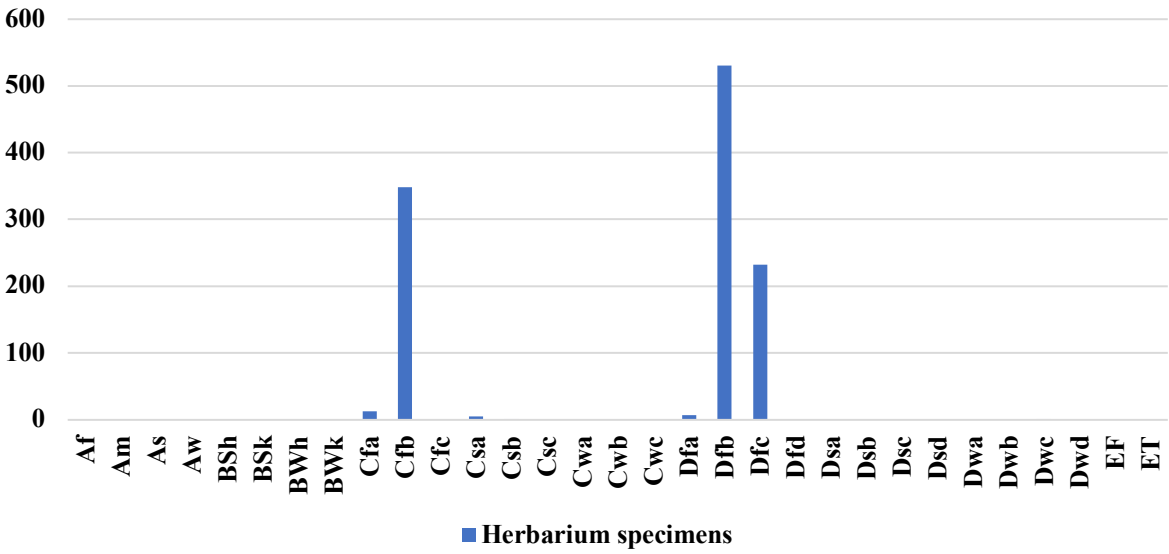
Köppen profile of *Hydrocharis laevigatum*



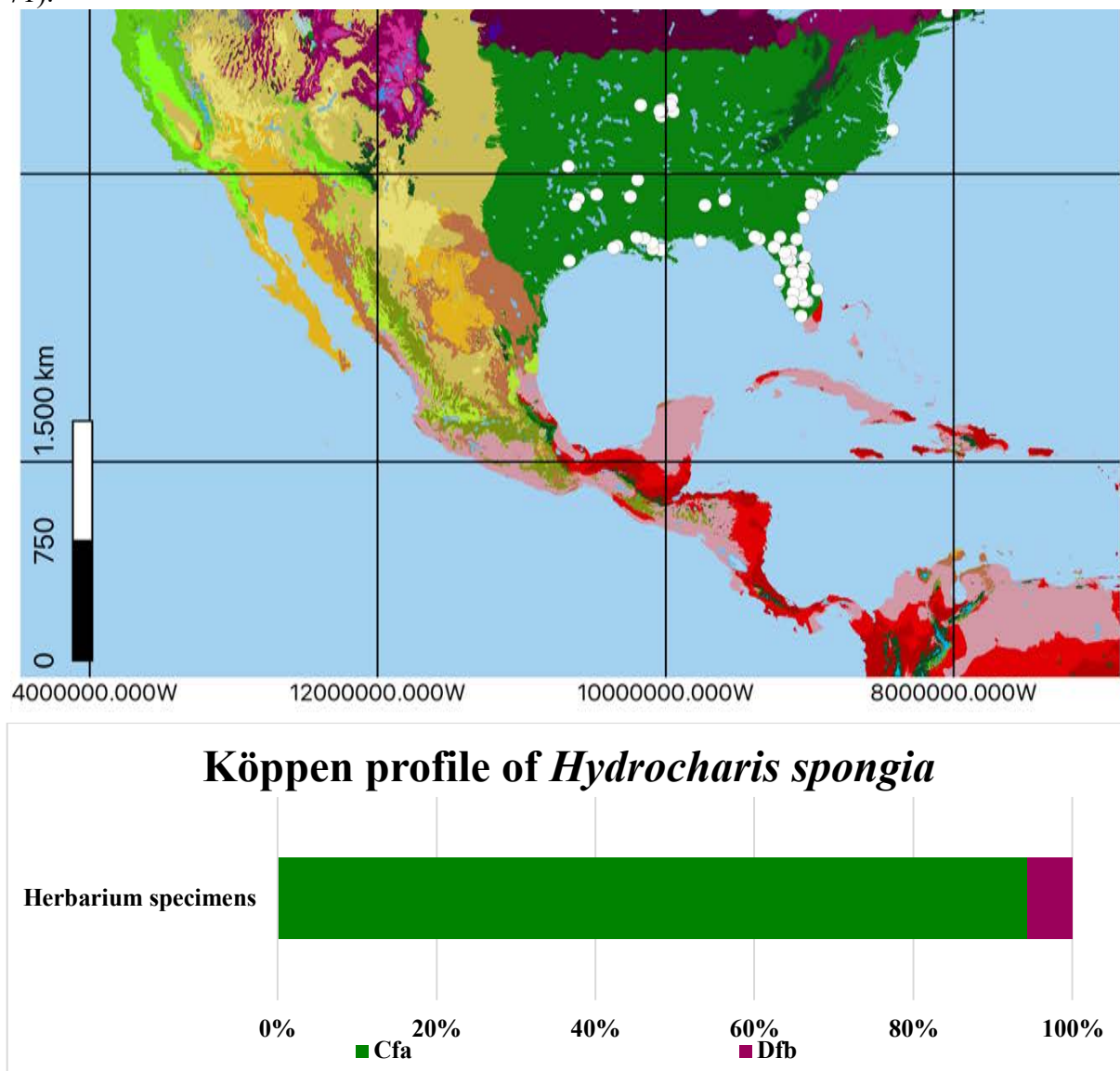
5.3.1.1.4. Köppen profile, distribution and climate map – GBIF occurrences of *Hydrocharis morsus-ranae* L. 1753; herbarium specimens excluding duplicate occurrences (n = 1138).



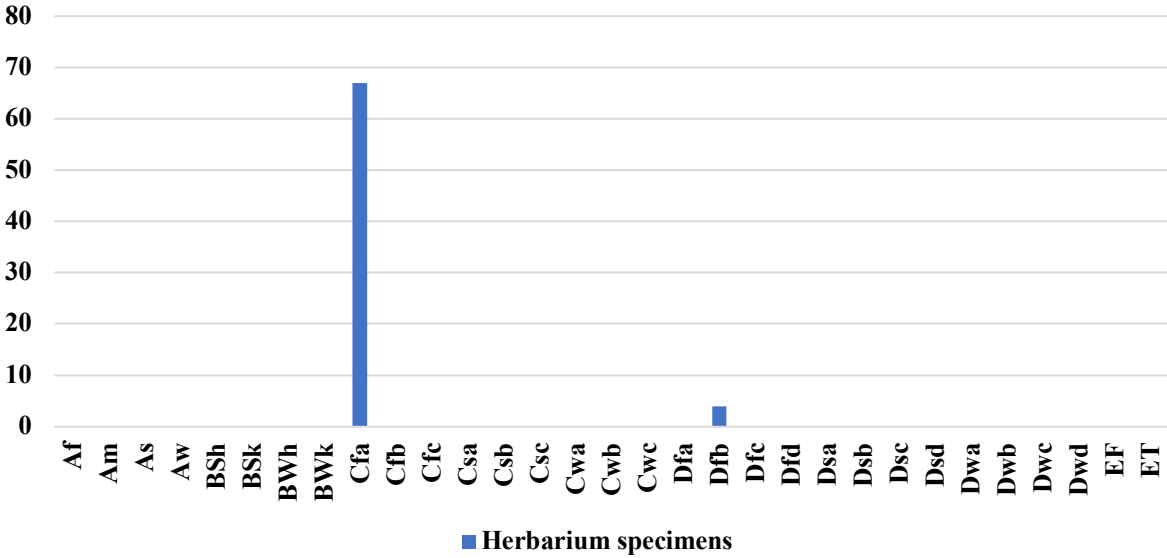
Köppen profile of *Hydrocharis morsus-ranae*



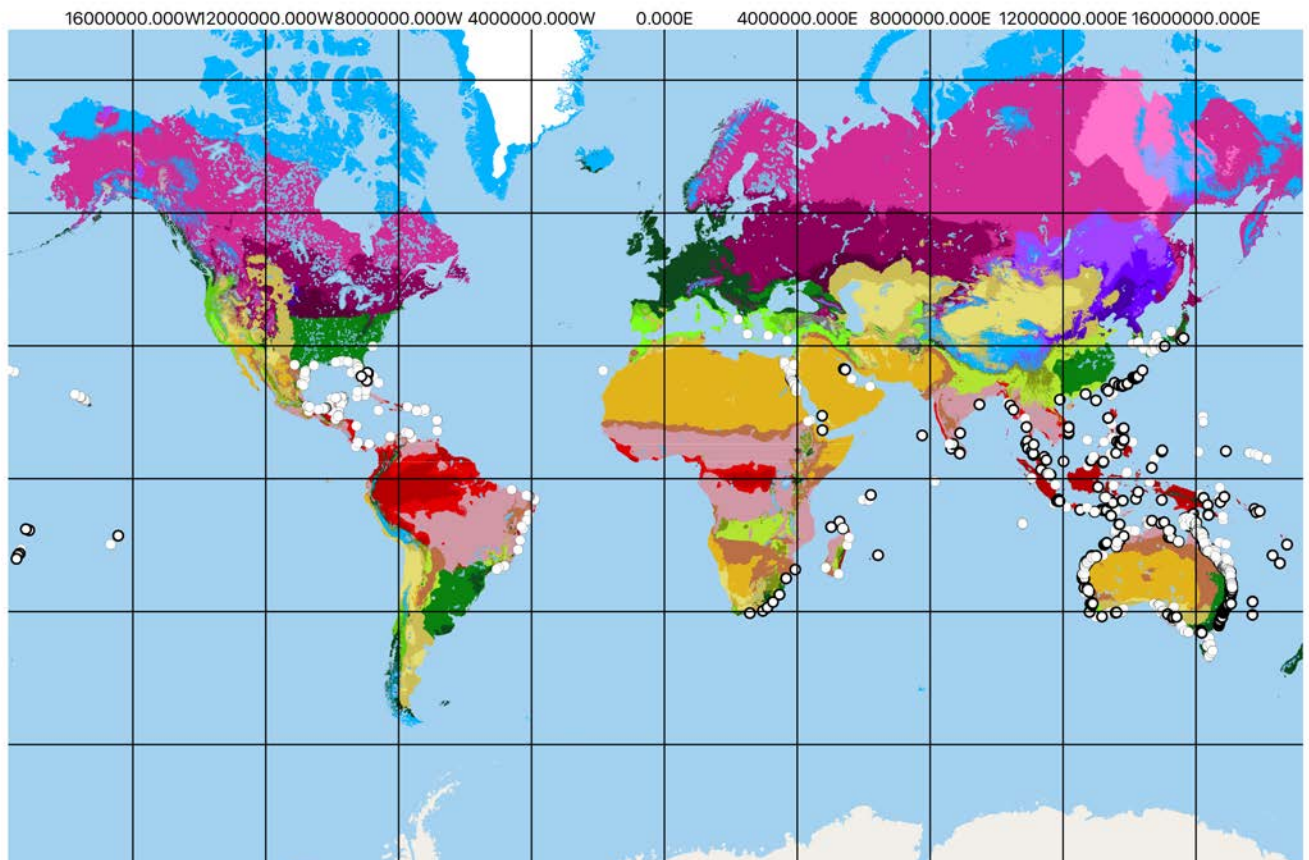
5.3.1.1.5. Köppen profile, distribution and climate map – GBIF occurrences of *Hydrocharis spongia* Bosc, 1807; herbarium specimens excluding duplicate occurrences (n = 71).



Köppen profile of *Hydrocharis spongia*

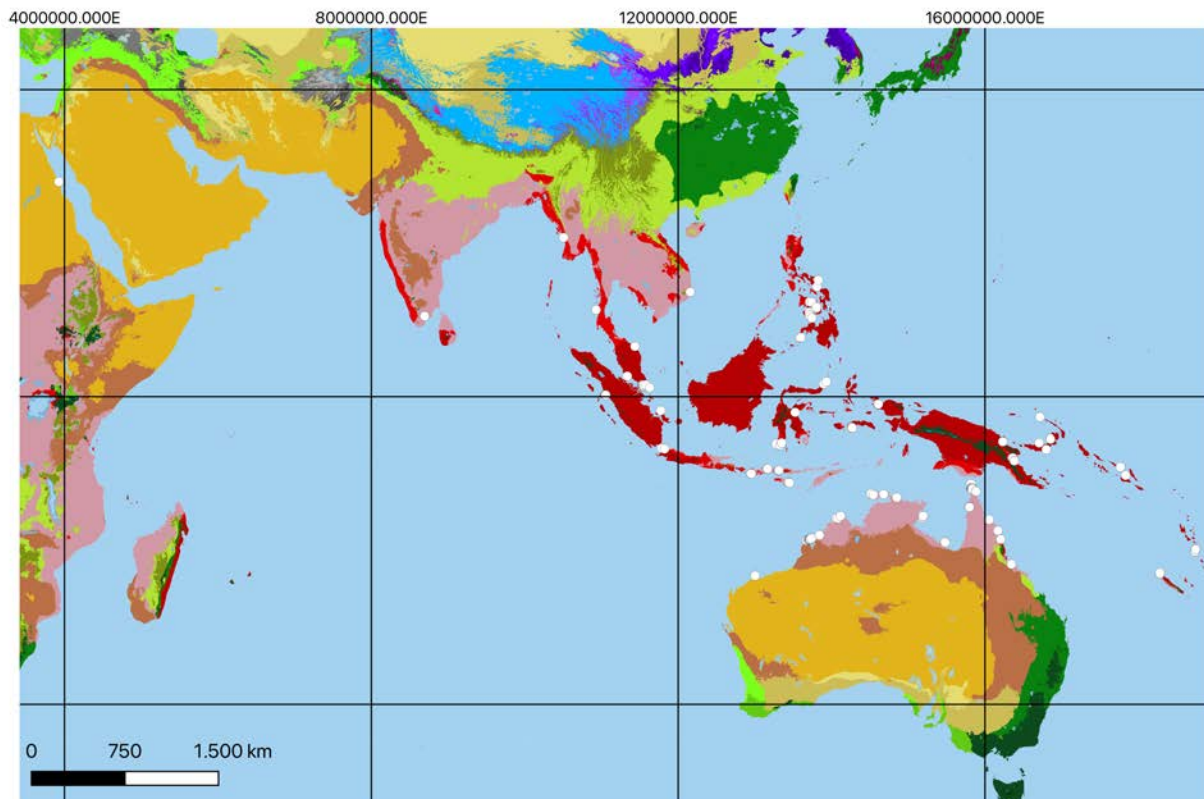


5.3.2. Second diverging genus within Clade A of Hydrocharitaceae cf. Chen et. al (2012), comprising *Enhalus* Rich. 1811, *Halophia* Thouars 1806, and *Thalassia* Banks ex K.D.Koenig 1805

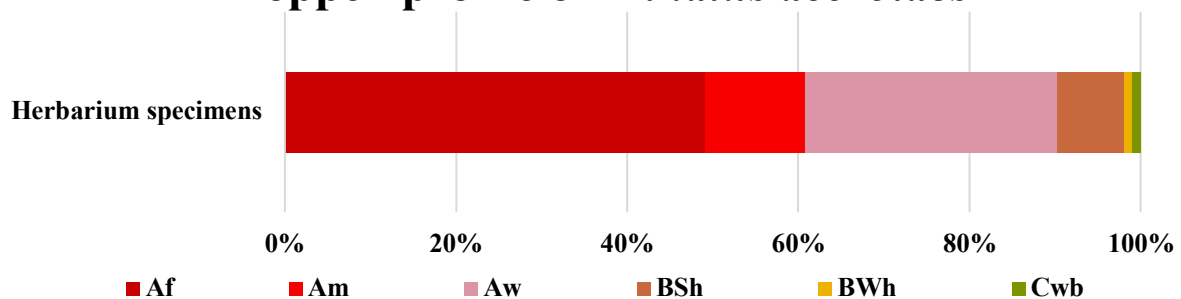


5.3.2.1. Genus *Enhalus* Rich. 1811.

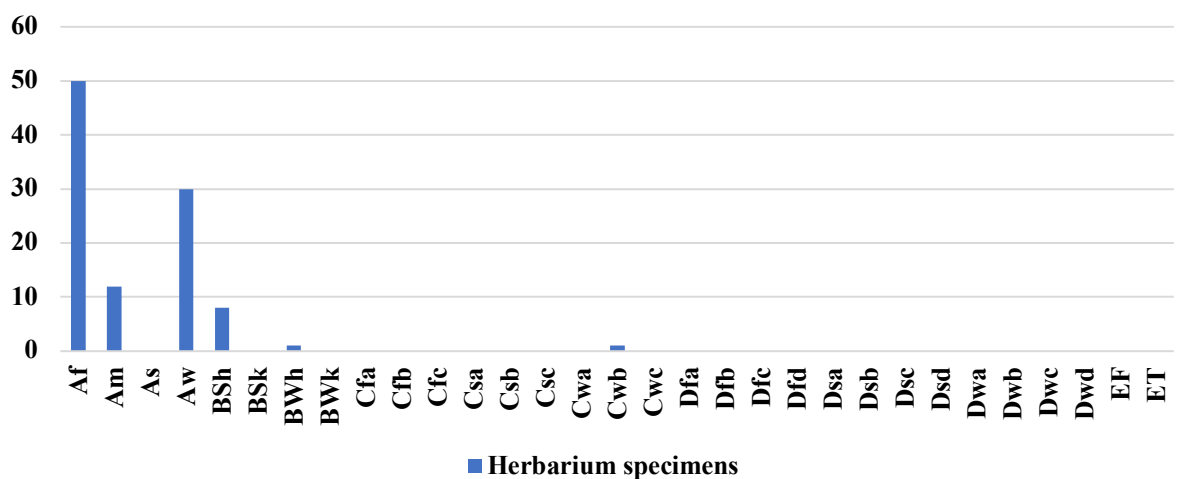
Köppen profile, distribution and climate map – GBIF occurrences of *Enhalus acoroides* (L.f. 1782) Royle 1839; herbarium specimens excluding duplicate occurrences (n = 102).



Köppen profile of *Enhalus acoroides*

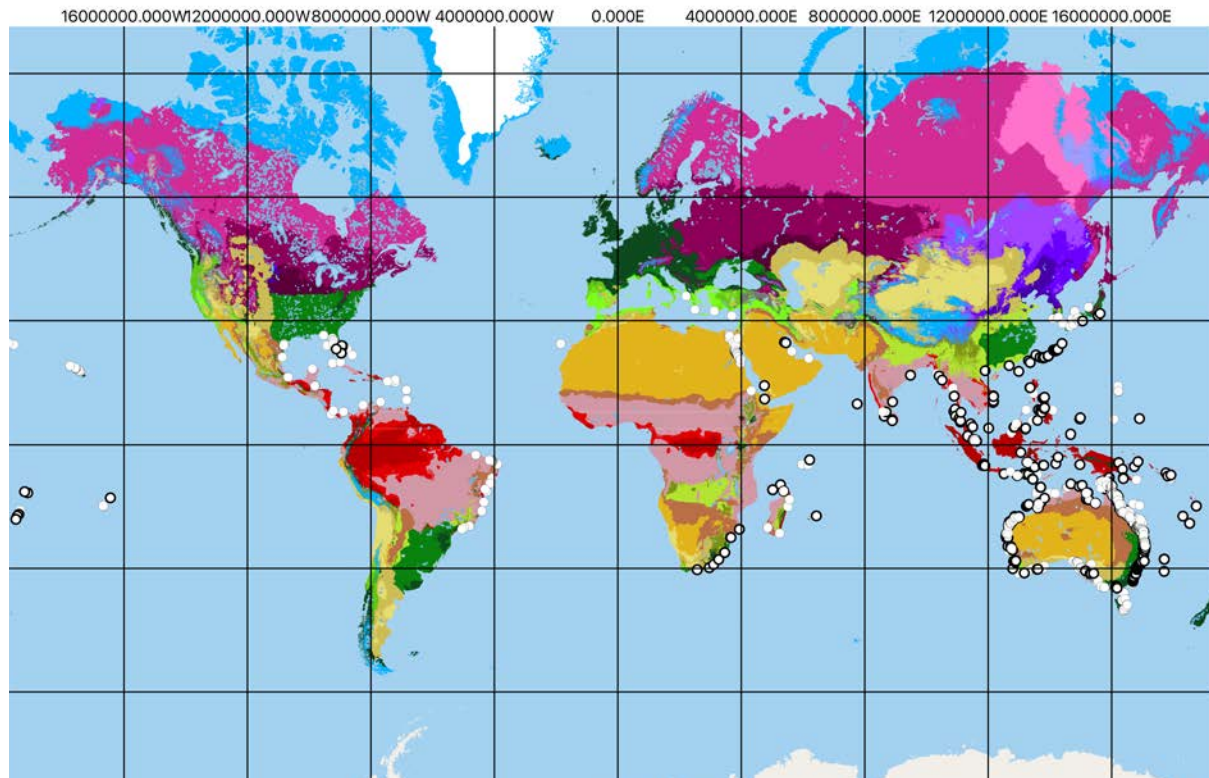


Köppen profile of *Enhalus acoroides*

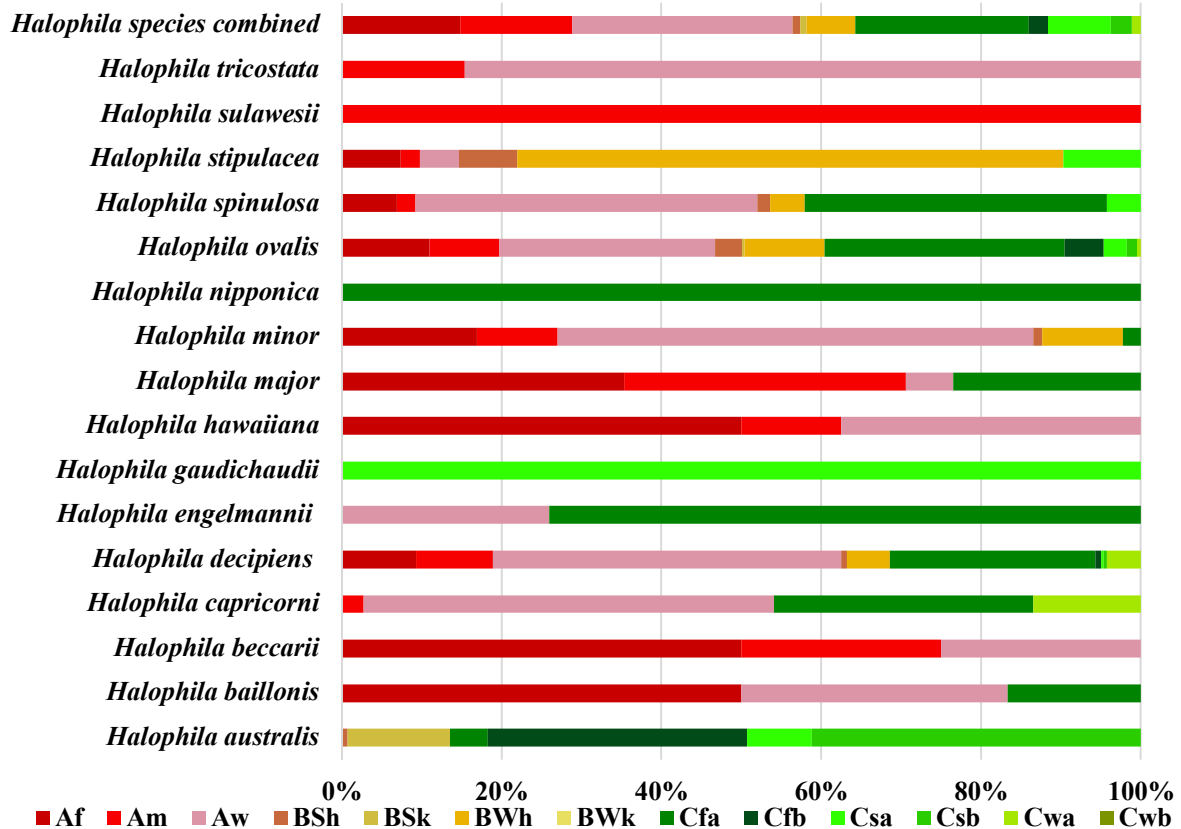


5.3.2.1. Genus *Halophila* Thouars 1806.

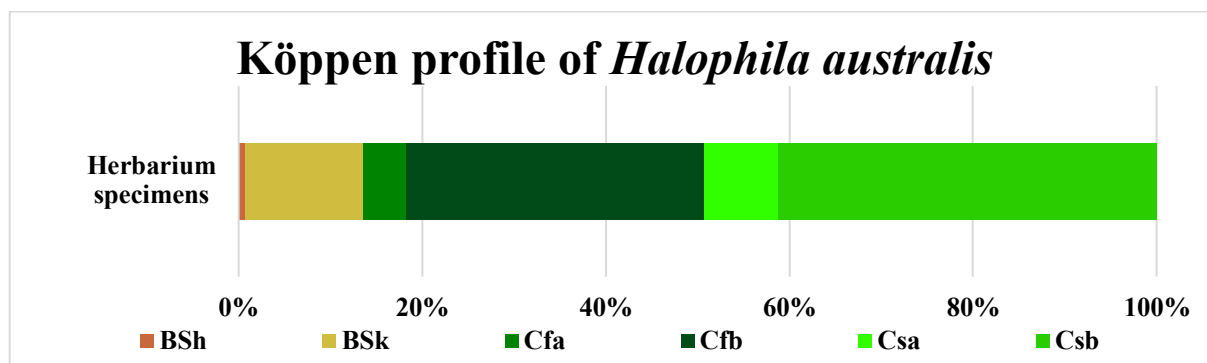
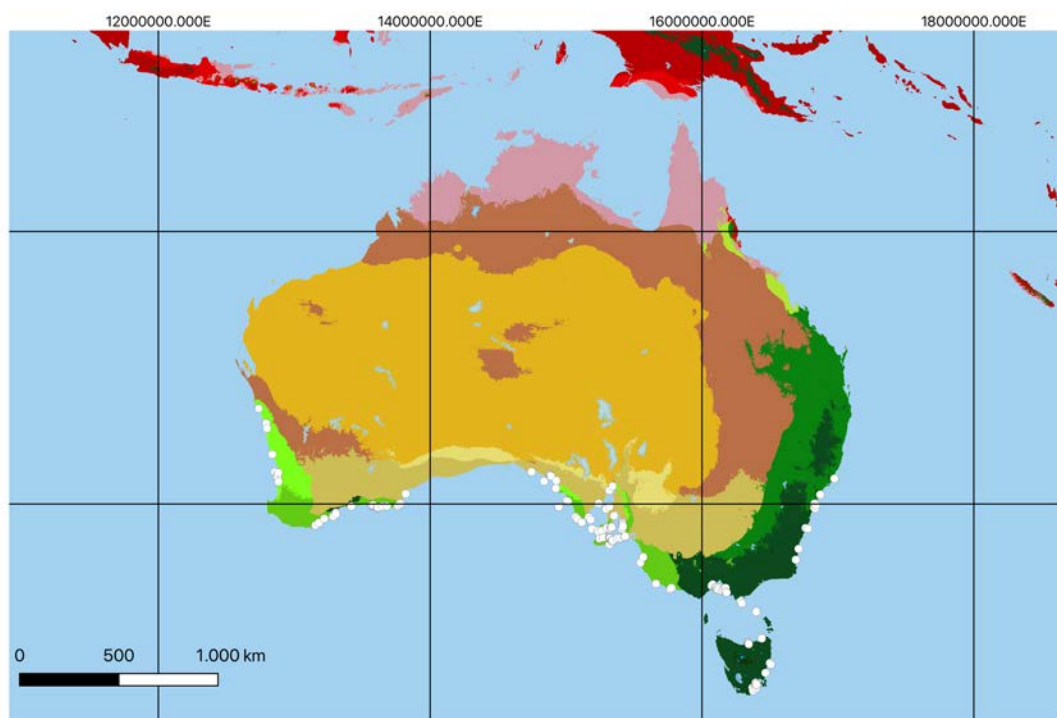
Distribution and Köppen profiles of genus *Halophila* incl. *H. australis*, *H. baillonis*, *H. beccarii*, *H. capricorni*, *H. decipiens*, *H. engelmannii*, *H. gaudichaudii*, *H. hawaiiiana*, *H. major*, *H. minor*, *H. nipponica*, *H. ovalis*, *H. spinulosa*, *H. stipulacea*, *H. sulawesii*, and *H. tricosata* (n = 1767).



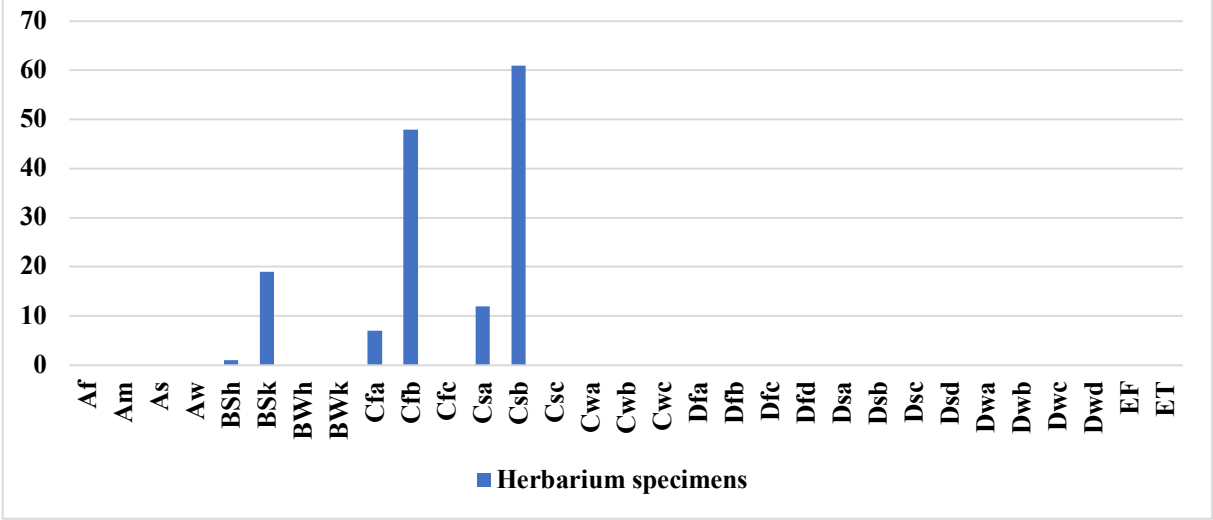
Köppen profiles of *Hydrocharis* species



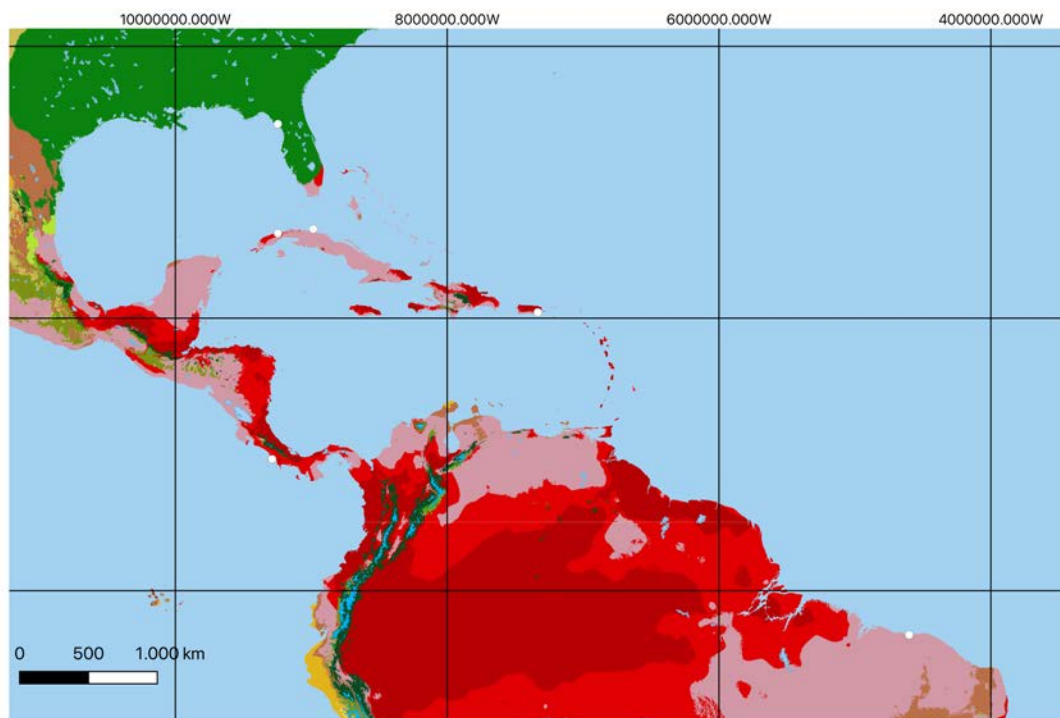
5.3.2.1.1. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila australis* Doty & B.C.Stone 1967; herbarium specimens excluding duplicate occurrences (n = 148).



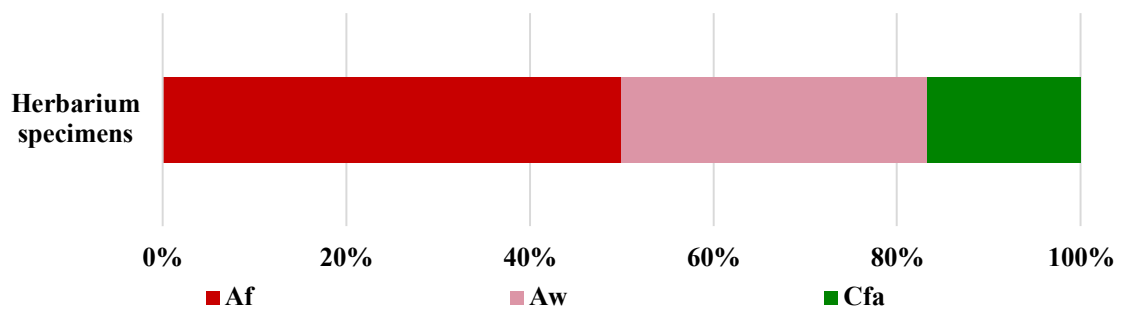
Köppen profile of *Halophila australis*



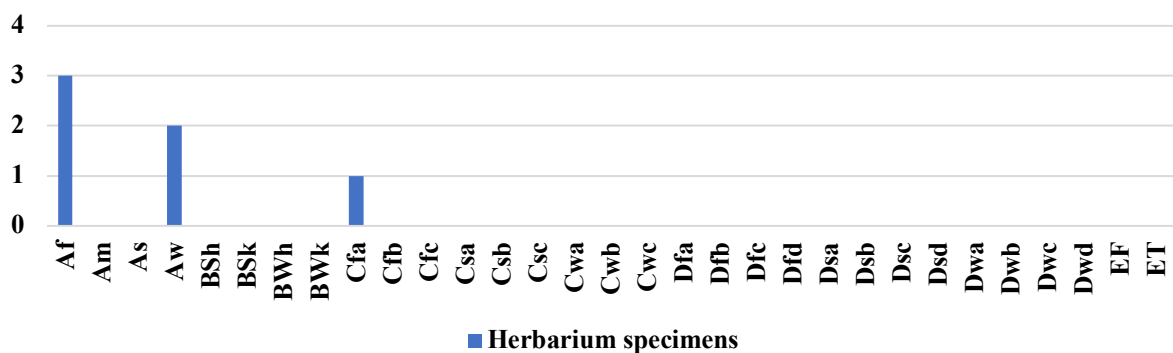
5.3.2.1.2. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila baillonis* Asch. ex Dickie 1874; herbarium specimens excluding duplicate occurrences (n = 6).



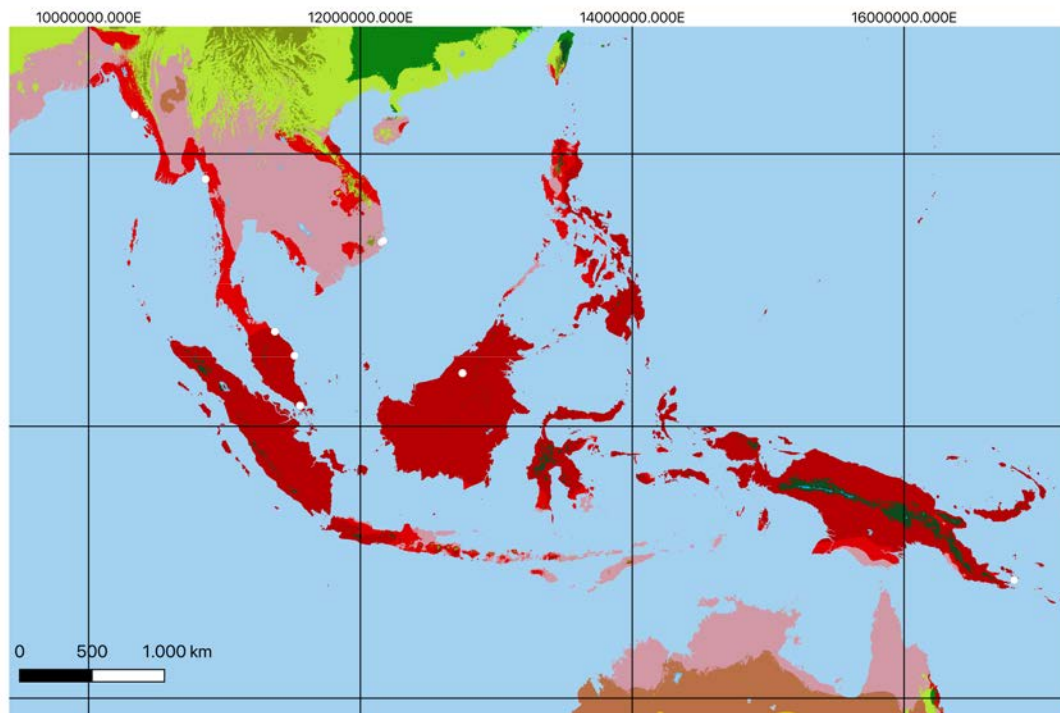
Köppen profile of *Halophila baillonis*



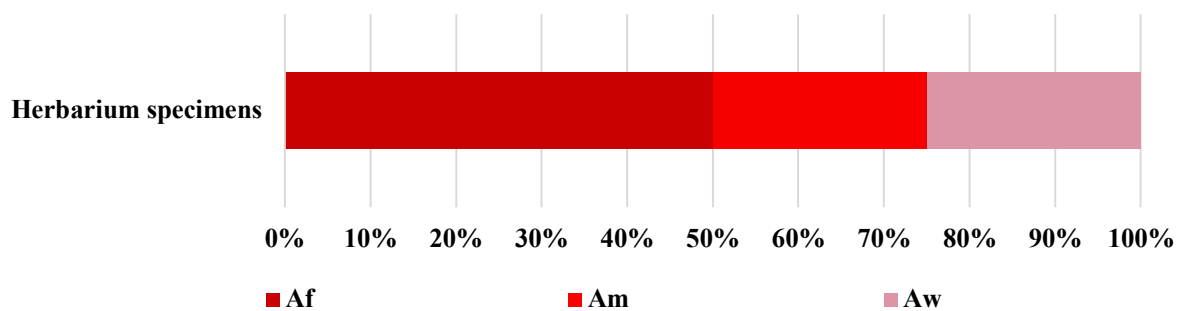
Köppen profile of *Halophila baillonis*



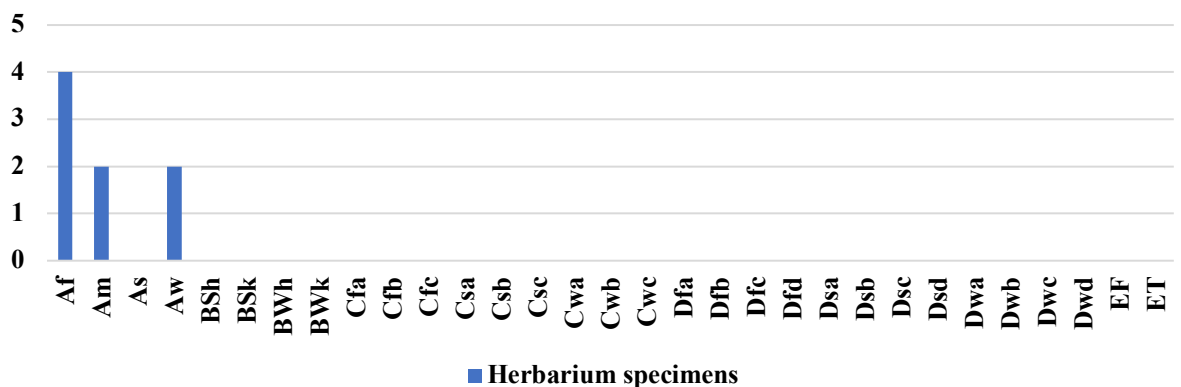
5.3.2.1.3. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila beccarii* Asch. 1874; herbarium specimens excluding duplicate occurrences (n = 8).



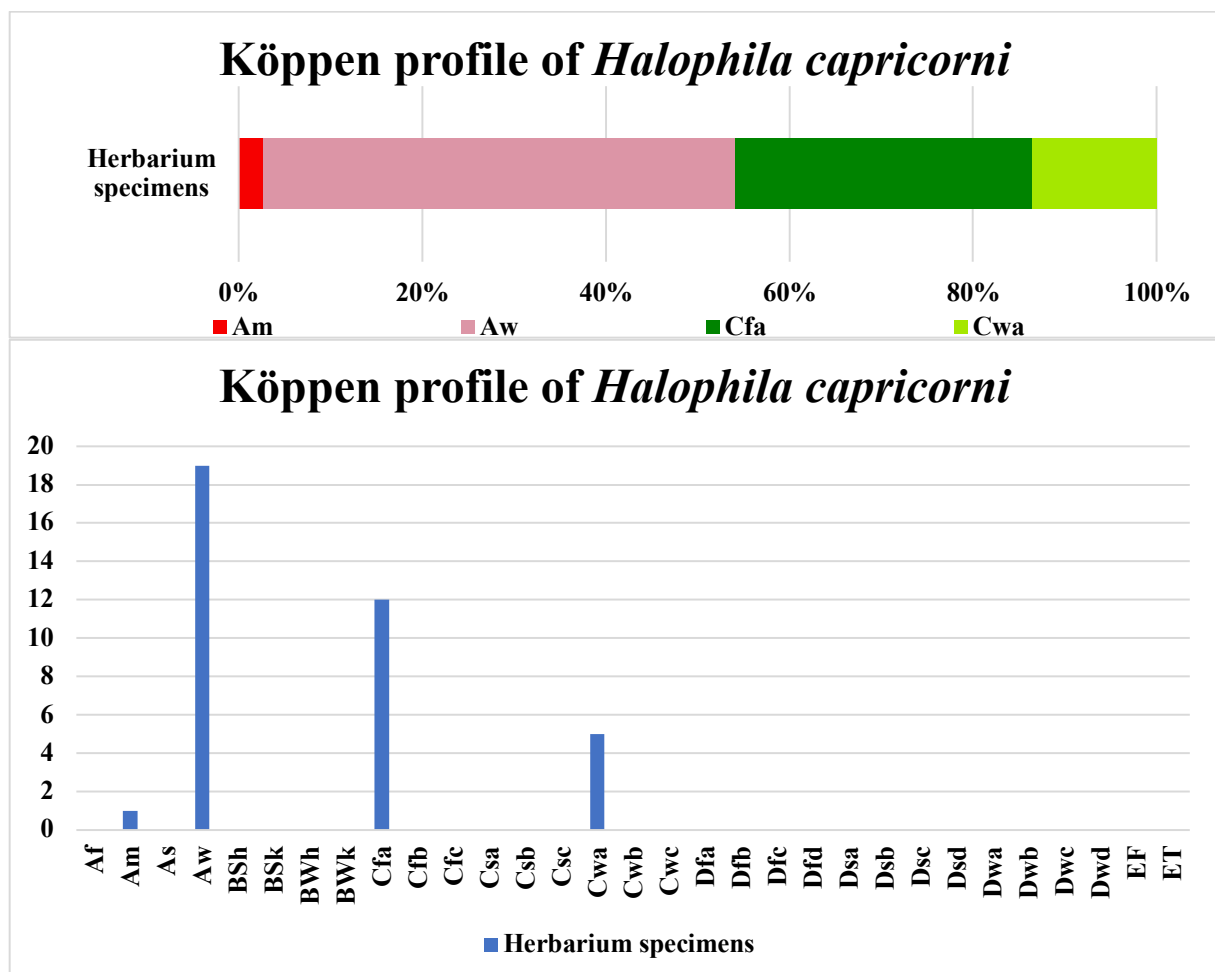
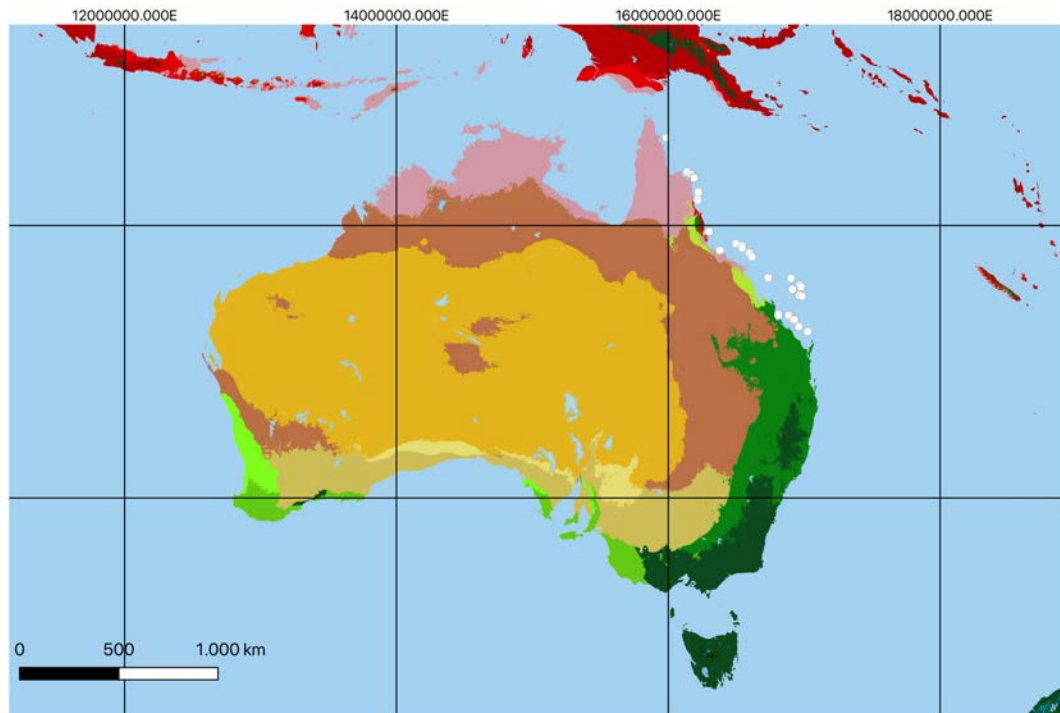
Köppen profile of *Halophila beccarii*



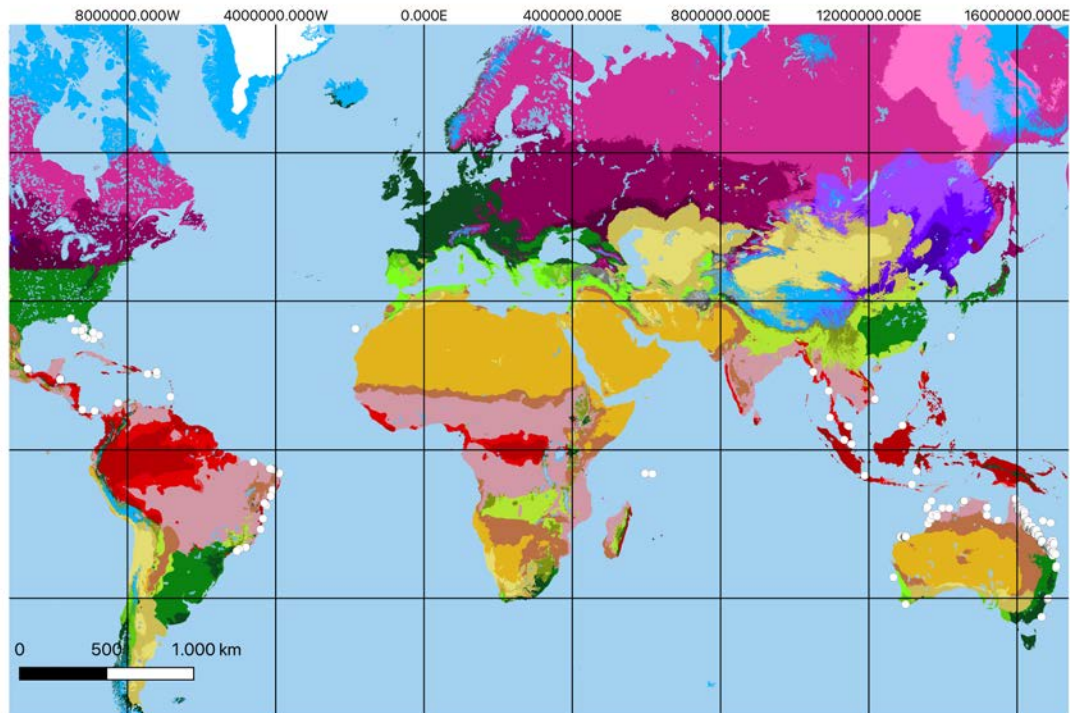
Köppen profile of *Halophila beccarii*



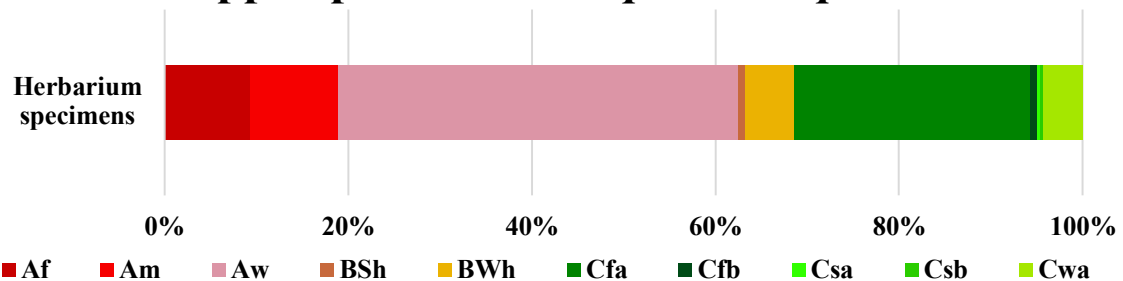
5.3.2.1.4. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila capricorni* Larkum 1995; herbarium specimens excluding duplicate occurrences (n = 37).



