

First records of *Landoltia punctata* (G.Mey.) Les & D.J.Crawford (Araceae, Lemnoideae) in Santa Catarina, southern Brazil

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Abstract: *Landoltia punctata* (G.Mey.) Les & D.J. Crawford is a cosmopolite duckweed species of significant economic and technological interest, which in the Americas had its southernmost occurrence recorded in Pontal do Paraná, Paraná state, southern Brazil. This work extends its distribution southwards to Santa Catarina state, representing a range extension of ca. 300 km.

Key words: aquatic plant, distribution extension, duckweed, new records, South America

Landoltia Les & D.J.Crawford (Araceae) is a monotypic genus recently segregated from *Spirodela* Schleid., after molecular phylogenetic studies have shown the latter to be paraphyletic should the former be included in it (Les and Crawford 1999). Its only species, *L. punctata* (G.Mey.) Les & D.J.Crawford (Figures 1, 2) is member of the duckweed subfamily (Lemnoideae), which includes five genera (*Landoltia*, *Lemna* L., *Spirodela*, *Wolffia* Horkel ex Schleid. and *Wolffiella* Hegelm.) and 35–37 species of small free-floating aquatic plants, being the smallest angiosperms known (Landolt 1986; Pott and Cervi 1999; Les et al. 2002; Pott 2002; Rothwell et al. 2004; Cabrera et al. 2008; Bogner 2009). Although formerly accepted as a separate family (Lemnaceae), currently most taxonomists accept this group as a subfamily nested inside Araceae (Cabrera et al. 2008; Bogner 2009; Cusimano et al. 2011; Nauheimer et al. 2012; Mayo et al. 2013; Henriquez et al. 2014). As other vascular aquatic plants, *L. punctata* has a wide and rather discontinuous distribution, most probably because of long distance dispersal by birds (Les et al. 2003).

In recent years a growing economic and technological interest has been developing on the duckweeds, particularly on *Landoltia punctata*, because of its applications in bioremediation (Cheng et al. 2002; Pott and Pott 2002; Xu and Shen 2011; Mohedano et al. 2012; Miranda et al. 2014), protein production for animal feeding (Chantiratikul et al. 2010; Mohedano et al. 2012) and also biofuel production (Xu et al. 2011; Chen et al. 2012; Ge et al. 2012; Miranda et al. 2014). Furthermore, duckweeds have a very rapid growth, and accumulate biomass at much higher rates than most other plants including crops (Cheng et al. 2002; Xu and Shen 2011; Ge et al. 2012; Miranda et al. 2014). As consequence of cultivation, the distribution of some duckweed species might be expanding. Also, due to their high growth rate, duckweeds could be considered as weedy plants and might cause ecological imbalances (Pott and Pott 2002).



Figure 1. Cultivated specimens of *Landoltia punctata*. Photo by RAM.



Figure 2. Detail of two specimens of *Landoltia punctata* showing roots: side view (upper plant) and bottom view (lower plant). Photo by RAM.

Landoltia punctata had hitherto its southernmost occurrence in the Americas recorded in Pontal do Paraná, Paraná state, southern Brazil (Pott 2002; Coelho et al. 2010). However, we collected this species in three different municipalities in eastern Santa Catarina state (Figure 3): in Ilhota in 1999, in Braço do Norte in 2009 and in Florianópolis in 2013. In all these three localities *L. punctata* was found growing spontaneously, i.e. without human interference. These are the first records of this species in Santa Catarina, and are also the southernmost records in the Americas, corresponding to a distribution expansion of ca. 300 km. In addition to these new collections, we revised the entire Lemnoideae collections at herbaria FLOR, MBM and UPCB.

Diagnostic characters of *Landoltia punctata* are: roots (1)2–7(12), to 7 cm long, all perforating the prophyllum; turions absent; fronds floating on the water surface, obovate to elliptic, 1.5–3 times longer than wide, above shining and green with a medial series of papillae, below smooth and red; veins 3–7; flowers infrequent; external locules of the anther above the internal locules; ovary with 1–2 ovules; upper part of fruit with a lateral wing; seeds 1–2, with 10–15 distinct ribs (Les and Crawford 1999; Li and Landolt 2010). The specimens of *L. punctata* collected in Santa Catarina are all in conformity with

