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Notes and Comments

Aquatic macrophyte mats as dispersers of one invasive plant species

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(With 2 figures)

Aquatic macrophytes can form mats that are carried by water flow. These mats are a means of dispersion of aquatic vertebrates and invertebrates (Horwath and Lamberti, 1997; Bulla et al., 2007). In tropical aquatic ecosystems, floating mats are composed mainly by a mixture of free floating, epiphytic and emergent macrophytes (Bulla et al., 2007). Dispersion of organisms by water flow in macrophyte mats may increase the delivery of propagules in sites far from the area where the organisms originated (Barrat-Segretain, 1996). This type of dispersion can enhance invasive species success (Aznar et al., 2006). For example, the invasive zebra mussel (*Dreissena polymorpha* (Pallas, 1771)) disperses by uprooted and drifting fragments of the submersed macrophyte *Vallisneria americana* Michx. in a lake outlet stream (Horwath and Lamberti, 1997). Despite the importance of macrophyte mats to disperse organisms, to our knowledge their role as dispersers of invasive macrophytes in tropical regions has not been investigated.

Macrophyte invaders cause troubles in ecosystems all over the world (e.g., Pieterse and Murphy, 1990), and they can change the composition and reduce diversity of aquatic assemblages (Douglas and O'Connor, 2003; Perna et al., 2012; Amorim et al. 2015). The macrophyte *Urochloa arrecta* (Hack. ex T. Durand & Schinz) Morrone & Zuloaga (in previous investigations identified as *Urochloa subquadripara*; e.g., Thomaz et al., 2009) is a highly invasive Poaceae native to Africa that reduces diversity and changes the composition of macrophytes and fish assemblages in Neotropical regions (Carniatto et al., 2013; Amorim et al., 2015). This species grows quickly from fragments (Michelan et al., 2010a), it roots in the shores and its stems extend toward limnetic regions, thus exhibiting a typical "rooted with floating stems" life form. The impacts caused by this species and its rapid regeneration are causes of concern and thus, knowing the potential vectors of this species has a practical interest.

In a sampling conducted at arms located in the East shore of the Itaipu Reservoir (Brazil-Paraguay) in March 2016, it was observed many floating mats formed by native macrophytes carrying *U. arrecta* individuals. One of these mats was composed by *Pistia stratiotes* L. and *Eichhornia crassipes* (Mart.) Solms and another by *Polygonum ferrugineum* Wedd. and *Salvinia auriculata* Aubl. Interestingly, the *U. arrecta* individuals were not rooted in the sediment, as usually occurs when it grows in the shores, but they were growing as an epiphyte over these natives macrophyte mats. Ten individuals of *U. arrecta* that were over these two mats (Figure 1A) of macrophytes were collected in the middle of two Itaipu's arms (depths 5.2 and 7.5 m) and their mean length was 4.11 m (± 1.04 SD; Figure 1B). The large sizes of these individuals indicate the capacity of surviving and growing of *U. arrecta* when it is over floating macrophytes mats.

The first step in the invasion process is related to the introduction of propagules (Levine, 2008). However, it is known that the potential and success of exotic species to become invaders in new sites are positively related to the "propagule pressure", measured as the number of propagules and the frequency at which they arrive in a site (Lockwood et al., 2005). It is important to note that the kind of dispersion of *U. arrecta* explained above and the high frequency of mats with this invasive species that was observed in Itaipu, probably increase the propagule pressure of this Poaceae. This observation indicates that after colonizing a site, *U. arrecta* could present diffusion dispersion (*sensu* Davis and Thompson, 2000) increasing its expansion in the ecosystem. Because these macrophyte mats can be transported downstream for long distances, we do not discard that this form of dispersion may also initiate colonization in other ecosystems. In consequence of this new observation of *U. arrecta*'s dispersion, it is possible that this species may increase its potential to invade new areas through macrophyte mats, both inside Itaipu or in other ecosystems located downstream from this reservoir.

The increased ability to disperse is a cause of concern because in Itaipu *U. arrecta* is considered an invasive species in view of its high frequency of occurrence, its resilience to disturbances (Thomaz et al., 2009) and because its great biomass accumulation impacts native macrophytes (Michelan et al., 2010b, see also Figure 2). However, to what extent the type of dispersion identified here helps to explain the invasion success of this species in Itaipu and in other ecosystems is an open question.

In summary, our observation evidenced that *U. arrecta* has a great plasticity, growing as an epiphyte life form over drifting floating macrophyte mats. Considering the common occurrence of macrophyte mats in different types of aquatic ecosystems, it was concluded that these mats could

Figure 1. Photo showing a floating mat dominated by *Pistia stratiotes* carrying individuals of *Urochloa arrecta* (A) and an individual of *U. arrecta* collected over the same mat (B).

Figure 2. Photos showing two arms of Itaipu Reservoir with patches of macrophytes dominated by *Urochloa arrecta*.

be efficient dispersers of this invasive Poaceae. Finally, identifying what are the sources of *U. arrecta* propagules and how far macrophyte mats can go, is important to assess the dispersion potential of this invasive species.

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