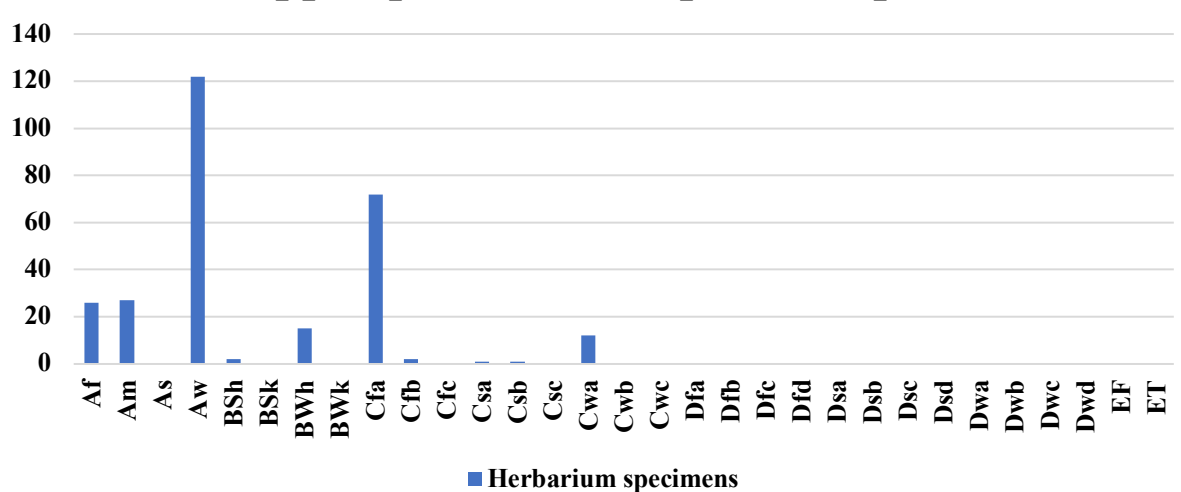
5.3.2.1.5. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila decipiens* Ostenf. 1902; herbarium specimens excluding duplicate occurrences (n = 280).



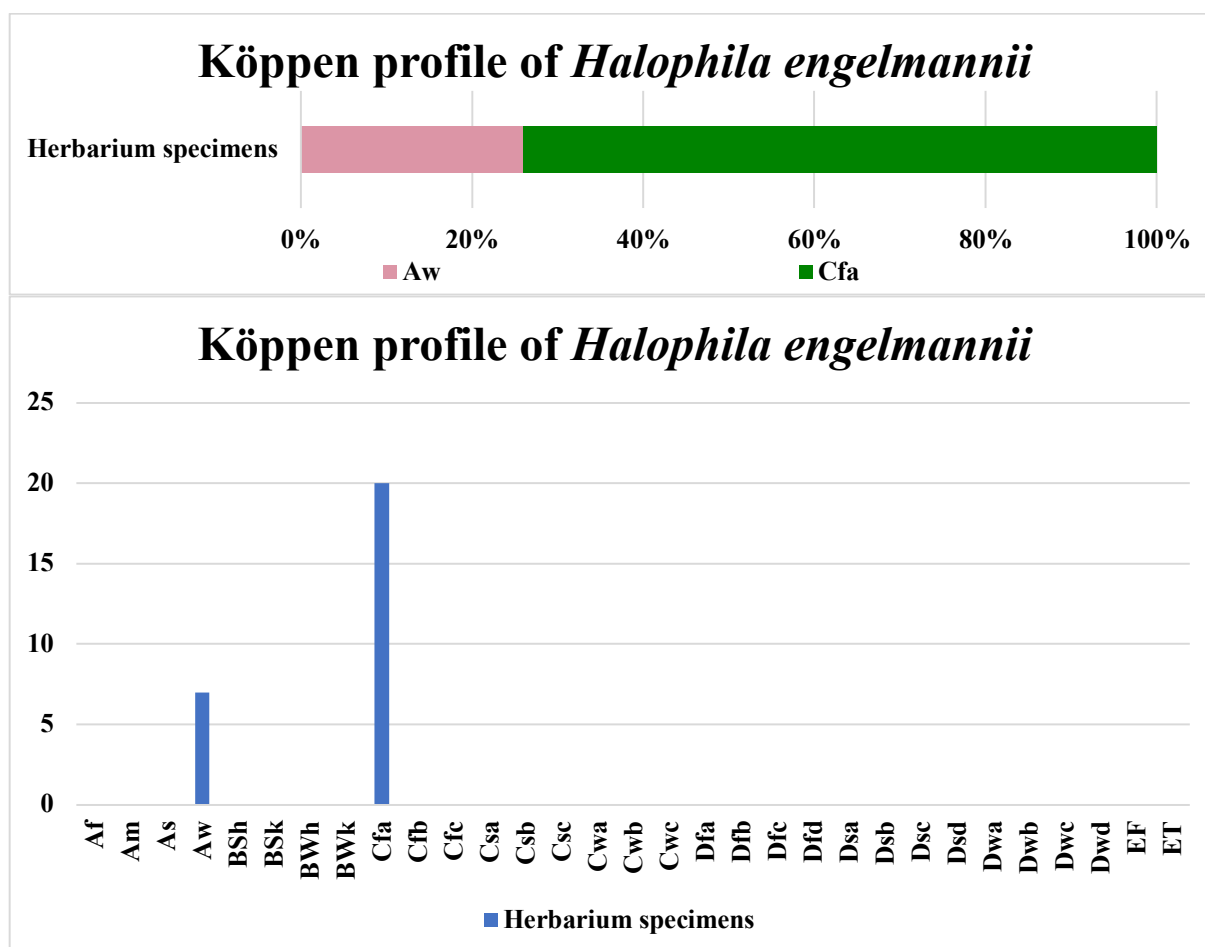
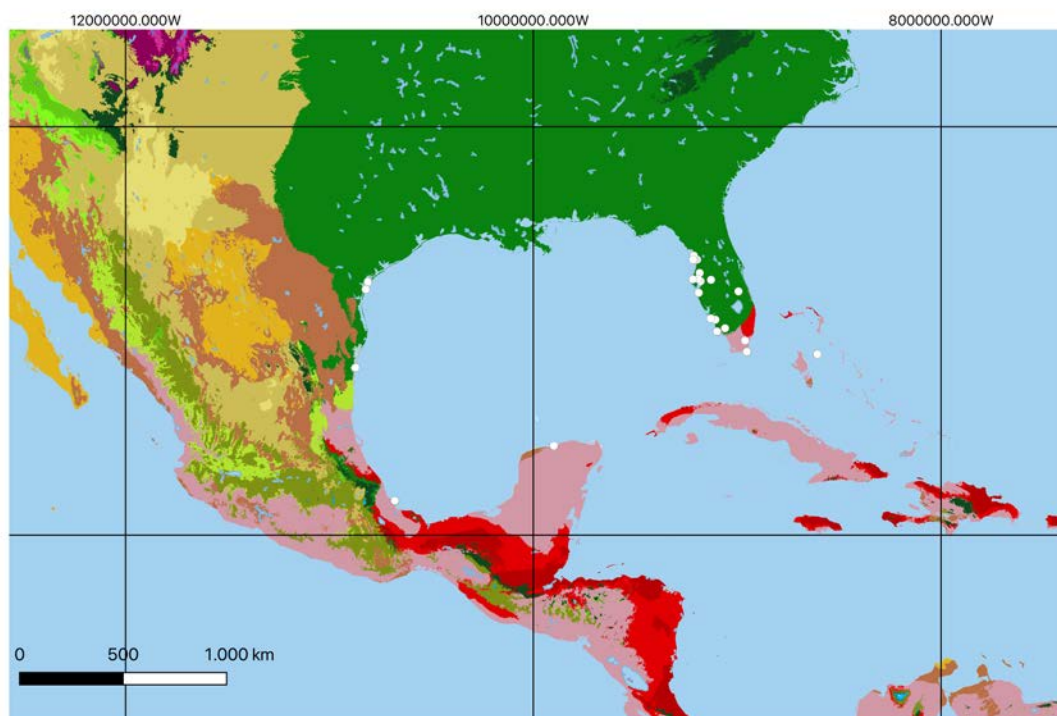
Köppen profile of *Halophila decipiens*



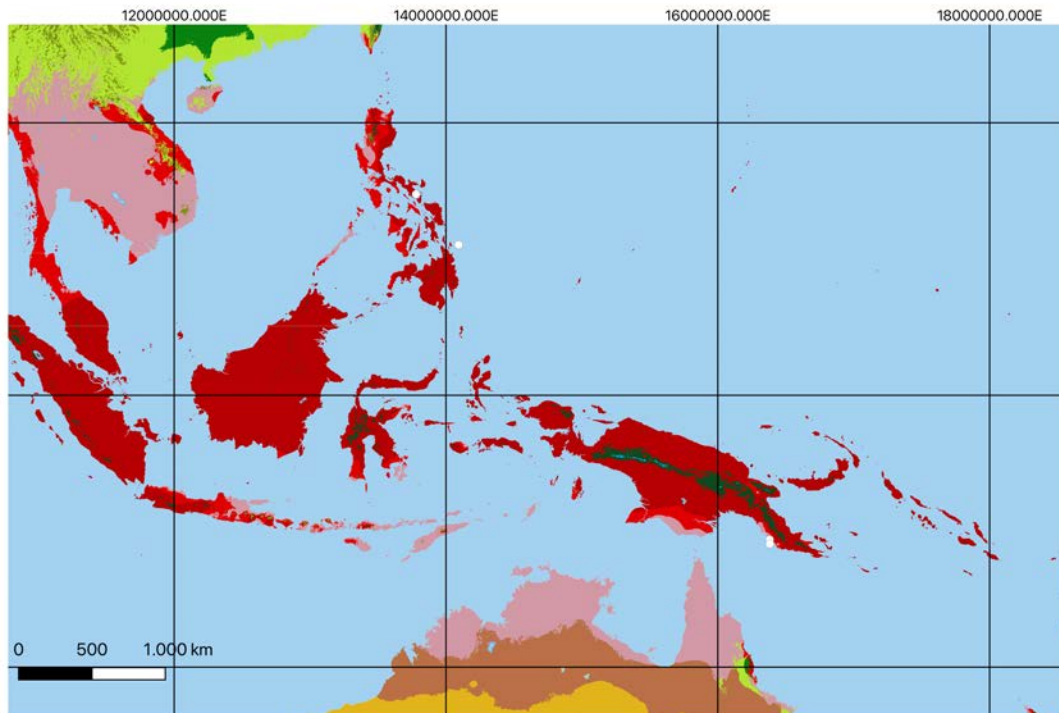
Köppen profile of *Halophila decipiens*



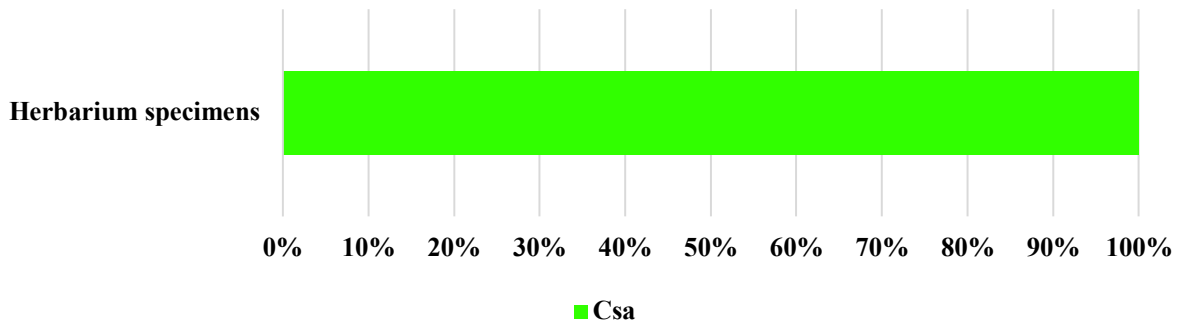
5.3.2.1.6. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila engelmannii* Asch. 1974; herbarium specimens excluding duplicate occurrences (n = 27).



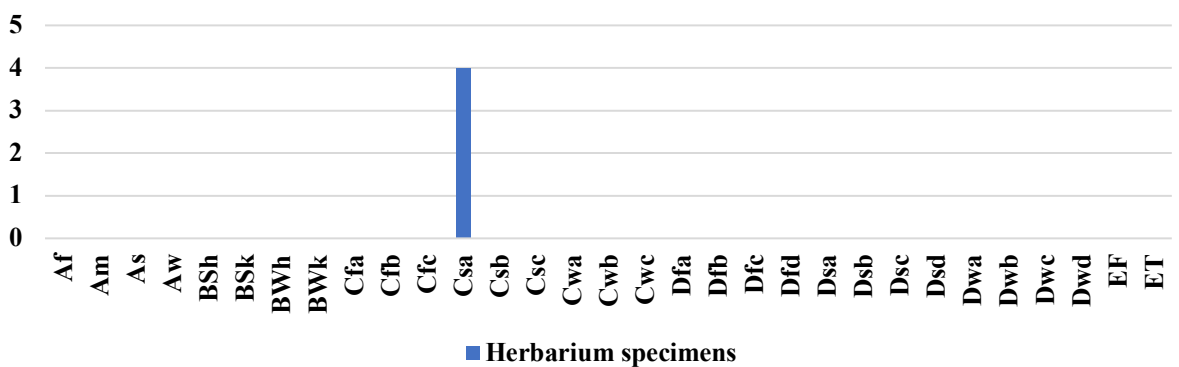
5.3.2.1.7. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila gaudichaudii* J.Kuo 2006; herbarium specimens excluding duplicate occurrences (n = 4).



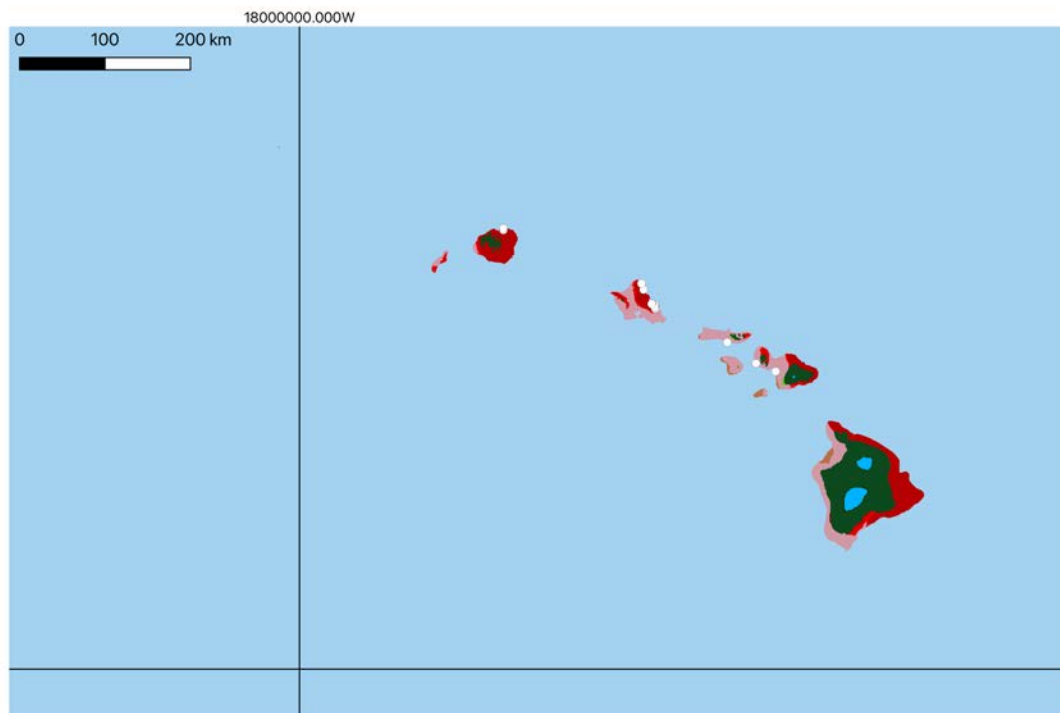
Köppen profile of *Halophila gaudichaudii*



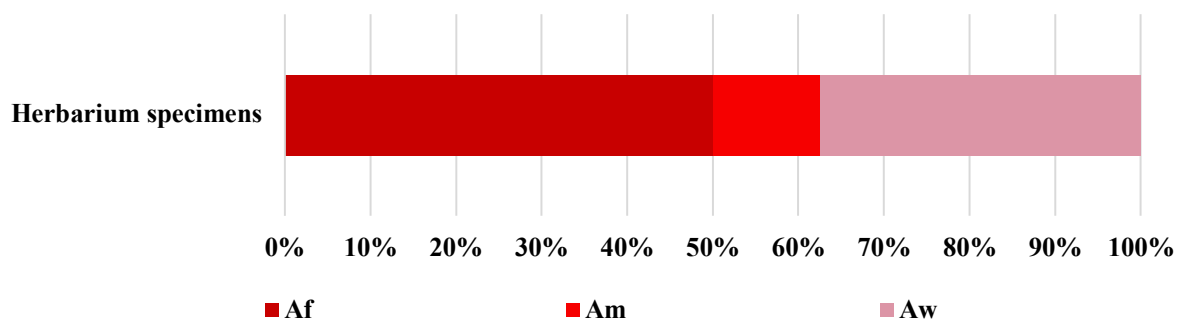
Köppen profile of *Halophila gaudichaudii*



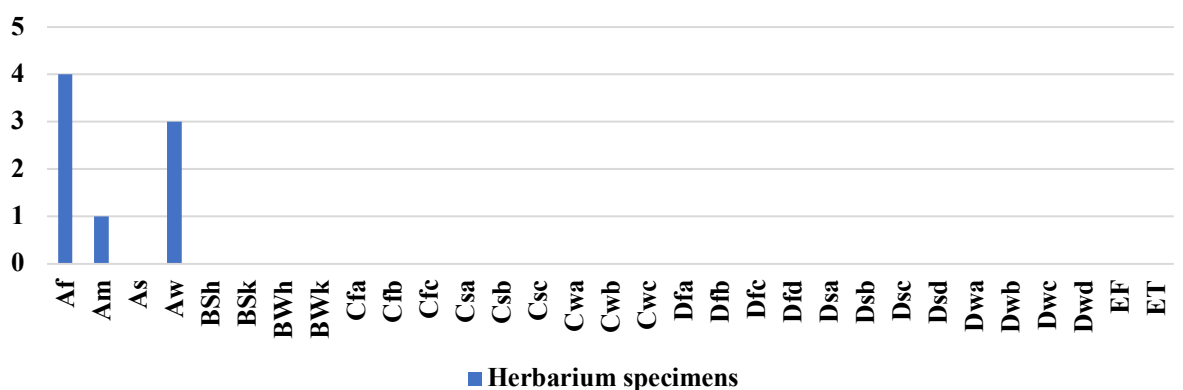
5.3.2.1.8. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila hawaiiiana* Kuo 2006; herbarium specimens excluding duplicate occurrences (n = 8).



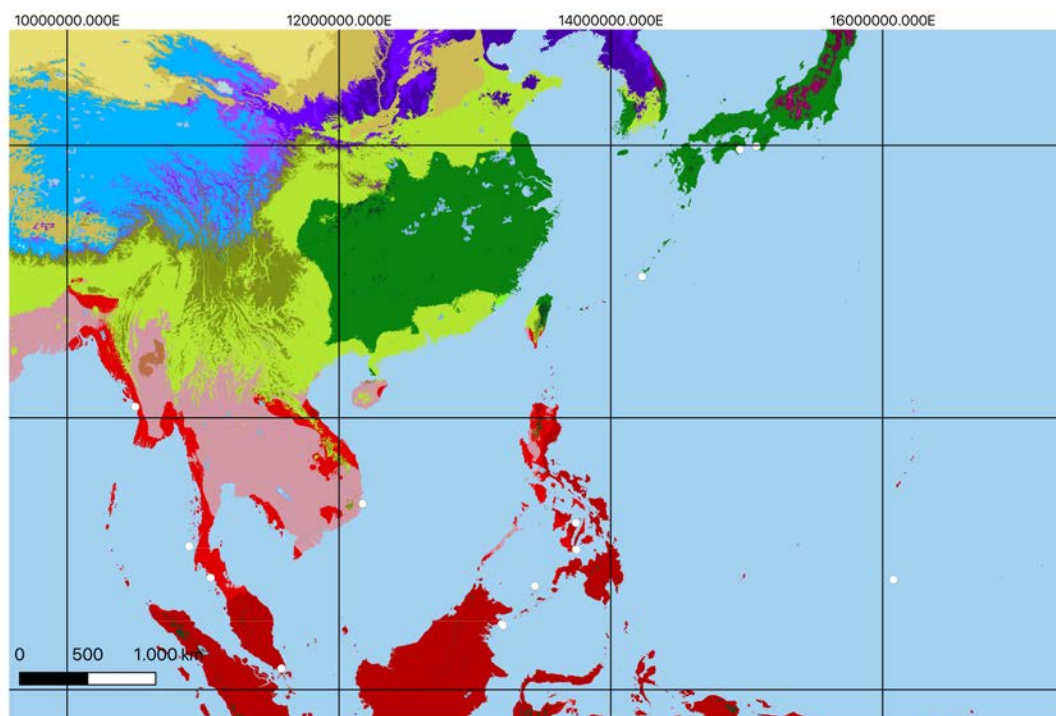
Köppen profile of *Halophila hawaiiiana*



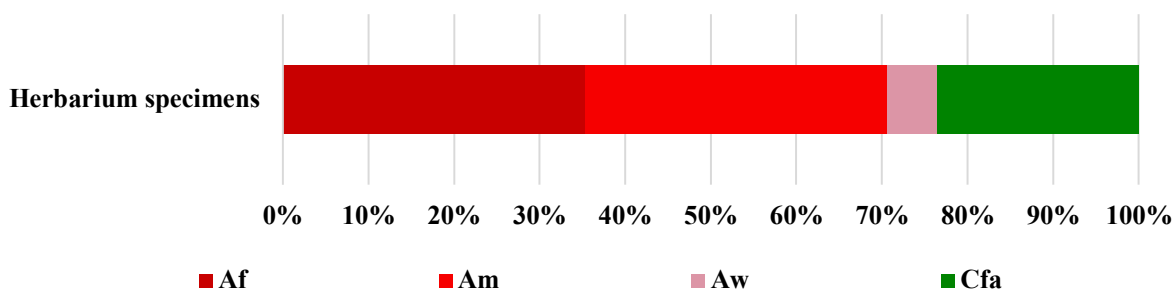
Köppen profile of *Halophila hawaiiiana*



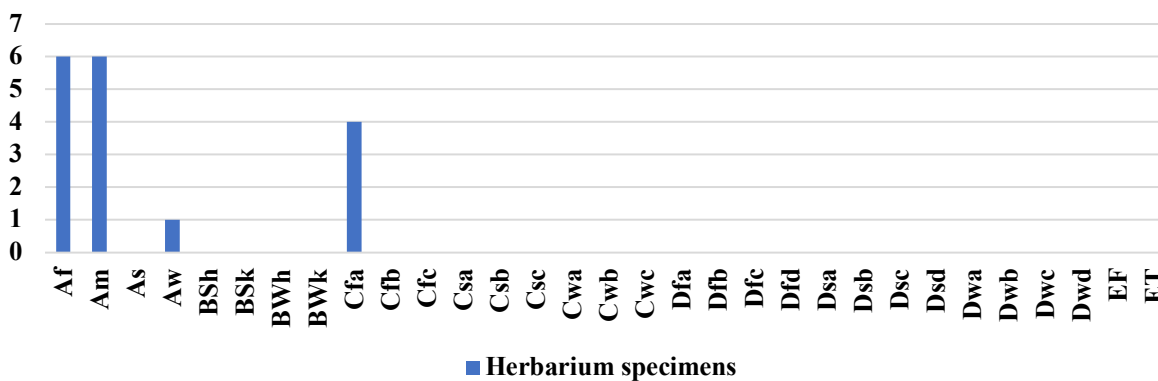
5.3.2.1.9. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila major* Mirq. 1856; herbarium specimens excluding duplicate occurrences (n = 17).



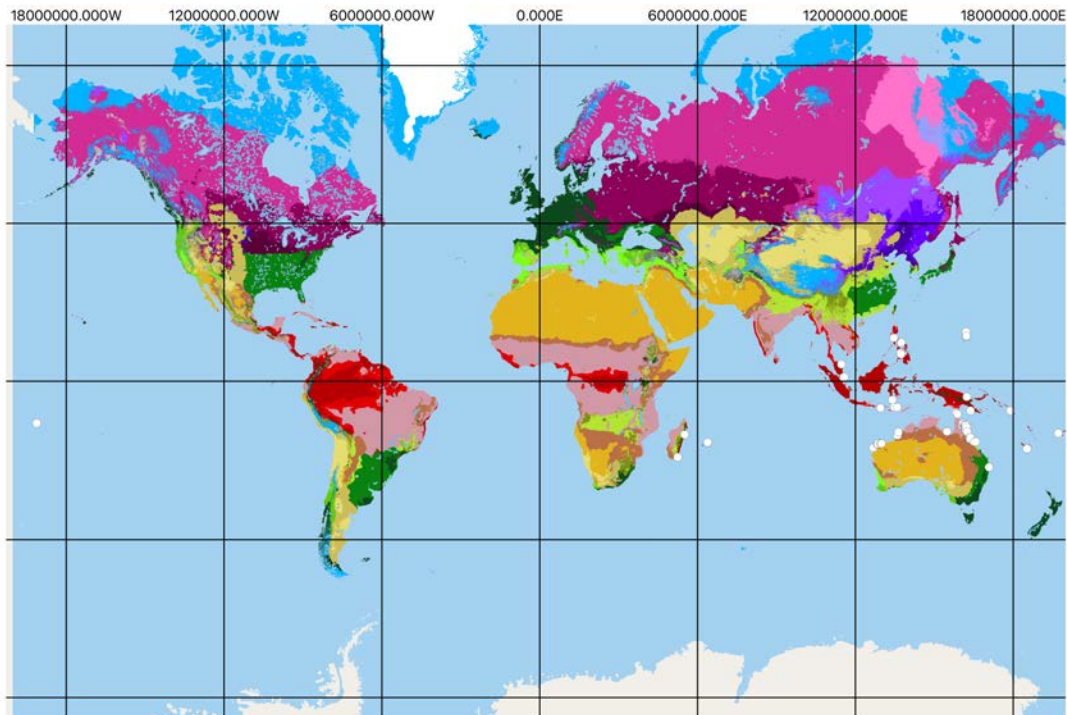
Köppen profile of *Halophila major*



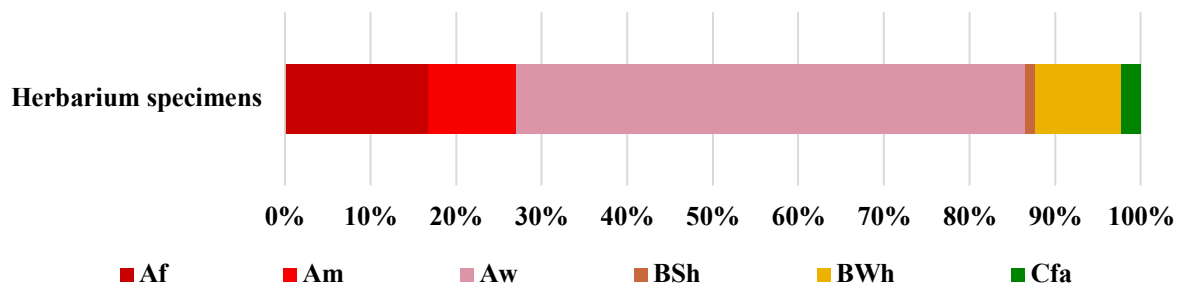
Köppen profile of *Halophila major*



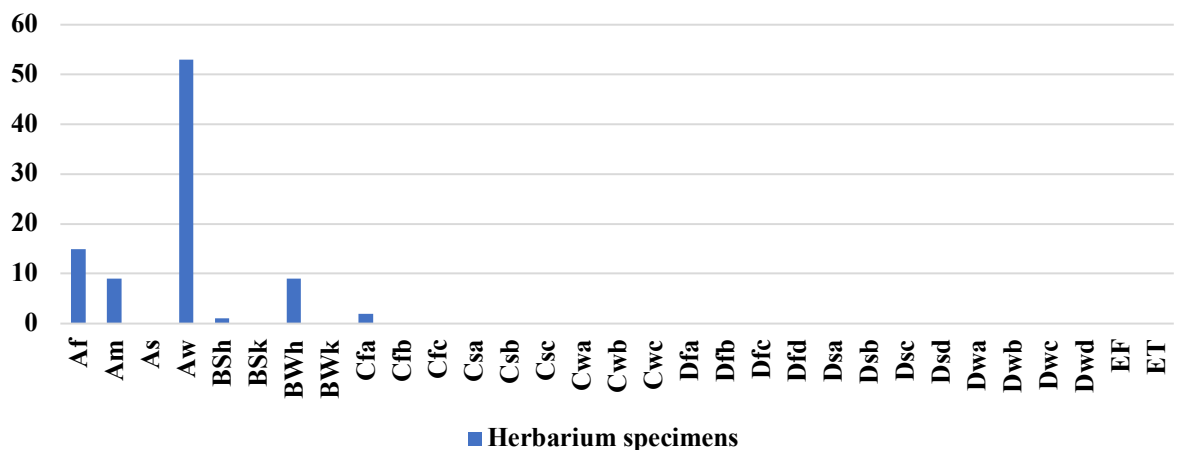
5.3.2.1.10. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila minor* (Zoll.) Hartog 1957; herbarium specimens excluding duplicate occurrences (n = 89).



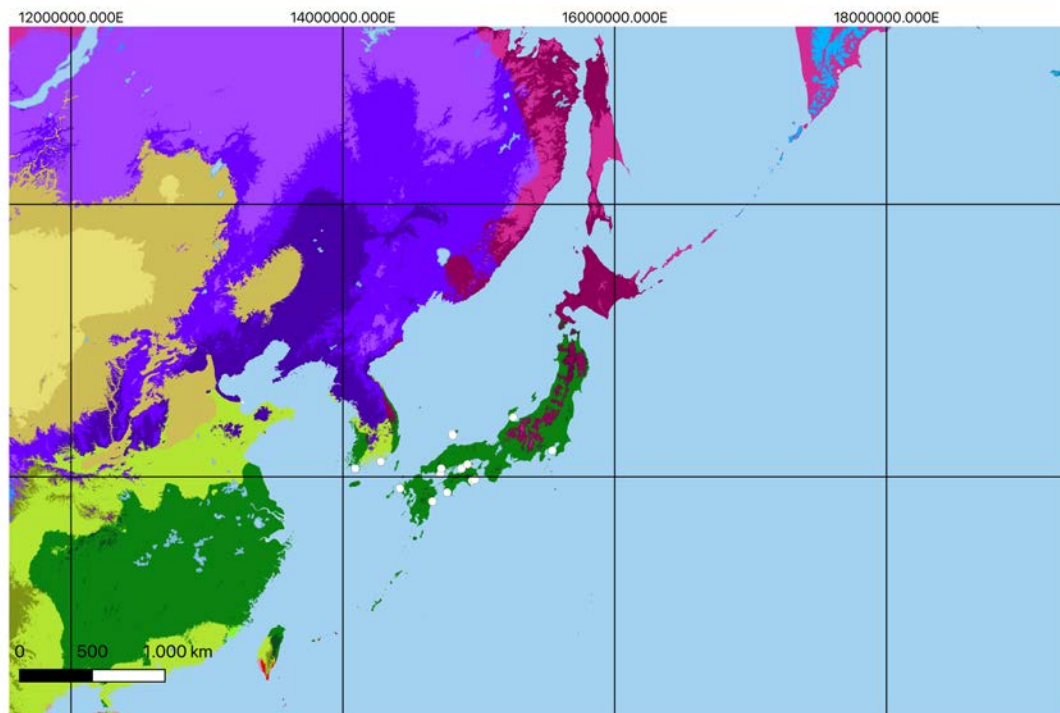
Köppen profile of *Halophila minor*



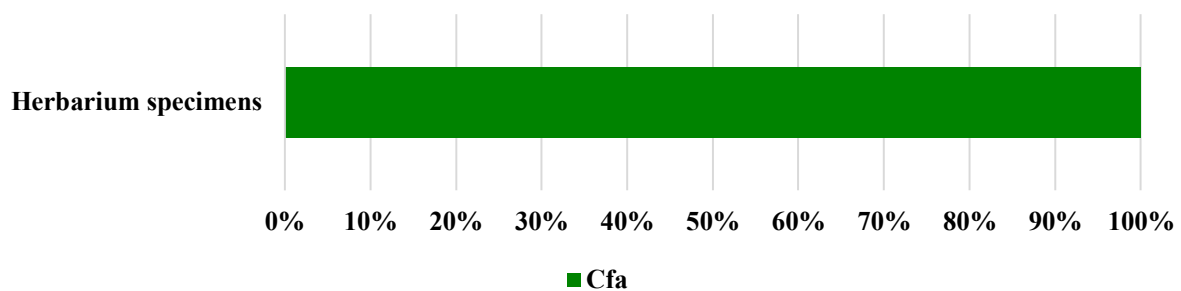
Köppen profile of *Halophila minor*



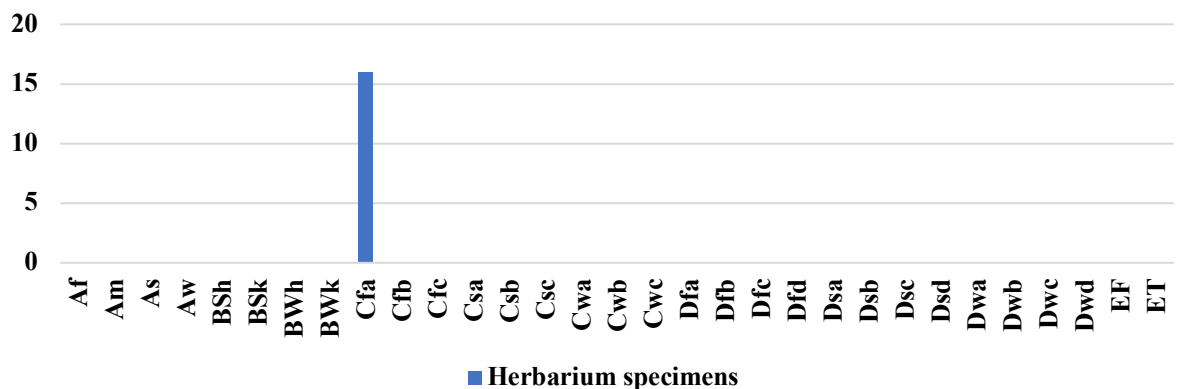
5.3.2.1.11. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila nipponica* J.Kuo 2006; herbarium specimens excluding duplicate occurrences (n = 16).



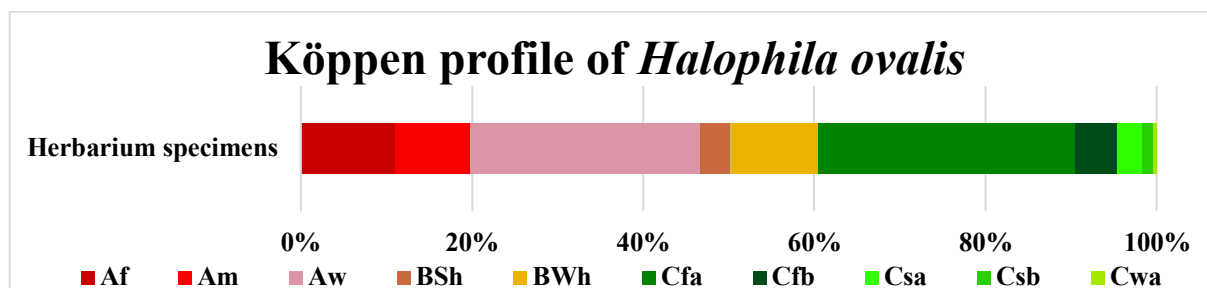
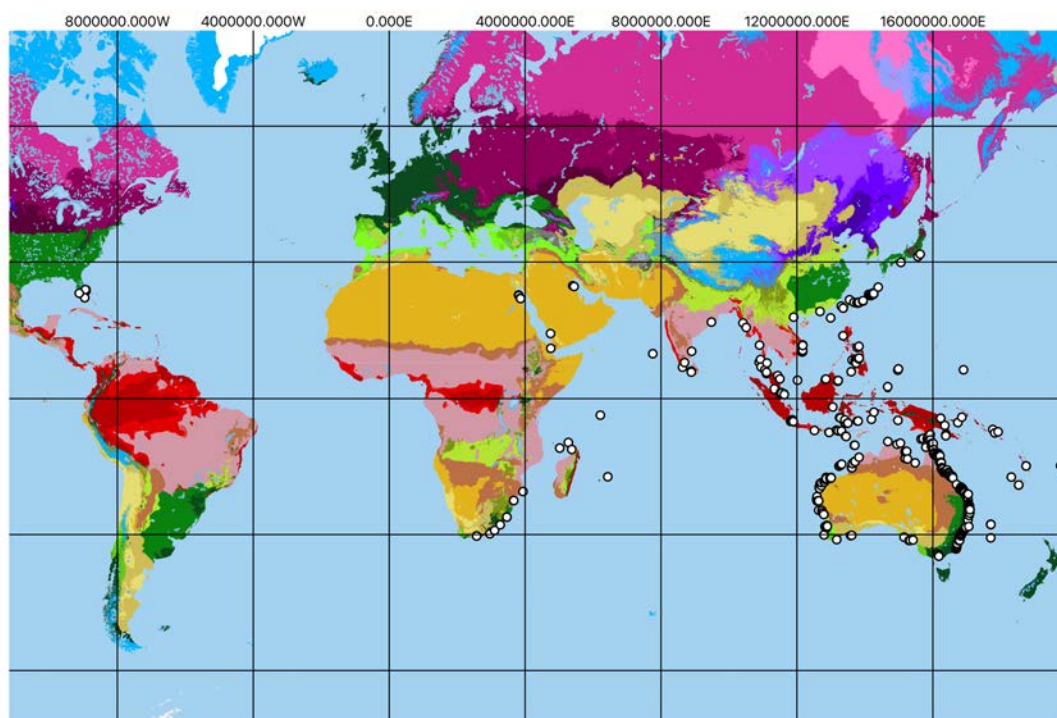
Köppen profile of *Halophila nipponica*



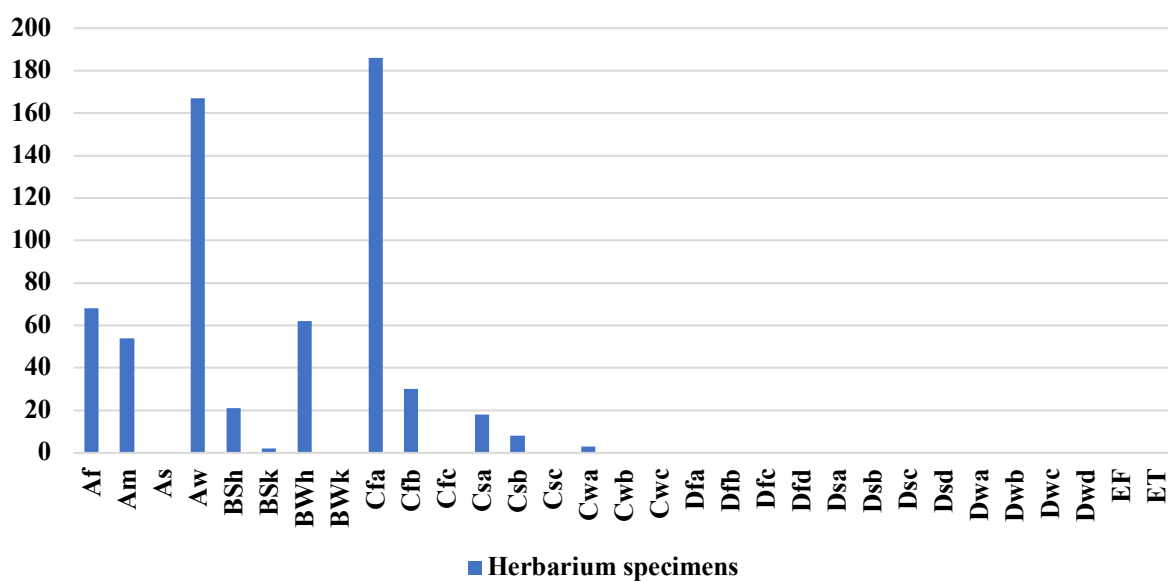
Köppen profile of *Halophila nipponica*



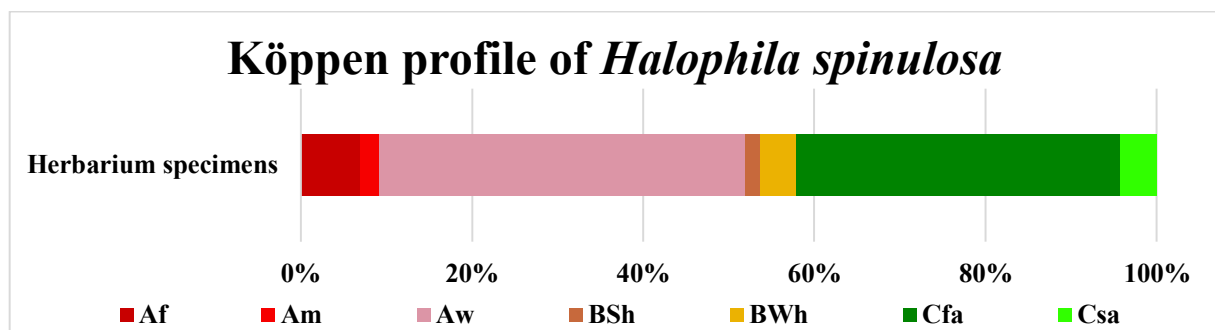
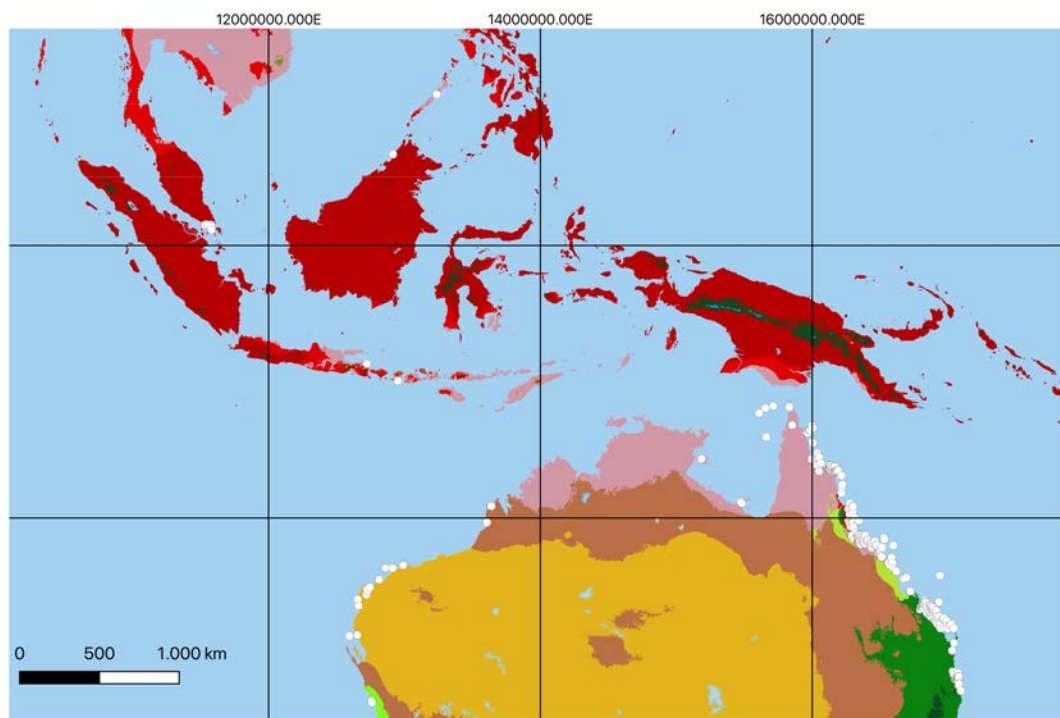
5.3.2.1.11. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila ovalis* (R.Br. 1810) Hook.f. 1859; herbarium specimens excluding duplicate occurrences (n = 619).



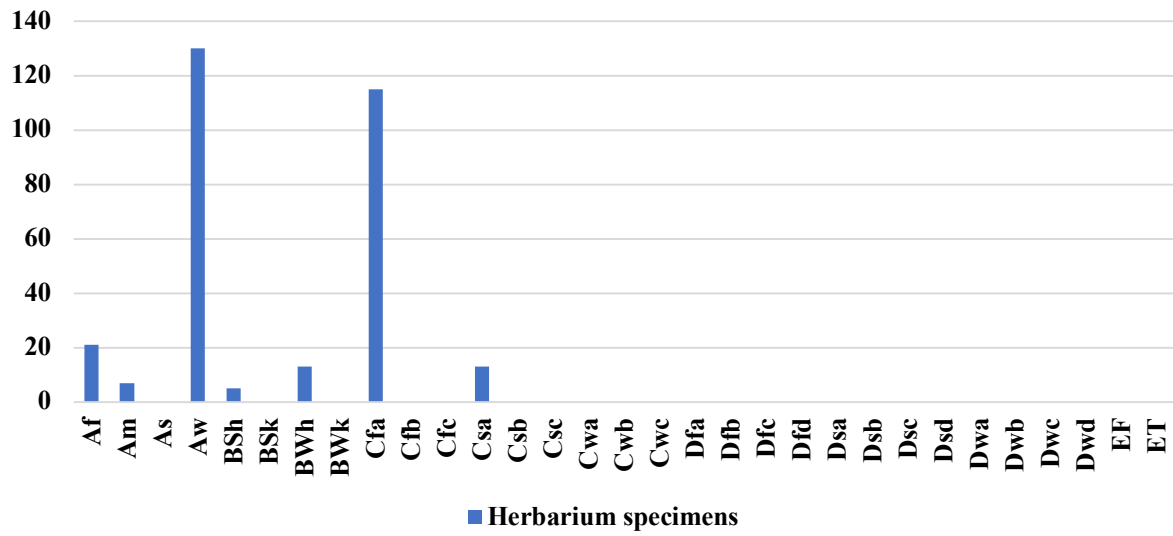
Köppen profile of *Halophila ovalis*



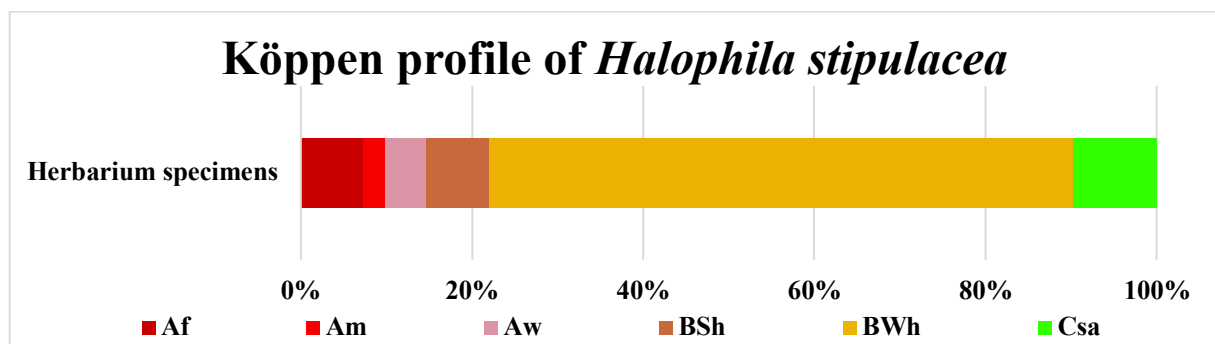
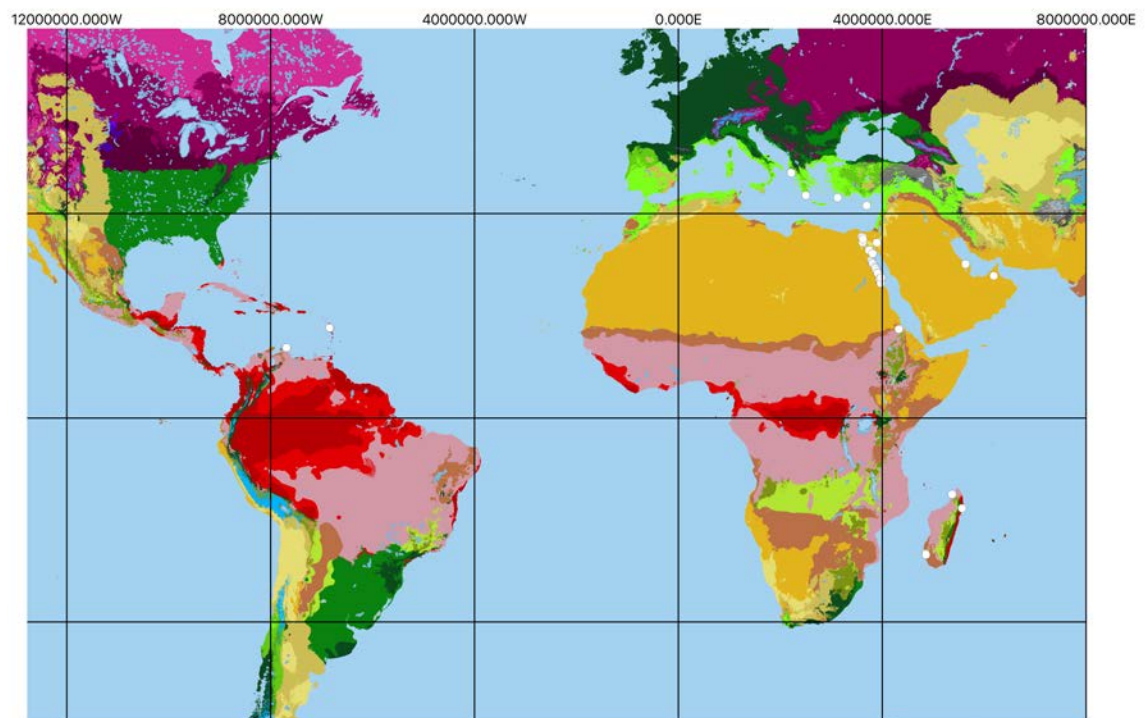
5.3.2.1.12. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila spinulosa* (R.Br. 1810) Asch. 1875; herbarium specimens excluding duplicate occurrences (n = 304).



