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Research note

Evidence for induced pseudo-vivipary in *Pennisetum setaceum* (Fountain grass) invading a dry river, arid Karoo, South Africa

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Abstract

We report the development of rootless plantlets in inflorescences of *Pennisetum setaceum* (Fountain grass) invasive in the Gamka River in the Karoo National Park, South Africa. The pseudo-vivipary appeared to have been induced by inundation of immature inflorescences when the river flooded. Plantlet production may facilitate the spread of this species in seasonally flooding rivers in arid regions. To the best of our knowledge this is the first record of induced pseudo-vivipary in this grass species.

Keywords: Dispersal; Inundation; Spikelet proliferation; Vegetative reproduction

Fountain grass, *Pennisetum setaceum* (Forssk.) Chiov. a perennial tussock grass native to North Africa, has escaped horticulture to become invasive in many arid and semi-arid areas including parts of Australia (Batianoff and Butler, 2002), Hawaii, Arizona and California in the USA (Williams et al., 1995; Poulin et al., 2005), and Southern Africa (Milton, 2004). In South Africa it is a declared weed (Henderson, 2001).

The species produces large quantities of seeds with feathered glumes. Dispersal is assumed to be mainly by wind, although seeds may also be moved on vehicles and animals (Williams et al., 1995). In addition to producing seed, vegetative reproduction through pseudo-vivipary (or production of plantlets in spikelets) is known for three species within the genus *Pennisetum* (Schmelzer, 1997), but has not been reported for *P. setaceum*.

While carrying out a survey of the distribution of *P. setaceum* as an alien species in the Droërivier, a tributary of the Gamka River in Karoo National Park near Beaufort West (Western Province of South Africa, 32° 18′S, 22° 33′E, 900°m a.s.l.), we noticed that inflorescences on some of the plants had proliferated, producing plantlets (Fig. 1). The distribution of inflorescences with plantlets appeared to be heterogeneous, and mainly confined to the central part of the river bed and the lower parts of the plants. We therefore hypothesised that the pseudo-vivipary may have been induced by submergence of developing inflorescences in water.

The Beaufort West region is semi-arid (mean annual rainfall 227 mm, range 62–515 mm). For this reason, river beds are usually dry, but tend to flash flood following heavy rain. The Gamka River had flowed 8 weeks before our visit, as a result of widespread rains in the region in mid May 2006, but at the time of the survey on 3 July 2006, only a few pools of water remained.

To test our hypothesis that pseudo-vivipary had been induced by submergence, we recorded the presence or absence of plantlet-bearing inflorescences on the first 80 flowering *P. setaceum* plants encountered in the bed of the river, and on the first 80 plants encountered on the adjacent stretch of the alluvial river bank, which was 0.5 to 1.5 m above the level of the river bed. We also measured the height above ground of each plantlet-bearing tussock encountered. Spikelets were later dissected to examine morphology.

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Fig. 1. Pseudo-vivipary in two *P. setaceum* inflorescences. Plantlets on the left-hand inflorescence are well developed whereas proliferation is in an early stage in the right-hand inflorescence.

We found that 15 (18%) of the 80 plants surveyed in the river bed had one or more inflorescences that were producing plantlets, whereas pseudo-vivipary was absent among plants growing on the bank of the river. The flowering *P. setaceum* plants in the river bed were 0.8–1.2 m in height and most of the inflorescence culms were in the upper parts of the plant. All 15 inflorescences with plantlets were on the lower parts of the grass tussocks, having a mean height above ground level of 0.34 m (SD 0.09 m).

Dissection of individual spikelet-bearing plantlets revealed immature anthers in the bases of the spikelets, indicating that the plantlets had developed asexually rather than from unshed seed in the inflorescence. The plantlets had no roots. The position and size of the proliferating inflorescences suggested that they were immature when inundated by the flooding river, supporting our hypothesis that pseudo-vivipary had been induced by inundation of young inflorescences.

Vegetative propagation through pseudo-vivipary (or spikelet proliferation) in grasses (Poaceae) can be caused by genetic factors, injury or unfavourable environmental conditions (Beetle, 1980). The phenomenon is known from over 100 species of grasses (Poaceae) worldwide (Beetle, 1980; Vega and Rúgolo de Agrasar, 2006), and has been reported for three species of *Pennisetum* (*P. polystachioin* (L.) Schult., *P. subangustum* (Schum.) Stapf & Hubb., *P. setosum* (Swartz) L. Rich.) by Schmelzer (1997).

As in most other sedges and grasses, the *P. setaceum* plantlets produced by pseudo-vivipary on inflorescences are rootless. However, as this grass species invades canyons and desert drainage lines in the USA (Halvorsen and Guertin, 2003) and South Africa (Milton, 2004), further research is needed to ascertain whether pseudo-viviparous plantlets can establish in moist sites and contribute to the spread or persistence of this invasive plant.

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