



## Variable morphology of the Madagascar endemic *Aristida tenuissima* (Poaceae: Aristidoideae) and the absence of *Stipa* (Poaceae: Pooideae, Stipeae) from Madagascar

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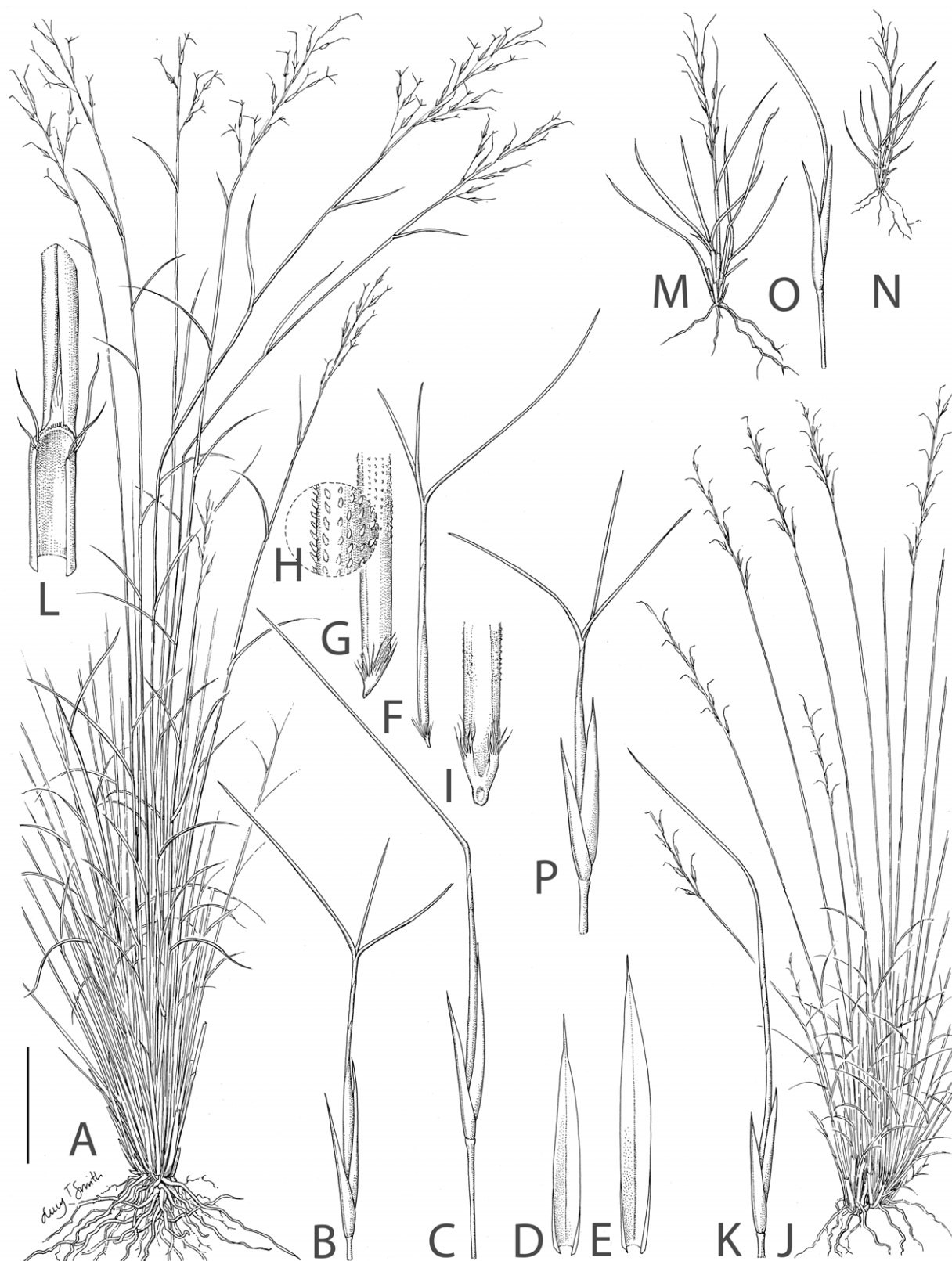
The widespread and species rich grass genera *Aristida* Linnaeus (1753: 82; Aristidoideae) and *Stipa* Linnaeus (1753: 78; Stipeae) are ordinarily simple to distinguish by the characteristic three awns in *Aristida* and a single awn in *Stipa*. A study of *Aristida* in Madagascar shows that the Madagascar endemic *Stipa perrieri* A.Camus (1934: 593) is in fact a 1-awned variant of *Aristida tenuissima* Camus (1933: 844) described and illustrated by Bosser (1969). There are no collections of *Stipa* or other members of Stipeae recorded from Madagascar.