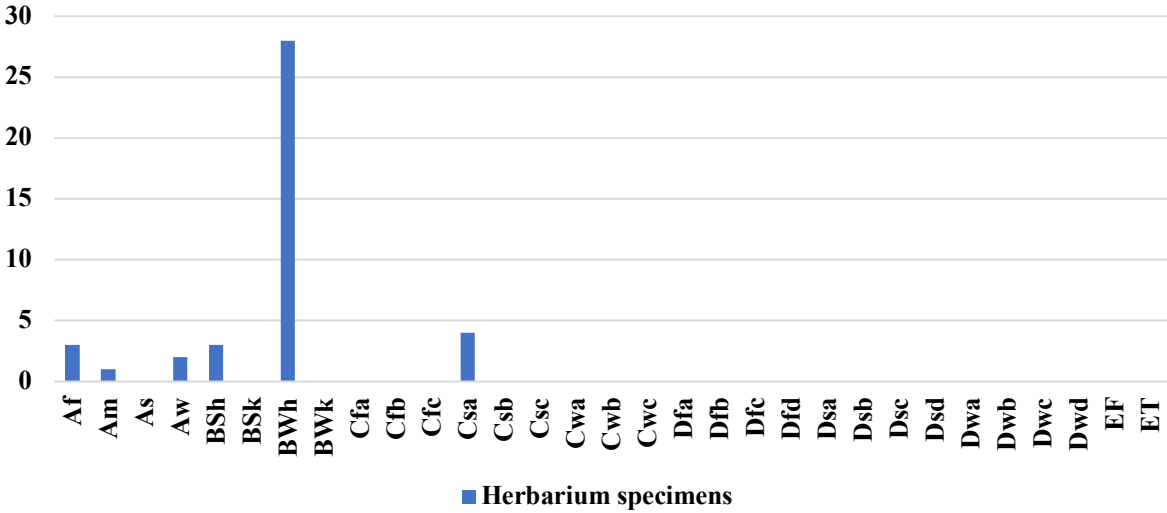
Köppen profile of *Halophila spinulosa*



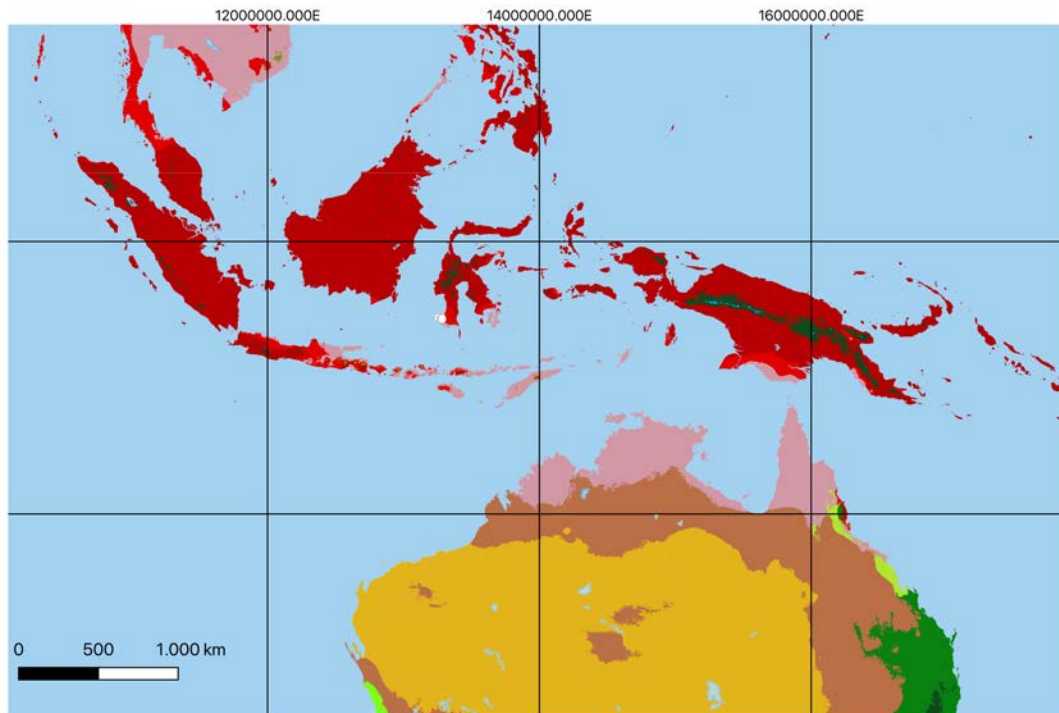
5.3.2.1.13. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila stipulacea* (Forssk.) Asch. 1867; herbarium specimens excluding duplicate occurrences (n = 41).



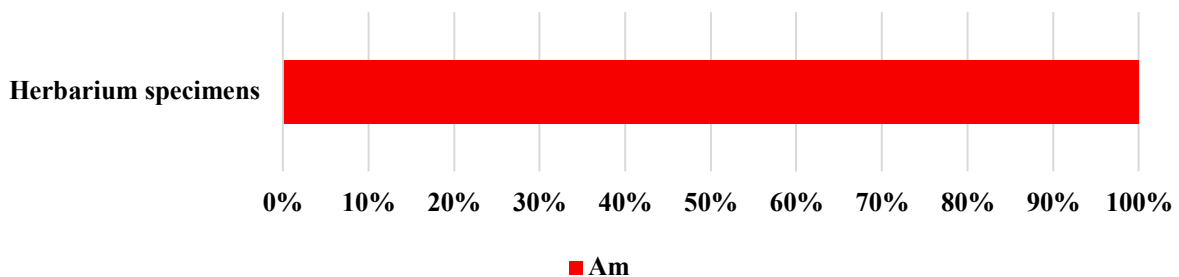
Köppen profile of *Halophila stipulacea*



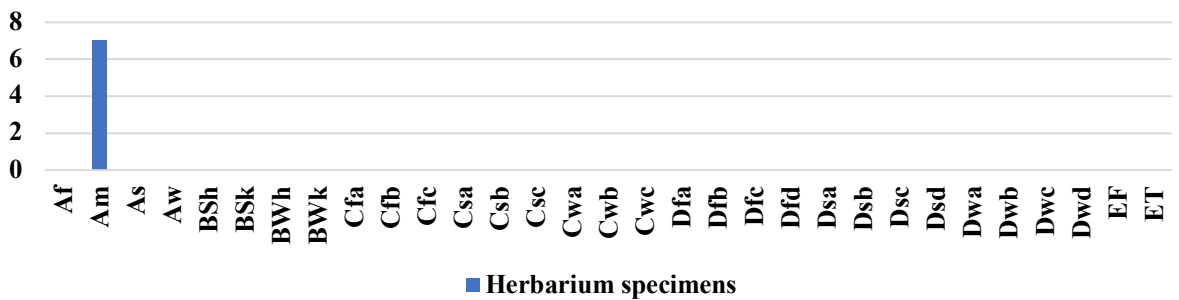
5.3.2.1.14. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila sulawesii* J.Kuo 2006; herbarium specimens excluding duplicate occurrences (n = 7).



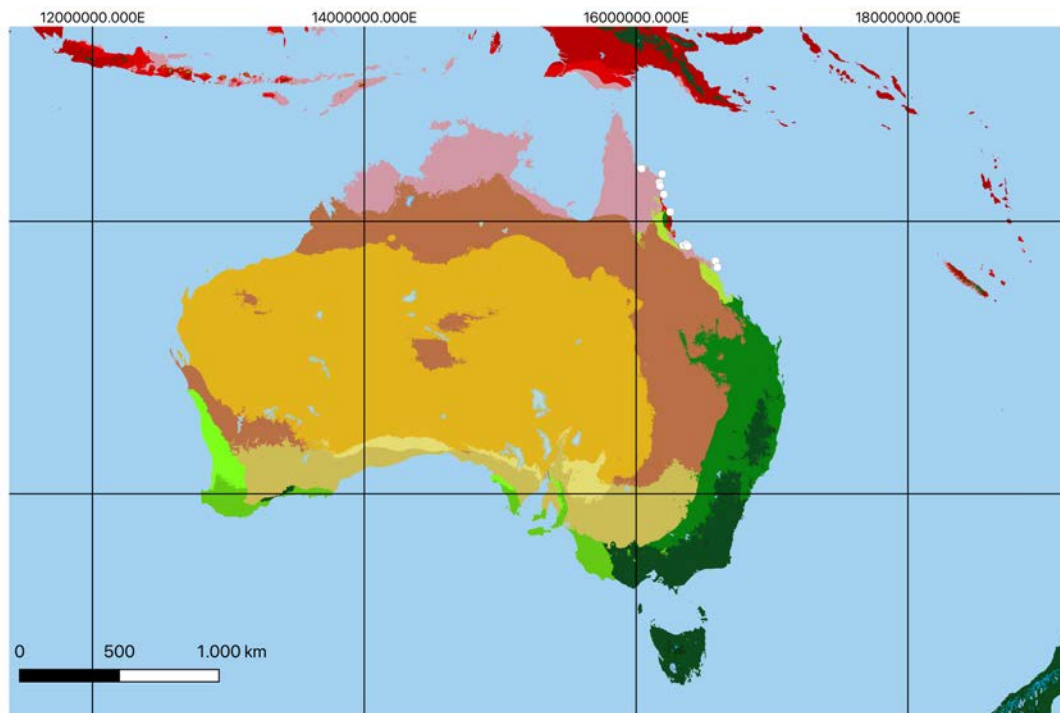
Köppen profile of *Halophila sulawesii*



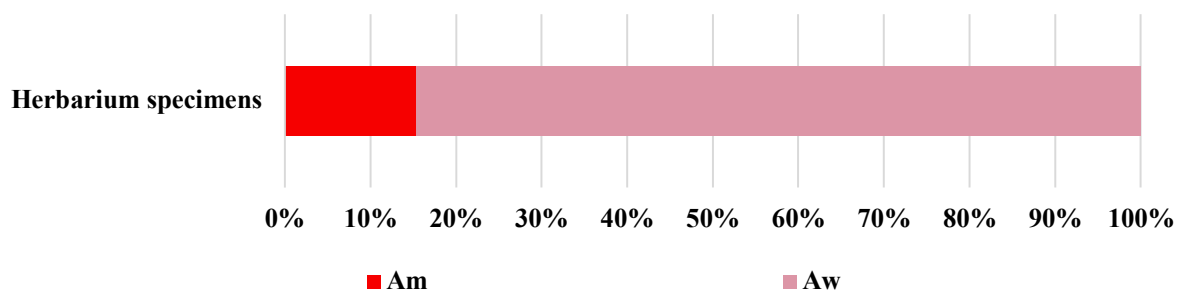
Köppen profile of *Halophila sulawesii*



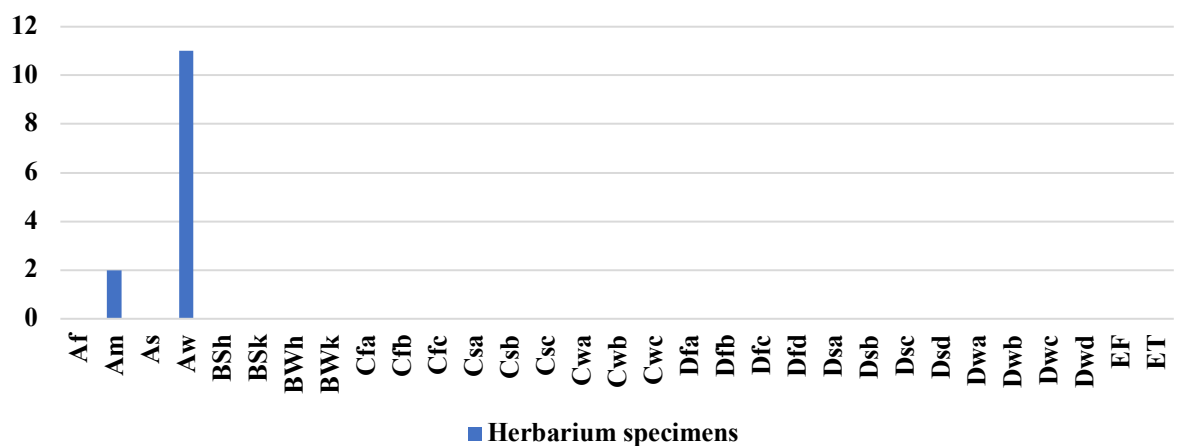
5.3.2.1.15. Köppen profile, distribution and climate map – GBIF occurrences of *Halophila tricostata* M.Greenway 1979; herbarium specimens excluding duplicate occurrences (n = 7).



Köppen profile of *Halophila tricostata*

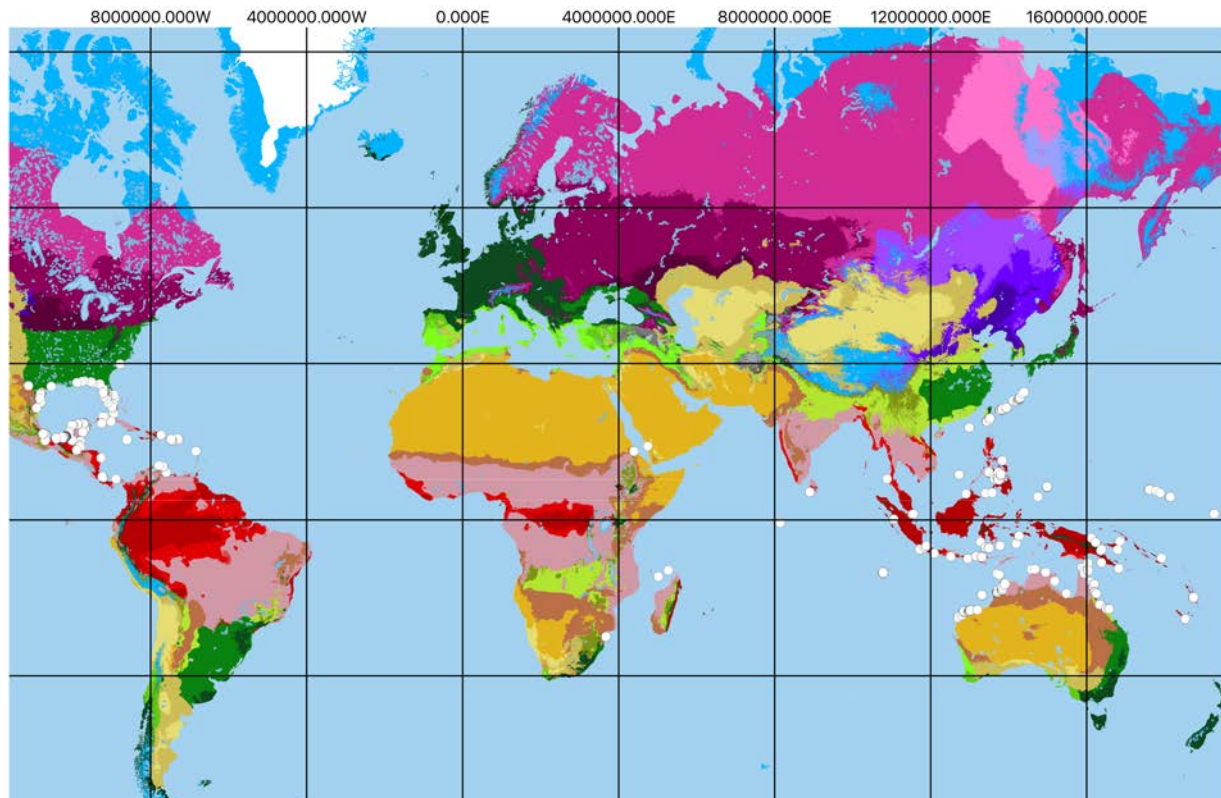


Köppen profile of *Halophila tricostata*

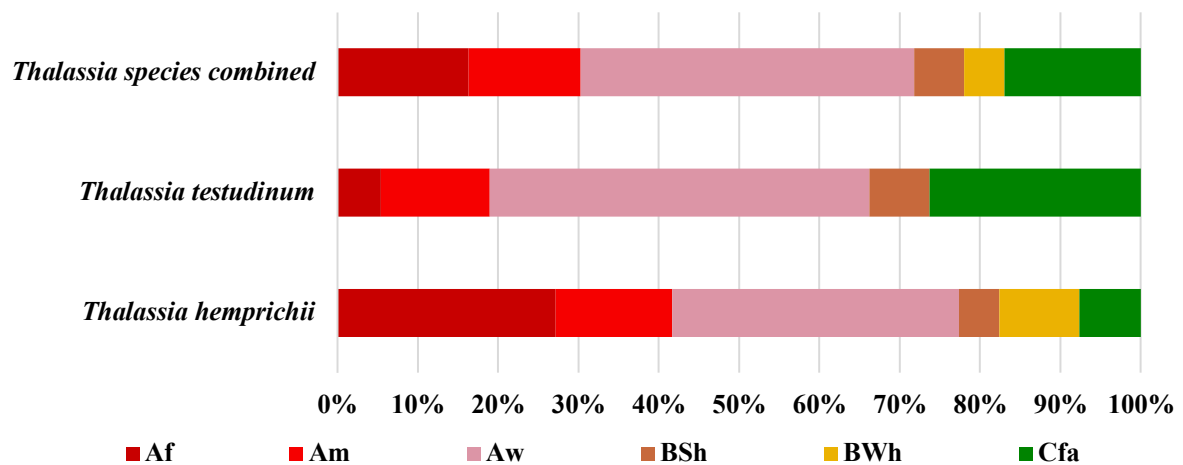


5.3.2.2. Genus *Thalassia* Banks & Sol. ex K.D.Koenig 1805.

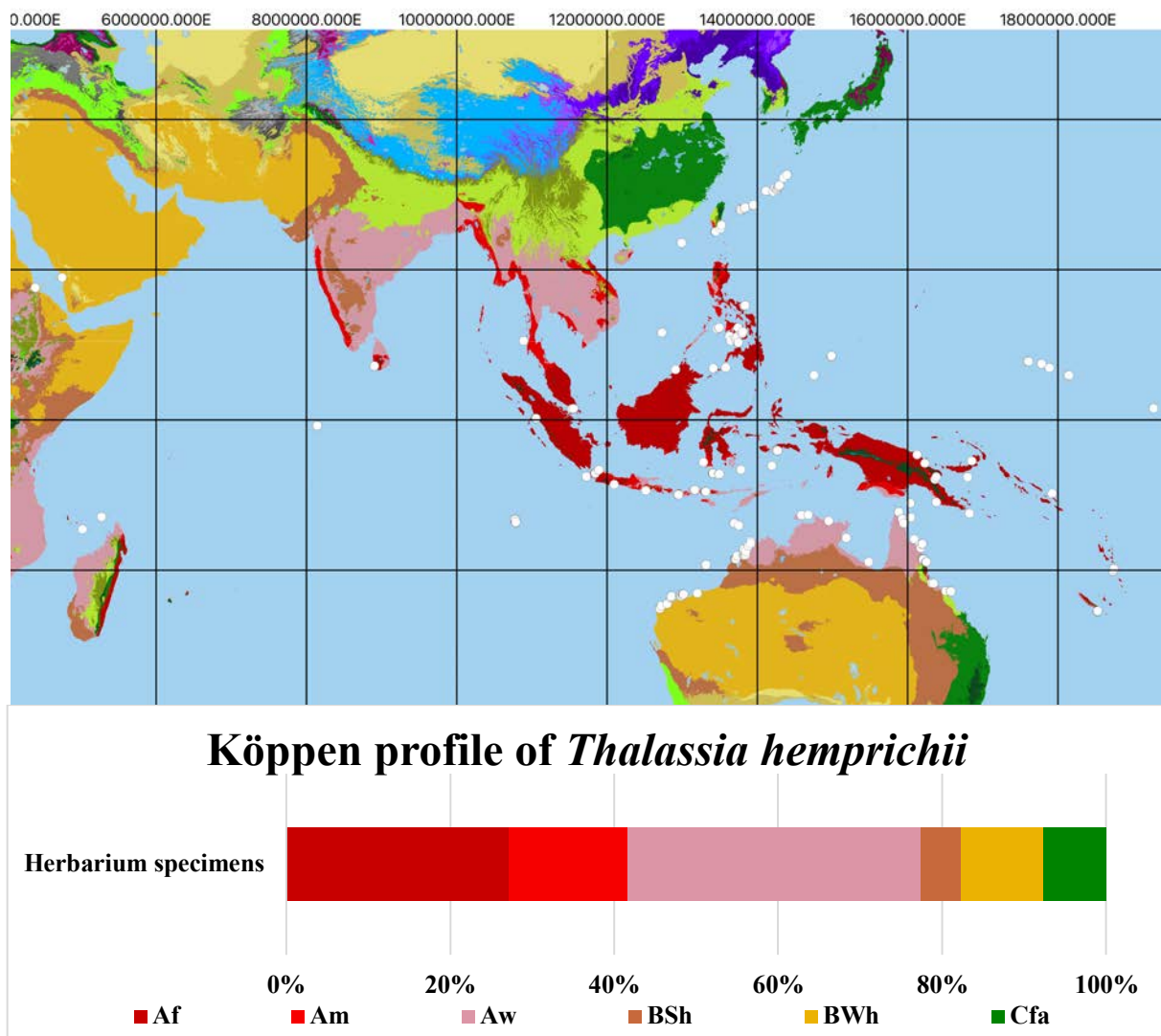
Distribution and Köppen profiles of genus *Thalassia* incl. *T. hemprichii* and *T. testudinum*, based on preserved specimen (n = 341).



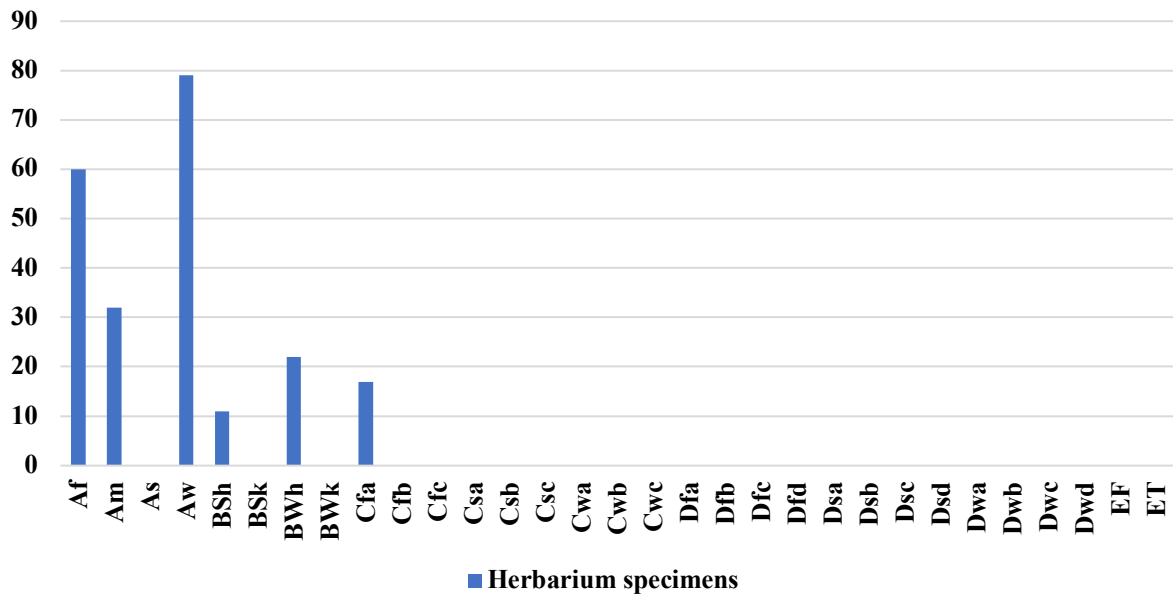
Köppen profiles of *Thalassia* species



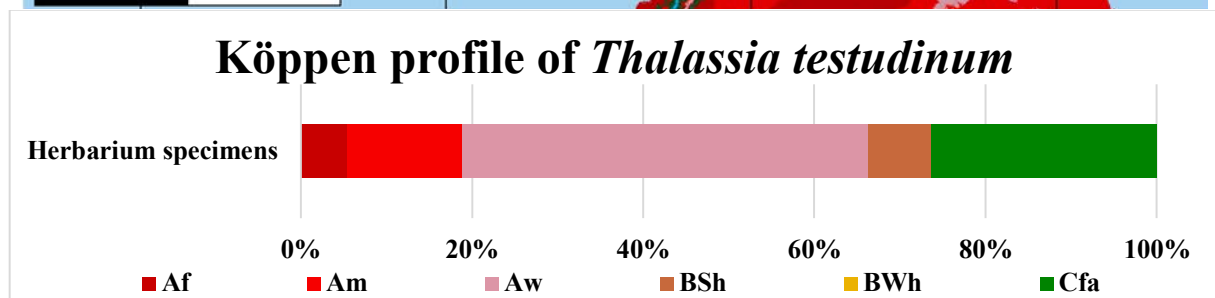
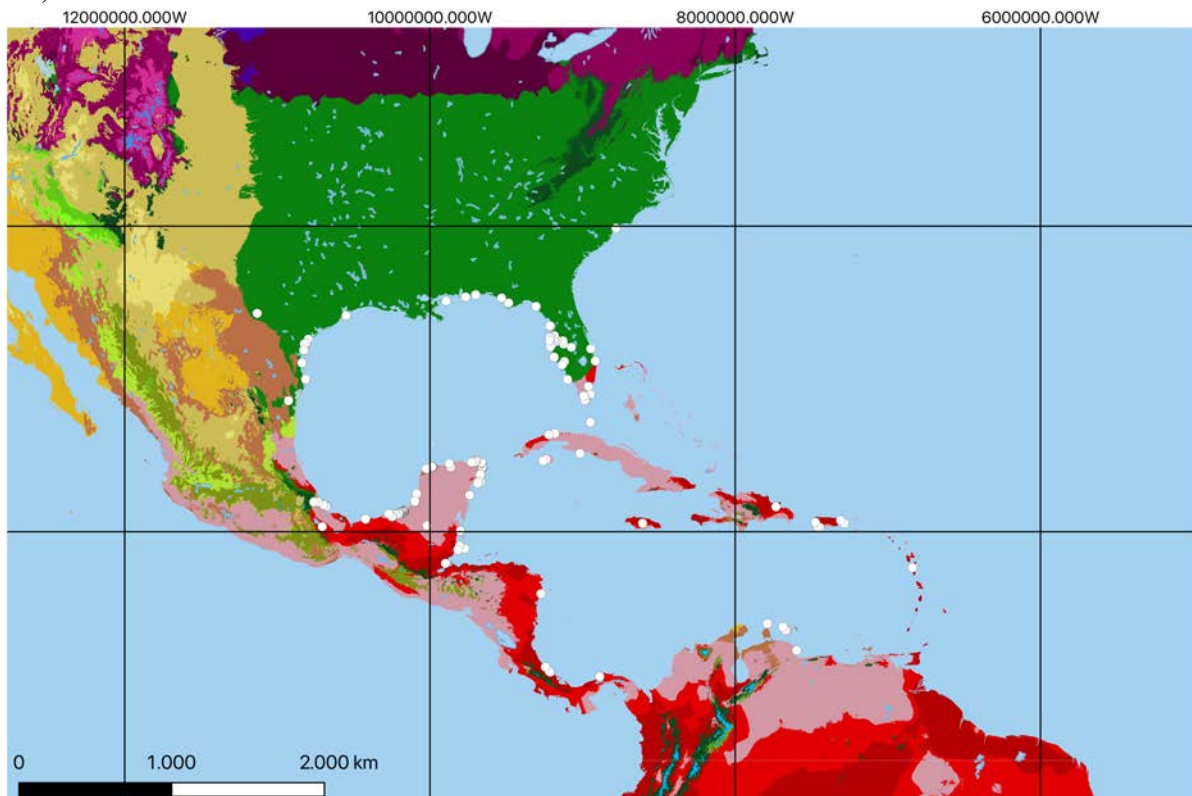
5.3.2.2.1. Köppen profile, distribution and climate map – GBIF occurrences of *Thalassia hemprichii* (Ehrenb. 1832) Asch. 1871; herbarium specimens excluding duplicate occurrences (n = 221).



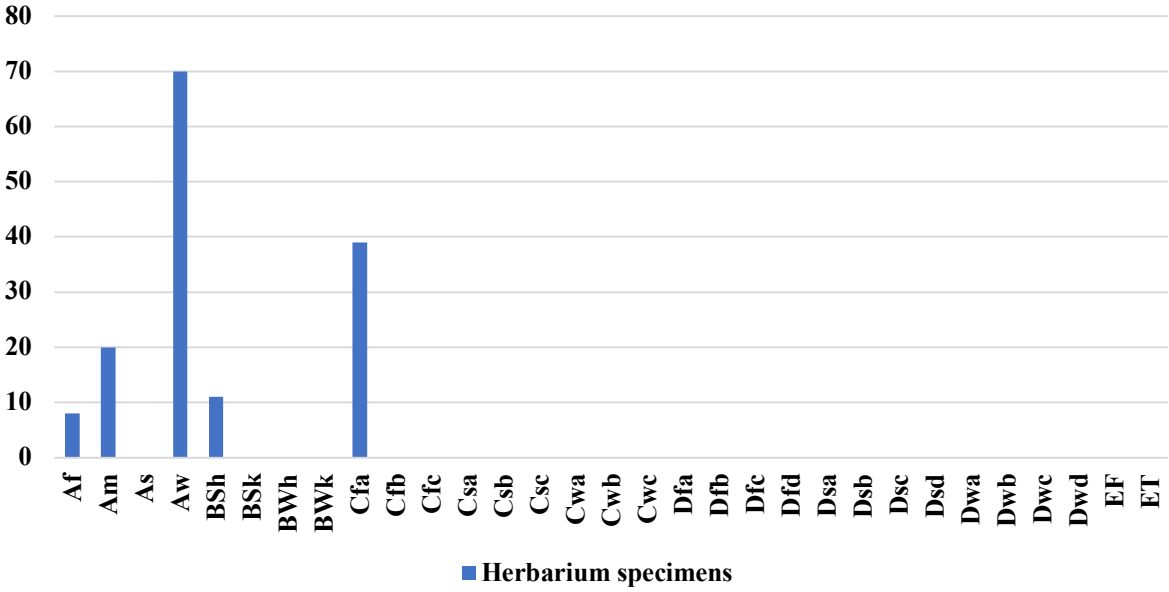
Köppen profile of *Thalassia hemprichii*



5.3.2.2.2. Köppen profile, distribution and climate map – GBIF occurrences of *Thalassia testudinum* K.D.Koenig 1805; herbarium specimens excluding duplicate occurrences (n = 148).

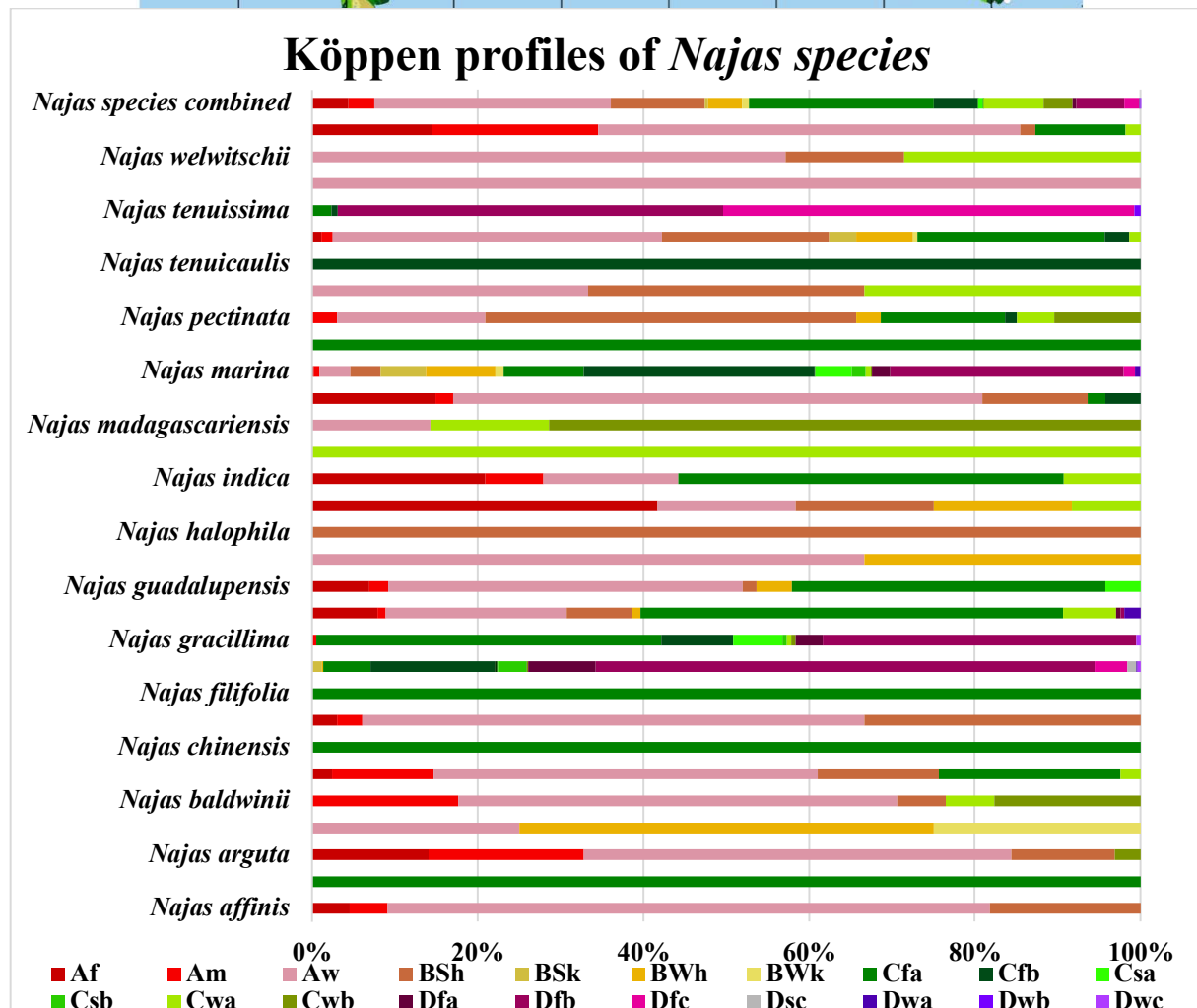
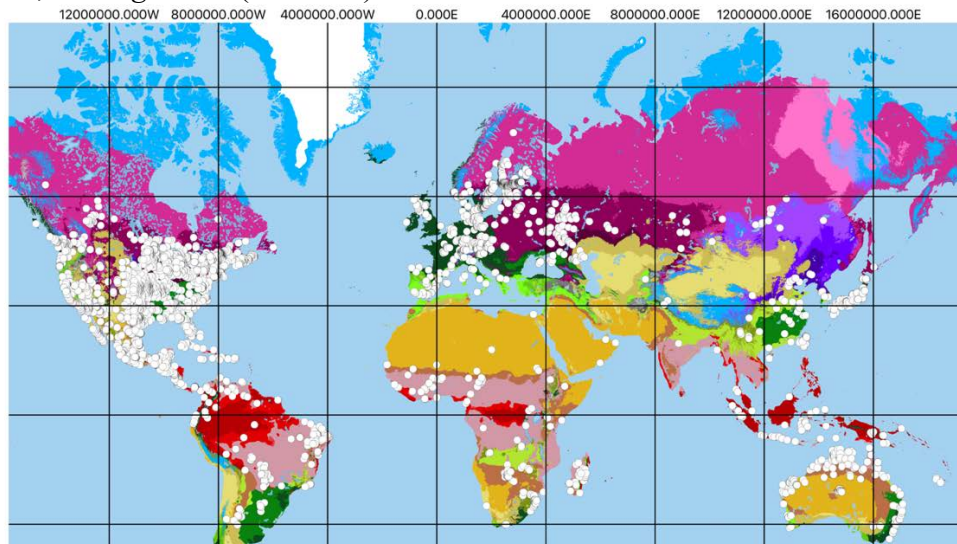


Köppen signatures of *Thalassia testudinum*

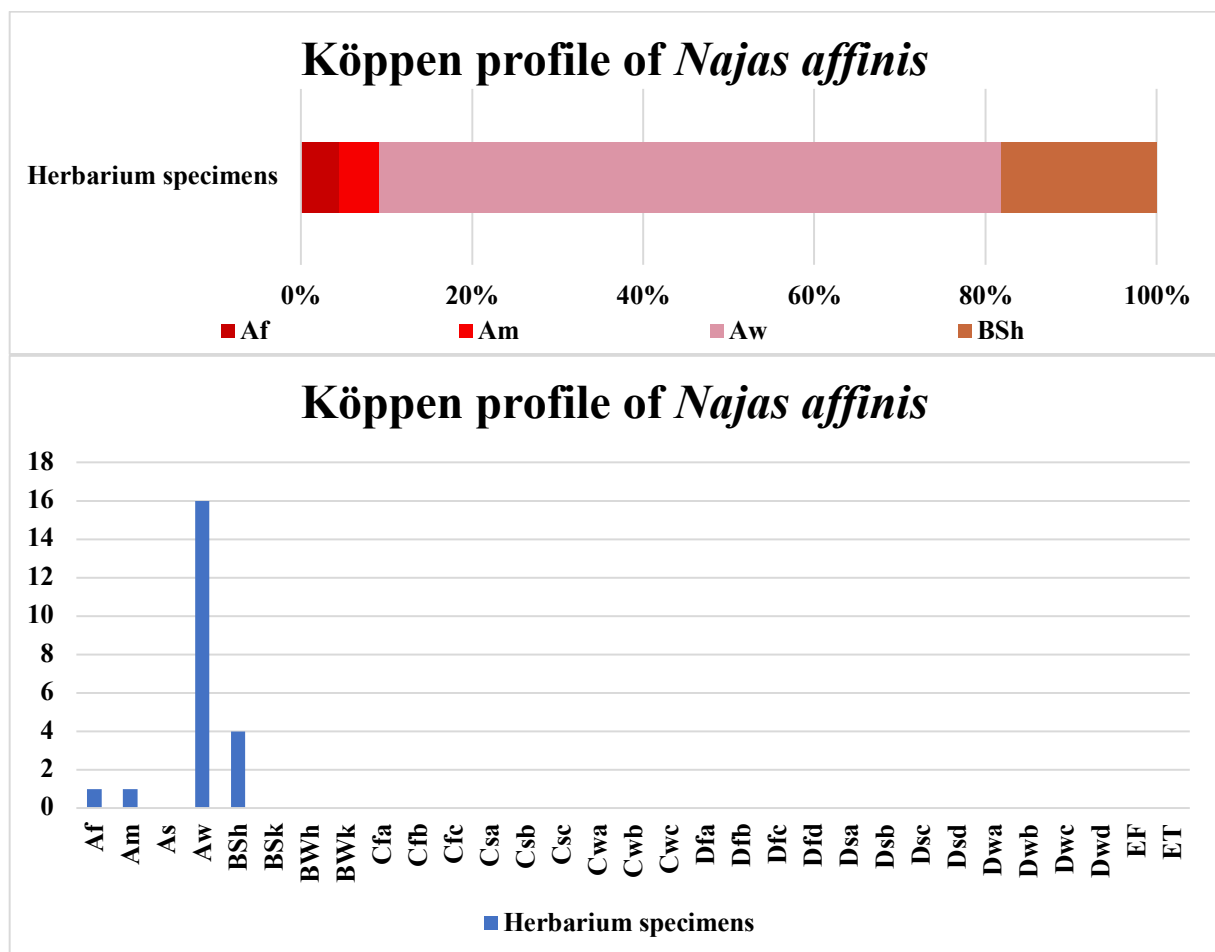
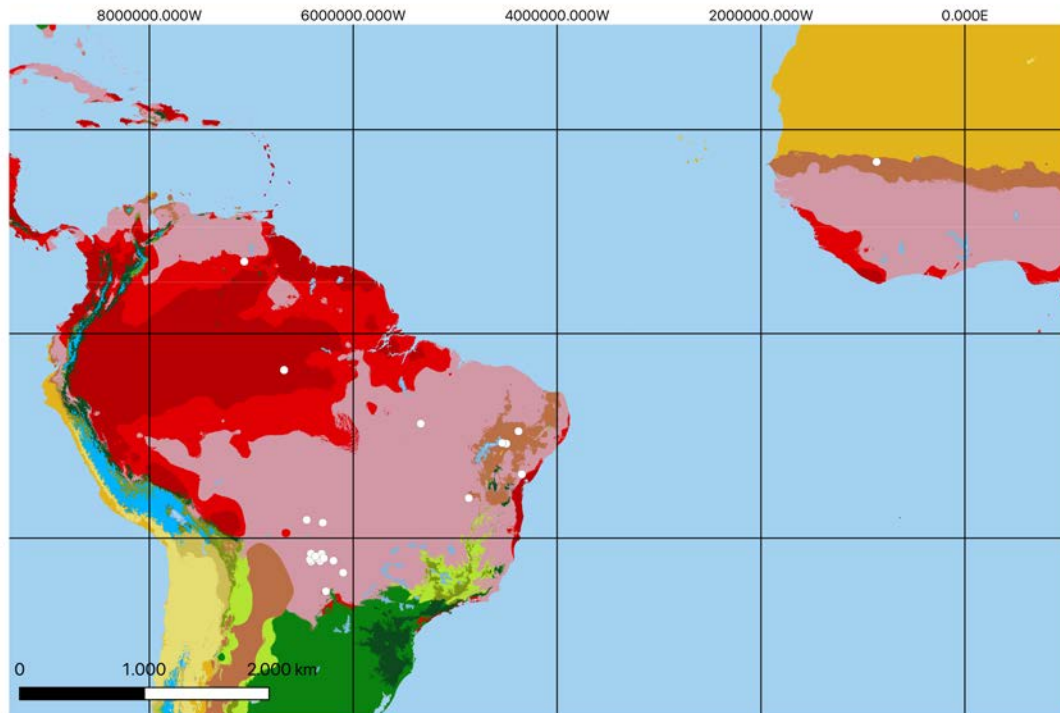


5.3.3.1. Genus *Najas* L. 1753.

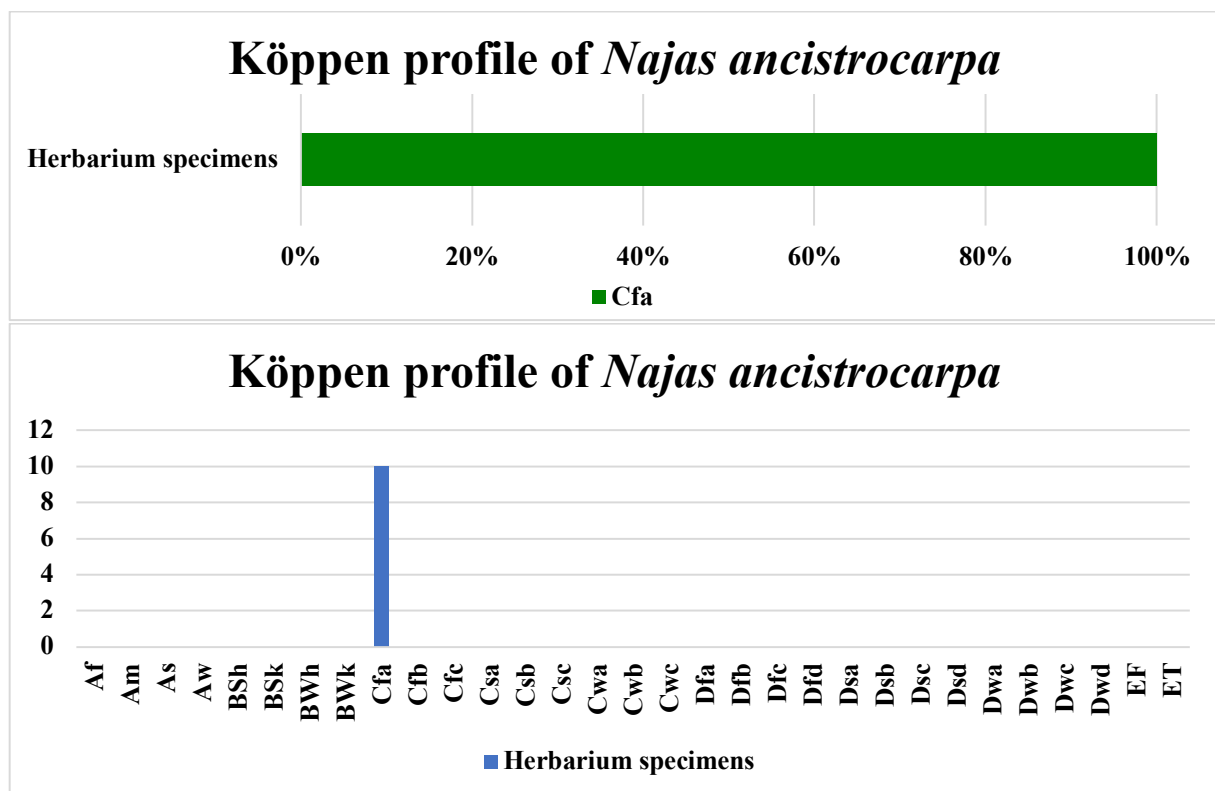
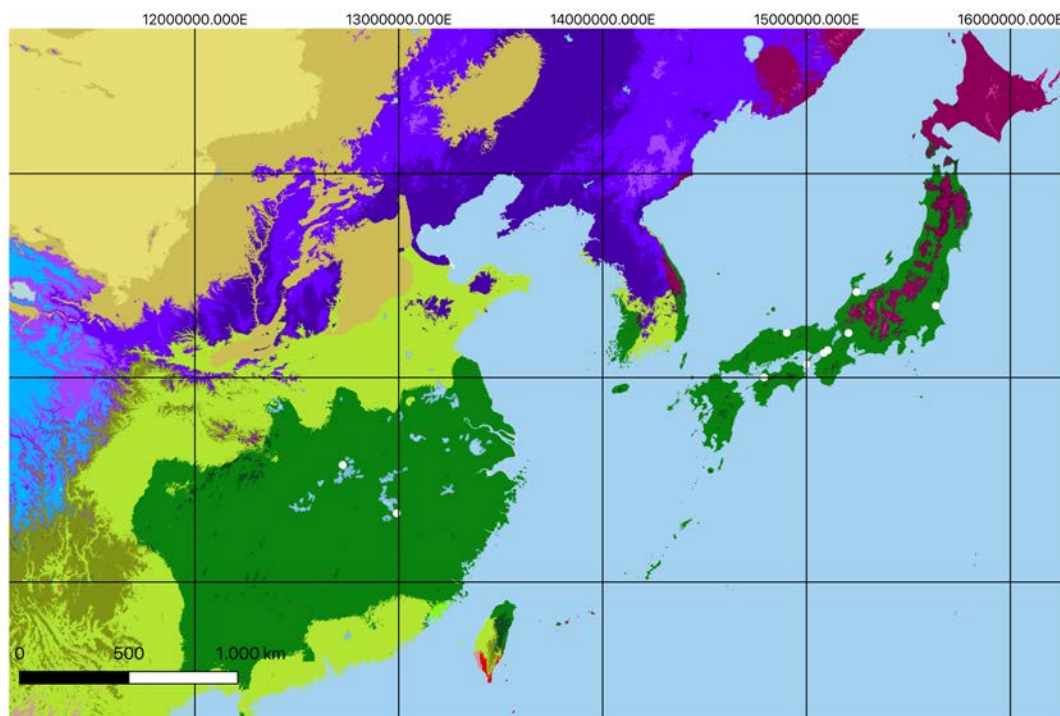
arguta, *N. australis*, *N. baldwinii*, *N. browniana*, *N. chinensis*, *N. conferta*, *N. filifolia*, *N. flexilis*, *N. gracillima*, *N. graminea*, *N. guadalupensis*, *N. hagerupii*, *N. halophila*, *N. horrida*, *N. indica*, *N. kurziana*, *N. madagascariensis*, *N. malesiana*, *N. marina*, *N. oguraensis*, *N. pectinate*, *N. schweinfurthii*, *N. tenuicaulis*, *N. tenuifolia*, *N. tenuissima*, *N. testui*, *N. welwitschia*, *N. wrightiana* (n = 8269).