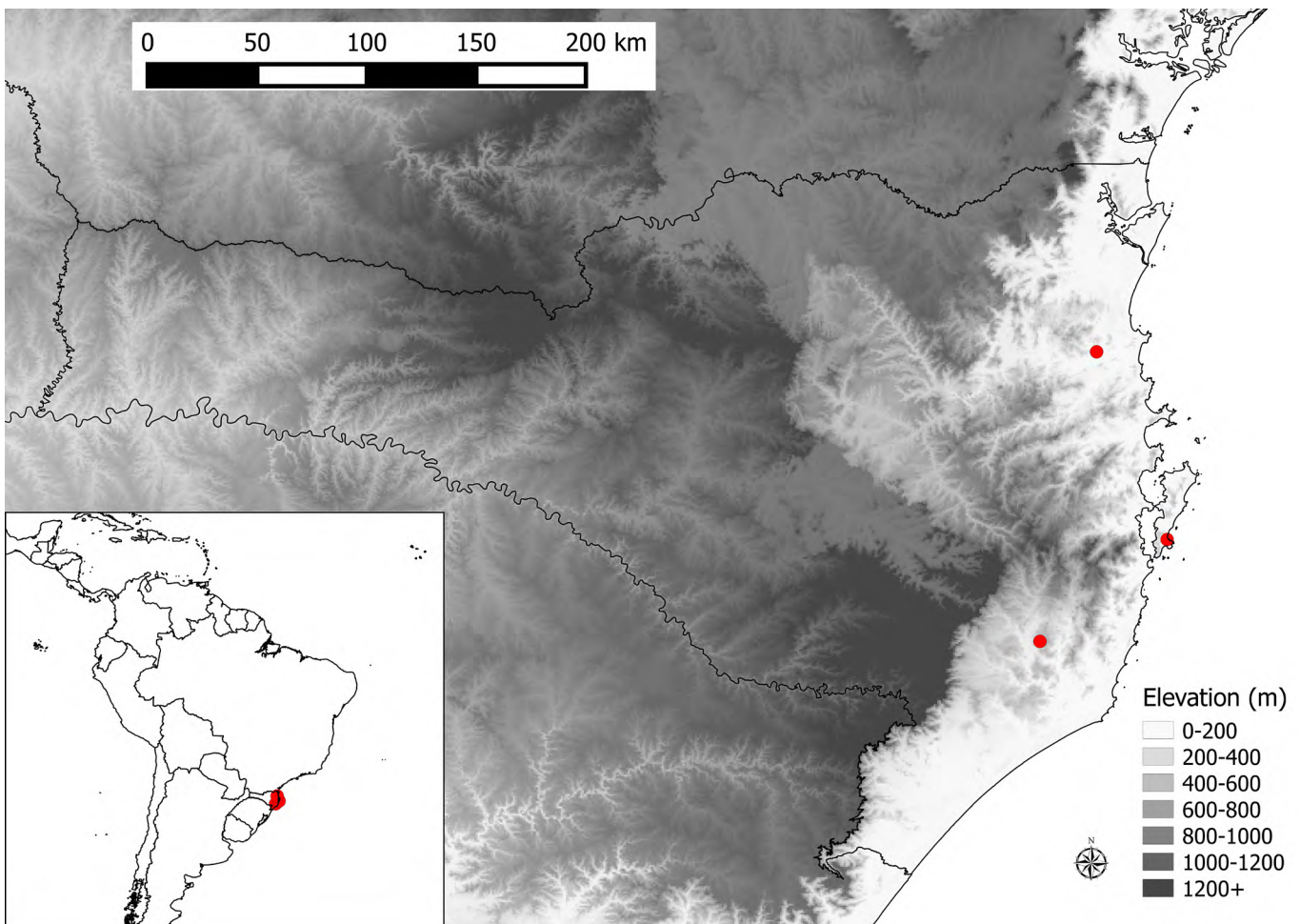


Figure 3. Location of the records of *Landoltia punctata* in Santa Catarina state, southern Brazil.

this diagnosis. Synonyms of *L. punctata* include *Lemna oligorrhiza* Kurz, *Lemna punctata* G.Mey., *Spirodela oligorrhiza* (Kurz) Hegelm., *S. punctata* (G.Mey.) C.H.Thomps. and *S. sichuanensis* M.G.Liu & K.M.Xie (Li and Landolt 2010).

Most probably having originated in Southeast Asia and Australia (Li and Landolt 2010), *Landoltia punctata* is now cosmopolite, occurring in regions with mild winters and not very hot summers, from sea level to 2400 m asl (Pott 2002; Pott and Pott 2002; Li and Landolt 2010). It occurs in bodies of fresh or low salinity water, protected from strong winds and currents, having a preference for waters rich in nutrients, especially nitrogen and phosphorus (Landolt and Kandeler 1987). We have found this species growing in eutrophic ponds contaminated by pig farming wastewaters. Nevertheless, we believe that the distribution advance of *L. punctata* to Santa Catarina is spontaneous, and not due to direct human activity, although it is possible that the cultivation of this species might be expanding its distribution in other areas. Its conservation status, according to the IUCN criteria (IUCN 2012, 2014), is Least Concern (LC). Despite probably being the Brazilian state with its flora best known, there are still considerable gaps in the knowledge of the flora of Santa Catarina (Hassemer et al. 2015a, 2015b).

MATERIAL EXAMINED:

Landoltia punctata. BRAZIL. MATO GROSSO DO SUL: Porto Murtinho: Around São João Indian village, floating in small temporary pond water, 10 March 2003, G.G. Hatschbach et al. 76706 (MBM). PARANÁ: Fazenda Rio Grande: Passo Amarelo, in spring water, 18.5°C, 5 July 1998, A. Dunaiski Jr. 642 (UPCB); Paranaguá: Ipanema, 20 April 1992, A. Dunaiski Jr. 224 (UPCB); Pinhais: Area 5, Centro Paranaense de Referência em Agroecologia, Jardim Boa Vista, 7 August 2009, S.G. Age & E.C. Bez-Batti 20 (MBM); Pontal do Paraná: Balneário Shangri-lá, in ditches by the roadside, aquatic, 25 November 1998, J.M. Cruz & J. Cordeiro 24 (MBM). SANTA CATARINA: Braço do Norte: Farm of Sr. Valdir Wiggers, Pinheiral district, in abandoned dunghill, 28°13'50.1" S, 049°06'29.2" W, 336 m, 9 May 2009, R.A. Mohedano s.n. (FLOR); Florianópolis: Sangradouro River, beside the bridge next to the interchange to Armação, 27°45'02.70" S, 048°30'32.47" W, 4 m, 4 March 2013, J.P.R. Ferreira & G. Hassemer 325 (FLOR); Ilhota: 1 km after the BR 470, km 512, at the junction for sand extraction, in ditch culvert, by the roadside near eucalypti, 26°52'01" S, 048°50'28" W, 10 m, 24 July 1999, V.J. Pott & A. Pott 3932 (CGMS, CPAP).

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