*Aristida tenuissima* is a morphologically variable species in both habit and awn structure. The full range of variability within *A. tenuissima* is described and presented graphically in Figure 1, with the distribution presented in Figure 2, expanding Bosser's (1969) description and distribution statement. Most collections have single geniculate awns, while the larger plants are more likely to have three awns. The combination of a twisted awn column and the lack of articulation in the awn distinguish this species from all other *Aristida* in Madagascar.

Both *Aristida* and *Stipa* are plants of open arid areas with a single fusiform hardened and awned fertile floret and a pointed callus in every spikelet and were historically placed together in the tribe Stipeae (de Winter 1965). This similarity is superficial and does not reflect common origin. *Aristida* is a member of the Aristidoideae within the PACMAD clade (Barker *et al.* 1995, Grass Phylogeny Working Group 2001) and differs from *Stipa* by its C4 photosynthetic system, two sheaths around each vascular bundle, the presence of epidermal microhairs and embryo characters, as well as the presence of three awns. The three awns of *Aristida* are remarkably morphologically plastic in their lengths, relative lengths, orientation, fusion, twisting and disarticulation (Henrard 1929–1932, Hitchcock 1924, Allred 1986, Allred & Valdés-Reyna 1997). A number of species have reduced side awns or fail to develop them altogether rendering them deceptively similar to *Stipa*, e.g. the Asian and African *A. abnormis* Chiov. in Pirota (1903: 48), *A. fredschoizii* H.Scholz & Kürschner in Scholz (2000: 273) from Oman, and the North American *A. ternipes* Cavanilles (1799: 46) and *A. schiedeana* Trinius & Ruprecht (1842: 120): these were placed in *Aristida* section *Uniseta* Hitch. by Hitchcock (1924).

All material available at K, P and TAN has been examined. The description was compiled from direct specimen measurements only. Material infected with smut fungus was not included. A full typification is presented. All specimens cited here have been seen by the author. The lectotype sheet has been chosen because it includes plants with both single and triple awns. The morphological variability is further complicated by the fact that one tuft infected with smut fungus resulting in aberrant inflated spikelets and reduced awns is mounted on the isolectotype sheet P00446502.

*Aristida tenuissima* A.Camus (1933: 844). Type:—MADAGASCAR. Fianarantsoa: Mont Belamboany, pres du pelouse d'xerophiles, 1000 m, March 2012, *Perrier de la Bâthie 10866 pro parte* (lectotype designated here: P-03346042!; isolectotype: P-00446502!).