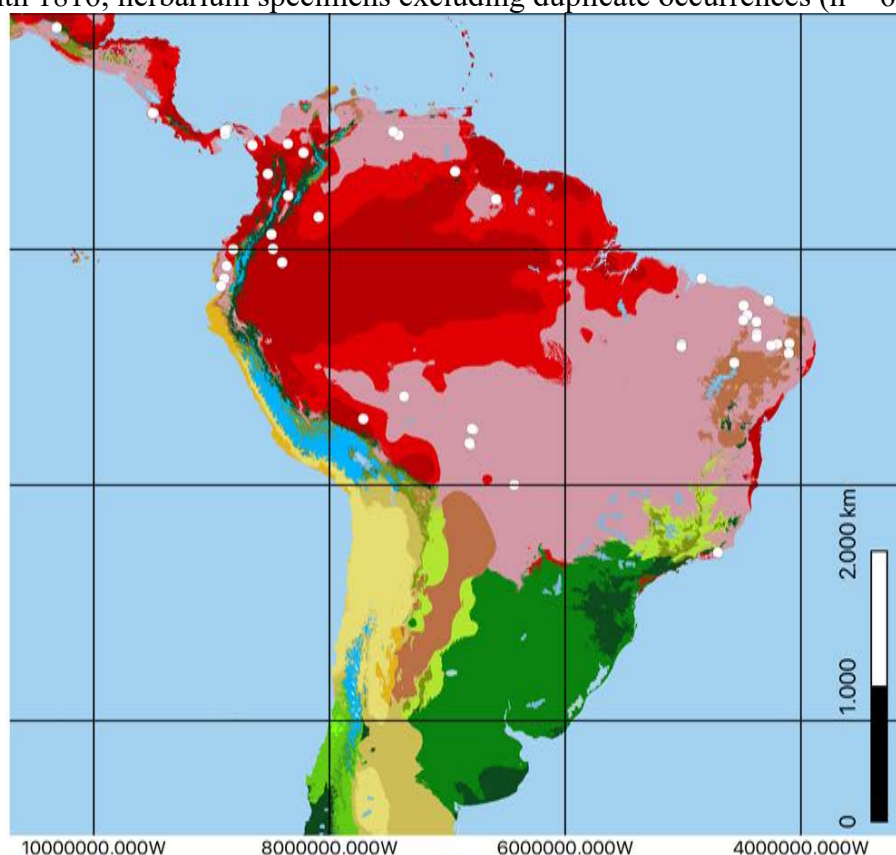
5.3.3.1.1. Köppen profile, distribution and climate map – GBIF occurrences of *Najas affinis* Rendle 1900; herbarium specimens excluding duplicate occurrences (n = 22).



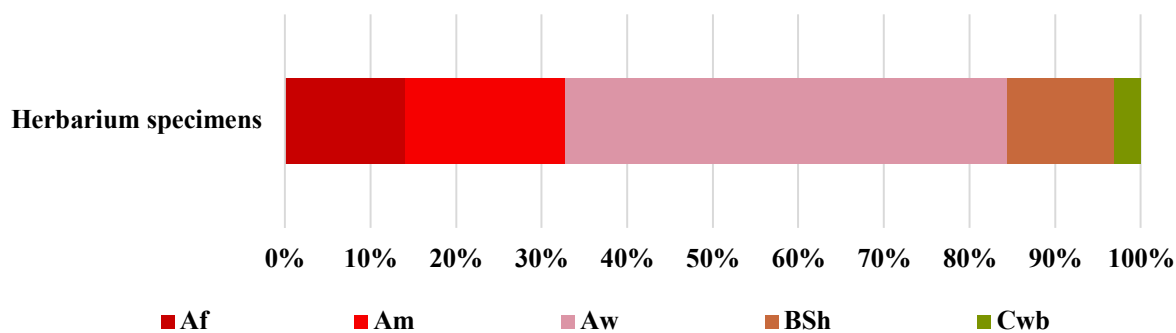
5.3.3.1.2. Köppen profile, distribution and climate map – GBIF occurrences of *Najas ancistrocarpa* A.Braun ex Magnus 1870; herbarium specimens excluding duplicate occurrences (n = 10).



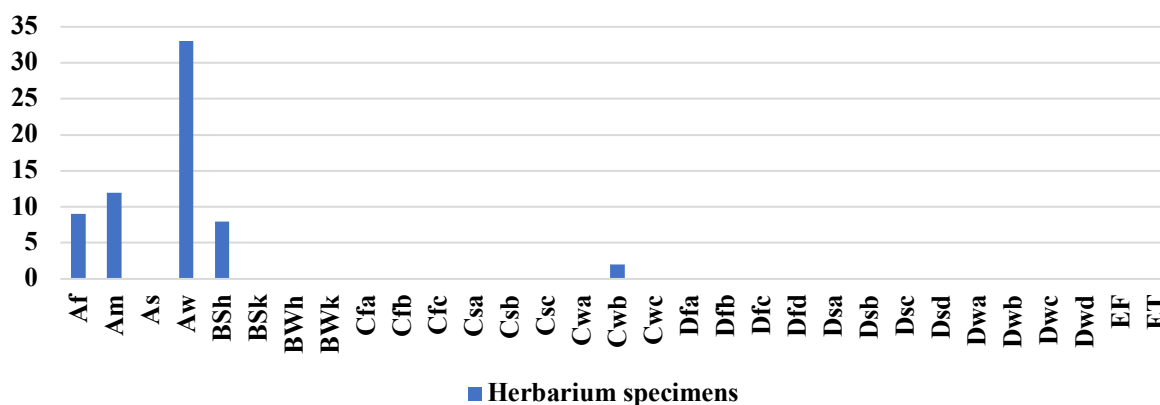
5.3.3.1.3. Köppen profile, distribution and climate map – GBIF occurrences of *Najas arguta* Kunth 1816; herbarium specimens excluding duplicate occurrences (n = 64).



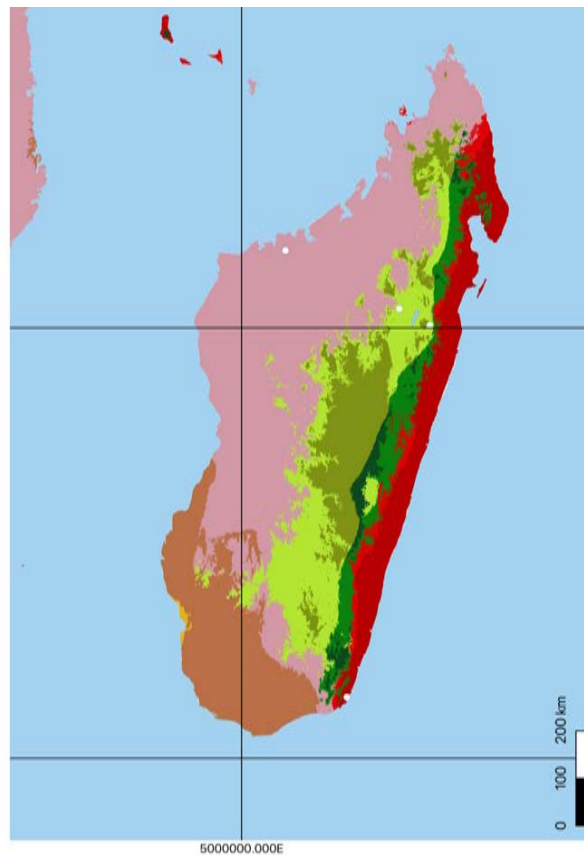
Köppen profile of *Najas arguta*



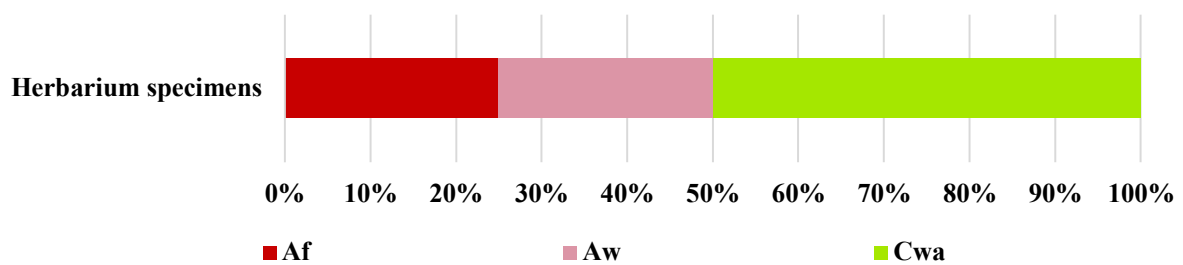
Köppen profile of *Najas arguta*



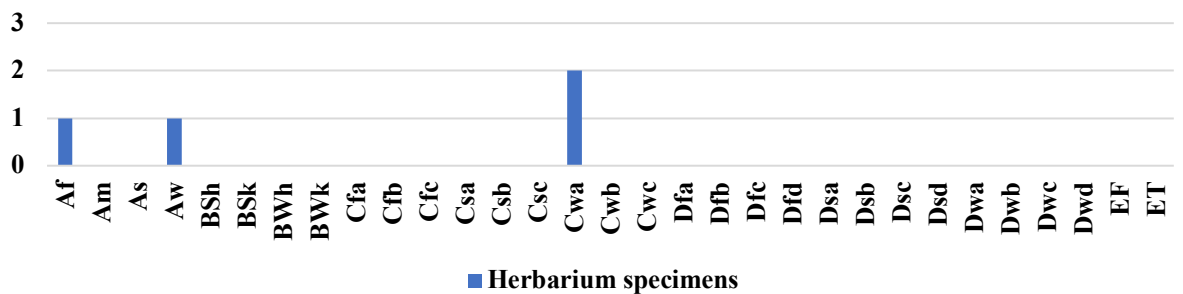
5.3.3.1.4. Köppen profile, distribution and climate map – GBIF occurrences of *Najas australis* Borey ex Cham. 1829; herbarium specimens excluding duplicate occurrences (n = 4).



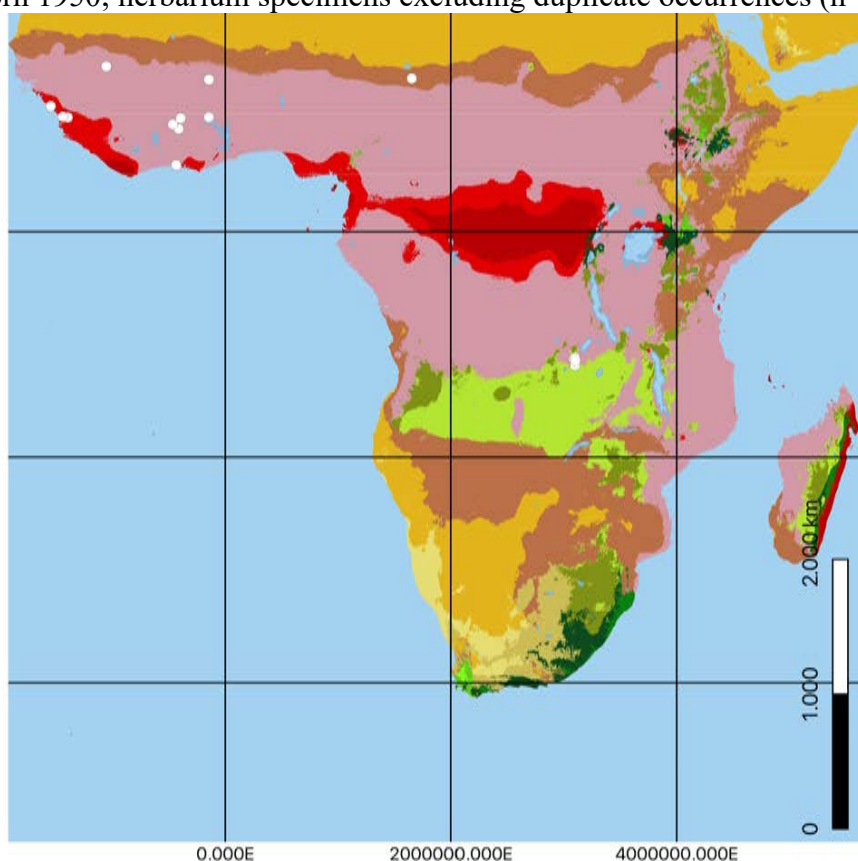
Köppen profile of *Najas australis*



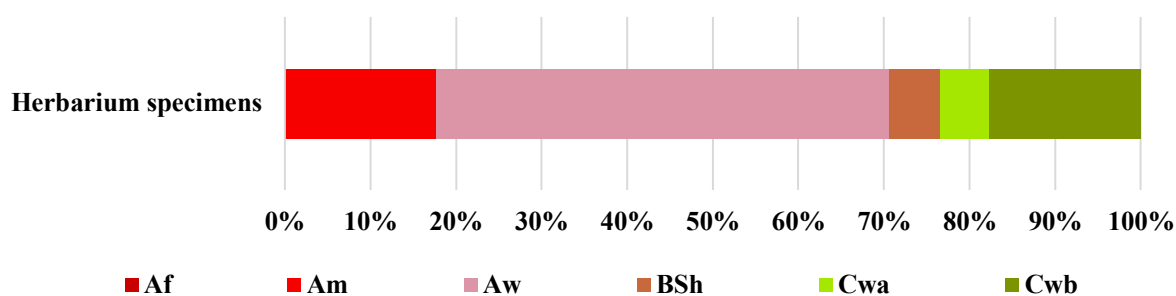
Köppen profile of *Najas australis*



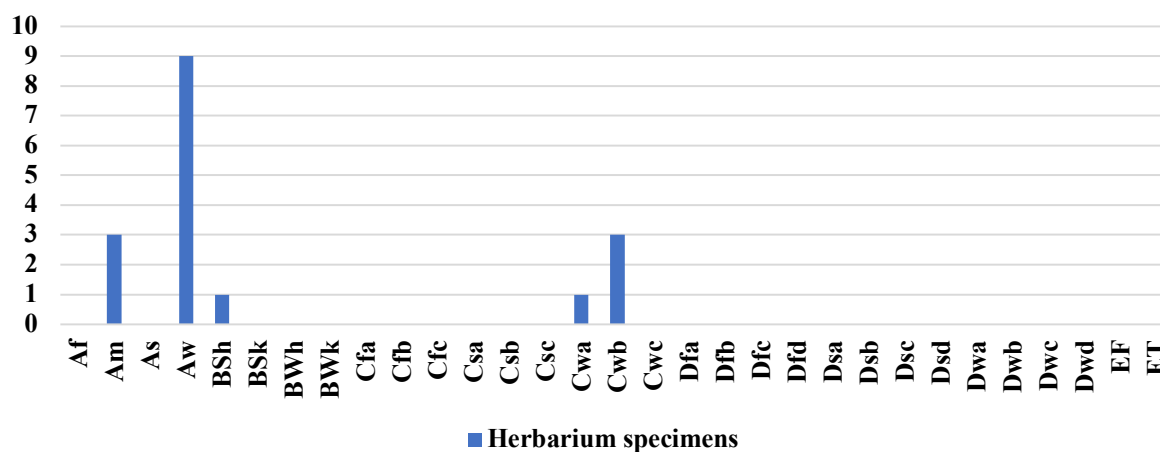
5.3.3.1.5. Köppen profile, distribution and climate map – GBIF occurrences of *Najas baldwinii* Horn 1950; herbarium specimens excluding duplicate occurrences (n = 17).



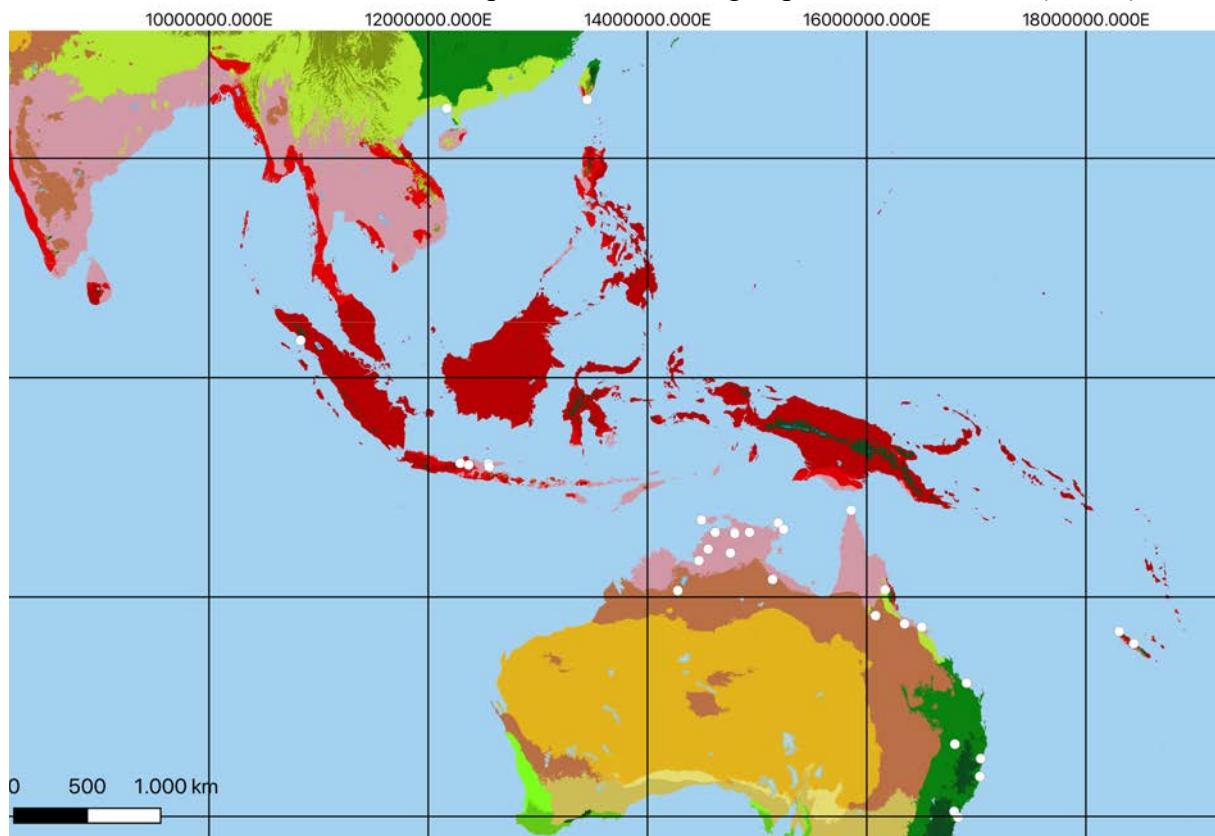
Köppen profile of *Najas baldwinii*



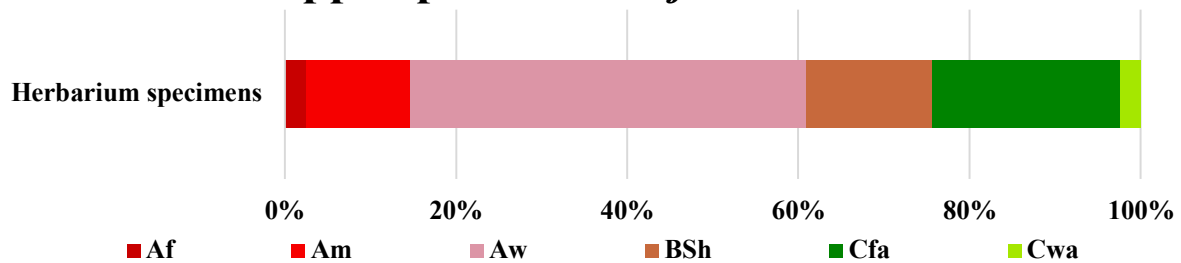
Köppen profile of *Najas baldwinii*



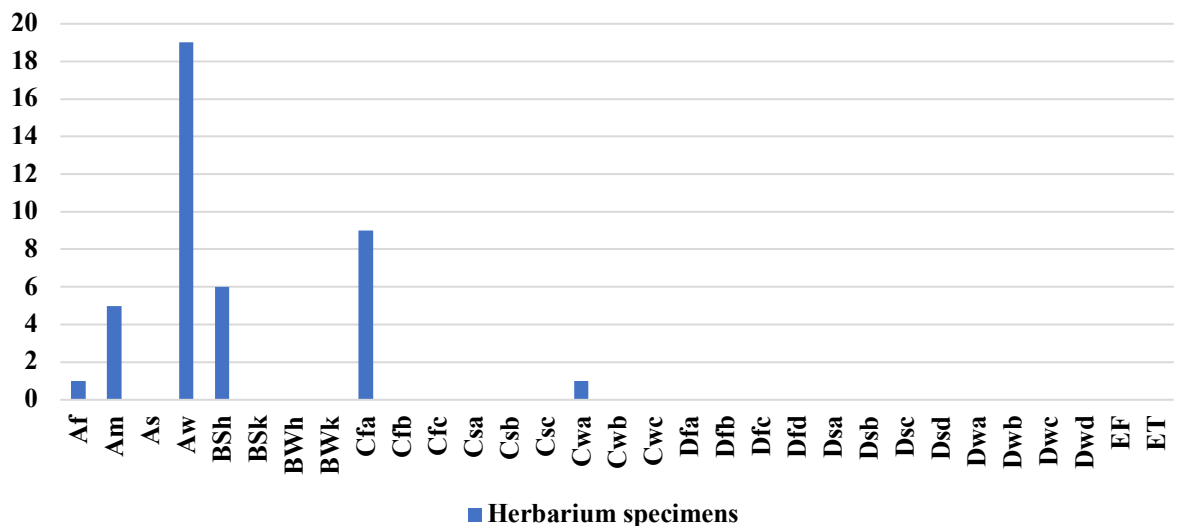
5.3.3.1.6. Köppen profile, distribution and climate map – GBIF occurrences of *Najas browniana* Rendle 1899; herbarium specimens excluding duplicate occurrences (n = 41).



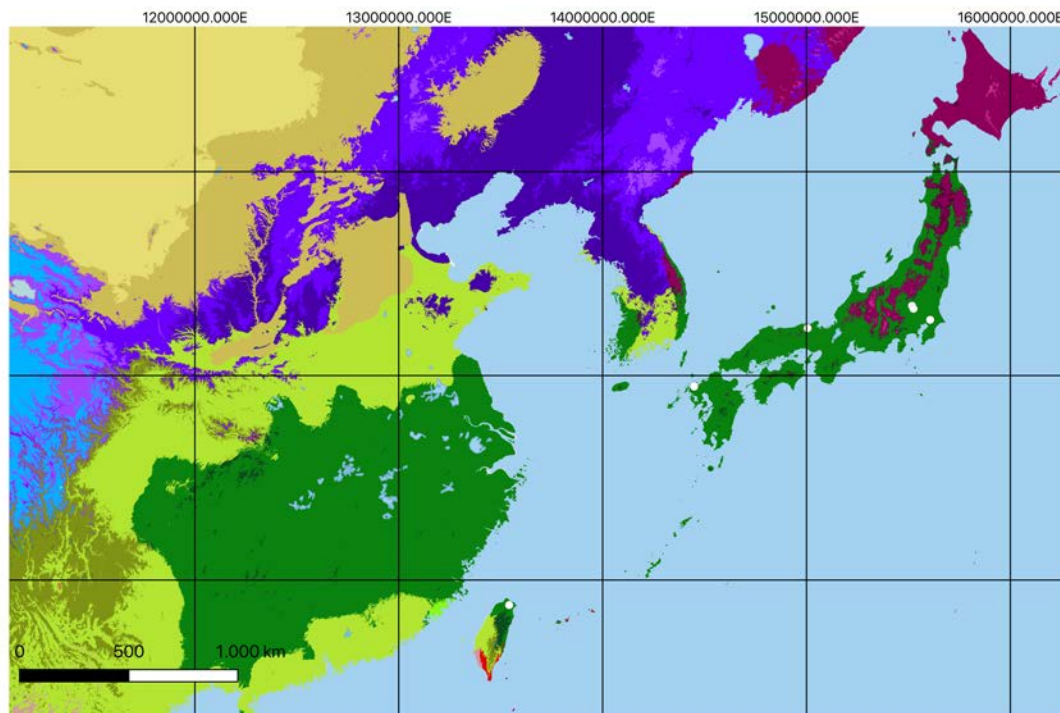
Köppen profile of *Najas browniana*



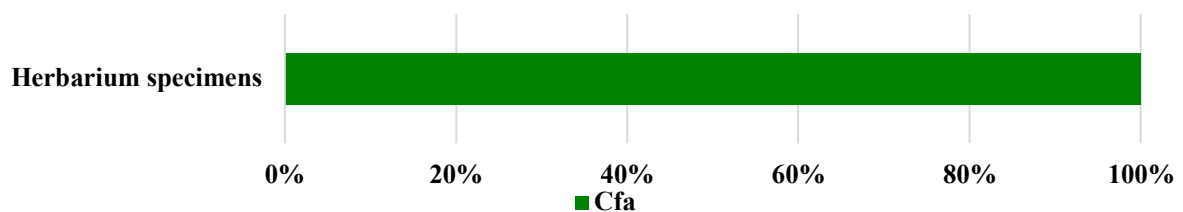
Köppen profile of *Najas browniana*



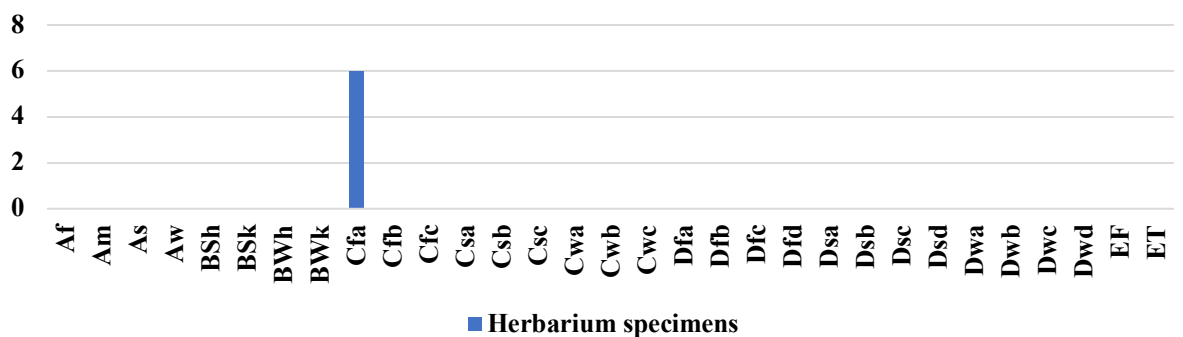
5.3.3.1.7. Köppen profile, distribution and climate map – GBIF occurrences of *Najas chinensis* N.Z.Wang 1985; herbarium specimens excluding duplicate occurrences (n = 6).



Köppen profile of *Najas chinensis*



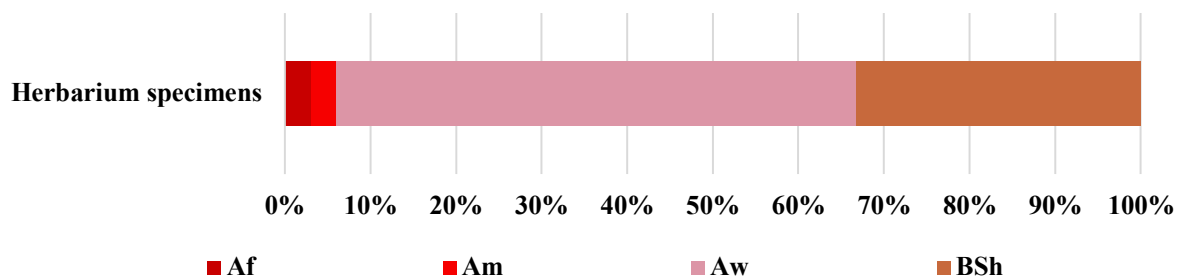
Köppen profile of *Najas chinensis*



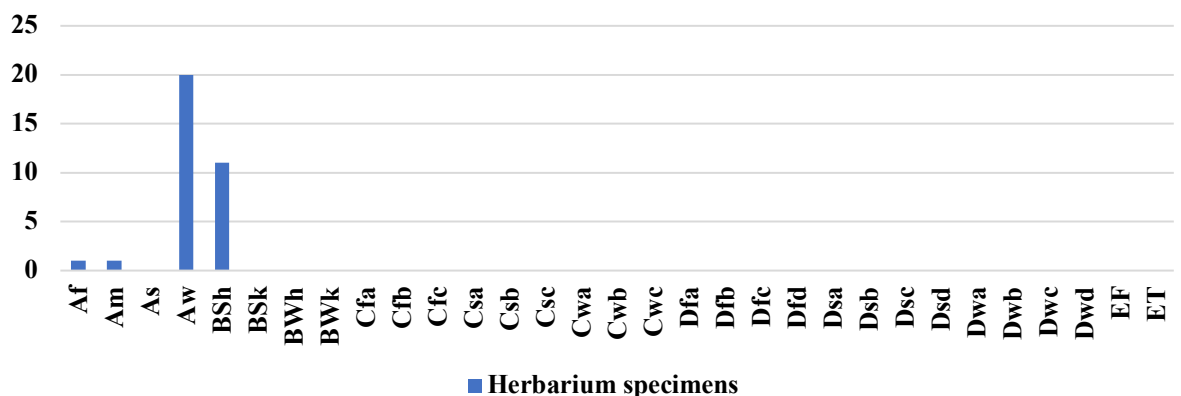
5.3.3.1.8. Köppen profile, distribution and climate map – GBIF occurrences of *Najas conferta* (A.Braun 1864) A.Braun 1868; herbarium specimens excluding duplicate occurrences (n = 33).



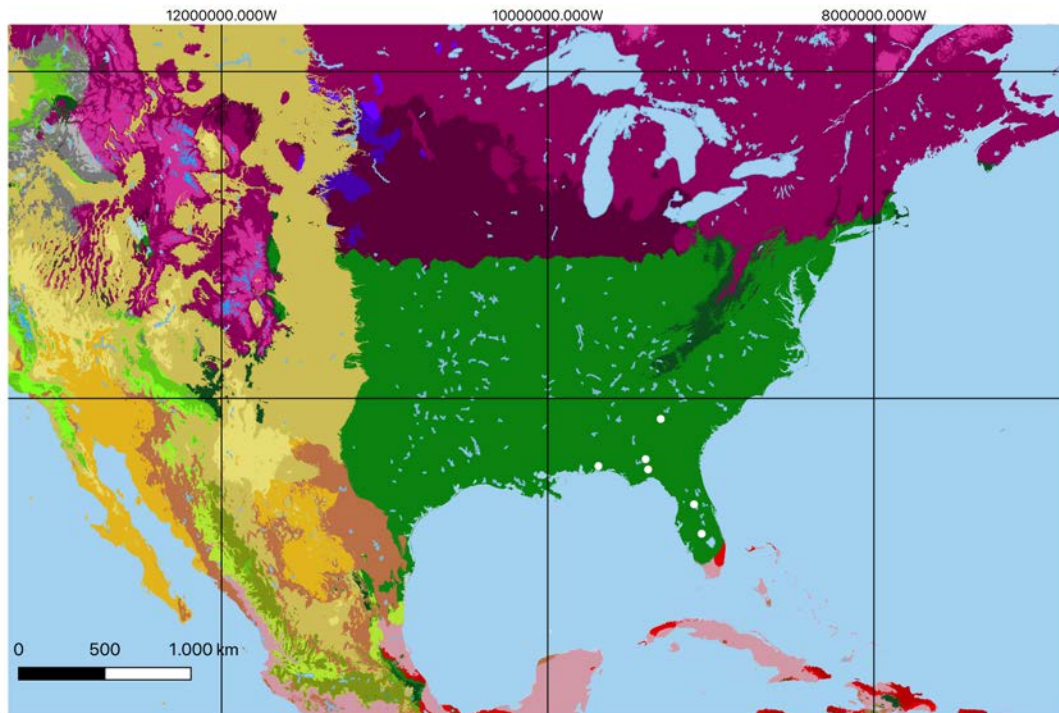
Köppen profile of *Najas conferta*



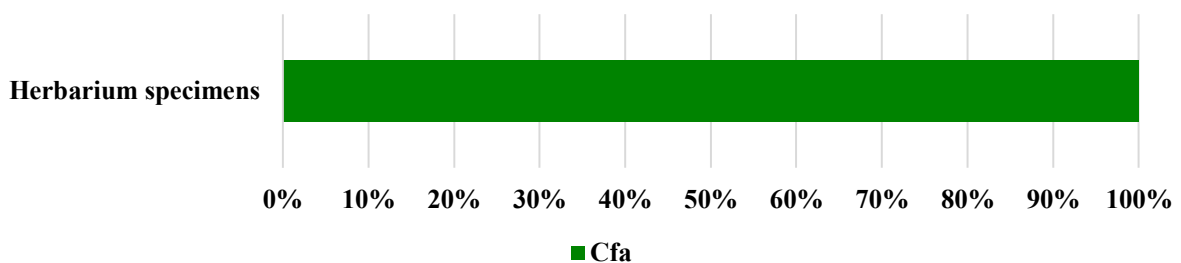
Köppen profile of *Najas conferta*



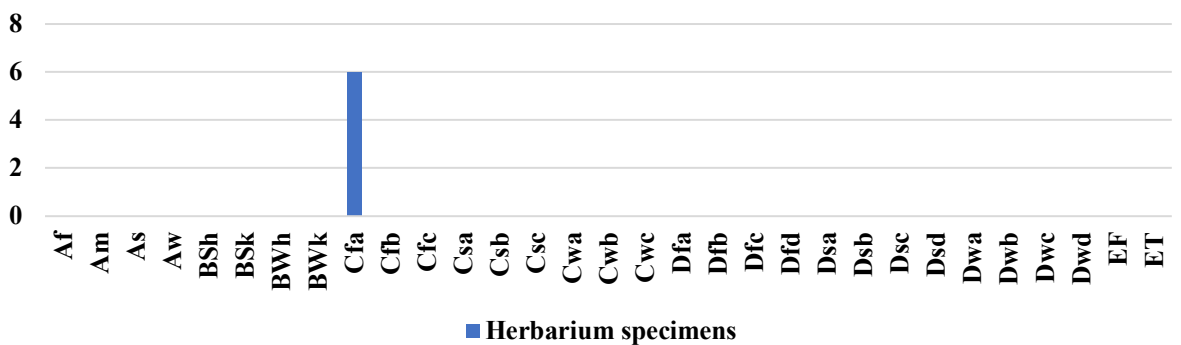
5.3.3.1.9. Köppen profile, distribution and climate map – GBIF occurrences of *Najas filifolia* R.R.Haynes 1985; herbarium specimens excluding duplicate occurrences (n = 6).



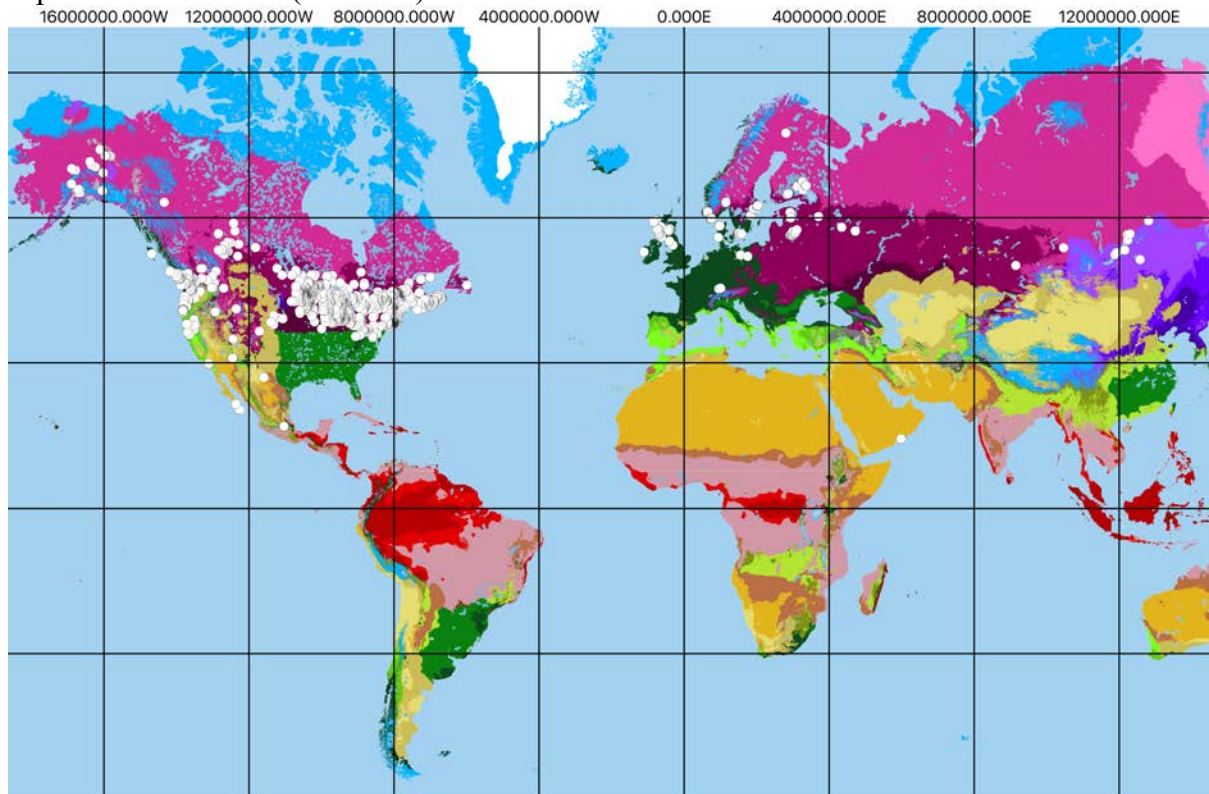
Köppen profile of *Najas filifolia*



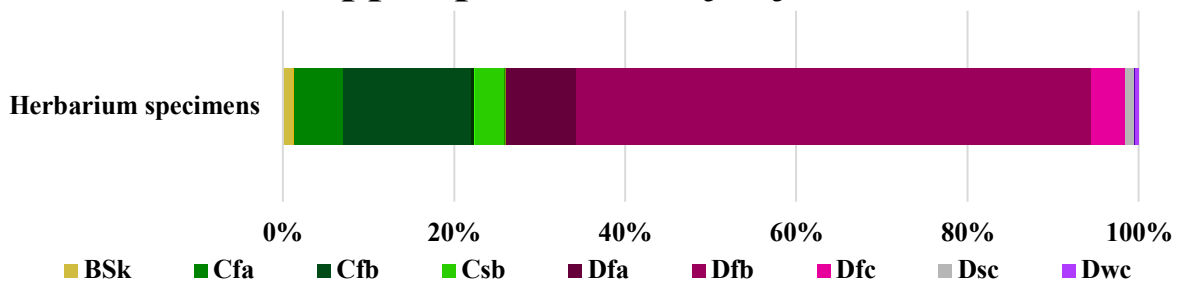
Köppen profile of *Najas filifolia*



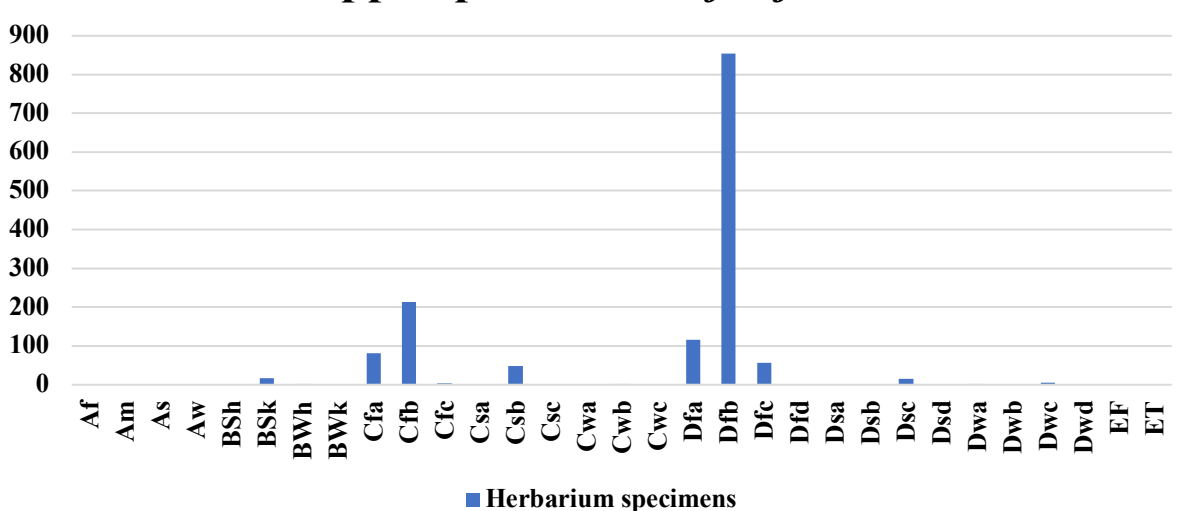
5.3.3.1.10. Köppen profile, distribution and climate map – GBIF occurrences of *Najas flexilis* (Willd. 1801) Rostk. & W.L.E.Schmidt 1924; herbarium specimens excluding duplicate occurrences (n = 1419).



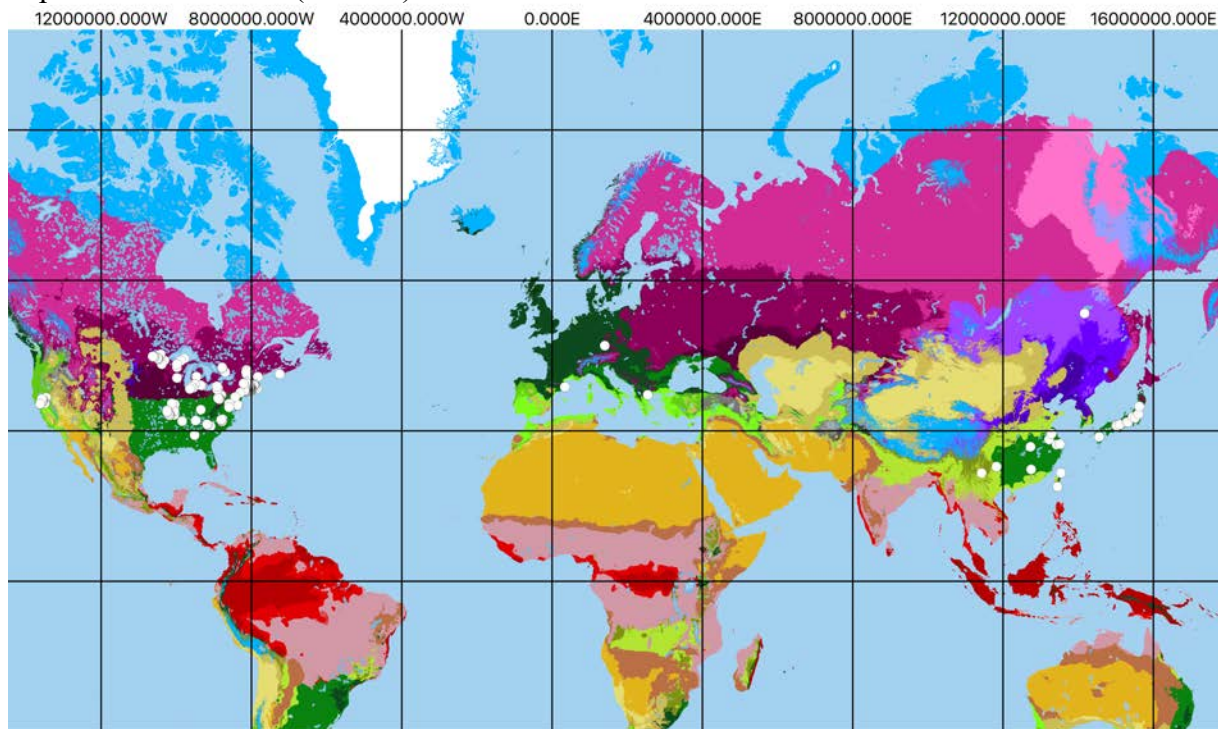
Köppen profile of *Najas flexilis*



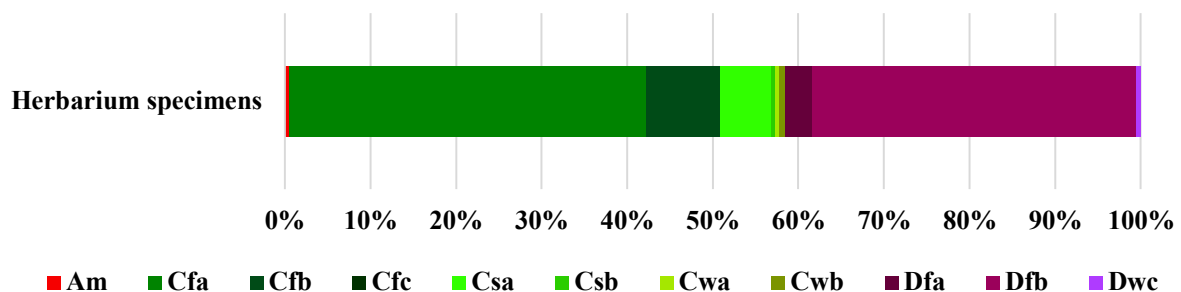
Köppen profile of *Najas flexilis*



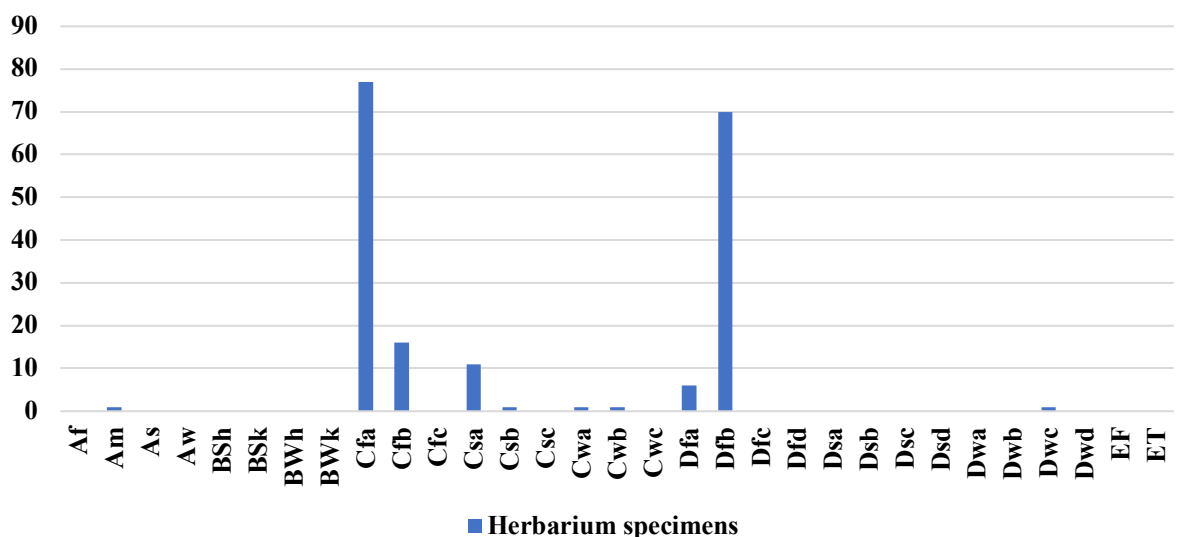
5.3.3.1.11. Köppen profile, distribution and climate map – GBIF occurrences of *Najas gracillima* (A.Braun ex Engelm. 1868) Magnus 1870; herbarium specimens excluding duplicate occurrences (n = 185).



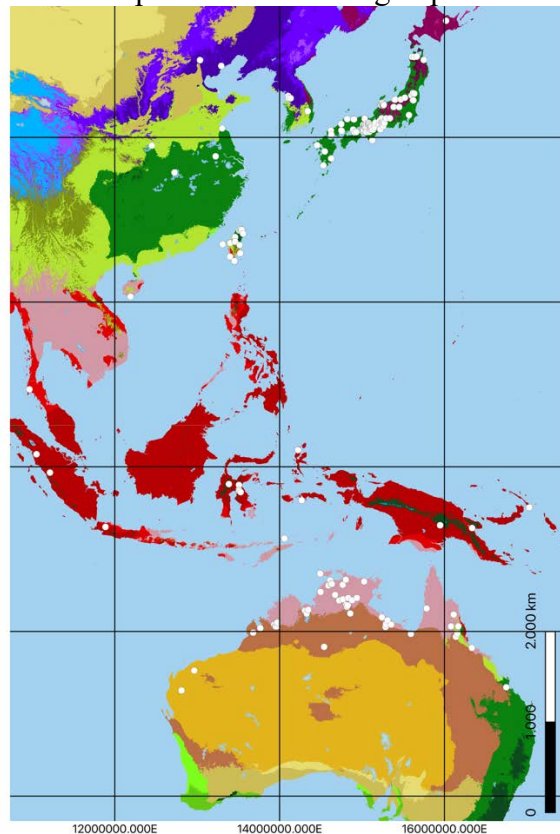
Köppen profile of *Najas gracillima*



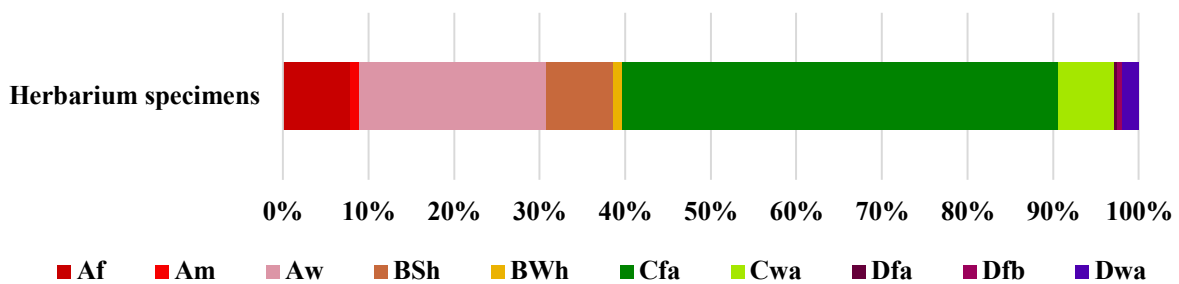
Köppen profile of *Najas gracillima*



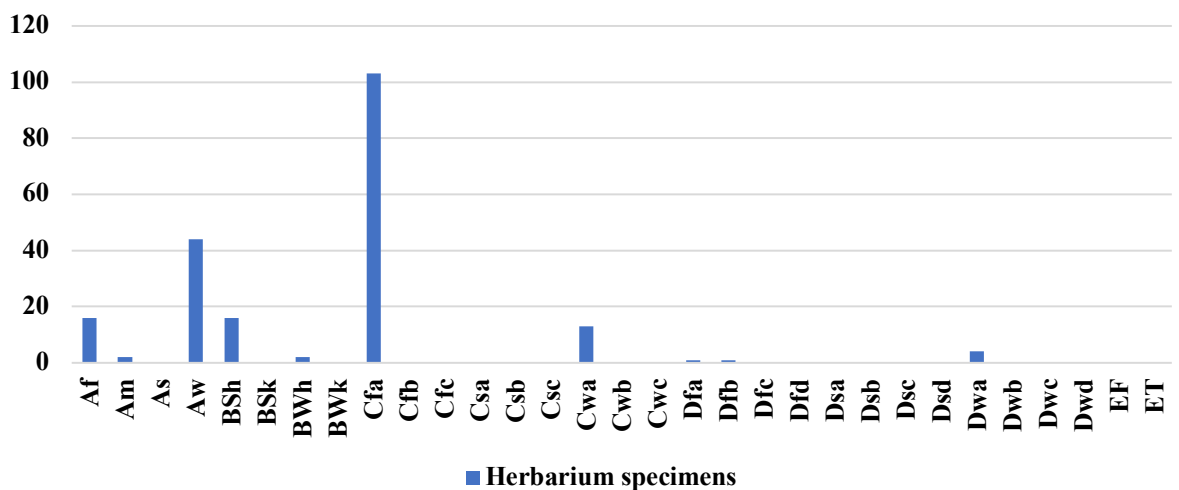
5.3.3.1.12. Köppen profile, distribution and climate map – GBIF occurrences of *Najas graminea* Delile 1814; herbarium specimens excluding duplicate occurrences (n = 202).



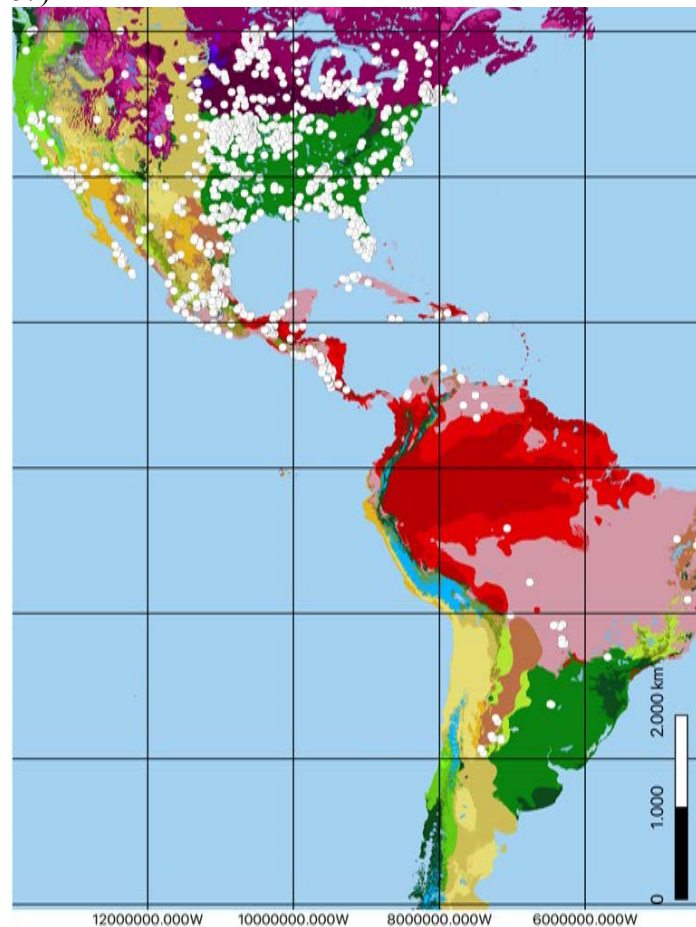
Köppen profile of *Najas graminea*



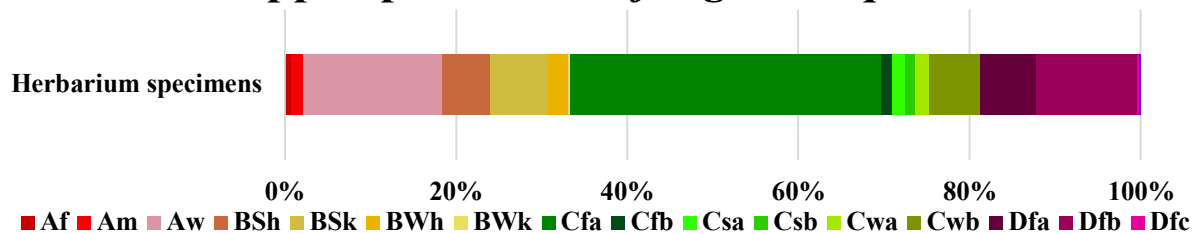
Köppen profile of *Najas graminea*



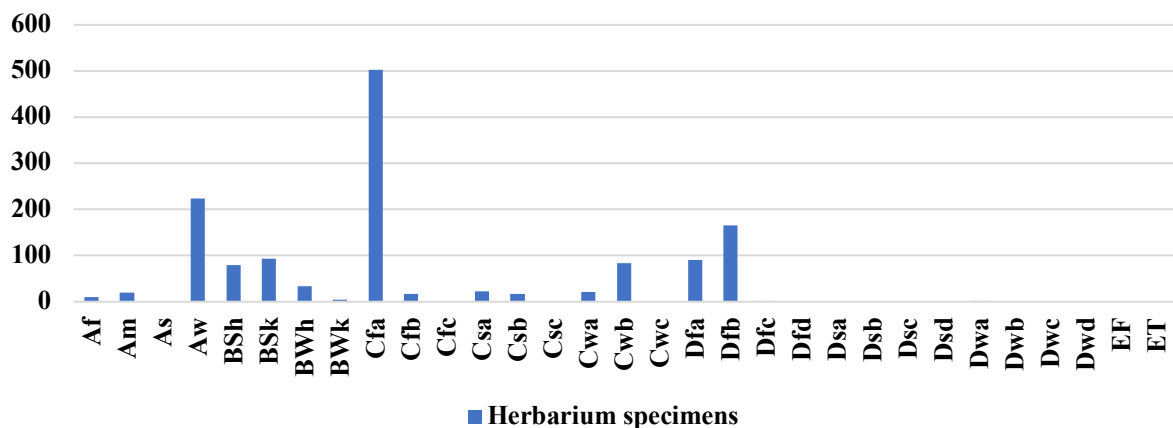
5.3.3.1.13. Köppen profile, distribution and climate map – GBIF occurrences of *Najas guadalupensis* (Spreng. 1824) Magnus 1870; herbarium specimens excluding duplicate occurrences (n = 1387).



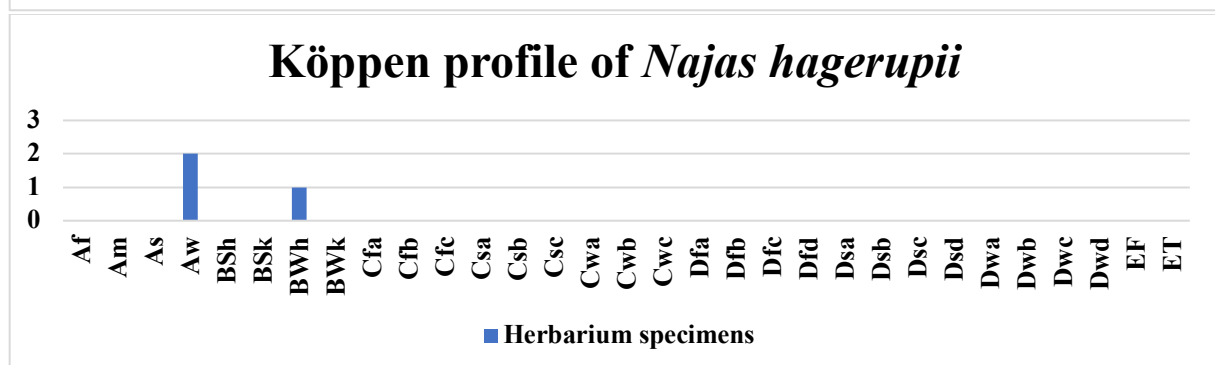
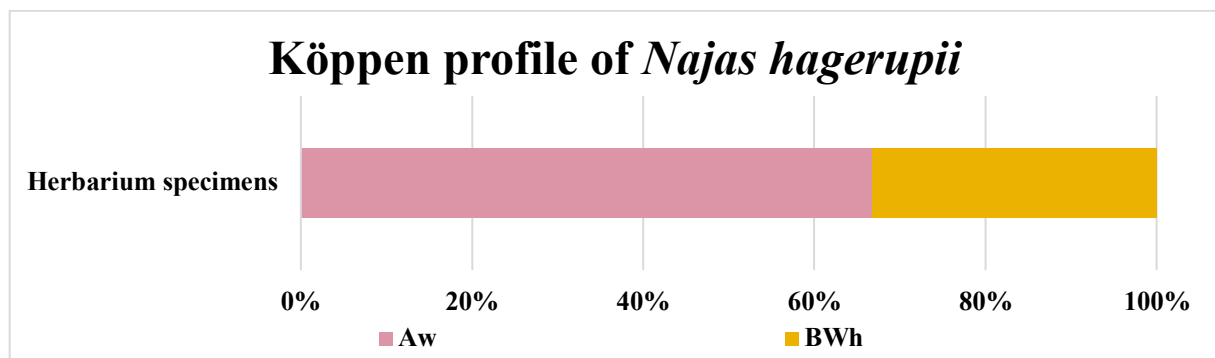
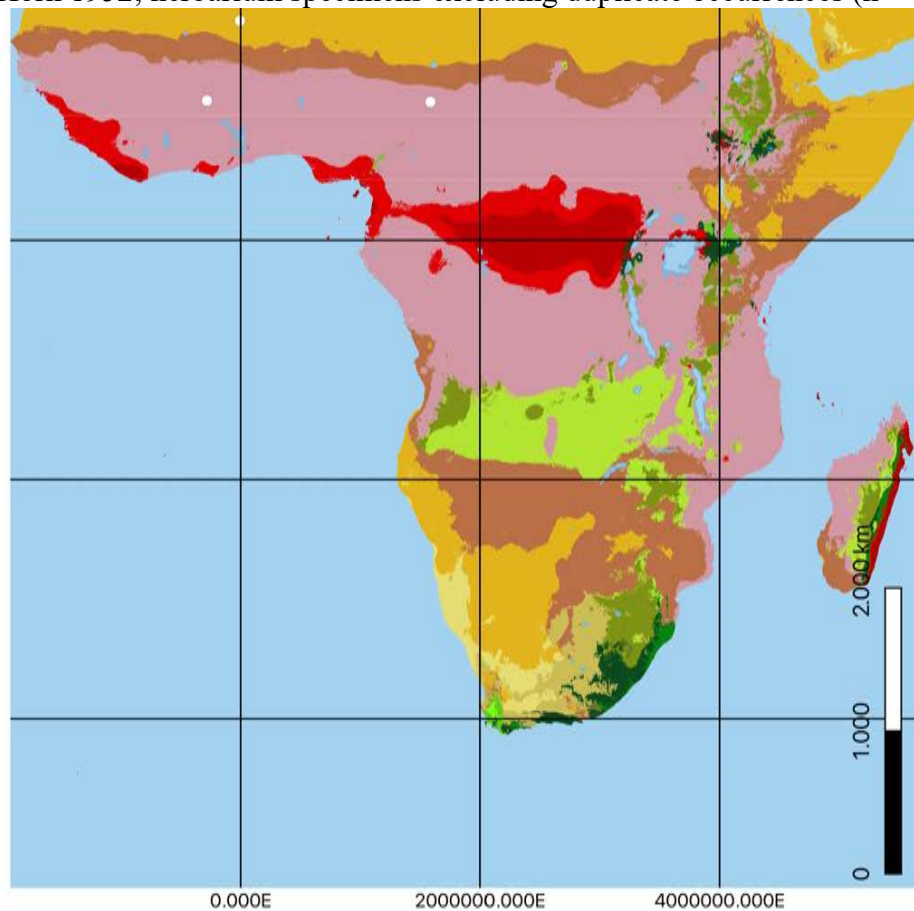
Köppen profile of *Najas guadalupensis*



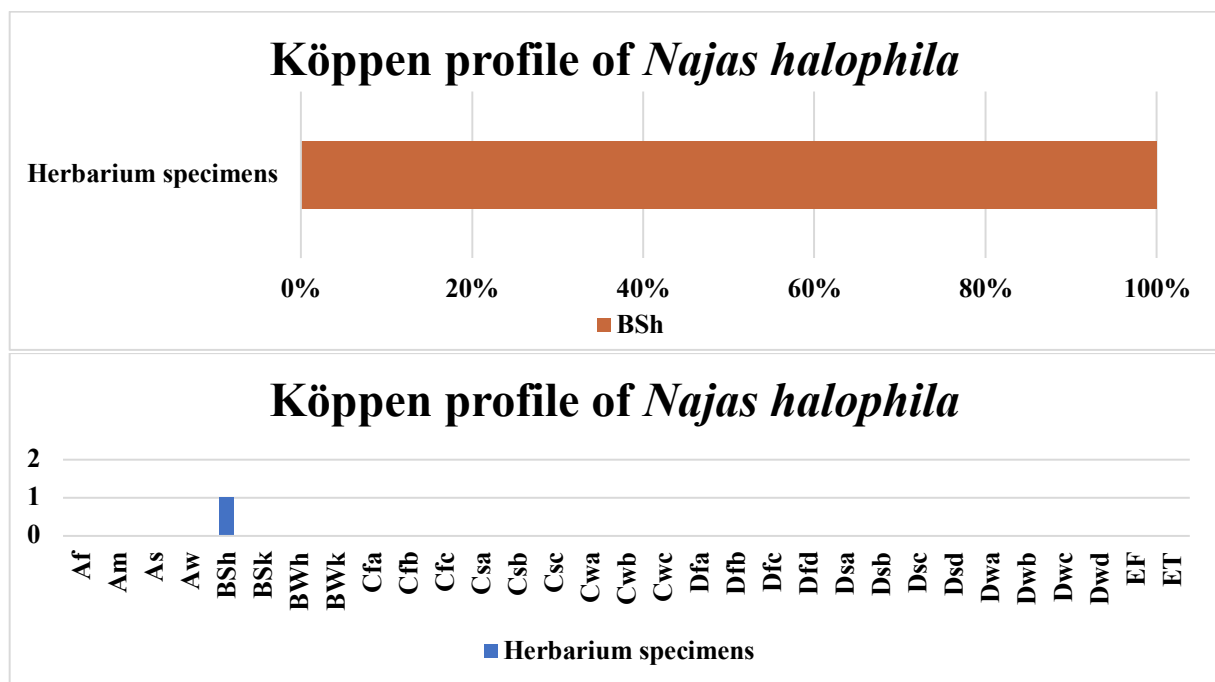
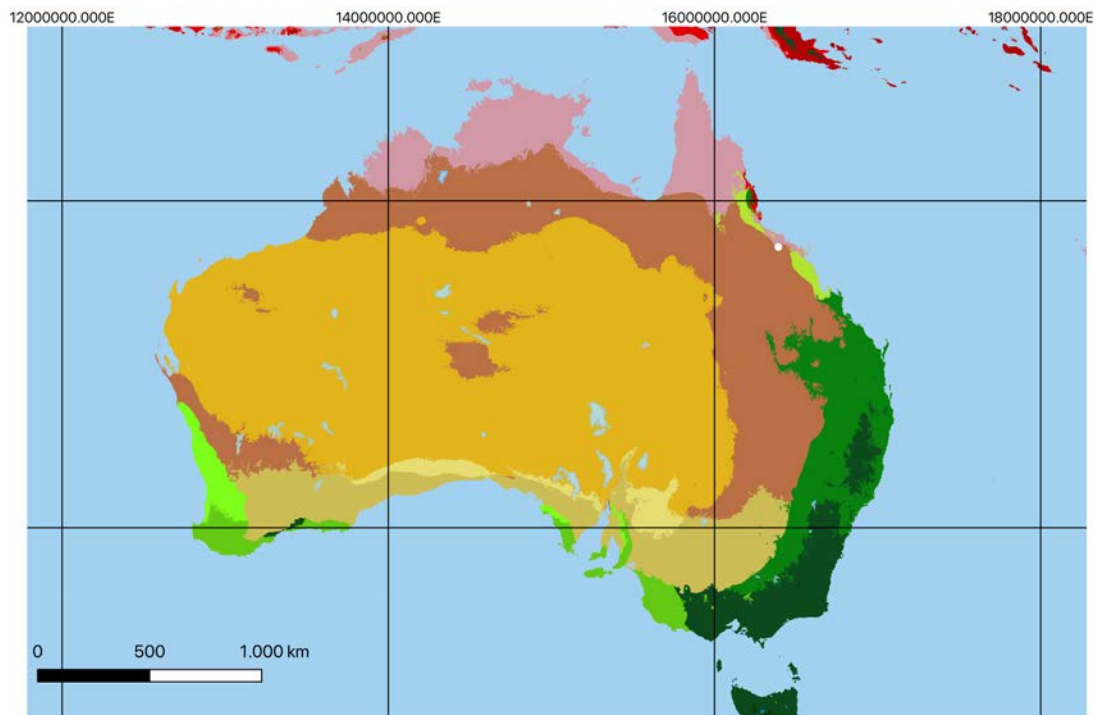
Köppen profile of *Najas guadalupensis*



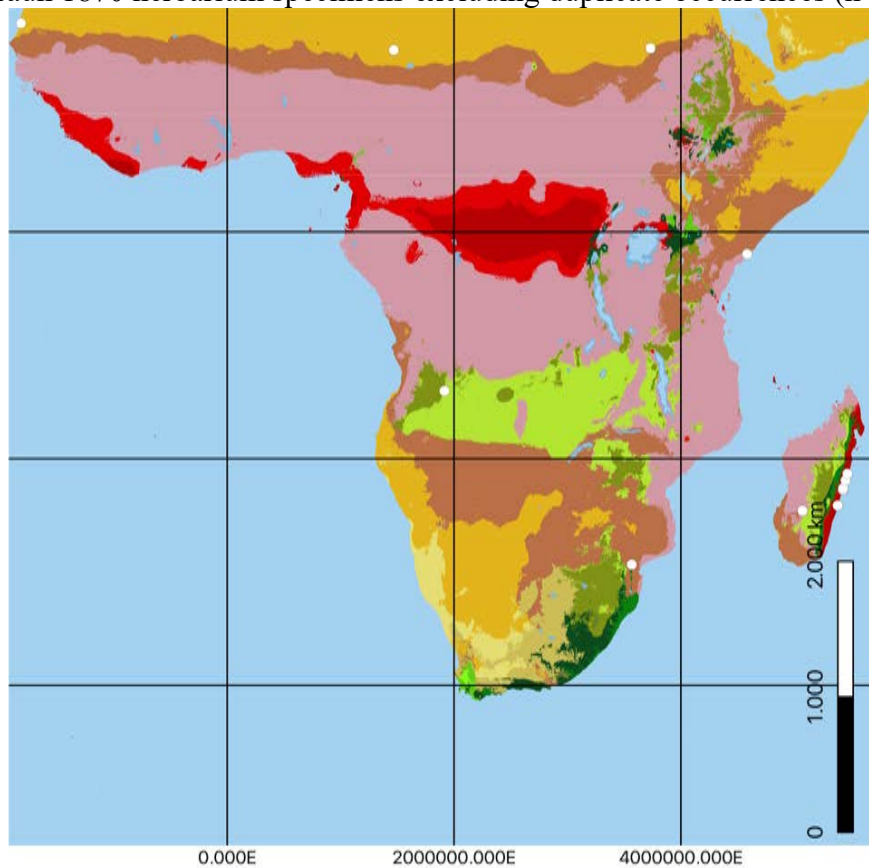
5.3.3.1.14. Köppen profile, distribution and climate map – GBIF occurrences of *Najas hagerupii* Horn 1952; herbarium specimens excluding duplicate occurrences (n = 3).



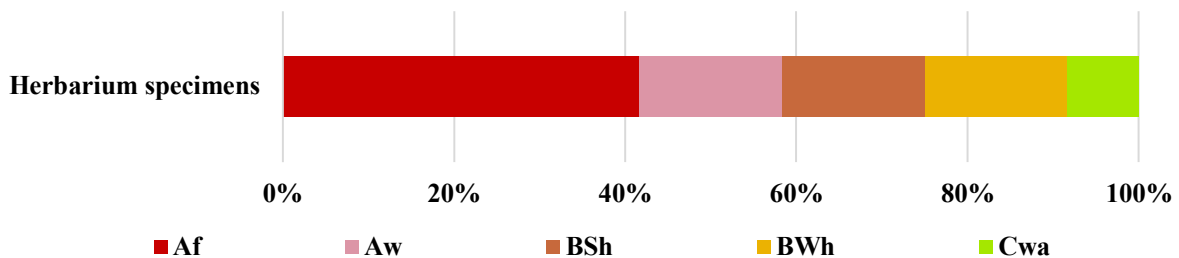
5.3.3.1.15. Köppen profile, distribution and climate map – GBIF occurrences of *Najas halophila* L. Triest 1988 herbarium specimens excluding duplicate occurrences (n = 1).



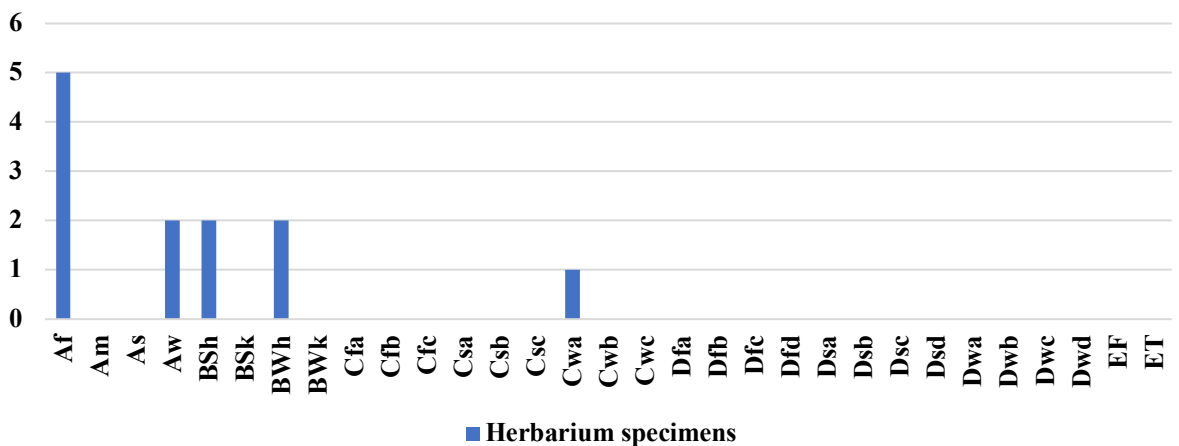
5.3.3.1.16. Köppen profile, distribution and climate map – GBIF occurrences of *Najas horrida* A.Braun 1870 herbarium specimens excluding duplicate occurrences (n = 12).



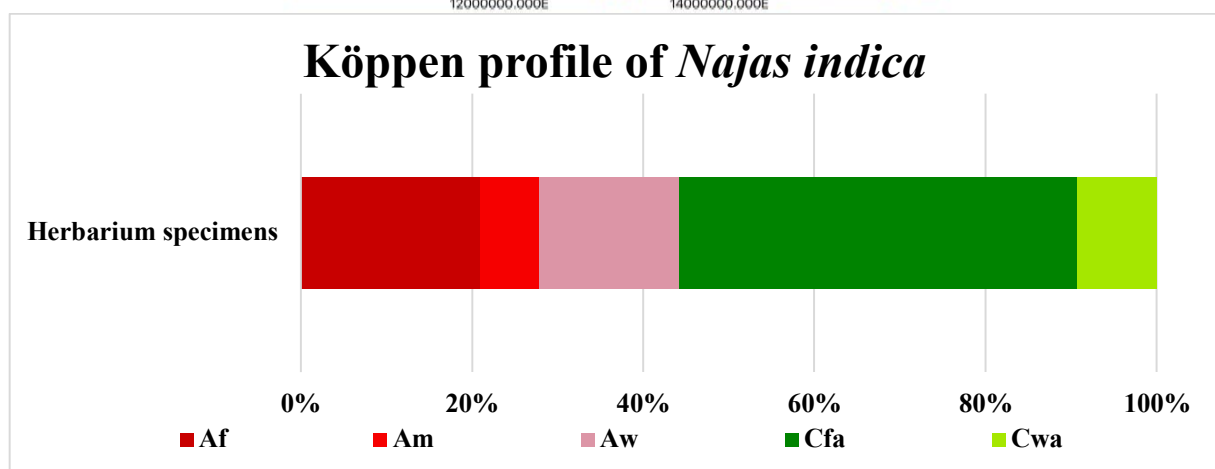
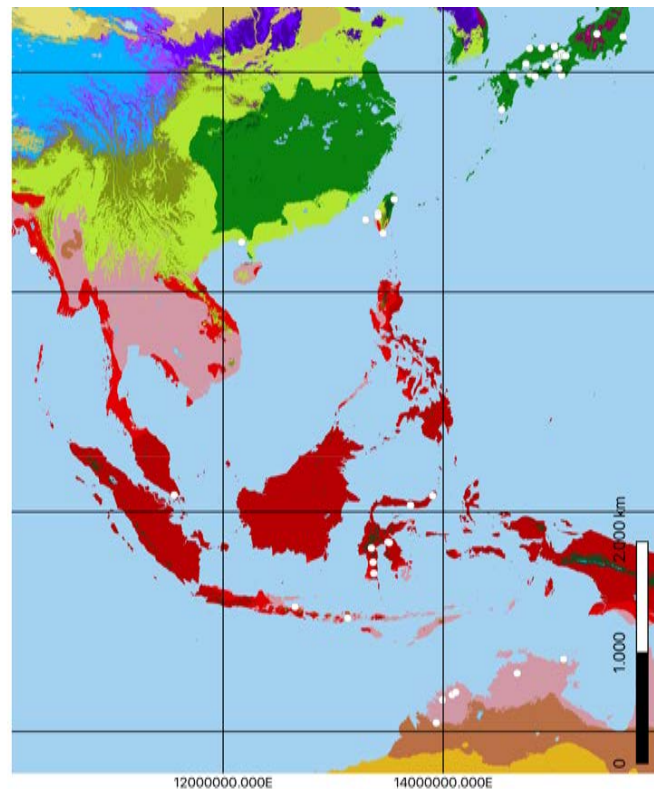
Köppen profile of *Najas horrida*

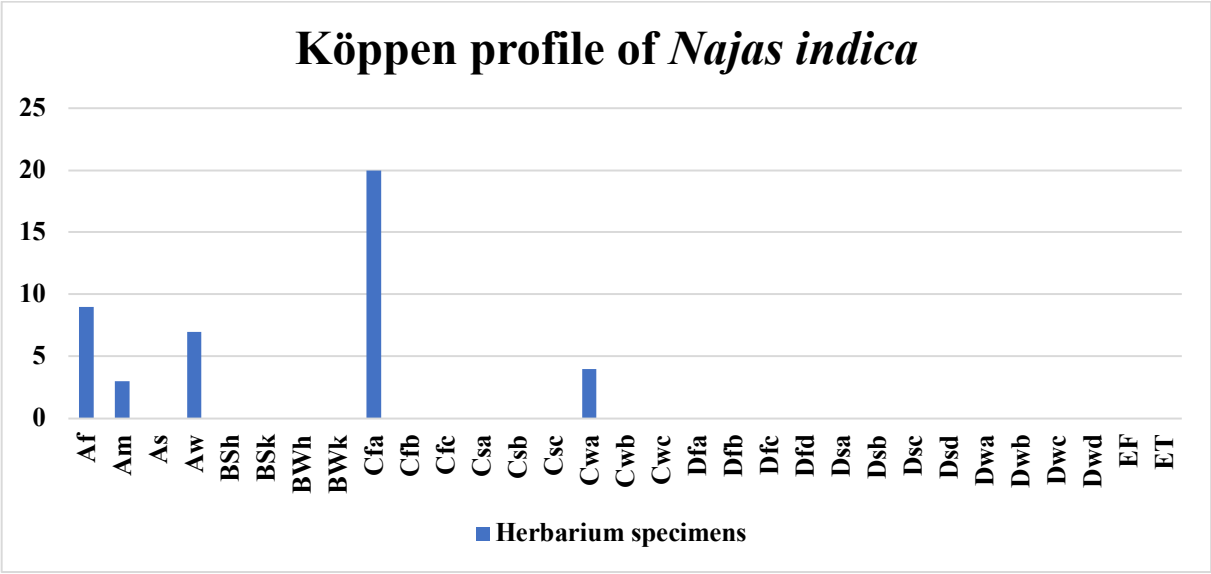


Köppen profile of *Najas horrida*

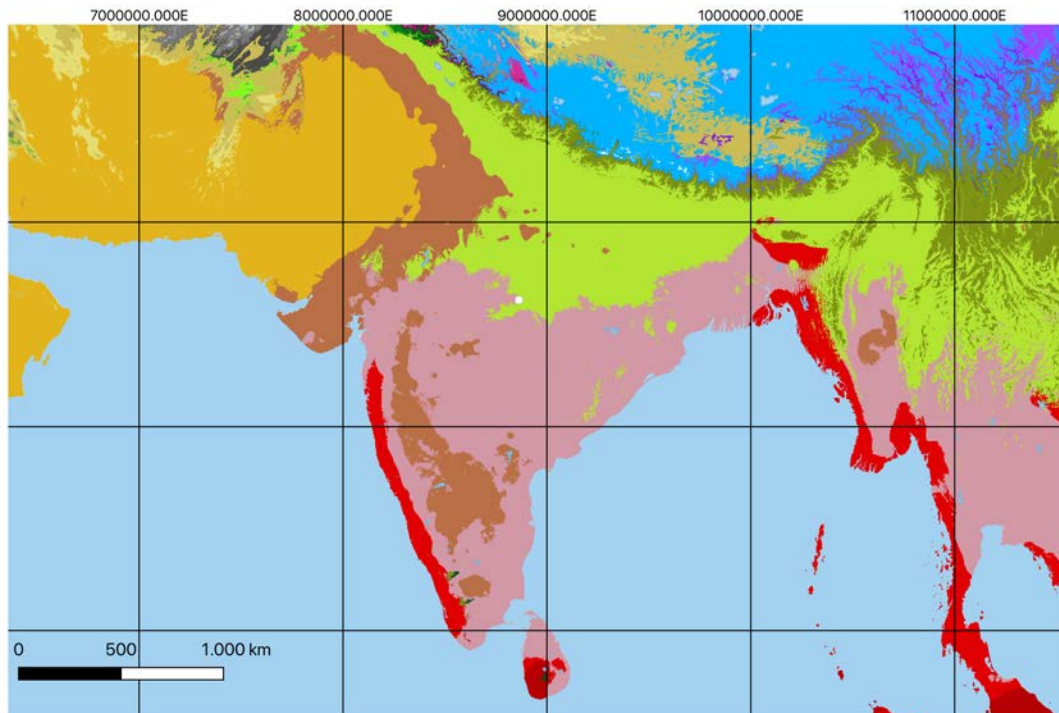


5.3.3.1.17. Köppen profile, distribution and climate map – GBIF occurrences of *Najas indica* (Willd. 1801) Cham. 1829; herbarium specimens excluding duplicate occurrences (n = 43).

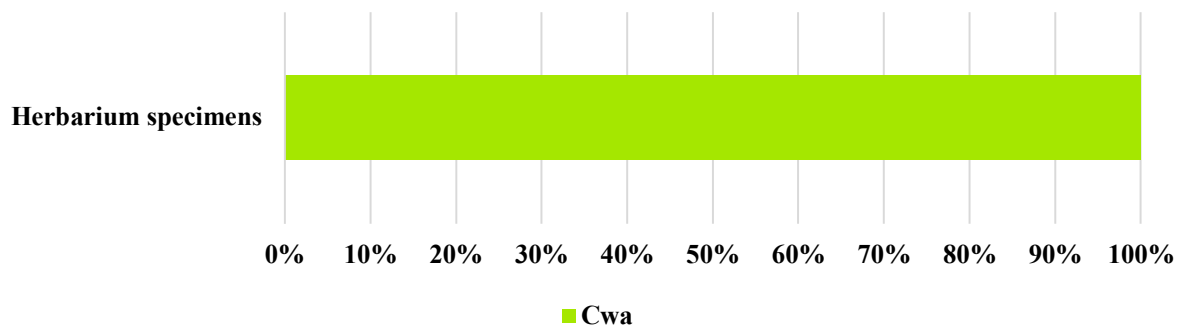




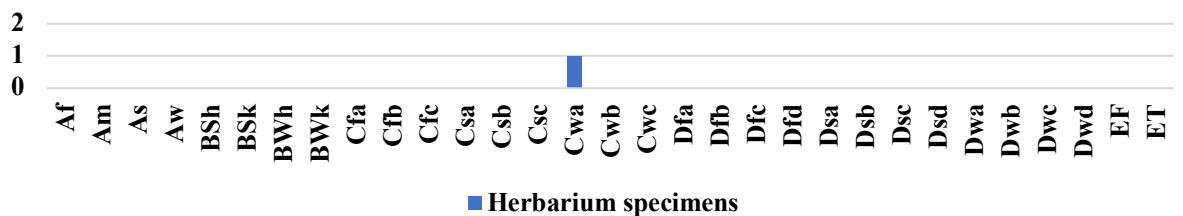
5.3.3.1.18. Köppen profile, distribution and climate map – GBIF occurrences of *Najas kurziana* Rendle 1899; herbarium specimens excluding duplicate occurrences (n = 1).



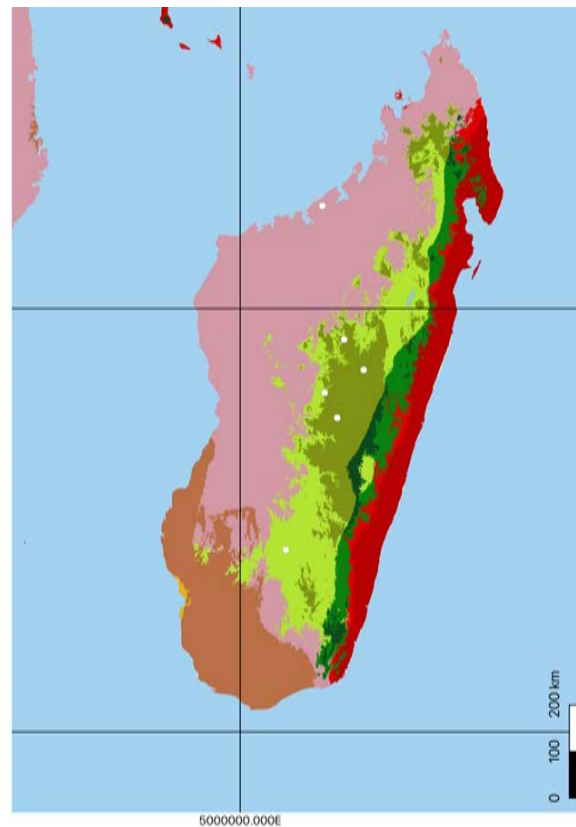
Köppen profile of *Najas kurziana*



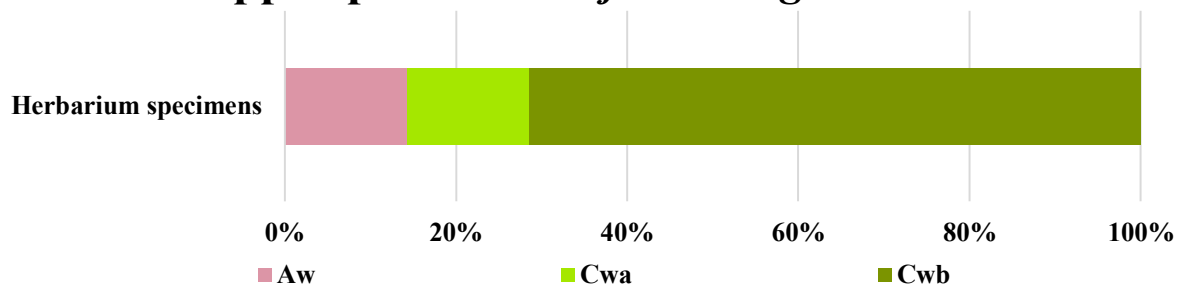
Köppen profile of *Najas kurziana*



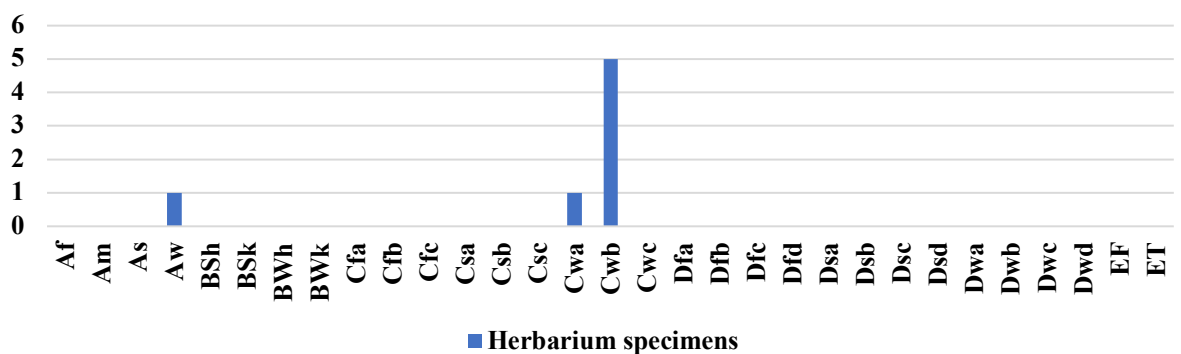
5.3.3.1.19. Köppen profile, distribution and climate map – GBIF occurrences of *Najas madagascariensis* Rendle 1889; herbarium specimens excluding duplicate occurrences (n = 7).



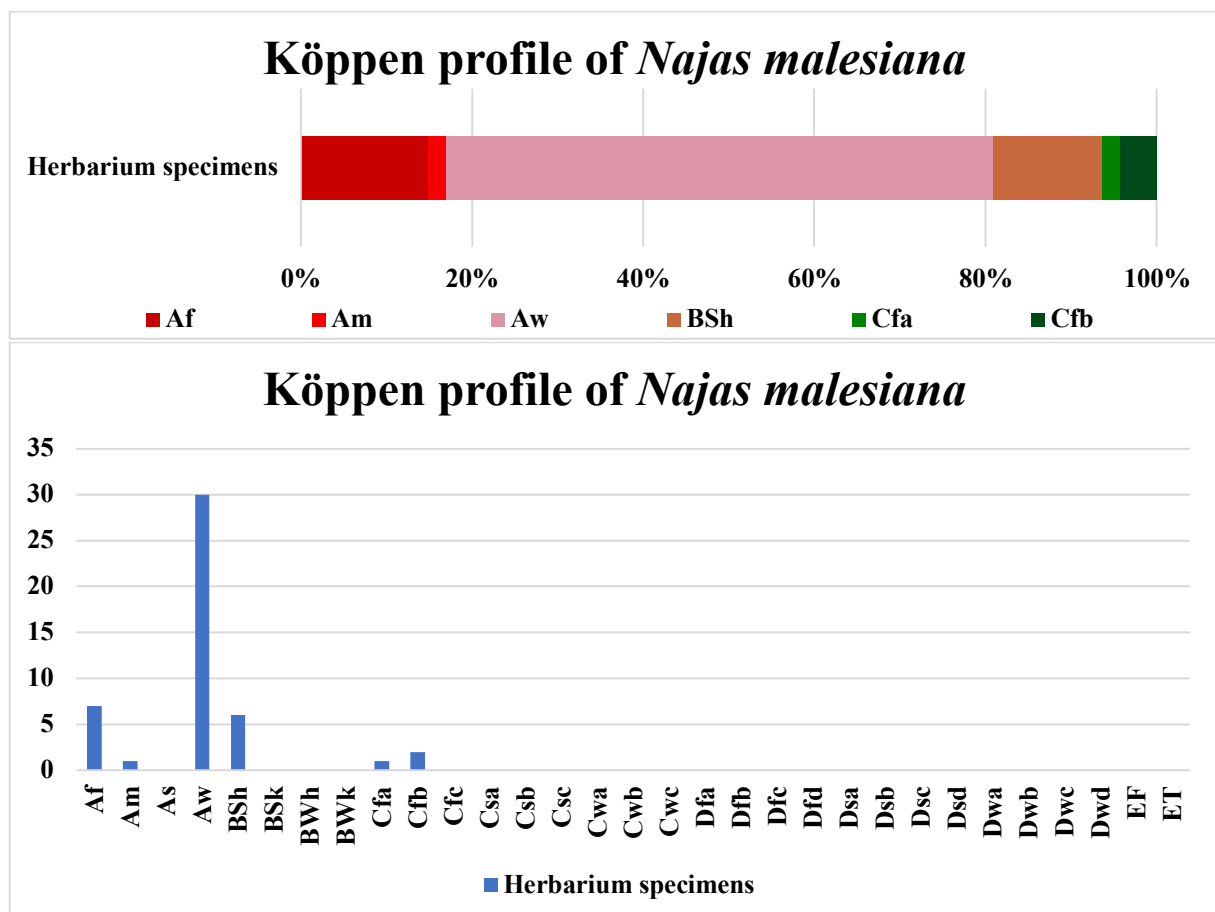
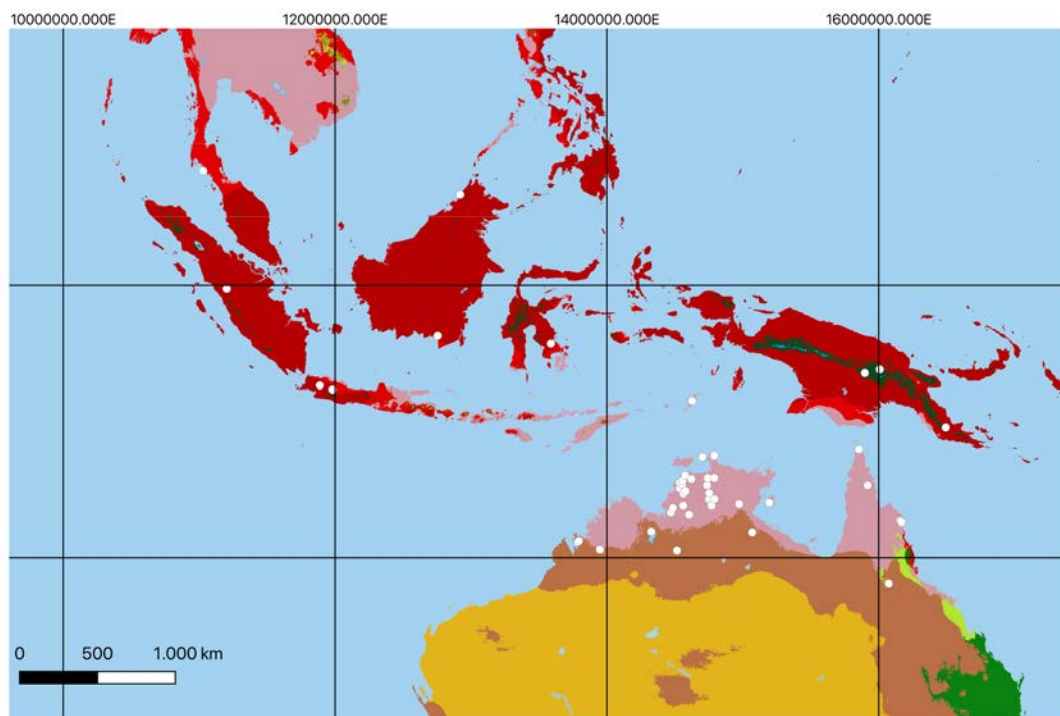
Köppen profile of *Najas madagascariensis*



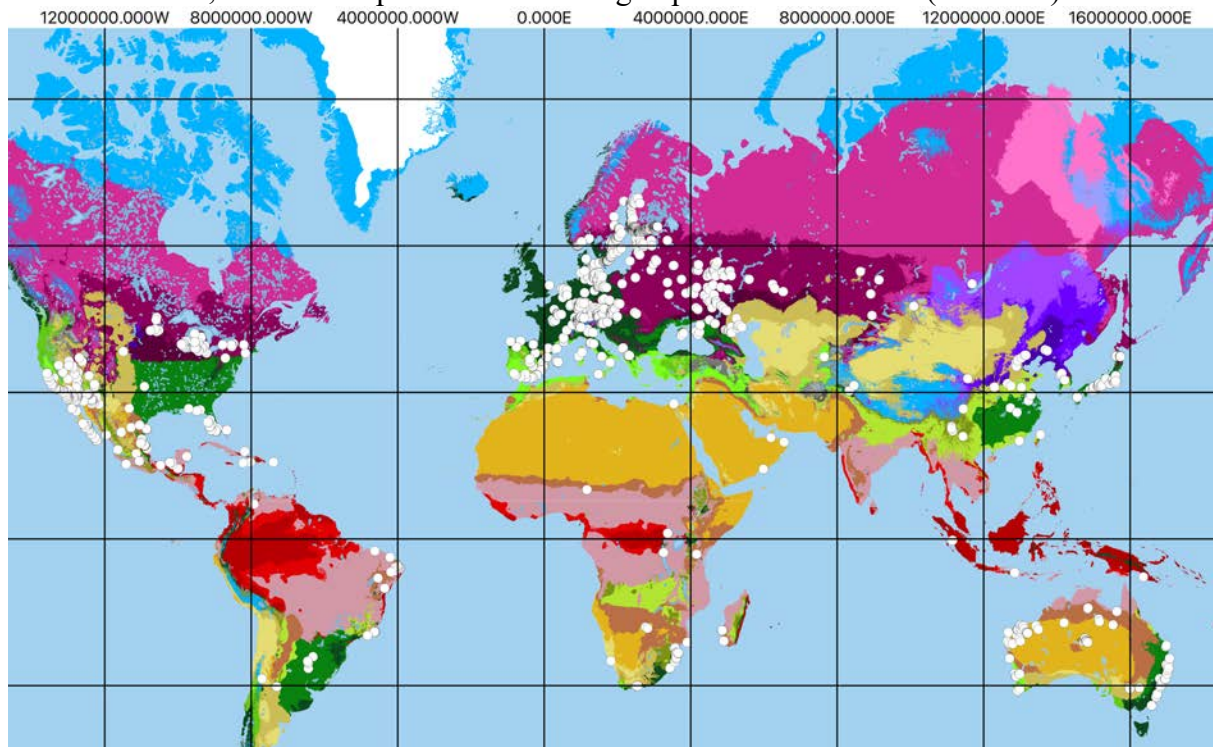
Köppen profile of *Najas madagascariensis*



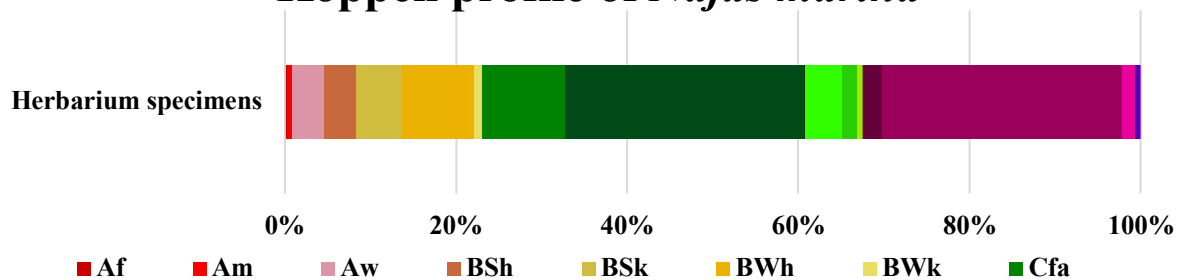
5.3.3.1.20. Köppen profile, distribution and climate map – GBIF occurrences of *Najas malesiana* W.J.de Wilde 1968; herbarium specimens excluding duplicate occurrences (n = 47).