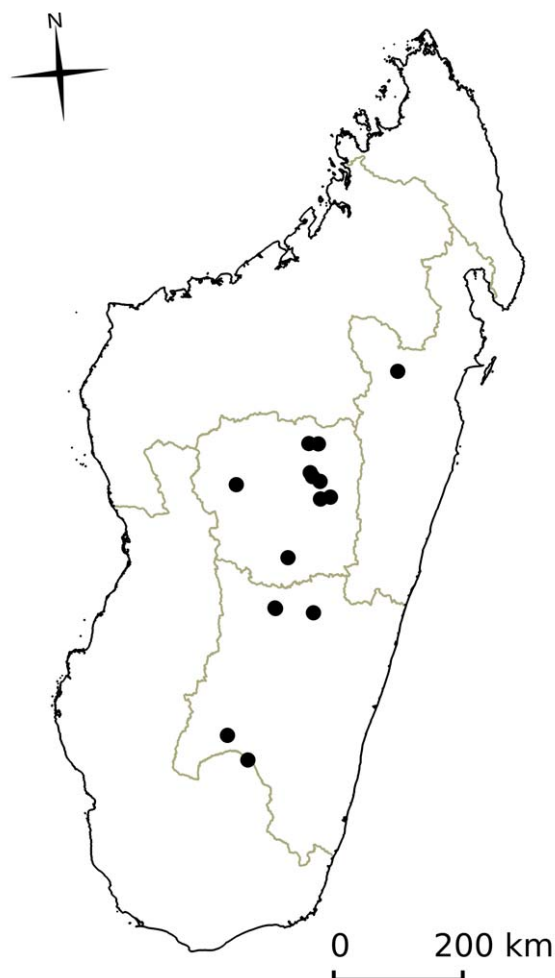


**FIGURE 1.** Morphological variability in habit and awn within *Aristida tenuissima*. **A-I:** large plants with one-awned and three-awned spikelets on the same individual **A** large habit **B** spikelet with three unequal awns **C** spikelet with a single awn **D** lower glume, ventral view **E** upper glume, ventral view **F** floret **G** lower part of the floret and callus, lateral view **H** lemma surface with prickly hairs **I** lower part of the floret and callus, ventral view. **J-L:** medium-sized plants with one-awned spikelets **J** habit **K** spikelet with a single awn **L** ligule. **M-O:** small-sized plants with one-awned spikelets **M** habit enlarged **N** habit life size **O** spikelet with a single awn. **P:** spikelet with 3 equal awns. Scale bar: A, J, M = 4 cm; L = 1.3 mm; D, E = 2 mm; B, C, F, K, O, P = 3.3 mm; G, I = 1.1 mm; H = 0.5 mm; N = 1 cm. A-I drawn from *Bosser 15438*, J-L drawn from *Bosser 15445*, M-O drawn from *Bosser 17926*, P drawn from *Perrier de la Bâthie 10866*. Drawn by Lucy T. Smith.

*Stipa perrieri* A.Camus (1934: 593), **synon. nov.** Type:—MADAGASCAR. Fianarantsoa: Mont Belamboany, pres du pelouse d'xerophiles, 1000 m, March 2012, *Perrier de la Bâthie 10866 pro parte* (holotype: P-00446286!).

Erect densely tufted compact wiry annual or perennial 5–54 cm tall, the culms unbranched or weakly branched near the base. Leaves usually all basal, 2–30 cm long, the basal leaves  $\frac{1}{4}$ – $\frac{1}{2}$  as long as the culms. Leaf sheaths glabrous. Ligule a line of hairs, with a variable number of long white cilia at the auricles. Leaf blades tightly rolled, 0.1–0.3 mm diameter when rolled, glabrous adaxially, densely hirsute abaxially, curling when dry, apically acute. Inflorescence an erect weakly branched or unbranched narrow panicle 3–9 × 0.5–2.0 cm, with 3–20 spikelets per panicle, the inflorescence branches usually held erect, glabrous to distally scaberulous, the axes of the panicle branches glandular. Spikelets 1.1–2.0 cm long, weakly laterally compressed, disarticulating above the glumes, dark red-purple when young. Glumes membranous, lanceolate, unequal to subequal, 1-veined, keeled, glabrous to scaberulous, the keels scabrous. Lower glume 3.5–5 mm long including an awnlet 0–1 mm long. Upper glume 5–6 mm long including an awnlet 0–1 mm long. Floret as long as the spikelet, terete. Callus entire, deltoid, apically obtuse, ca 0.4 mm long, the callus hair 0.5–1.0 mm long. Lemma cartilaginous, terete, 4–6 mm long, densely covered in prickle hairs in the upper half. Awns 1–3, fused at base to form the column, with no articulation, equal or unequal, the side awns usually shorter than the central, 4–10 mm long, scaberulous. Single awns geniculate, the bend above the middle. Column 3–6 mm long, twisted 2–4 times. Fig. 1.