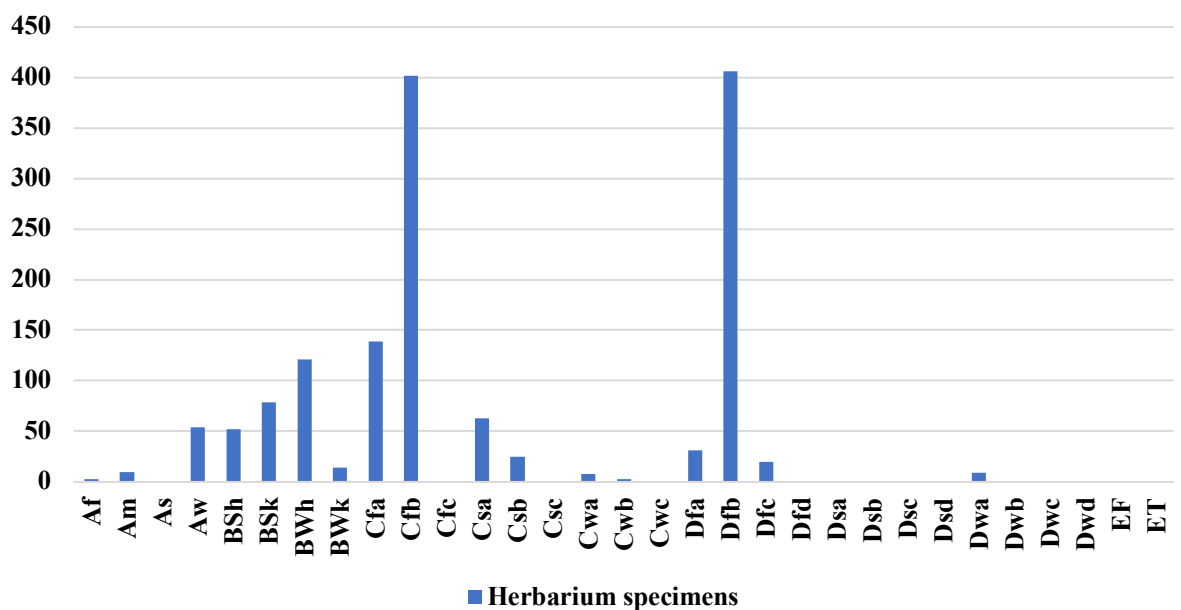
5.3.3.1.21. Köppen profile, distribution and climate map – GBIF occurrences of *Najas marina* L. 1753; herbarium specimens excluding duplicate occurrences (n = 1441).



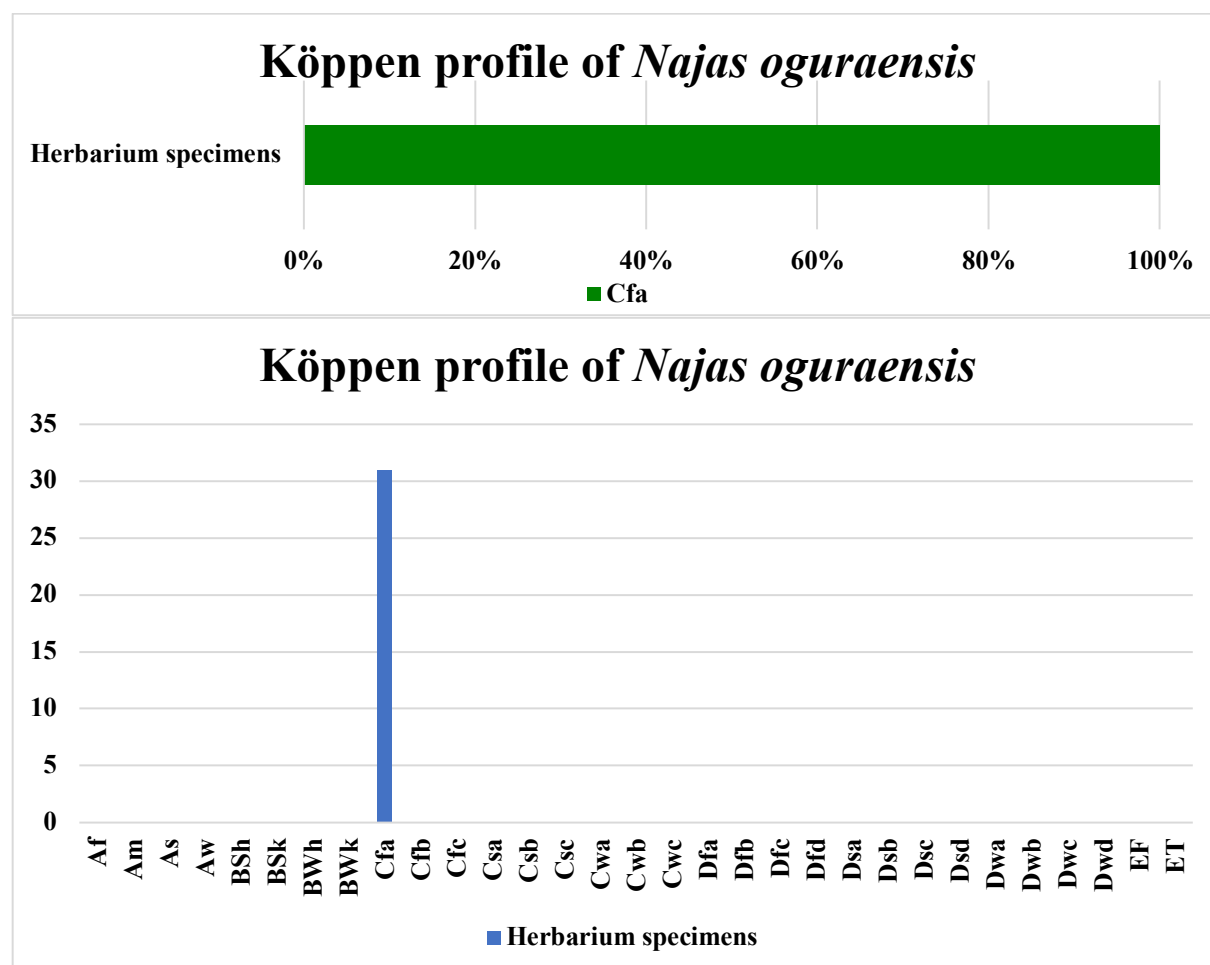
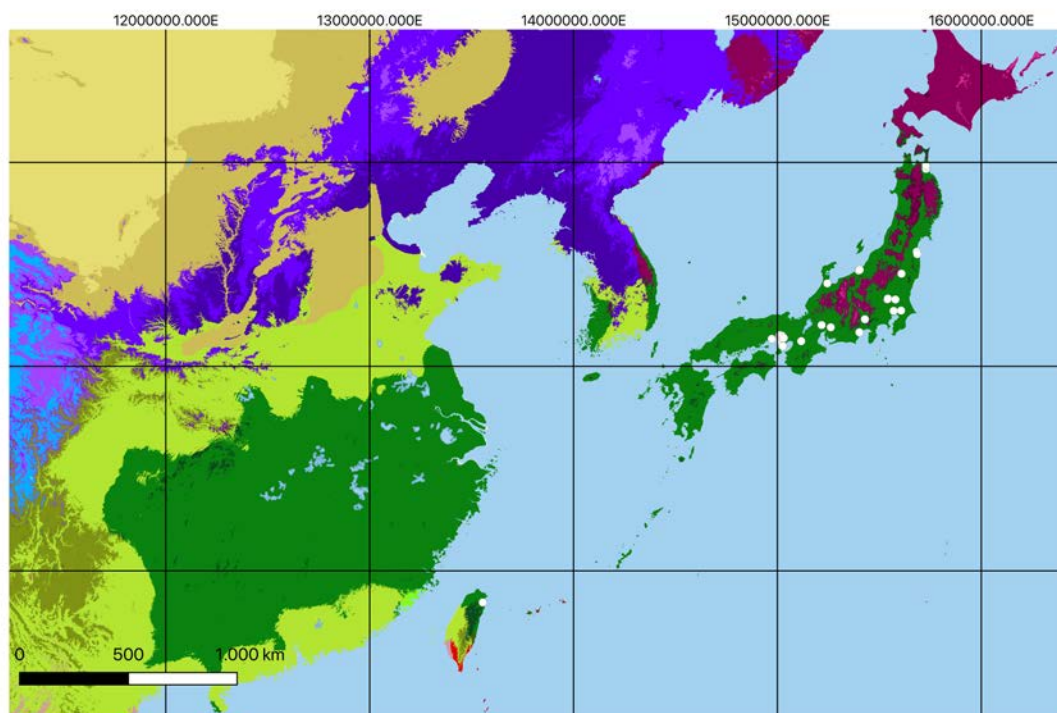
Köppen profile of *Najas marina*



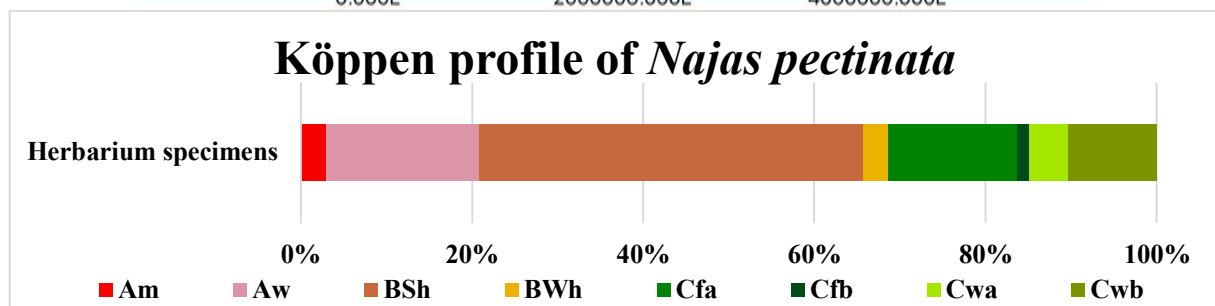
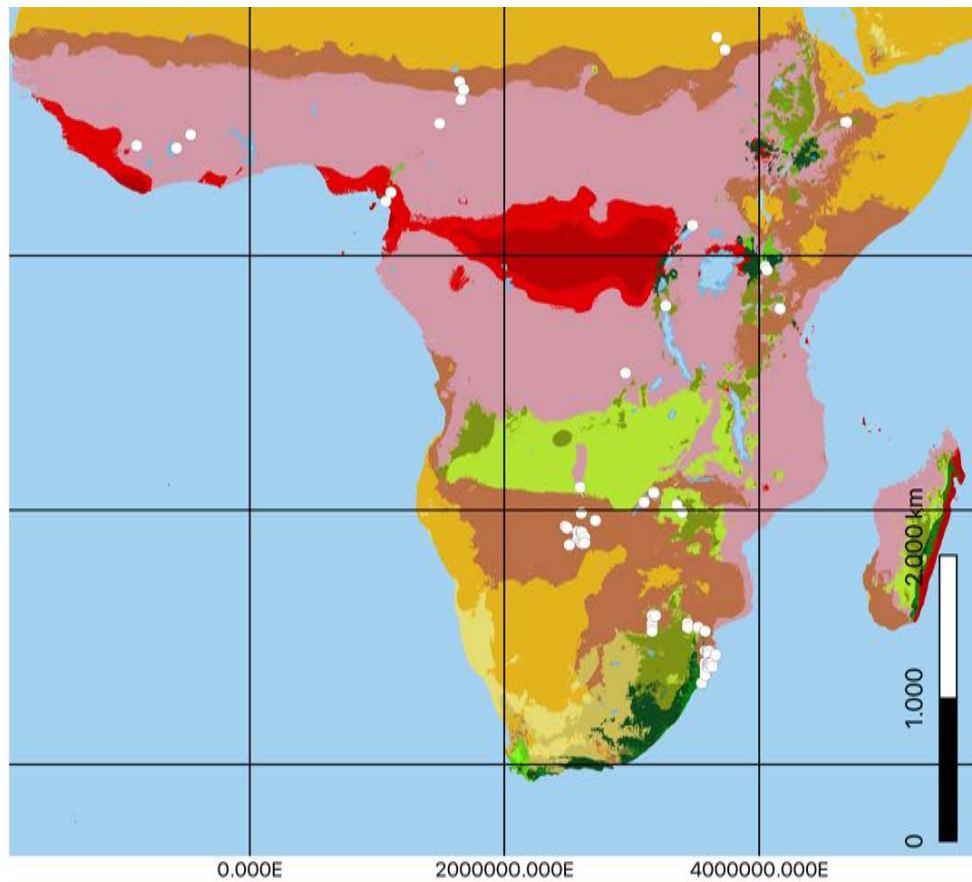
Köppen profile of *Najas marina*



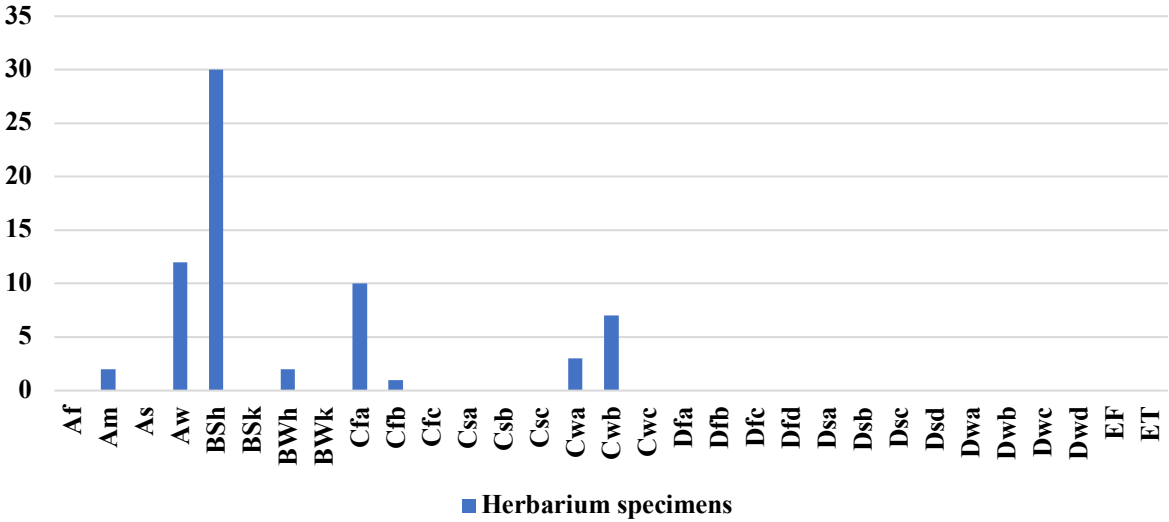
5.3.3.1.22. Köppen profile, distribution and climate map – GBIF occurrences of *Najas oguraensis* Miki 1935; herbarium specimens excluding duplicate occurrences (n = 31).



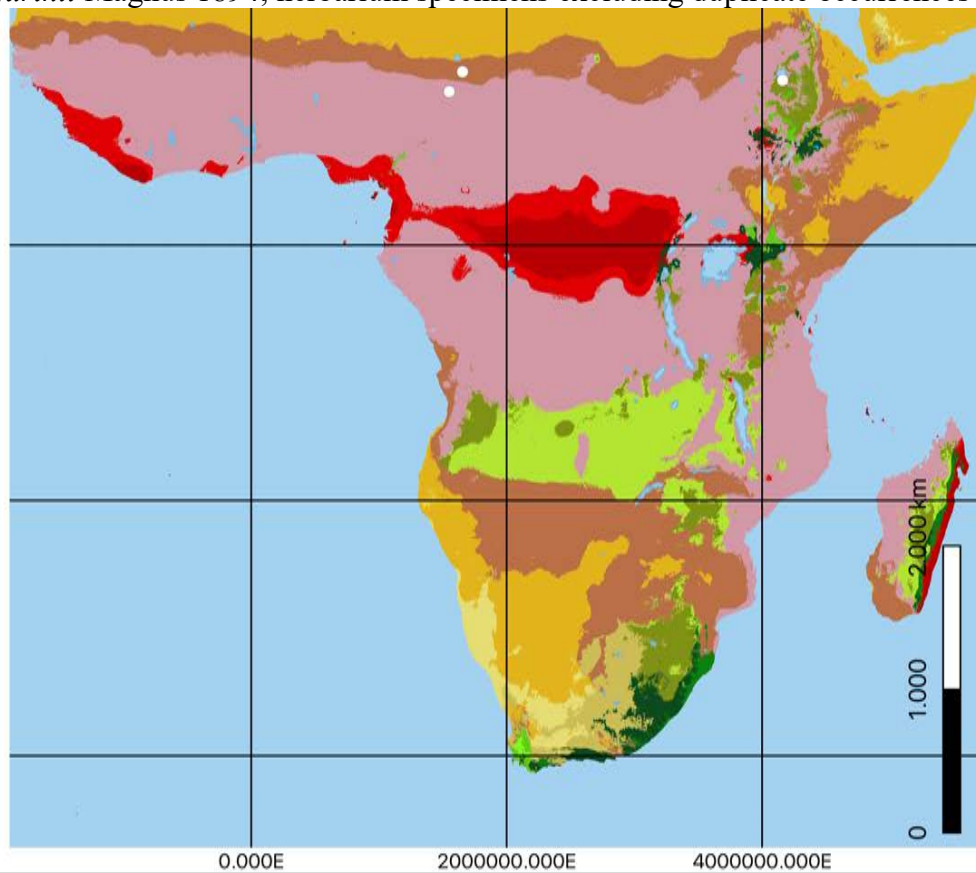
5.3.3.1.23. Köppen profile, distribution and climate map – GBIF occurrences of *Najas pectinate* (Parl. 1860) Magnus 1887; herbarium specimens excluding duplicate occurrences (n = 67).



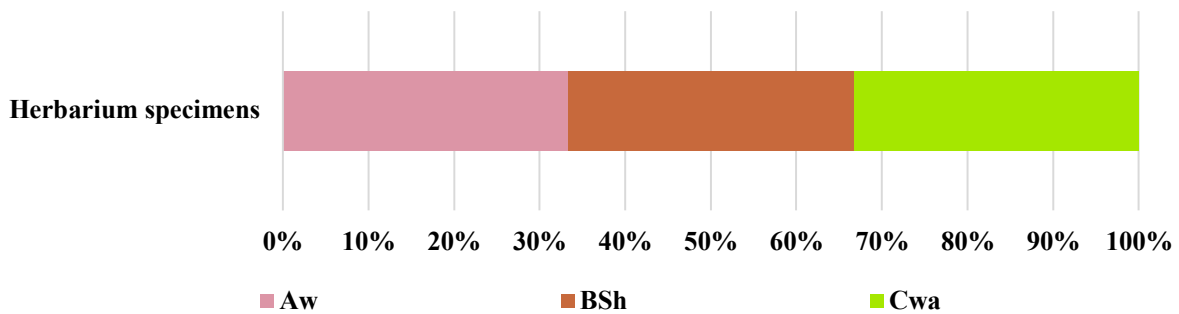
Köppen profile of *Najas pectinata*



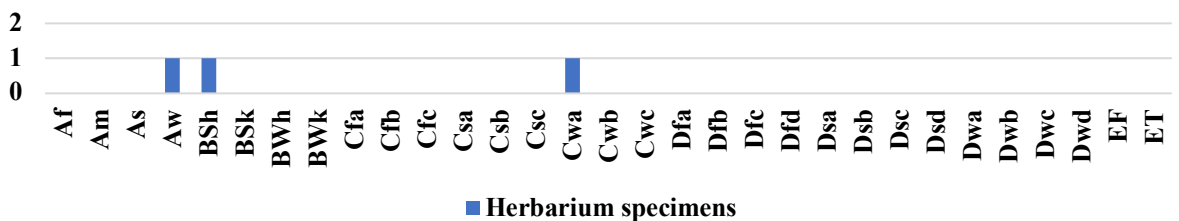
5.3.3.1.24. Köppen profile, distribution and climate map – GBIF occurrences of *Najas schweinfurthii* Magnus 1894; herbarium specimens excluding duplicate occurrences (n = 3).



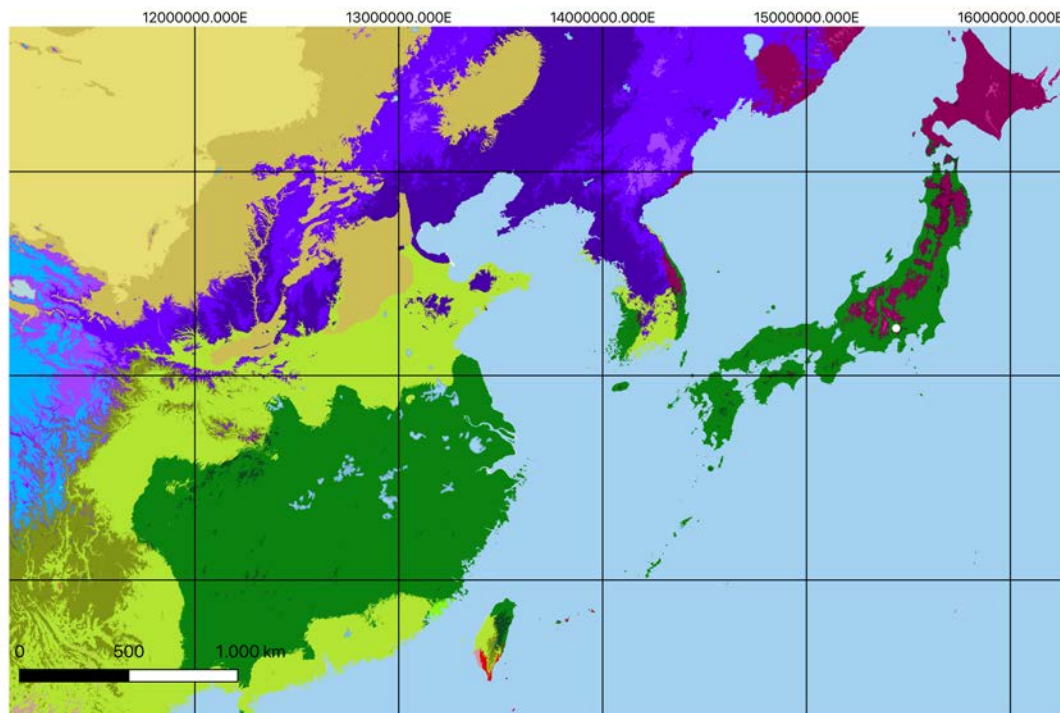
Köppen profile of *Najas schweinfurthii*



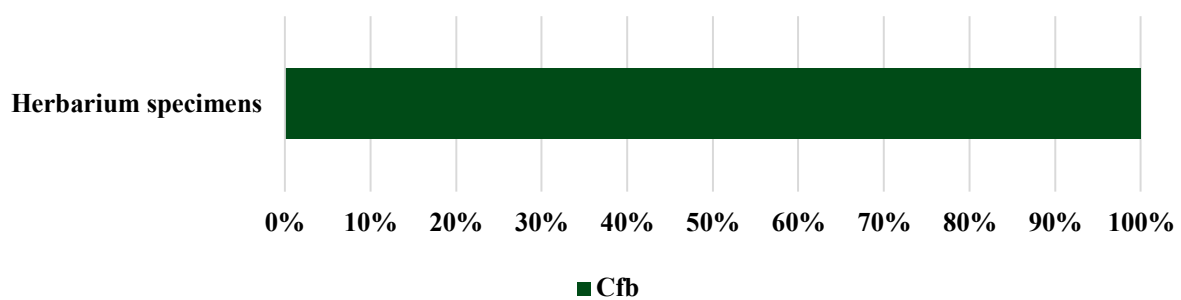
Köppen profile of *Najas schweinfurthii*



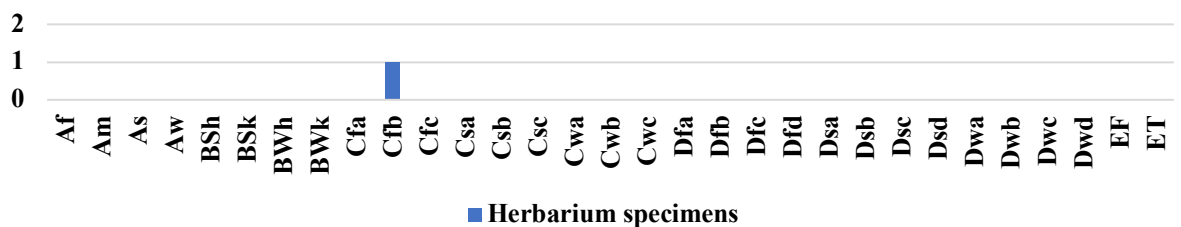
5.3.3.1.25. Köppen profile, distribution and climate map – GBIF occurrences of *Najas tenuicaulis* Miki 1935; herbarium specimens excluding duplicate occurrences (n = 1).



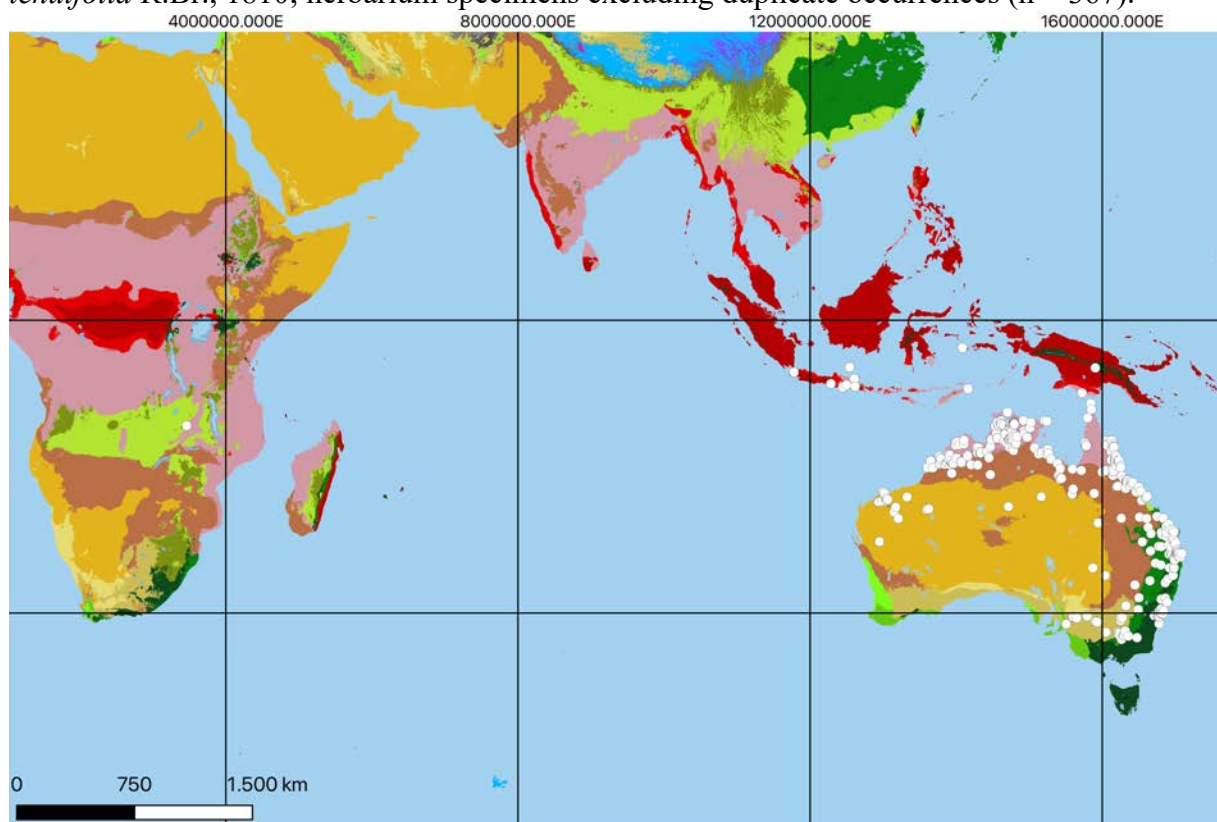
Köppen profile of *Najas schweinfurthii*



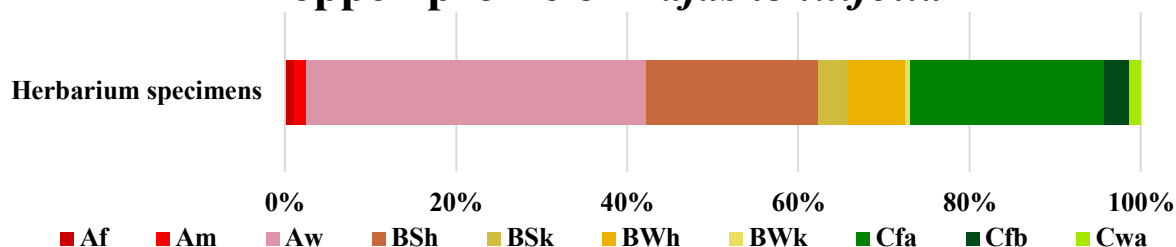
Köppen profile of *Najas schweinfurthii*



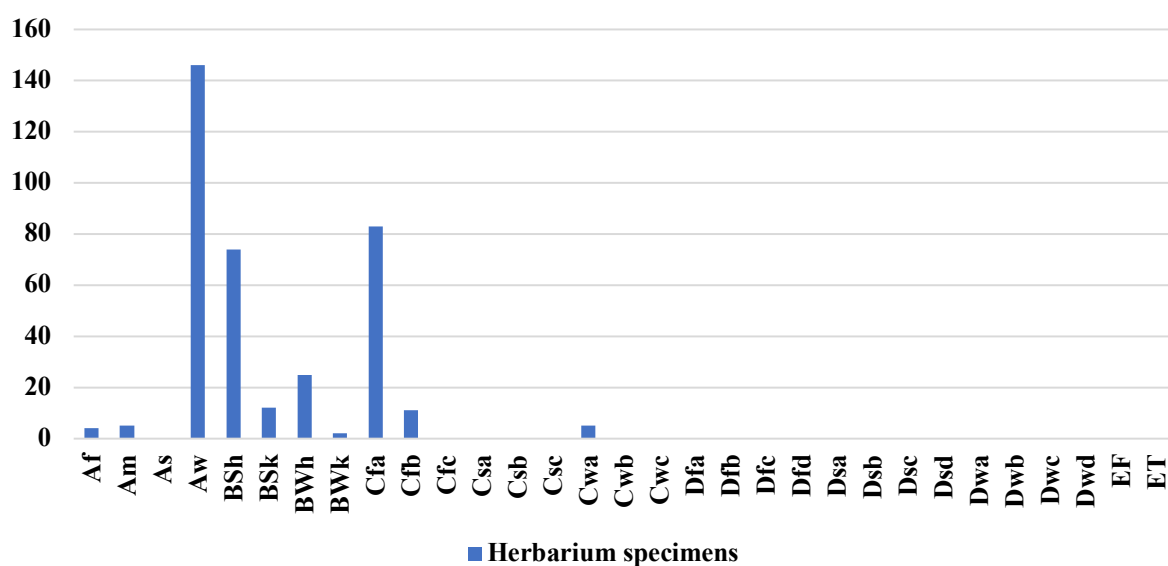
5.3.3.1.26. Köppen profile, distribution and climate map – GBIF occurrences of *Najas tenuifolia* R.Br., 1810; herbarium specimens excluding duplicate occurrences (n = 367).



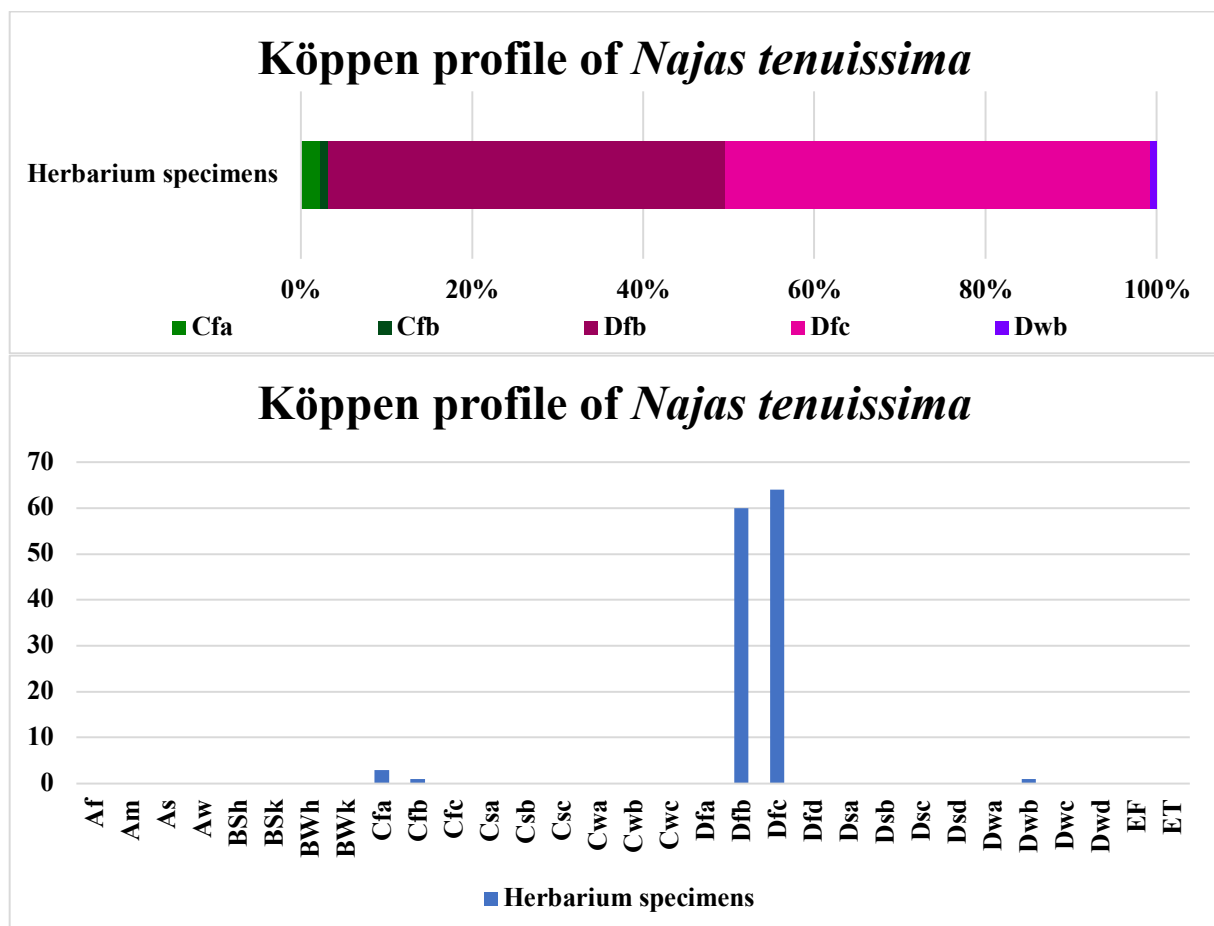
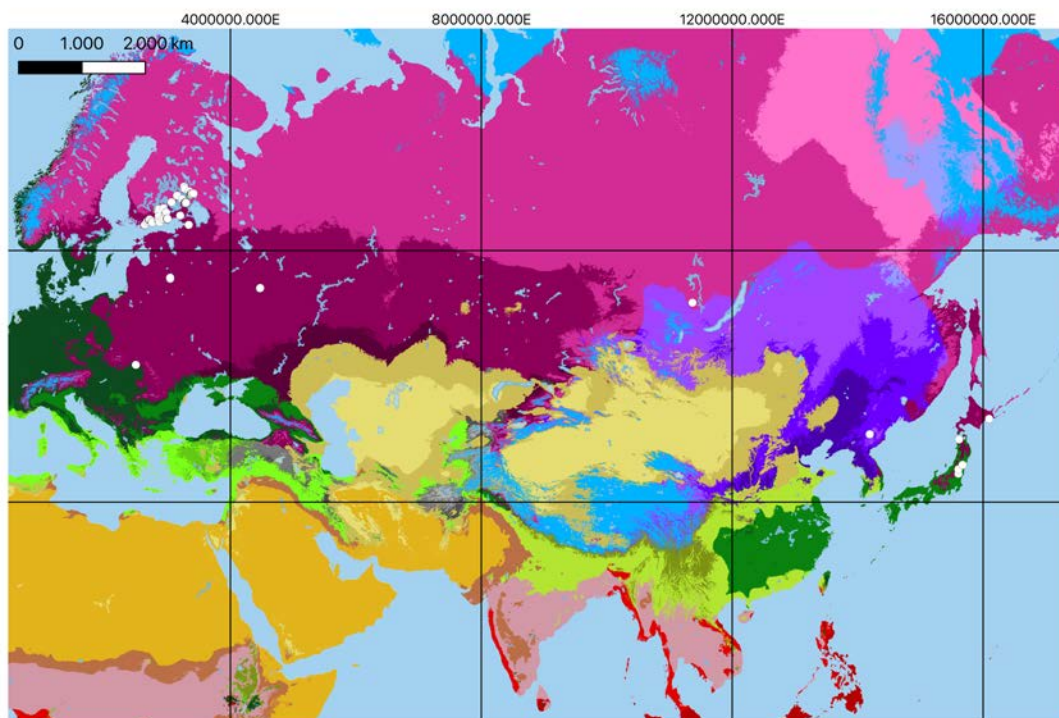
Köppen profile of *Najas tenuifolia*



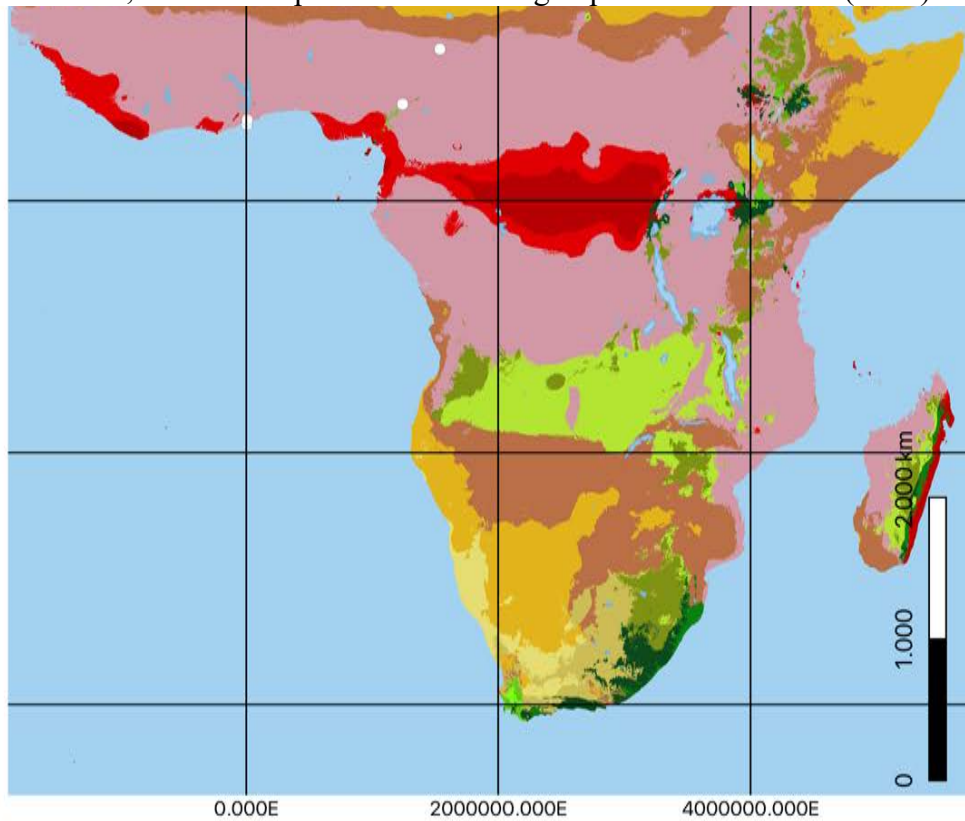
Köppen profile of *Najas tenuifolia*



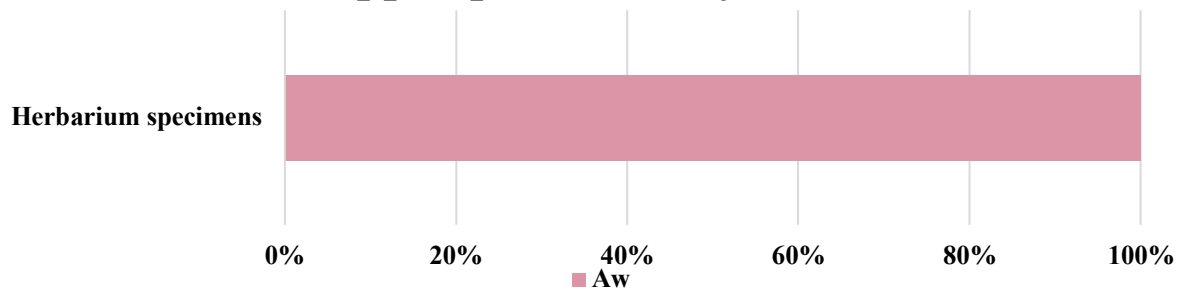
5.3.3.1.27. Köppen profile, distribution and climate map – GBIF occurrences of *Najas tenuissima* (A.Braun ex Magnus 1868) Magnus 1870; herbarium specimens excluding duplicate occurrences (n = 129).



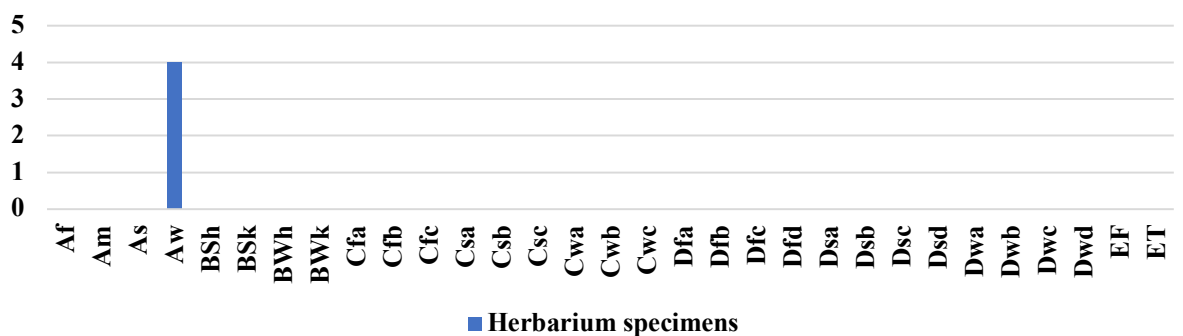
5.3.3.1.28. Köppen profile, distribution and climate map – GBIF occurrences of *Najas testui* Rendle 1937; herbarium specimens excluding duplicate occurrences (n = 4).



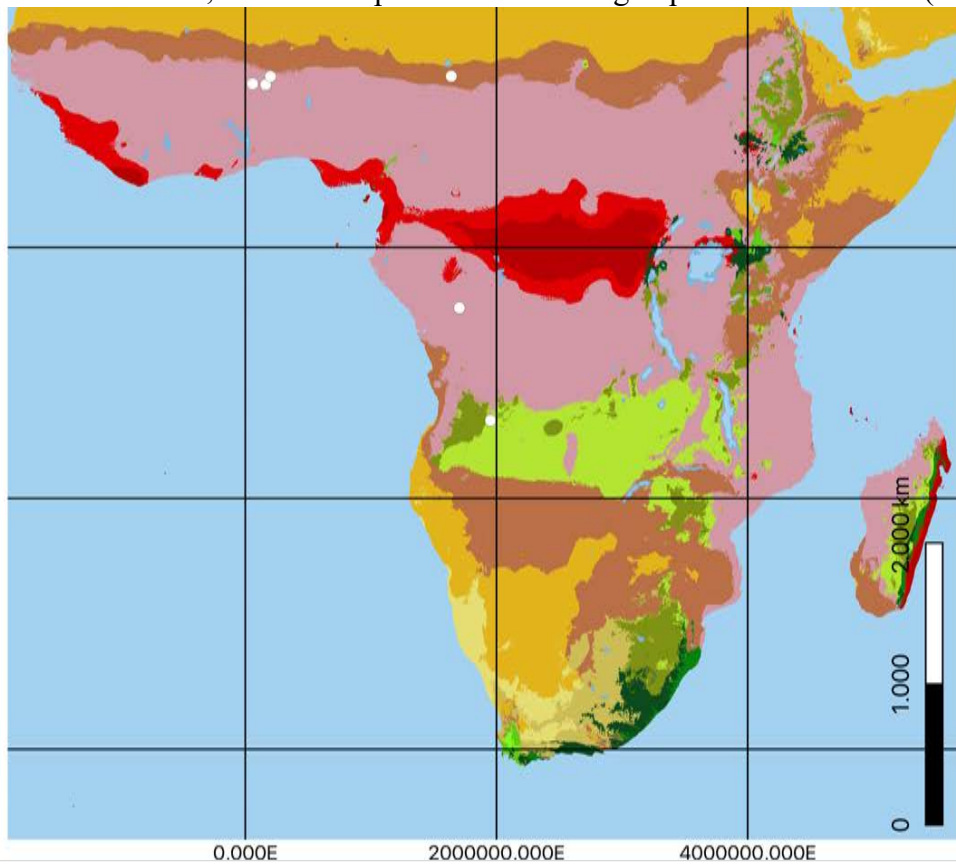
Köppen profile of *Najas testui*



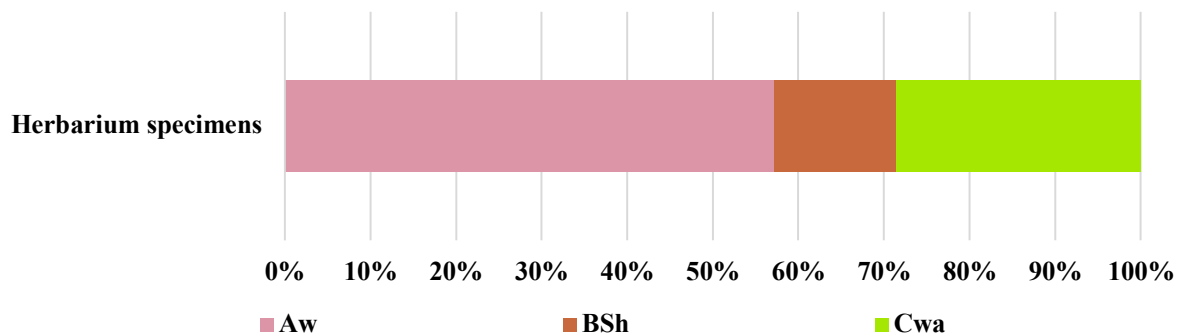
Köppen profile of *Najas testui*



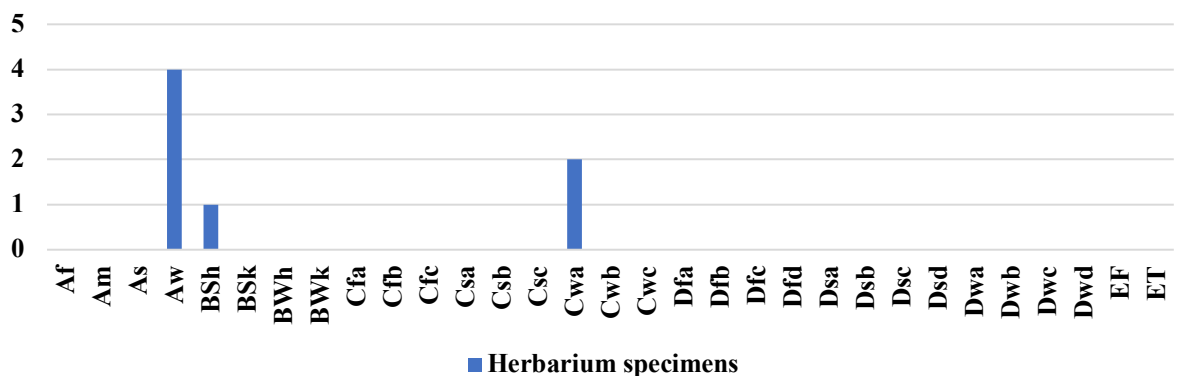
5.3.3.1.29. Köppen profile, distribution and climate map – GBIF occurrences of *Najas welwitschia* Rendle 1899; herbarium specimens excluding duplicate occurrences (n = 7).



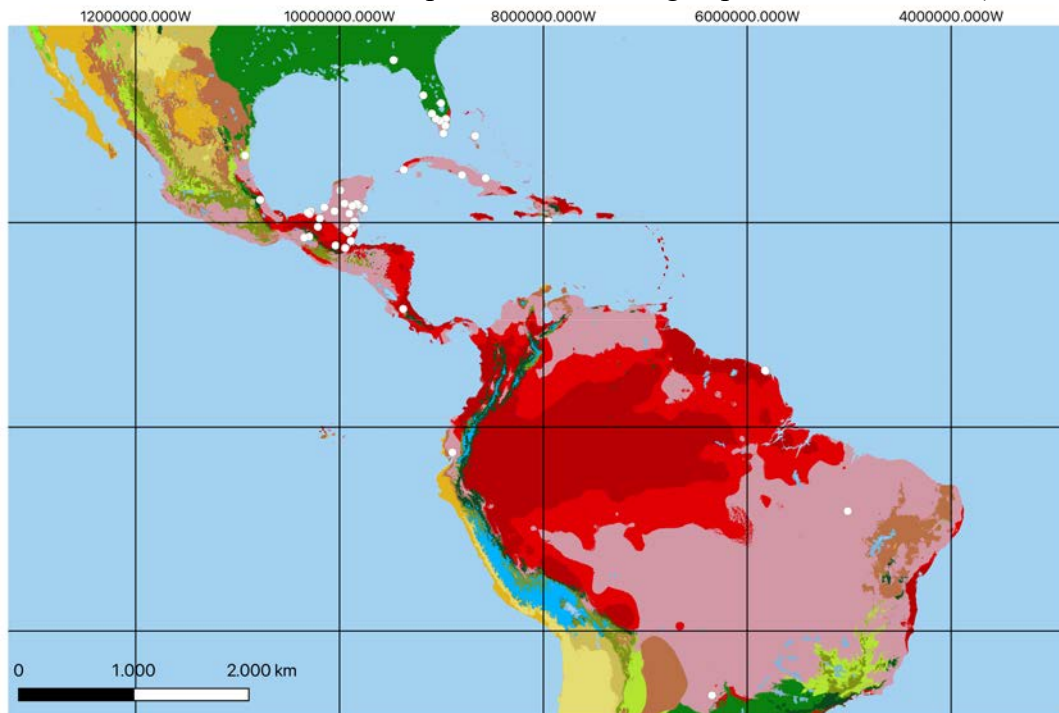
Köppen profile of *Najas welwitschii*



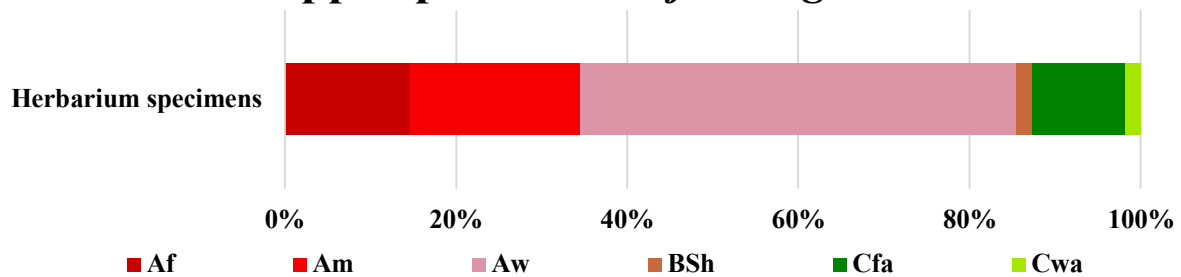
Köppen profile of *Najas welwitschii*



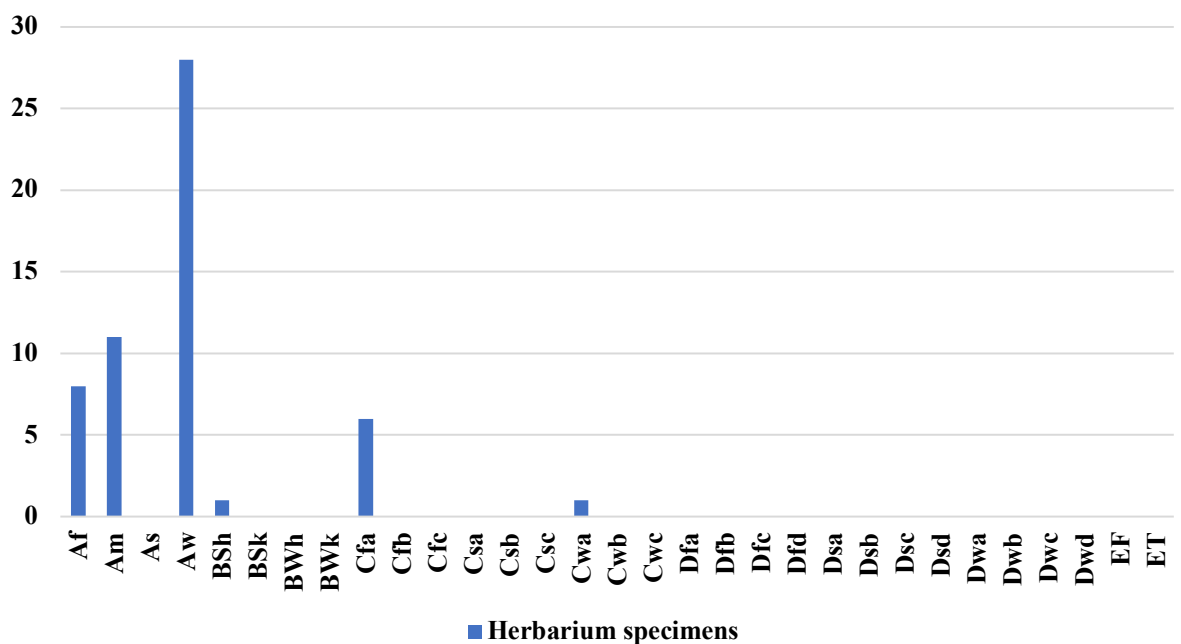
5.3.3.1.30. Köppen profile, distribution and climate map – GBIF occurrences of *Najas wrightiana* A.Braun 1868; herbarium specimens excluding duplicate occurrences (n = 55).



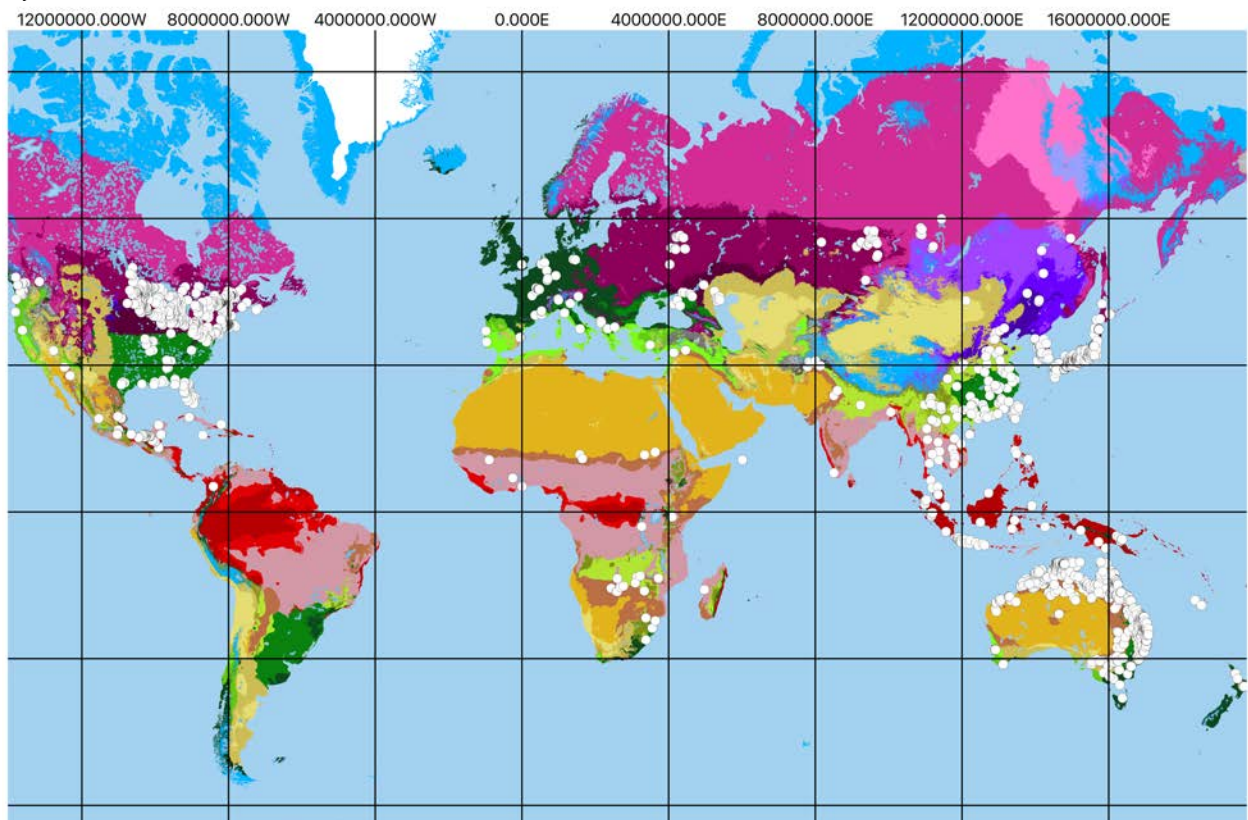
Köppen profile of *Najas wrightiana*



Köppen profile of *Najas wrightiana*

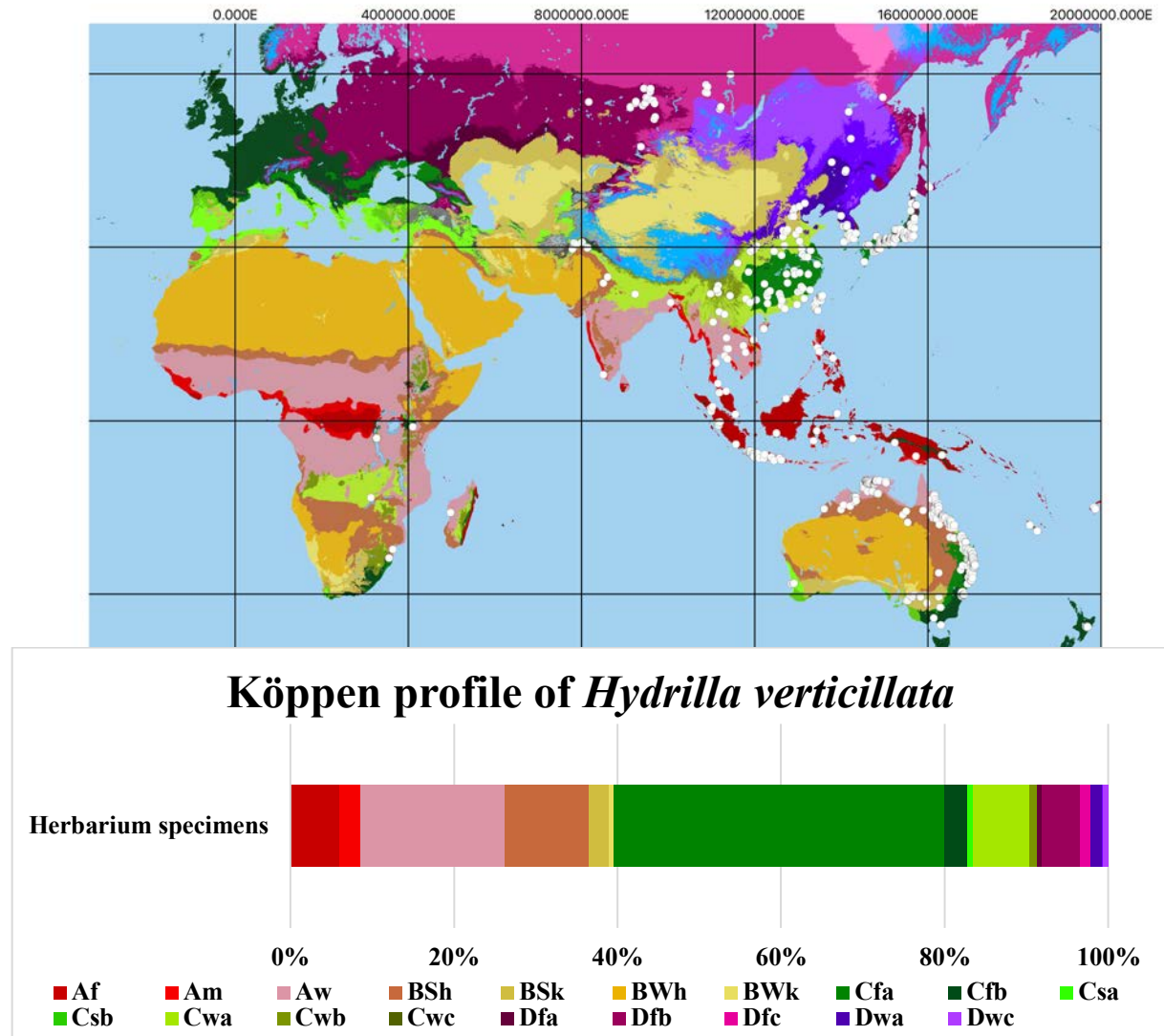


5.3.4. Crown group Clade A of Hydrocharitaceae cf. Chen et. al (2012), comprising *Hydrilla* Rich. 1811, *Nechamandra* Planch. 1849, and *Vallisneria* P.Micheli ex L. 1753

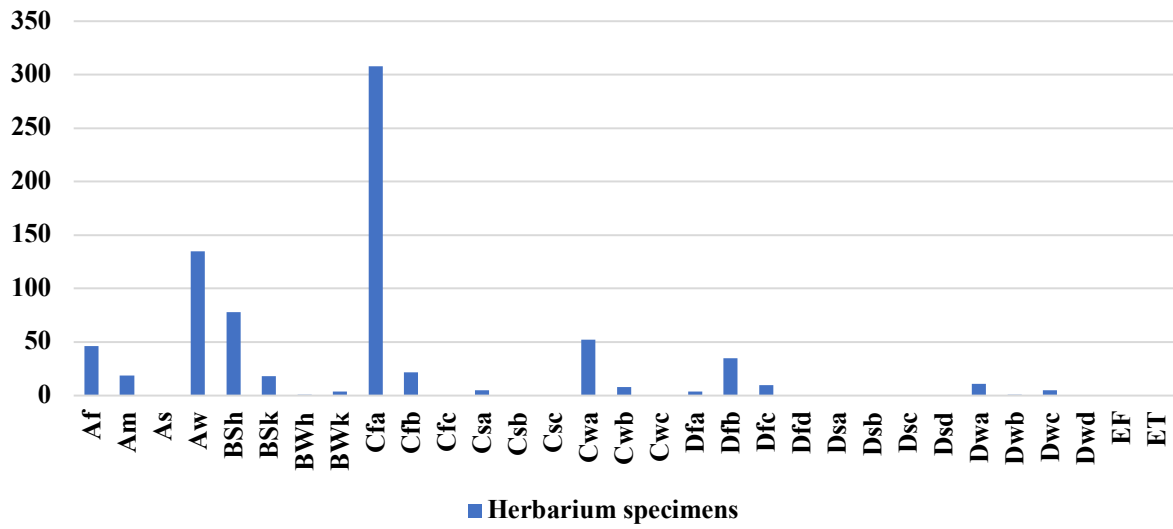


5.3.4.1. Genus *Hydrilla* Rich. 1811

5.3.4.1.1. Köppen profile, distribution and climate map – GBIF occurrences of *Hydrilla verticillate* (L.f 1782) Royle 1839; herbarium specimens excluding duplicate occurrences (n = 762).

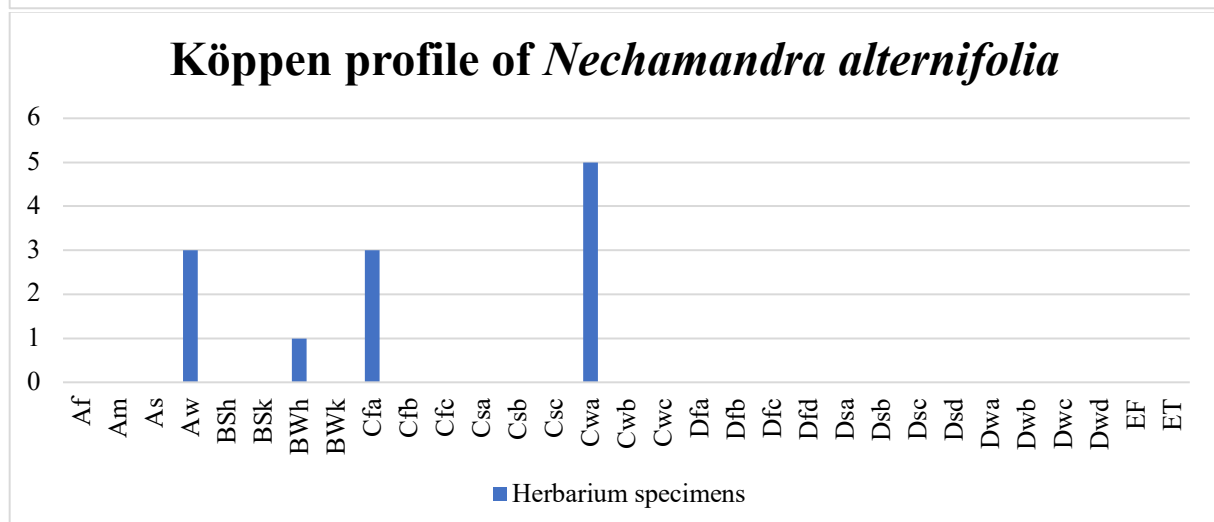
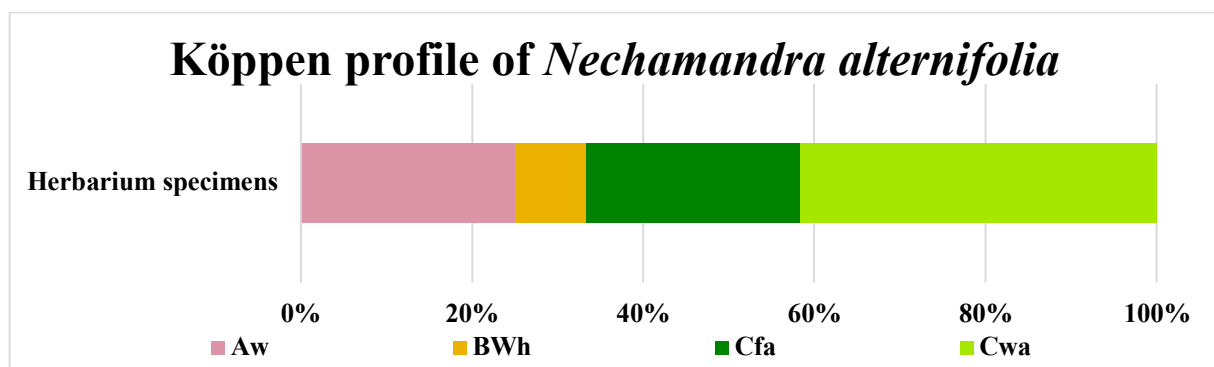
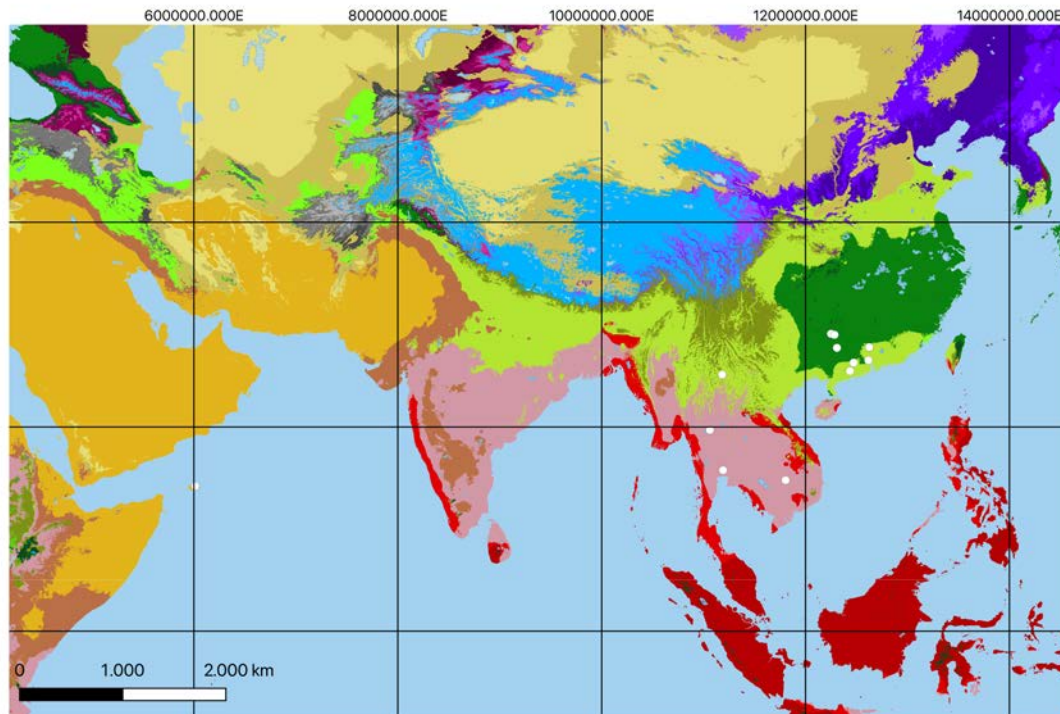


Köppen profile of *Hydrilla verticillata*

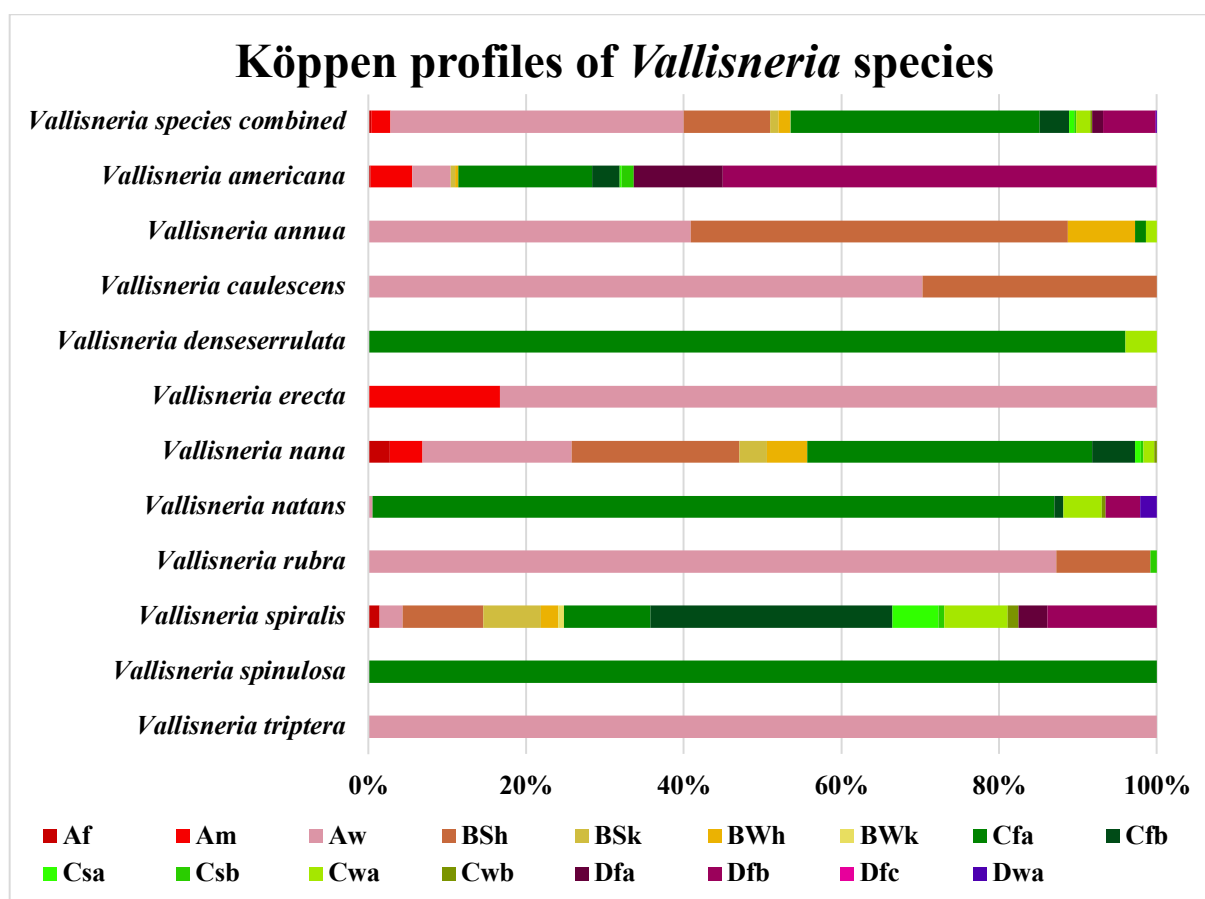
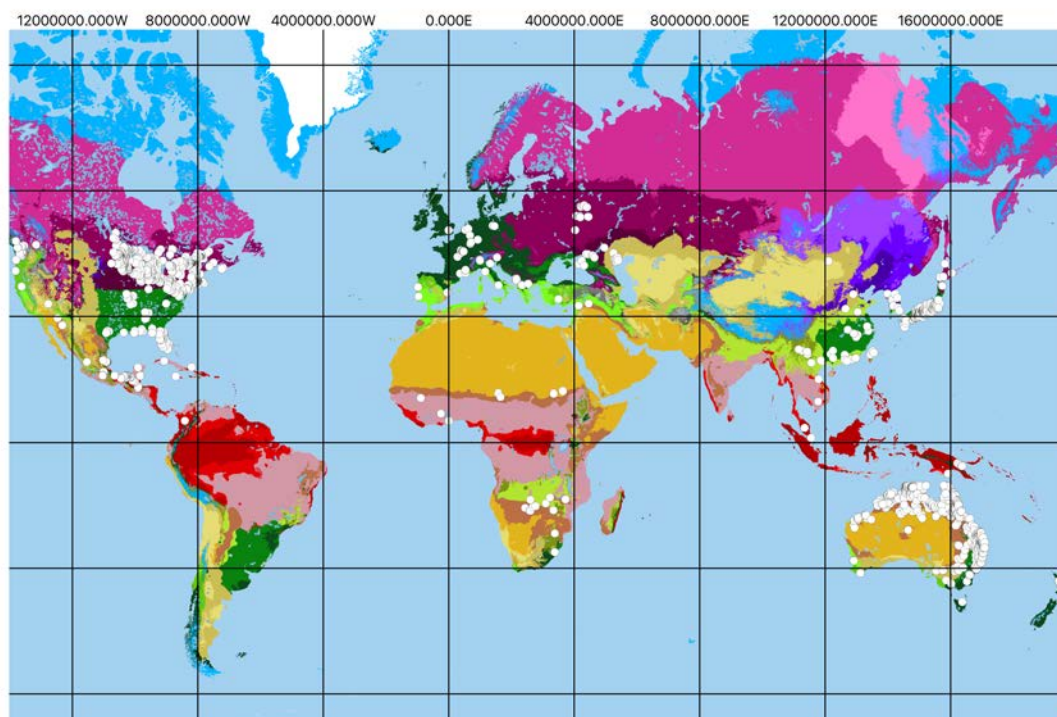


5.3.4.2. Genus *Nechamandra* Planch. 1849.

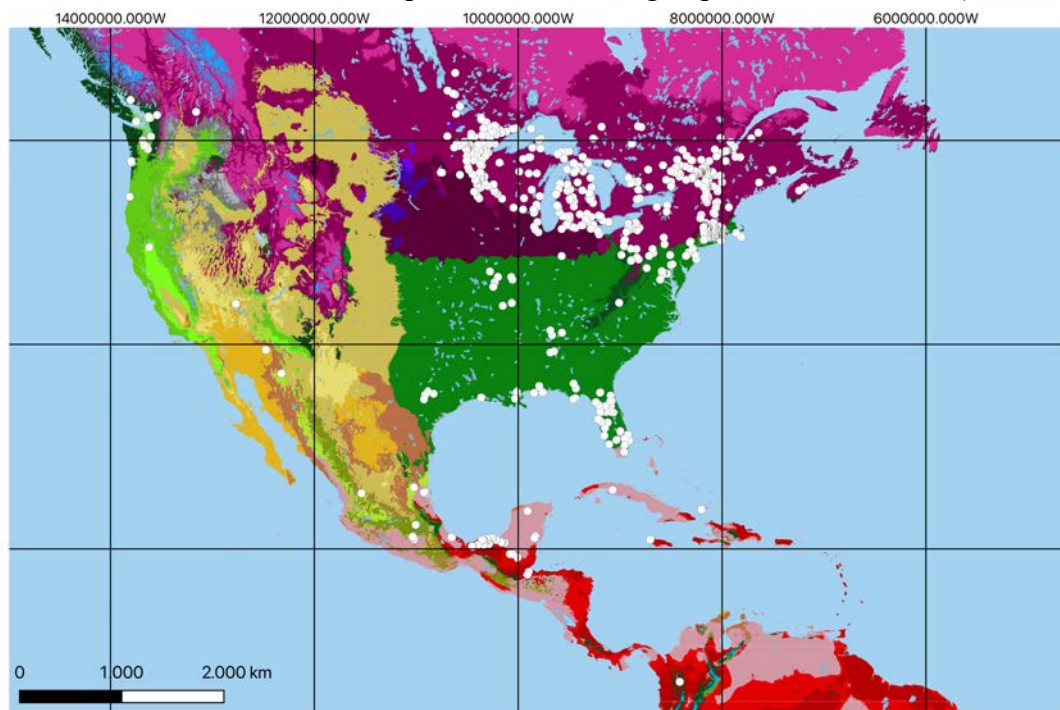
5.3.4.2.1. Köppen profile, distribution and climate map – GBIF occurrences of *Nechamandra alternifolia* Thwaites, 1864; herbarium specimens excluding duplicate occurrences (n = 12).



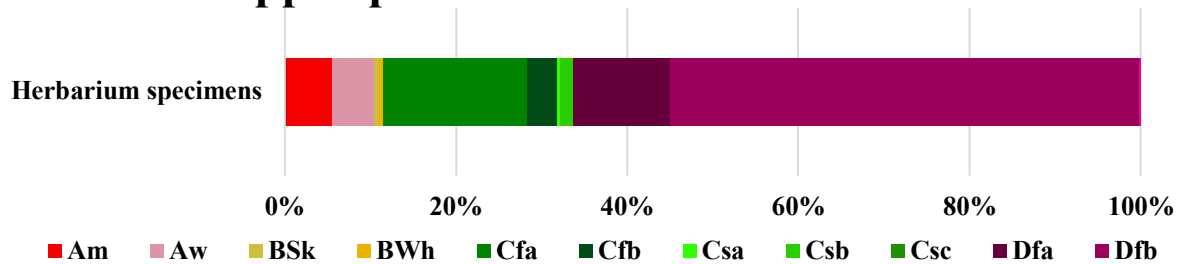
Distribution and Köppen profiles of genus *Vallisneria*, incl. *V. americana*, *V. annua*, *V. caulescens*, *V. denseserrulata*, *V. erecta*, *V. nana*, *V. natans*, *V. rubra*, *V. spiralis*, *V. spinulosa*, and *V. triptera*. (n = 2698).



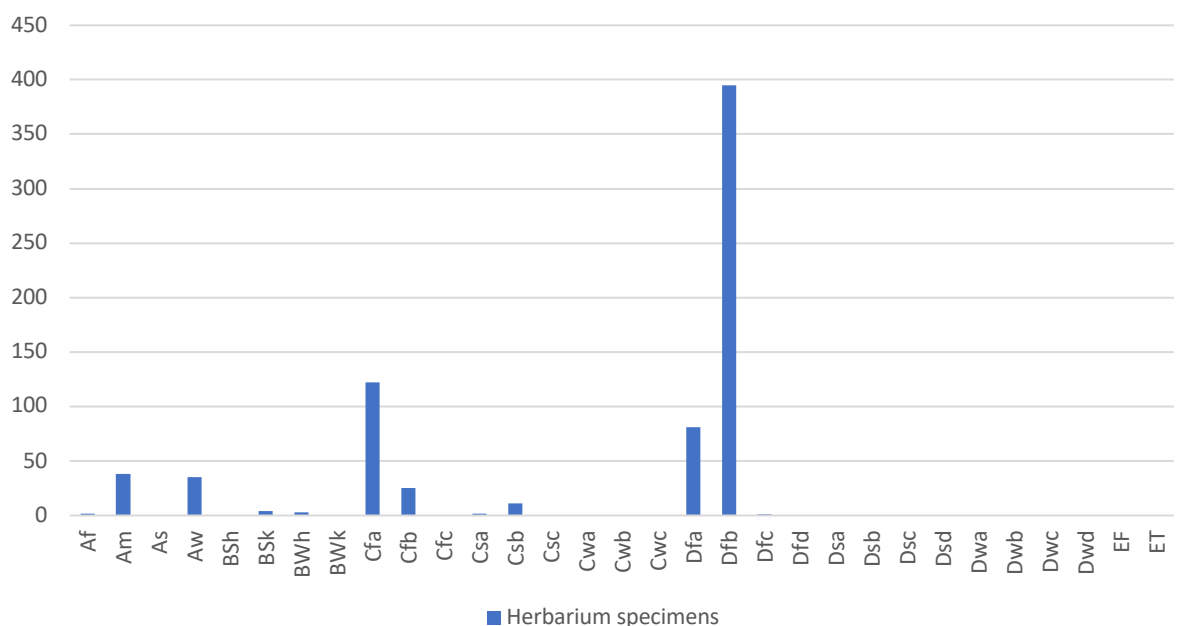
5.3.4.3.1. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria americana* Michx. 1803; herbarium specimens excluding duplicate occurrences (n = 719).



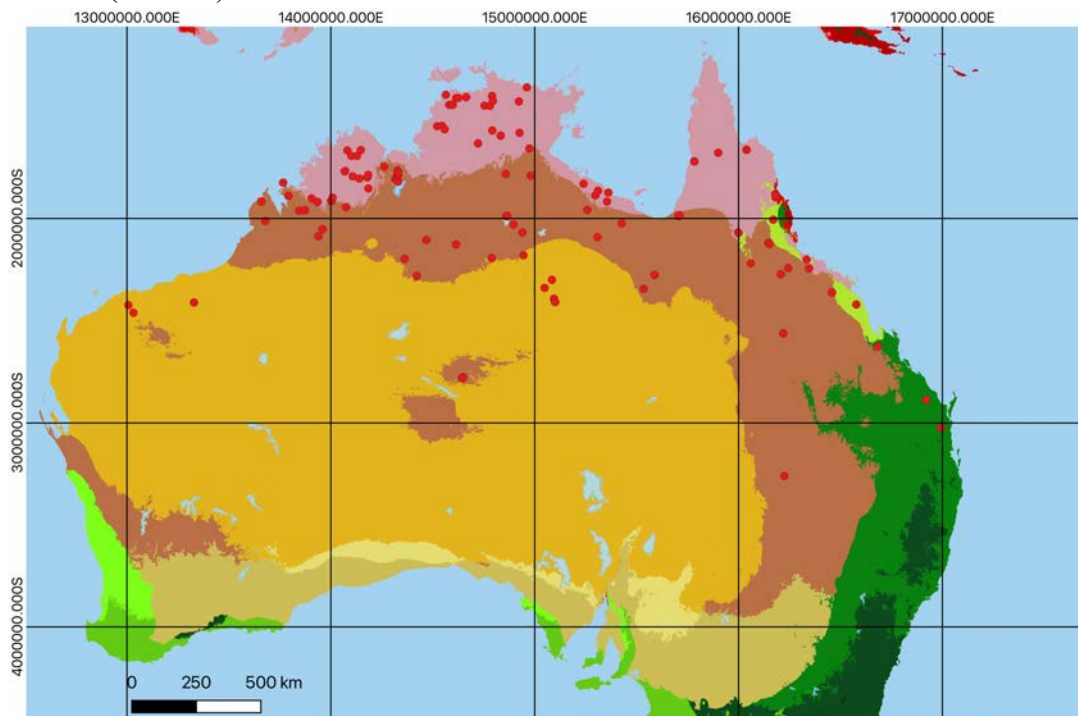
Köppen profile of *Vallisneria americana*



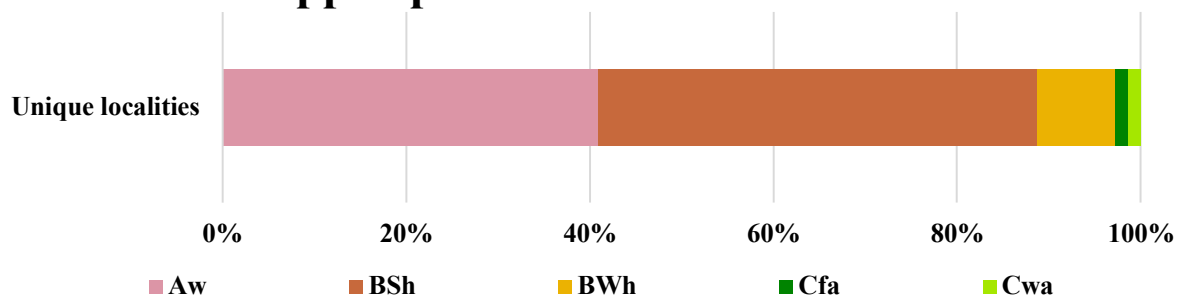
Köppen profile of *Vallisneria americana*



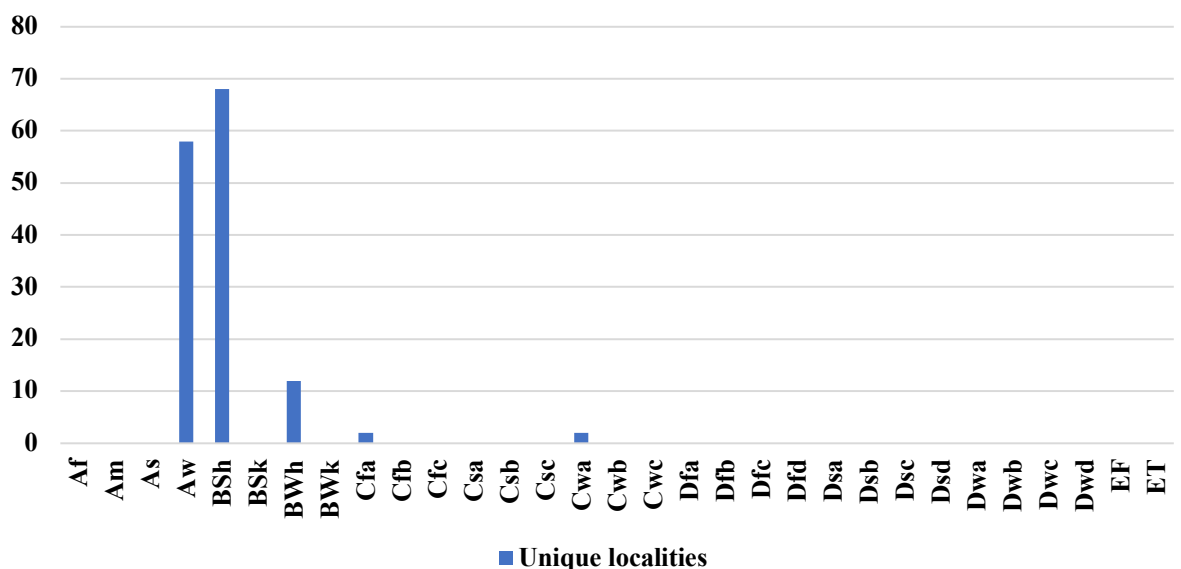
5.3.4.3.2. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria annua* S.W.L.Jacobs & K.A.Frank 1997; herbarium specimens excluding duplicate occurrences (n = 142).



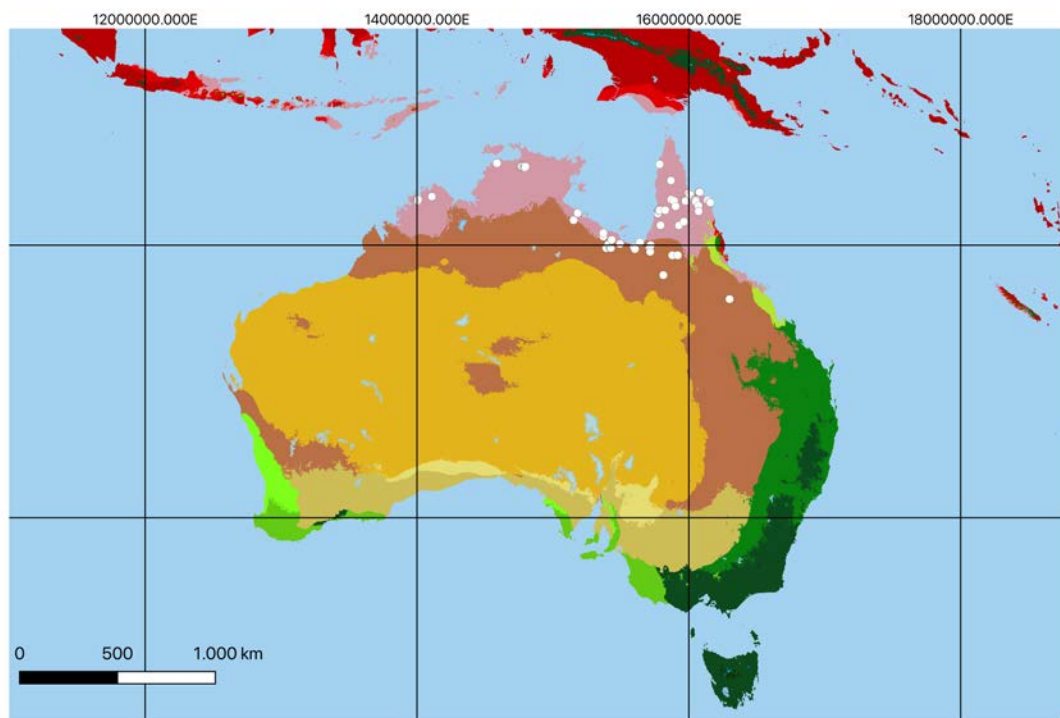
Köppen profile of *Vallisneria annua*



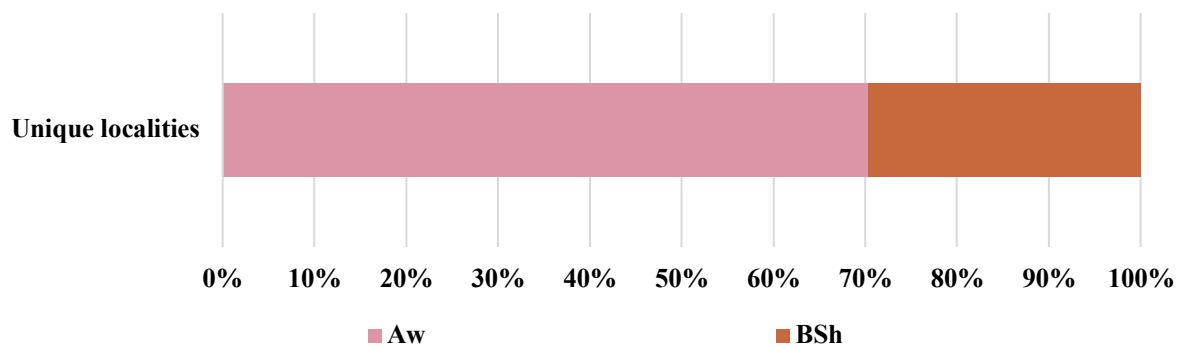
Köppen profile of *Vallisneria annua*



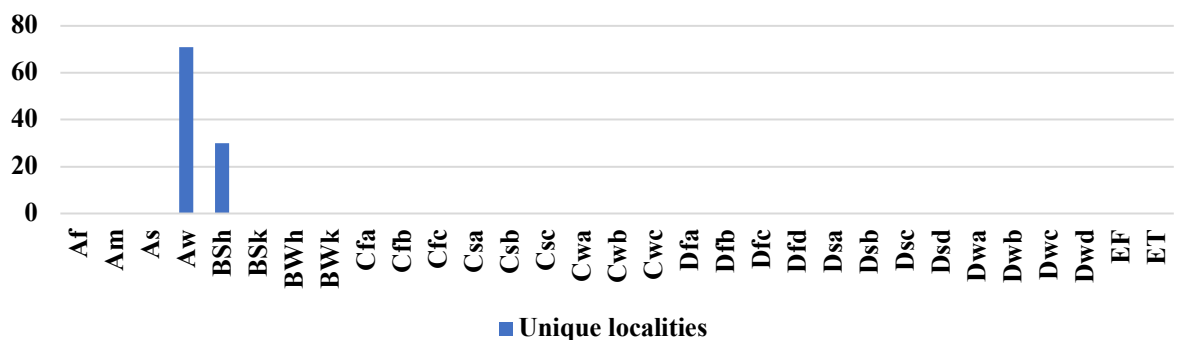
5.3.4.3.3. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria caulescens* F.M.Bailey & F.Muell. 1888; herbarium specimens excluding duplicate occurrences (n = 101).



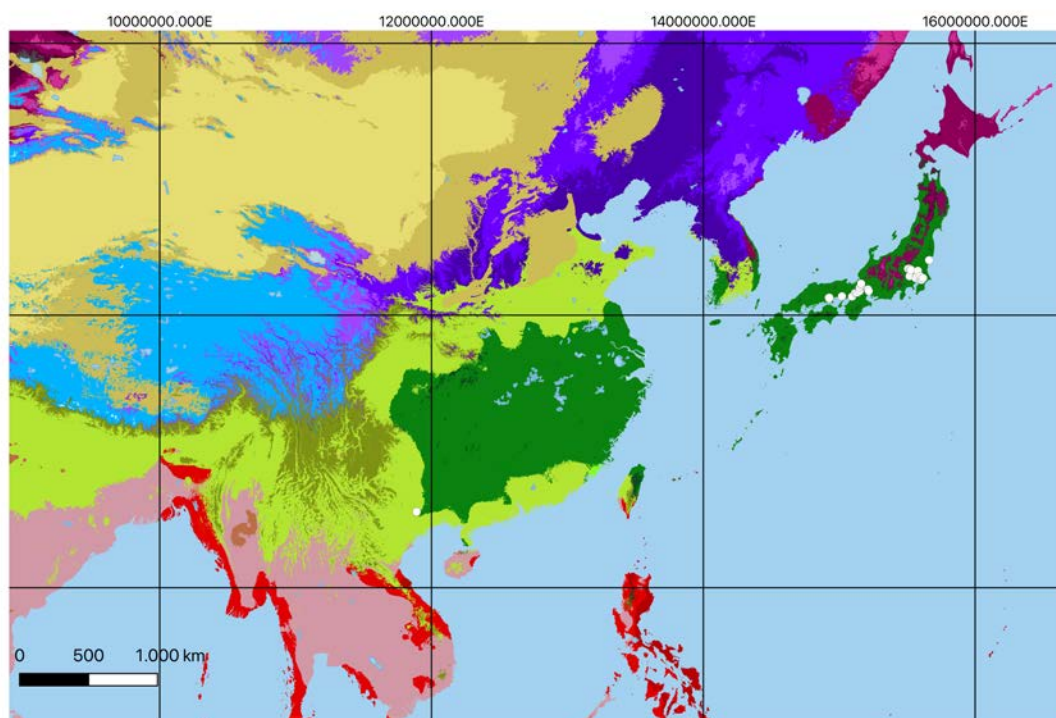
Köppen profile of *Vallisneria caulescens*



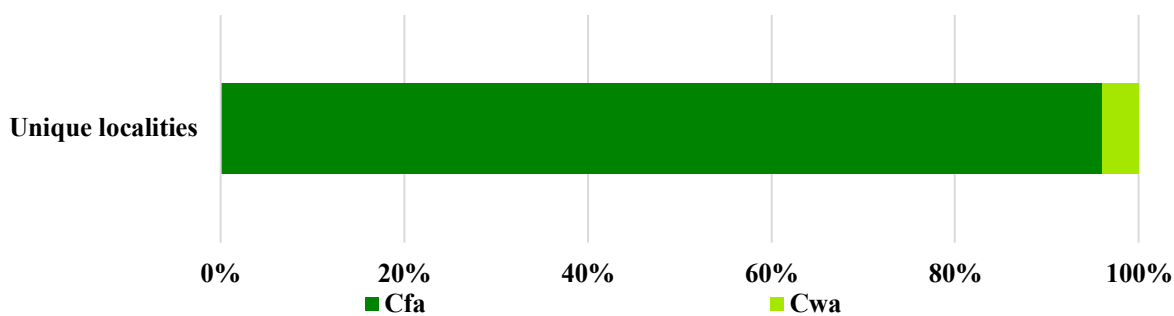
Köppen profile of *Vallisneria caulescens*



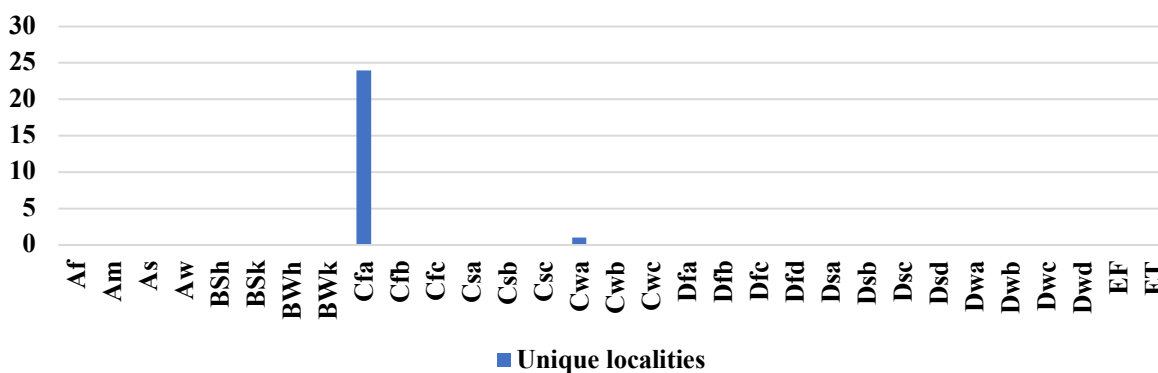
5.3.4.3.4. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria denseserrulata* (Makino 1914) Makino 1921; herbarium specimens excluding duplicate occurrences (n = 25).