**Distribution:**—Streams and waterlogged areas on open rocky outcrops, often on quartz, at 1000–1700 m elevation in Antananarivo, Toamasina, Fianarantsoa, and Toliara provinces of Madagascar. Fig. 2.



**FIGURE 2.** Distribution of *Aristida tenuissima* in Madagascar.

**Specimens examined:**—MADAGASCAR. **Antananarivo:** Ankaratra massif, March 1953, *Bosser 5089* (P); Tananarive, May 1955, *Bosser 8030* (P, TAN); P.K. 22 Route d'Arivonimamo, May 1959, *Bosser 12987* (P); P.K. 22 Route d'Arivonimamo, May 1959, *Bosser 12988* (MO, P, TAN); P.K. 22 Route d'Arivonimamo, May 1959, *Bosser 12989* (P, TAN); P.K. 22 Route d'Arivonimamo, May 1962, *Bosser 15438* (P, TAN); P.K. 22 Route d'Arivonimamo, May 1962, *Bosser 15445* (P, TAN); P.K. 22 Route d'Arivonimamo, May 1962, *Bosser 15447* (P, TAN); P.K. 22 Route d'Arivonimamo, May 1962, *Bosser 15449* (P, TAN); NW of Betafo, 19°50'00" S, 46°51' E, May 1962, *Bosser 16376* (P); Manankazo, 18°09'00" S, 47°14'00" E, May 1964, *Bosser 19639* (P); Mt Ambohibihy, Tsironomandidy, 18°48' S, 46°08' E, 19 May 1970, *Bosser 20311* (P); Tsimbazaza, 18°55' S, 47°31' E, February 1959, *Bosser 12930* (P); Antananarivo, 18°55' S, 47°31' E, 15 April 1889, *Catalt 105* (P), P.K. 50 route de Majunga, February 1954, *Bosser 7369* (P, TAN); route de Majunga, February 1954, *Bosser 7389* (P); P.K. 60 route de Majunga, February 1954, *Bosser 7393* (P); P.K. 60 route de Majunga, February 1954, *Bosser 7395* (P, TAN); P.K. 60 route de Majunga, February 1954, *Bosser 7396* (P, TAN); P.K. 60 route de Majunga, February 1954, *Bosser 7397* (P, TAN); P.K. 60 route de Majunga, February 1954, *Bosser 7400* (P); P.K. 60 route de Majunga, April 1955, *Bosser 7825* (P); P.K. 60 route de Majunga, April 1955, *Bosser 7825bis* (P); P.K. 140 route Majunga, 1955, *Bosser 7963* (P, P); P.K. 44 Route de Majunga, June 1962, *Bosser 16248* (P); P.K. 44 Route de Majunga, March 1963, *Bosser 17926* (P, TAN). **Toamasina:** route Moramanga - Lac Alaotra P.K. 15, June 1959, *Bosser 13042* (P); environs d'Andilamena, 17°01'00" S, 48°35'00" E, 19 April 1853, *Portères s.n.* (P). **Fianarantsoa:** Horombe plateau, 22°27'30" S, 45°50'00" E, February 1963, *Bosser 17680* (P, TAN); Montagnes à l'Ouest d'Itremo, Ouest Betsileo, 1500–1700 m, 20°34'30" S, 46°37'30", 18 April 1955, *Humbert s.n.* (P); Itremo, 20°35' S, 46°38' E, April 1964, *Bosser 19559* (P, TAN); route d'Ambatofinandrahana, 10 km après Ivato, 20°37' S, 47°12' E, April 1964, *Bosser 19667* (P, TAN). **Toliara:** P.K. 65-66 route Ihosy-Betroka, February 1963, *Bosser 17338* (P, TAN).

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