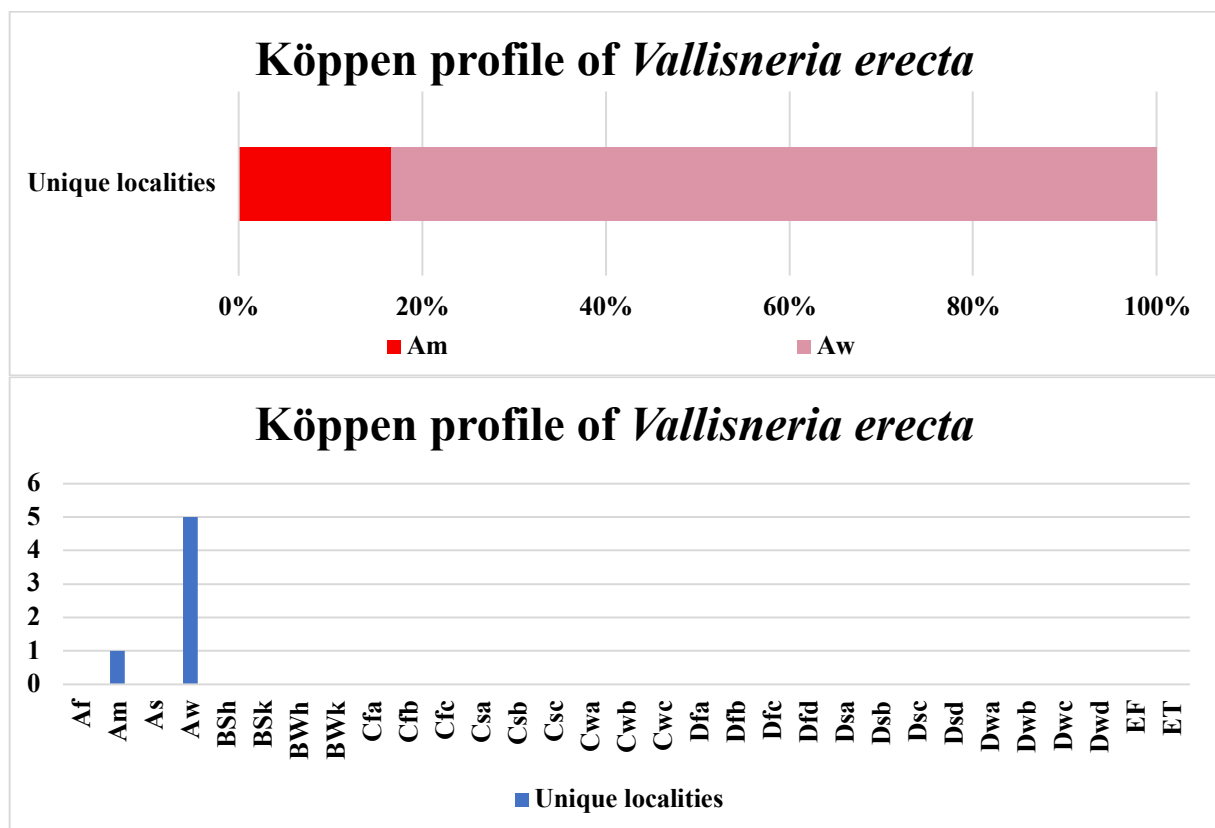
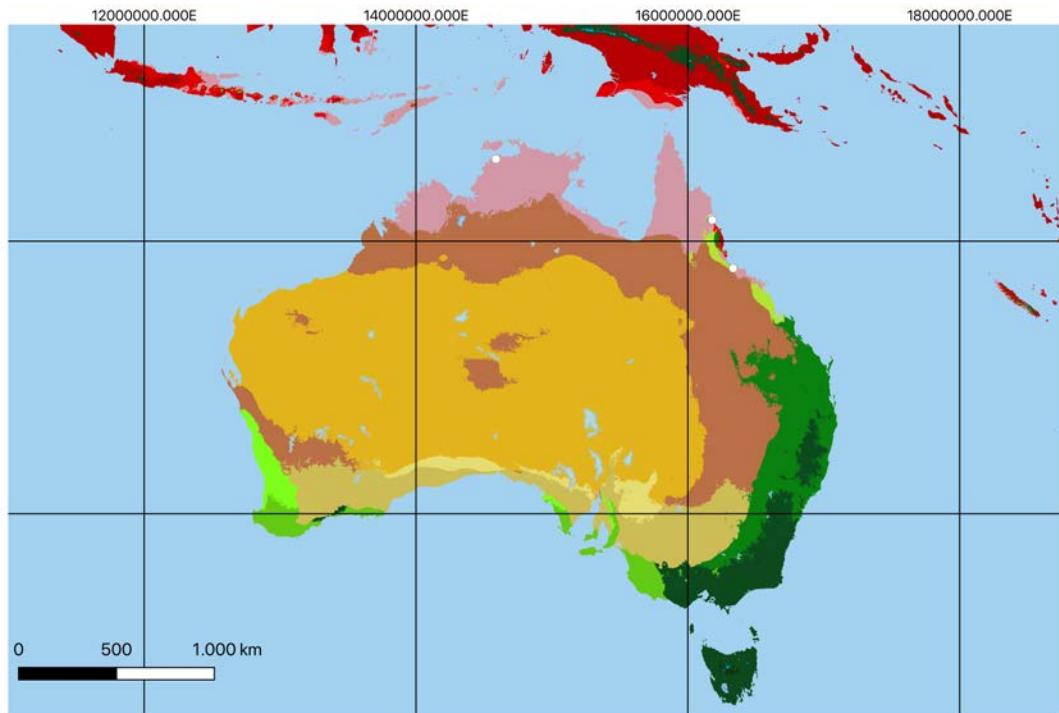
Köppen profile of *Vallisneria denseserrulata*



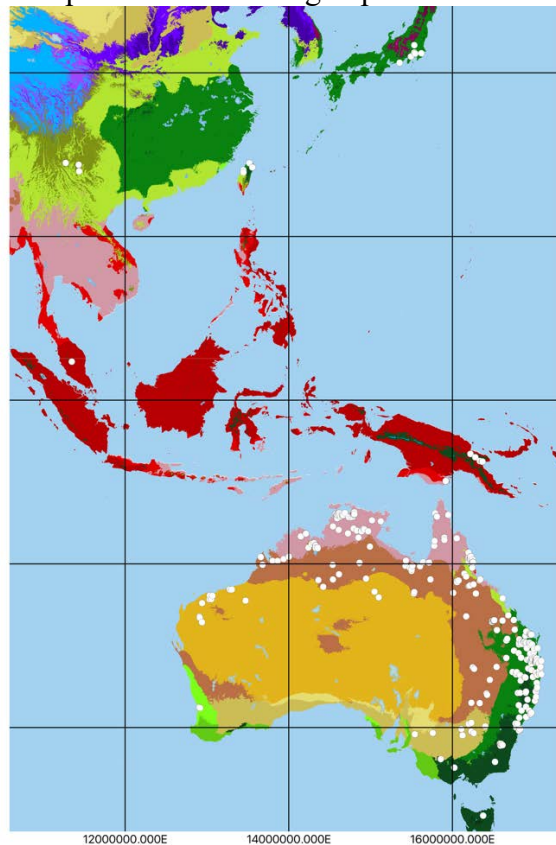
Köppen profile of *Vallisneria denseserrulata*



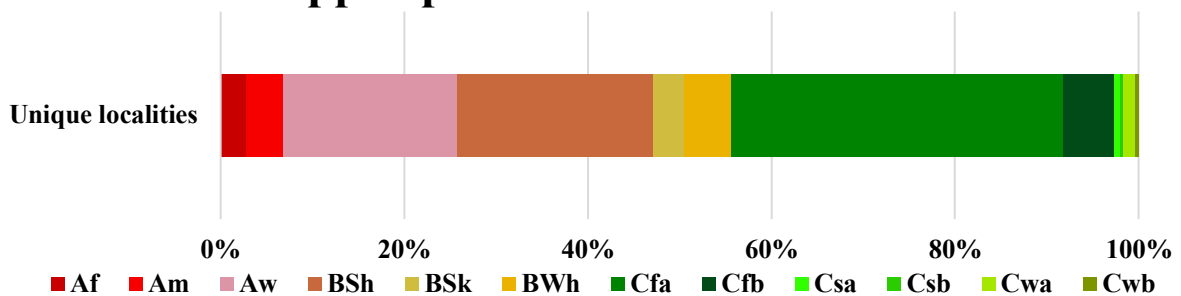
5.3.4.3.5. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria erecta* S.W.L.Jacobs 2008; herbarium specimens excluding duplicate occurrences (n = 6).



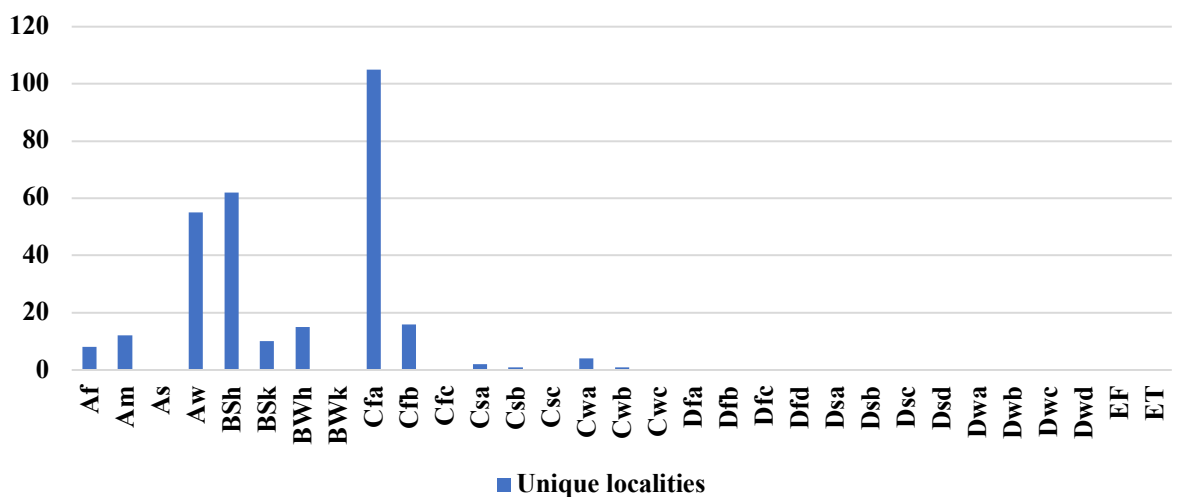
5.3.4.3.6. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria nana* R.Br. 1810; herbarium specimens excluding duplicate occurrences (n = 291).



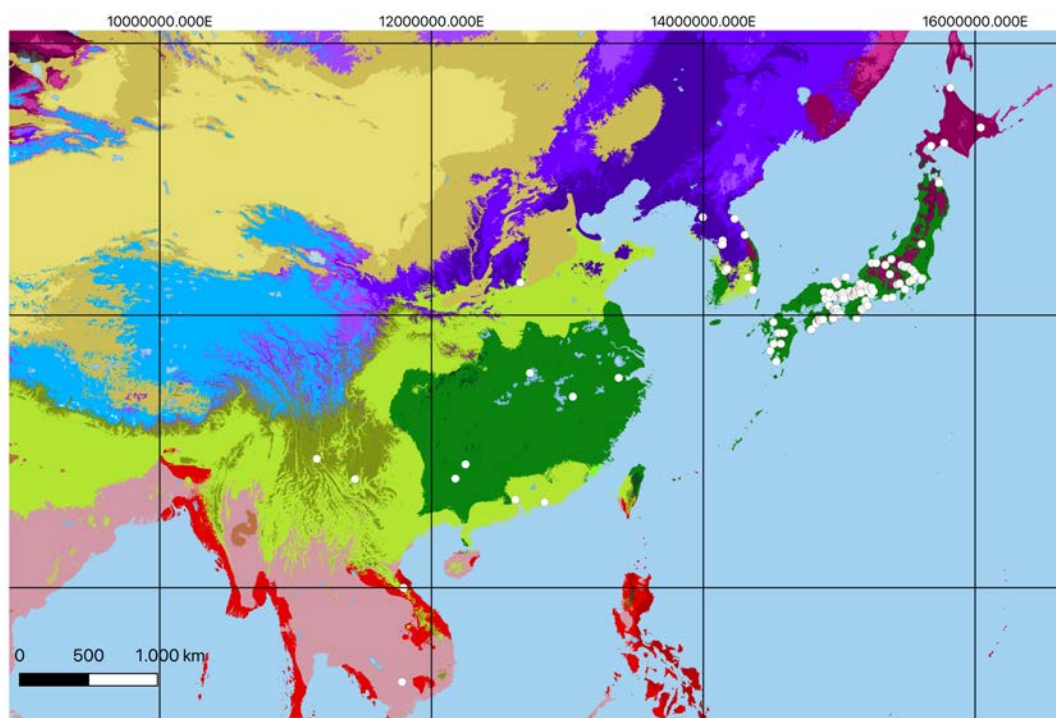
Köppen profile of *Vallisneria nana*



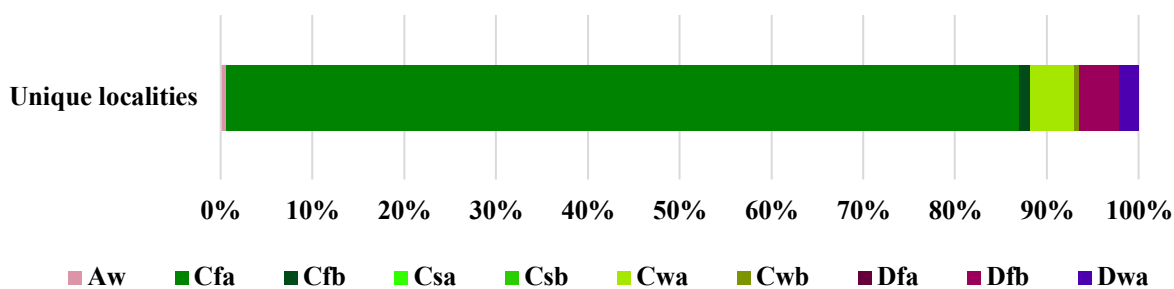
Köppen profile of *Vallisneria nana*



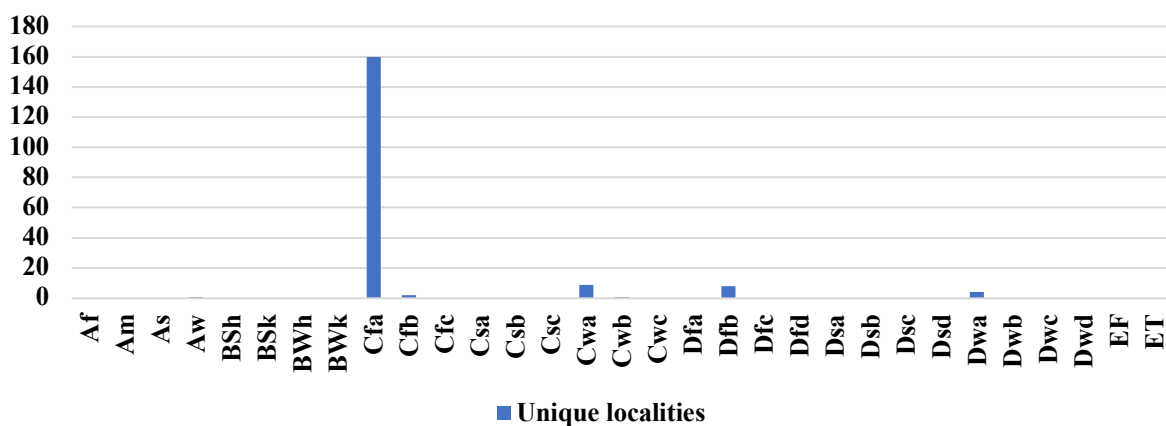
5.3.4.3.7. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria natans* (Lour. 1790) H.Hara 1974 herbarium specimens excluding duplicate occurrences (n = 185).



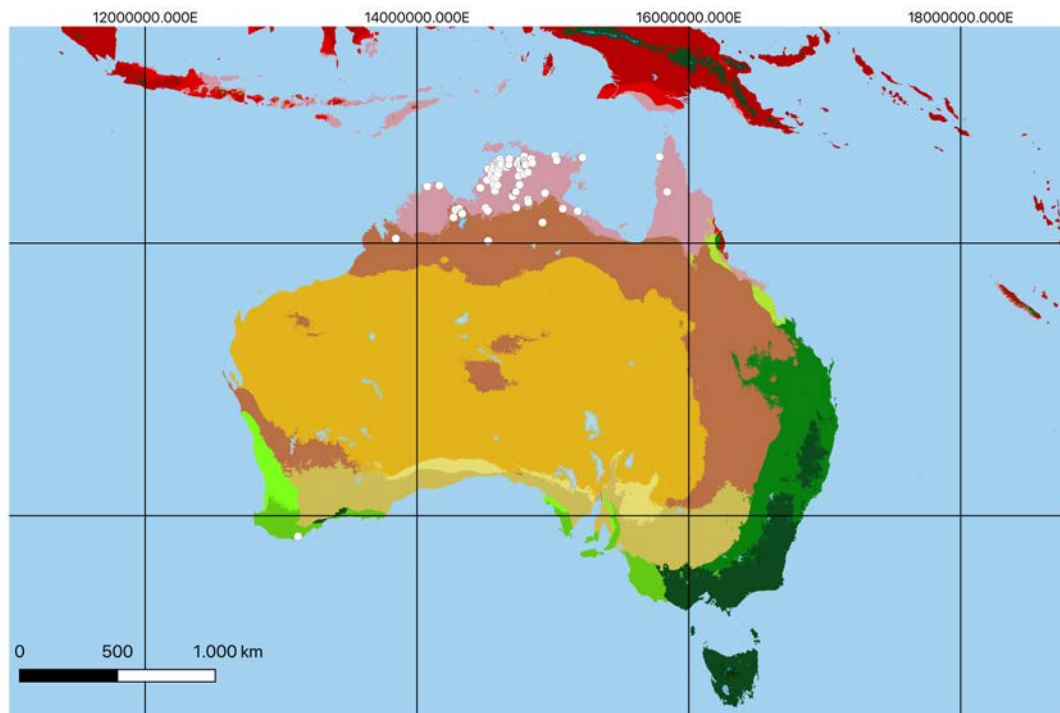
Köppen profile of *Vallisneria natans*



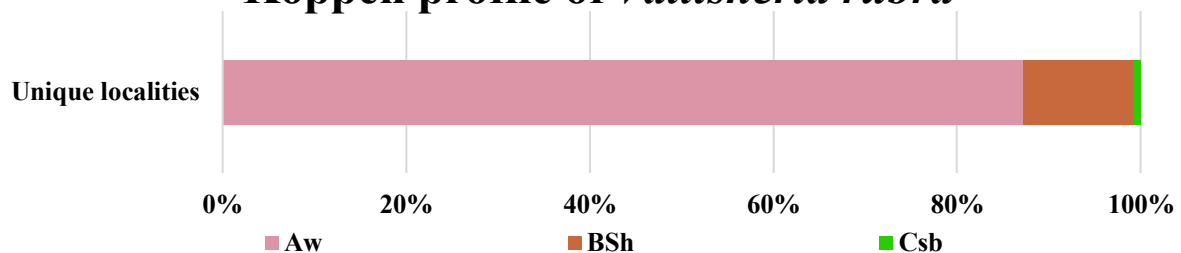
Köppen profile of *Vallisneria natans*



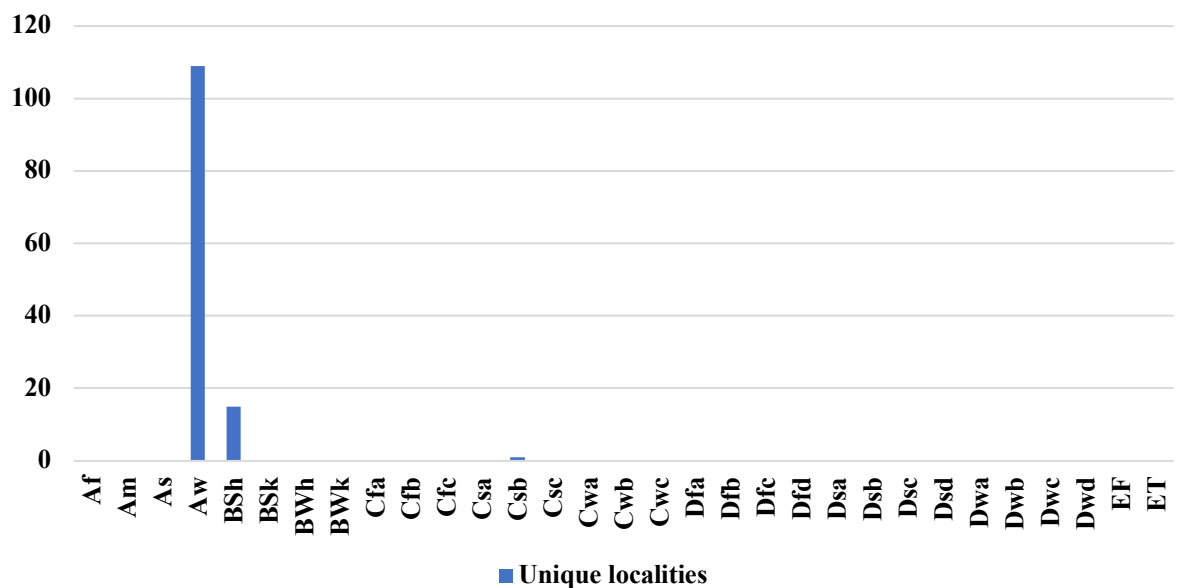
5.3.4.3.8. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria rubra* (Rendle 1916) Les & S.W.L.Jacobs 2008; herbarium specimens excluding duplicate occurrences (n = 125).



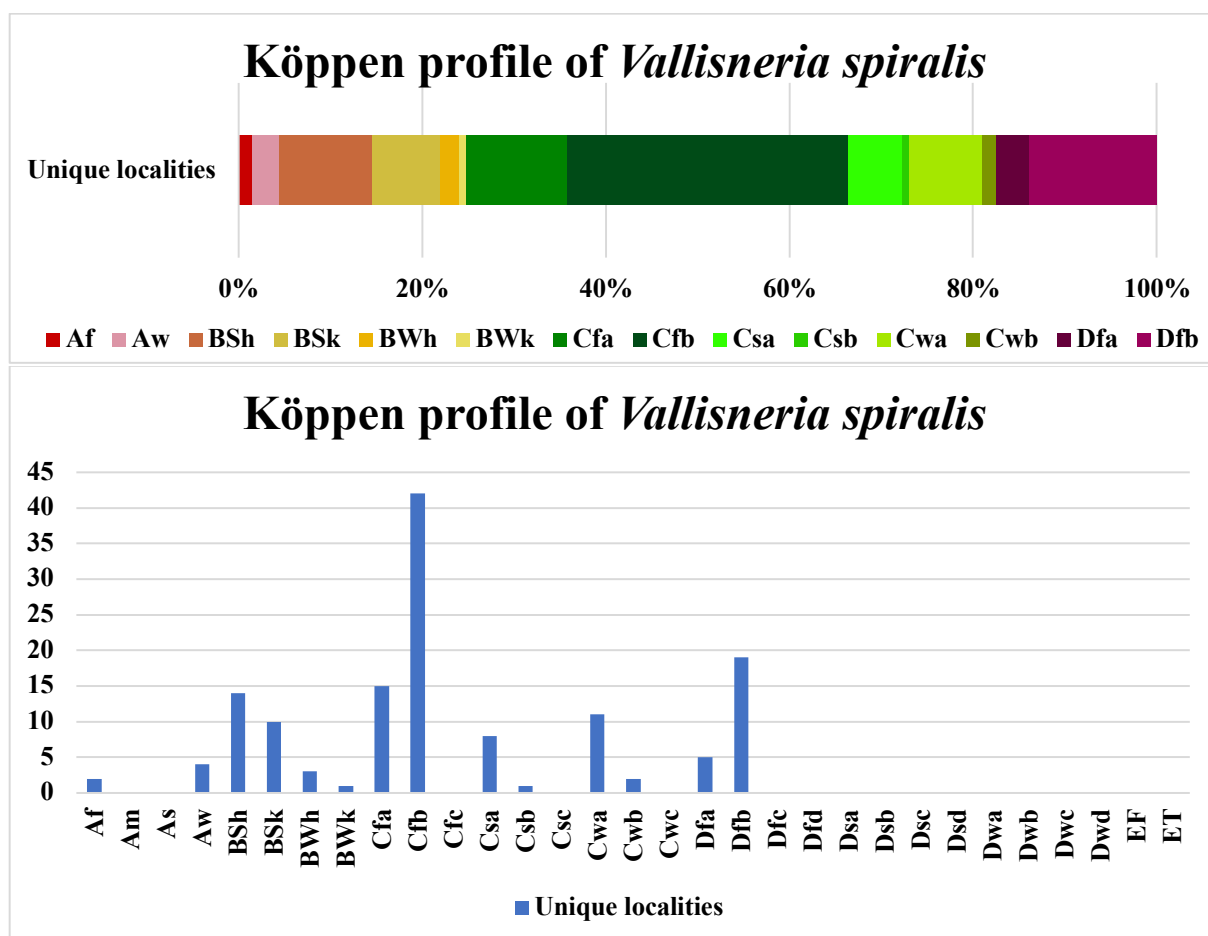
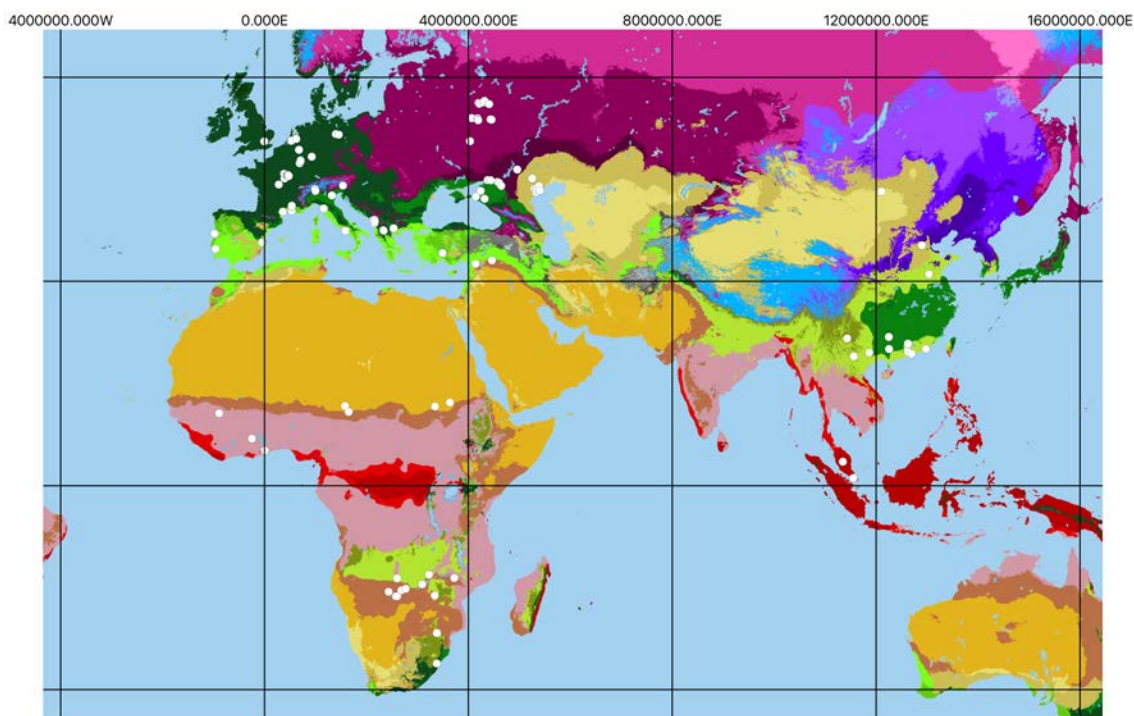
Köppen profile of *Vallisneria rubra*



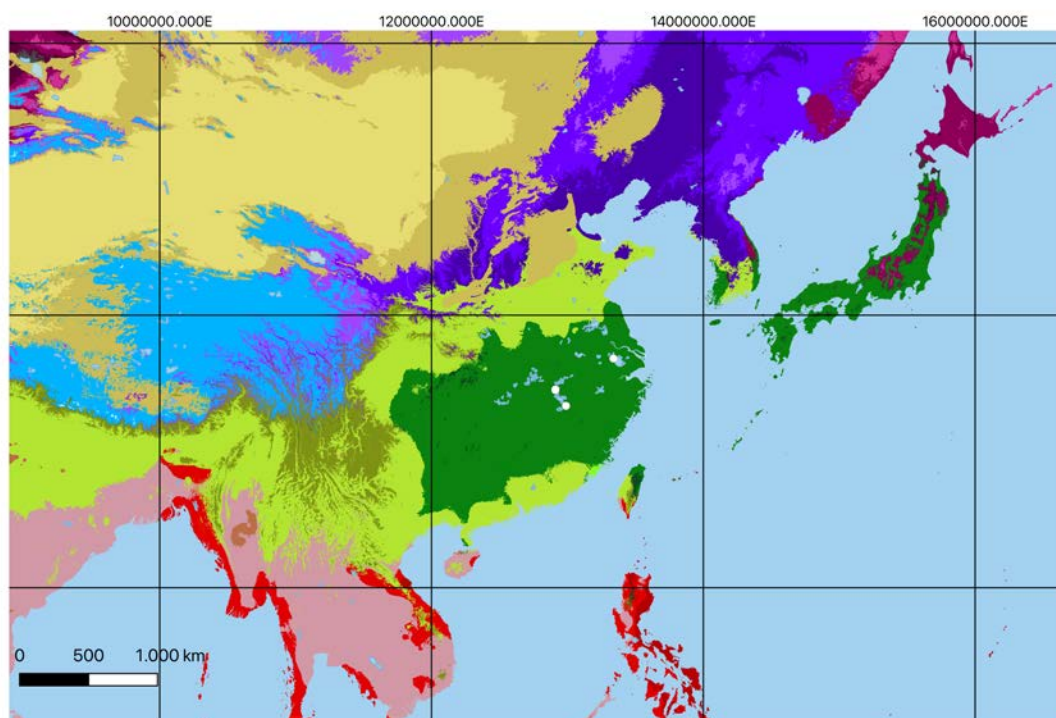
Köppen profile of *Vallisneria rubra*



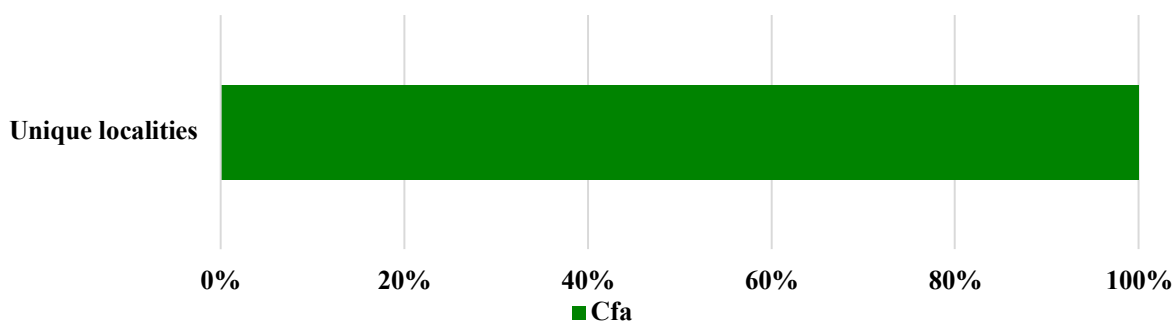
5.3.4.3.9. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria spiralis* L. 1753; herbarium specimens excluding duplicate occurrences (n = 137).



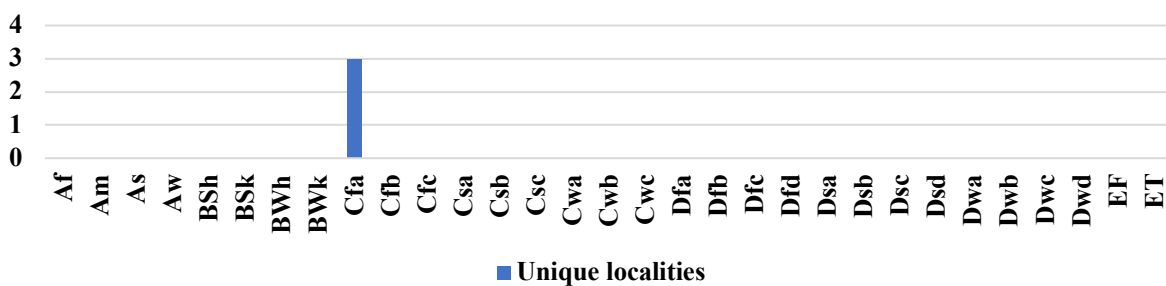
5.3.4.3.10. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria spinulosa* S.Z.Yan 1982; herbarium specimens excluding duplicate occurrences (n = 3).



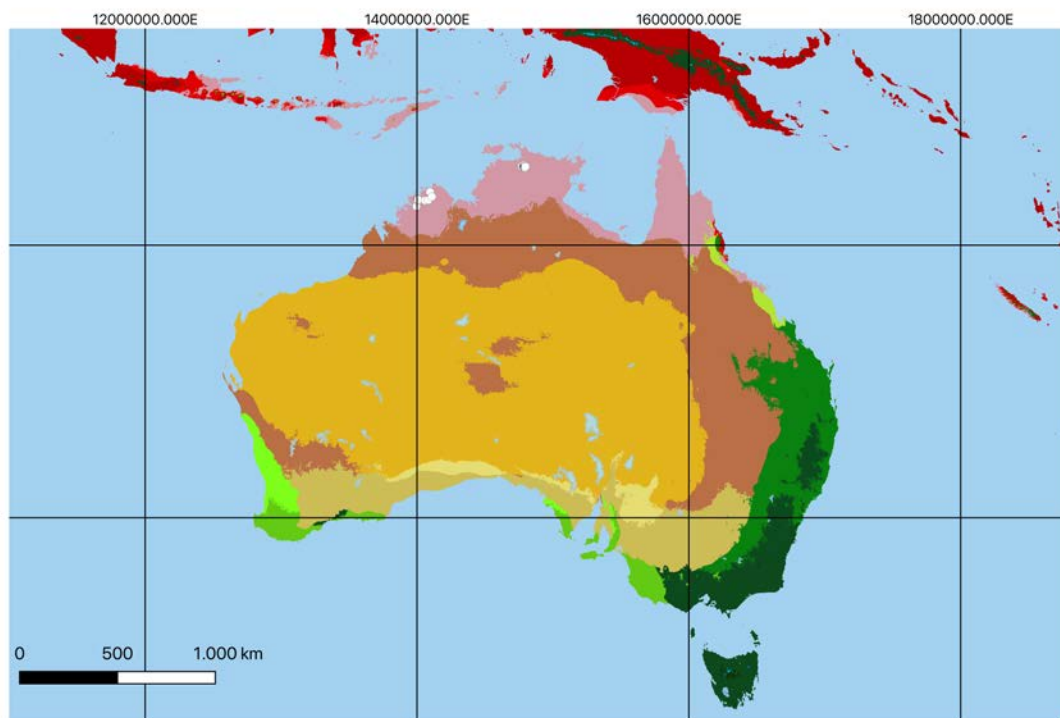
Köppen profile of *Vallisneria spinulosa*



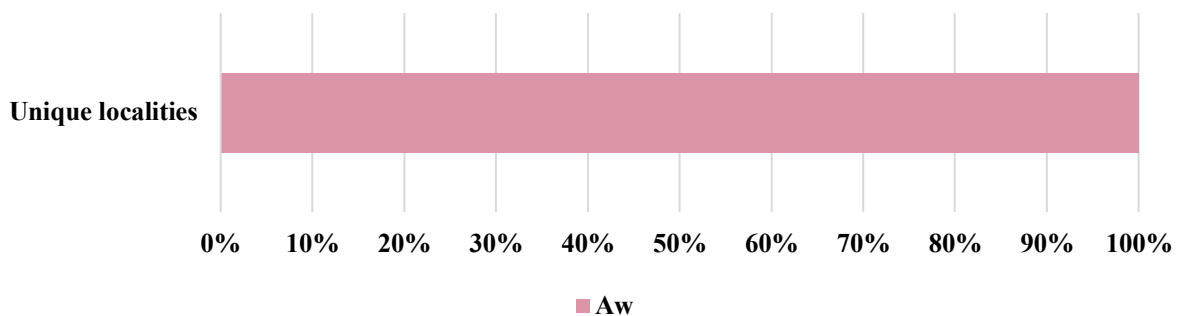
Köppen profile of *Vallisneria spinulosa*



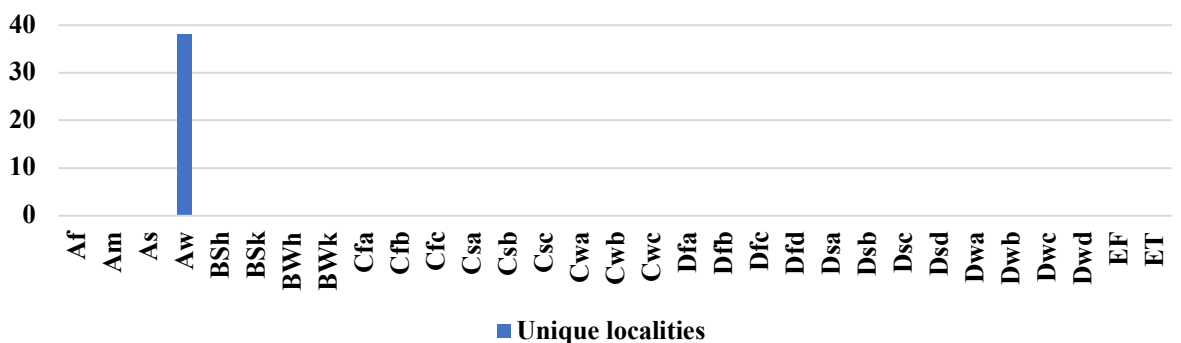
5.3.4.3.11. Köppen profile, distribution and climate map – GBIF occurrences of *Vallisneria triptera* S.W.L.Jacobs & K.A.Frank 1997; herbarium specimens excluding duplicate occurrences (n = 38).



Köppen profile of *Vallisneria triptera*



Köppen profile of *Vallisneria triptera*



GBIF datasets:

Blyxa:

Blyxa auberti GBIF Data set: <https://doi.org/10.15468/dl.3j4svh>
Blyxa echinosperma GBIF Data set: <https://doi.org/10.15468/dl.tz2q94>
Blyxa hexandra GBIF Data set: <https://doi.org/10.15468/dl.m74dkr>
Blyxa japonica GBIF Data set: <https://doi.org/10.15468/dl.qa5fwa>
Blyxa octandra GBIF Data set: <https://doi.org/10.15468/dl.4cn2yg>
Blyxa senegalensis GBIF Data set: <https://doi.org/10.15468/dl.tju7pg>
Blyxa shimadai GBIF Data set: <https://doi.org/10.15468/dl.gt7uv3>
Blyxa somai GBIF Data set: <https://doi.org/10.15468/dl.7ejqk9>

Egeria:

Egeria densa GBIF Data set: <https://doi.org/10.15468/dl.ukwfx3>
Egeria heterostemon GBIF Data set: <https://doi.org/10.15468/dl.hasy2z>
Egeria najas GBIF Data set: <https://doi.org/10.15468/dl.9h5hst>

Elodea:

Elodea bifoliata GBIF Data set: <https://doi.org/10.15468/dl.hhnwbb>
Elodea callitrichoides GBIF Data set: <https://doi.org/10.15468/dl.neghzn>
Elodea canadensis GBIF Data set: <https://doi.org/10.15468/dl.3nr47e>
Elodea granatensis GBIF Data set: <https://doi.org/10.15468/dl.7t6hms>
Elodea nuttallii GBIF Data set: <https://doi.org/10.15468/dl.7t79ef>
Elodea potamogeton GBIF Data set: <https://doi.org/10.15468/dl.gacw7j>

Enhalus:

Enhalus bifoliata GBIF Data set: <https://doi.org/10.15468/dl.7m27pd>

Halophila:

Halophila australis GBIF Data set: <https://doi.org/10.15468/dl.g6maep>
Halophila baillonis GBIF Data set: <https://doi.org/10.15468/dl.6uswb5>
Halophila beccari GBIF Data set: <https://doi.org/10.15468/dl.9bk8sz>
Halophila capricorni GBIF Data set: <https://doi.org/10.15468/dl.4ug7ez>
Halophila decipiens GBIF Data set: <https://doi.org/10.15468/dl.4z58jg>
Halophila engelmannii GBIF Data set: <https://doi.org/10.15468/dl.sv6uhx>
Halophila gaudichaudii GBIF Data set: <https://doi.org/10.15468/dl.9zx4bm>
Halophila hawaiiiana GBIF Data set: <https://doi.org/10.15468/dl.ycijn6>
Halophila major GBIF Data set: <https://doi.org/10.15468/dl.ipu9t2>
Halophila minor GBIF Data set: <https://doi.org/10.15468/dl.rn36mp>
Halophila nipponica GBIF Data set: <https://doi.org/10.15468/dl.sxxf8d>
Halophila ovalis GBIF Data set: <https://doi.org/10.15468/dl.9kye3d>
Halophila spinulosa GBIF Data set: <https://doi.org/10.15468/dl.e8gzfx>
Halophila stipulaceae GBIF Data set: <https://doi.org/10.15468/dl.ekfzps>
Halophila sulawesii GBIF Data set: <https://doi.org/10.15468/dl.wzyxq6>
Halophila tricostrata GBIF Data set: <https://doi.org/10.15468/dl.he7ef8>

Hydrilla:

Hydrilla verticillata GBIF Data set: <https://doi.org/10.15468/dl.fq8rxg>

Hydrocharis:

Hydrocharis chevalieri GBIF Data set: <https://doi.org/10.15468/dl.rvpz6w>

Hydrocharis dubia GBIF Data set: <https://doi.org/10.15468/dl.r8nnx4>

Hydrocharis morsus-ranae GBIF Data set: <https://doi.org/10.15468/dl.naq388>

Hydrocharis laevigatum GBIF Data set: <https://doi.org/10.15468/dl.59kdvq>

Hydrocharis spongia GBIF Data set: <https://doi.org/10.15468/dl.rwq9fy>

Hydromystris:

Hydromystris stolonifera GBIF Data set: <https://doi.org/10.15468/dl.jpuj77>

Lagarosiphon:

Lagarosiphon cordofanus GBIF Data set: <https://doi.org/10.15468/dl.kvunr9>

Lagarosiphon hydrilloides GBIF Data set: <https://doi.org/10.15468/dl.6hmd2f>

Lagarosiphon ilicifolius GBIF Data set: <https://doi.org/10.15468/dl.ff3xzb>

Lagarosiphon madagascariensis GBIF Data set: <https://doi.org/10.15468/dl.8fmajb>

Lagarosiphon major GBIF Data set: <https://doi.org/10.15468/dl.2p5pe5>

Lagarosiphon muscoides GBIF Data set: <https://doi.org/10.15468/dl.yk5qmf>

Lagarosiphon rubellus GBIF Data set: <https://doi.org/10.15468/dl.j9n25k>

Lagarosiphon steudneri GBIF Data set: <https://doi.org/10.15468/dl.ry68r9>

Lagarosiphon verticillifolius GBIF Data set: <https://doi.org/10.15468/dl.hmndzn>

Najas:

Najas affinis GBIF data set: <https://doi.org/10.15468/dl.t26may>

Najas ancistrocarpa GBIF data set: <https://doi.org/10.15468/dl.6rxsax>

Najas arguta GBIF data set: <https://doi.org/10.15468/dl.c85mtz>

Najas australis GBIF data set: <https://doi.org/10.15468/dl.sd69ng>

Najas baldwinia GBIF data set: <https://doi.org/10.15468/dl.ejhxz2>

Najas browniana GBIF data set: <https://doi.org/10.15468/dl.5a374t>

Najas chinensis GBIF data set: <https://doi.org/10.15468/dl.kg84zf>

Najas conferta GBIF data set: <https://doi.org/10.15468/dl.ya2xhn>

Najas filifolia GBIF data set: <https://doi.org/10.15468/dl.a5h9cz>

Najas flexilis GBIF data set: <https://doi.org/10.15468/dl.wtfxmf>

Najas gracillima GBIF data set: <https://doi.org/10.15468/dl.kfnjf9>

Najas graminea GBIF data set: <https://doi.org/10.15468/dl.ckrhqm>

Najas guadalupensis GBIF data set: <https://doi.org/10.15468/dl.v9ncbf>

Najas hagerupi GBIF data set: <https://doi.org/10.15468/dl.5449n3>

Najas halophila GBIF data set: <https://doi.org/10.15468/dl.vbrmdz>

Najas horrida GBIF data set: <https://doi.org/10.15468/dl.gudekj>

Najas indica GBIF data set: <https://doi.org/10.15468/dl.5dkpwa>

Najas kurziana GBIF data set: <https://doi.org/10.15468/dl.6xpwq9>

Najas madagascariensis GBIF data set: <https://doi.org/10.15468/dl.qukumw>

Najas malesiana GBIF data set: <https://doi.org/10.15468/dl.a6npgw>

Najas marina GBIF data set: <https://doi.org/10.15468/dl.56v9xt>

Najas oguraensis GBIF data set: <https://doi.org/10.15468/dl.3r3wnd>

Najas pectinata GBIF data set: <https://doi.org/10.15468/dl.xgwnfj>

Najas schweinfurthii GBIF data set: <https://doi.org/10.15468/dl.eckvda>

Najas tenuicaulis GBIF data set: <https://doi.org/10.15468/dl.2rsn6q>

Najas tenuifolia GBIF data set: <https://doi.org/10.15468/dl.j6vqgj>

Najas tenuis GBIF data set: <https://doi.org/10.15468/dl.wsdw8n>

Najas tenuissima GBIF data set: <https://doi.org/10.15468/dl.xepmw8>

Najas testui GBIF data set: <https://doi.org/10.15468/dl.yufchs>

Najas welwitschii GBIF data set: <https://doi.org/10.15468/dl.pqb8za>
Najas wrightiana GBIF data set: <https://doi.org/10.15468/dl.388e94>

Nechamandra:

Nechamandra alternifolia GBIF data set: <https://doi.org/10.15468/dl.f8c75z>

Ottelia:

Ottelia acuminata GBIF Data set: <https://doi.org/10.15468/dl.nhbs3u>
Ottelia alismoides GBIF Data set: <https://doi.org/10.15468/dl.9n24x3>
Ottelia balansae GBIF Data set: <https://doi.org/10.15468/dl.wkv6zr>
Ottelia brasiliensis GBIF Data set: <https://doi.org/10.15468/dl.grsbhp>
Ottelia cordata GBIF Data set: <https://doi.org/10.15468/dl.bwkw4n>
Ottelia cylindrica GBIF Data set: <https://doi.org/10.15468/dl.ncjp28>
Ottelia exserta GBIF Data set: <https://doi.org/10.15468/dl.v2aebv>
Ottelia fischeri GBIF Data set: <https://doi.org/10.15468/dl.7bzdda>
Ottelia javanica GBIF Data set: <https://doi.org/10.15468/dl.9dgnap>
Ottelia kunensis GBIF Data set: <https://doi.org/10.15468/dl.e47va7>
Ottelia mesenterium GBIF Data set: <https://doi.org/10.15468/dl.6p8qdx>
Ottelia muricata GBIF Data set: <https://doi.org/10.15468/dl.p4yhfufu>
Ottelia ovalifolia GBIF Data set: <https://doi.org/10.15468/dl.5pdqds>
Ottelia ulvifolia GBIF Data set: <https://doi.org/10.15468/dl.x5dm62>
Ottelia verdickii GBIF Data set: <https://doi.org/10.15468/dl.csnbg2>

Stratiotes:

Stratiotes aloides GBIF Data set: <https://doi.org/10.15468/dl.stx76u>

Thalassia:

Thalassia GBIF Data set: <https://doi.org/10.15468/dl.82h3sg>

Vallisneria:

Vallisneria americana GBIF data set: <https://doi.org/10.15468/dl.wqf33a>
Vallisneria annua GBIF data set: <https://doi.org/10.15468/dl.cq9ngt>
Vallisneria australis GBIF data set: <https://doi.org/10.15468/dl.cq9ngt>
Vallisneria caulescens GBIF data set: <https://doi.org/10.15468/dl.2m7v5v>
Vallisneria denseserrulata GBIF data set: <https://doi.org/10.15468/dl.ukg4ed>
Vallisneria erecta GBIF data set: <https://doi.org/10.15468/dl.rdyx2b>
Vallisneria natans GBIF data set: <https://doi.org/10.15468/dl.wkhqv4>
Vallisneria nana GBIF data set: <https://doi.org/10.15468/dl.hvka99>
Vallisneria rubra GBIF data set: <https://doi.org/10.15468/dl.knjwsx>
Vallisneria spinulosa GBIF data set: <https://doi.org/10.15468/dl.j364pd>
Vallisneria spiralis GBIF data set: <https://doi.org/10.15468/dl.72599d>
Vallisneria triptera GBIF data set: <https://doi.org/10.15468/dl.8vs4g9>

References:

- Chen, L.-Y., Chen, J.-M., Gituru, R. W., Wang, Q.-F. 2012. Generic phylogeny, historical biogeography and character evolution of the cosmopolitan aquatic plant family Hydrocharitaceae. *BMC Evolutionary Biology*, 12, 30.
- Cui, D., Liang, S., Wang, D., Liu, Z. 2021. A 1 km global dataset of historical (1979–2013) and future (2020–2100) Köppen–Geiger climate classification and bioclimatic variables. *Earth Syst. Sci. Data*, 13, 5087–5114. <https://doi.org/10.5194/essd-13-5087-2021>
- Kottek, M., Grieser, J., Beck, C., Rudolf, B., and Rubel, F. 2006. World map of the Köppen–Geiger climate classification updated, *Meteorol. Z.*, 15, 259–263.
- Peel, M. C., Finlayson, B. L., and McMahon, T. A. 2007. Updated world map of the Köppen–Geiger climate classification, *Hydrol. Earth Syst. Sci.*, 11, 1633–1644, <https://doi.org/10.5194/hess-11-1633-2007>.
- Rubel, F., Brugger, K., Haslinger, K., and Auer, I. 2017. The climate of the European Alps: Shift of very high resolution Köppen–Geiger climate zones 1800–2100, *Meteorol. Z.*, 26, 115–125, <https://doi.org/10.1127/metz/2016/0816>.