SHORT NOTE

Chemical composition of *Salvinia molesta* from the eastern Caprivi Strip

by

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Received: 12 April 1983
Accepted: 5 January 1984

The Kwando-Linyanti-Chobe River system, which includes Lake Liambezi, is infested with *Salvinia molesta.* This plant endangers the ecological balance of the aquatic environment of eastern Caprivi and could spread with disastrous consequences to the Okavango swamps in Botswana (Edwards and Thomas, 1977).

Observations that single fronds of *S. molesta* in the system exhibited what appeared to be healthy, dying and dead parts, raised two questions. Firstly, whether a plant nutrient(s) is present in potentially growth-limiting concentrations in *S. molesta,* and secondly, whether translocation of nutrients takes place when a part of a frond dies back? The first question deals with an understanding of the role of plant nutrients as environmental factors controlling the adventive spread and survival of *S. molesta* in the system. The second deals with the ability of the plant to recycle nutrients internally, thereby adding to its nutrient 'scavenging' (e.g. Cary and Weerts, 1980; Toerien, Cary, Finlayson, Mitchell and Weerts, 1983) abilities.

Fronds (duplicates) were sampled at Sitwa on the Kwando River (82-04-26), at Mujako on Lake Liambezi (82-05-04) and at Ngoma Bridge on the Chobe River (82-05-04). The fronds were separated into their healthy, dying and dead parts and these samples were oven-dried at 100°C. The material was milled and analysed for major elements by standard procedures.

The chemical composition (Table 1) differed between sources and conditions. A comparison with the chemical composition of wetland plants (Boyd, 1978) (Table 2) revealed that sodium (Na), calcium (Ca) and magnesium (Mg) were in all cases above the minimum values reported by Boyd (1978), but that nitrogen (N), phosphorus (P) and potassium (K) (the latter only in the dying and dead plants) were below the minimum values reported by Boyd (1978). Gerloff and Krombholtz (1966) suggested that the minimum values for N and P in aquatic macrophytes are 1,3% and 0,13% respectively. Cary and Weerts (1980) reported minimum concentrations of 1,46 to 1,74% N and 0,135% P in *S. molesta* under their respective growth-limiting conditions. The chemical composition of healthy material from Caprivi suggests that either N or P (or both) could have been limiting the growth of the plants, but that Ca, Na, K and Mg were probably present in excess of needs since their concentrations exceeded the minimum concentrations for wetland plants given by Boyd (1978). Potassium concentration was below Boyd's minimum only in dead material (Table 2). It is unlikely that K limited growth.

The composition of aquatic macrophytes does not always correlate well with the water quality of their environment (e.g. Allenby, 1980). However, Seaman, Scott, Walmsley, Van der Waal and Toerien (1978) reported low concentrations of soluble reactive phosphorus (SRP) and inorganic nitrogen (NH_4-N, NO_2-N and NO_3-N) in Lake Liambezi which correspond with low concentrations of N and P in *S. molesta* from the system (Table 1). The chemical composition of the water supported the hypothesis of N and/or P growth limitation of *S. molesta.*

Dying and dead plants did not differ significantly (P = 0,05) from healthy plants in P, Ca or Mg, but contained significantly less K (Table 3). Dying and dead plants did appear to have less N although this difference was not significant. Dead plants also contained significantly less Na than healthy or dying plants. It is possible that death might have been due to a K deficiency, possibly induced by large uptakes of Na, Ca and/or Mg as illustrated by the relative ionic concentrations in Table 3. If this is true, there should be less mortality on the Kwando River. However, the differences might also reflect *post-mortem* changes, e.g. a rapid diffusion out of dead or dying tissue of mobile K and Na ions, with death being due to some other variable. Potassium was rapidly leached from dead *Eichhornia crassipes* on Hartbeespoort Dam (Ashton, Scott, Steÿn and Wells, 1979).

The evidence obtained suggests that *Salvinia* is probably growth-limited by either nitrogen or phosphorus (or both) in the rivers and swamps of the Caprivi Strip. The plant is probably unable to translocate phosphorus from the older (dying) parts of the plant to the growth point, but some translocation of nitrogen might take place. Phosphorus needs must therefore be supplied from external sources, whilst some of the nitrogen needs might be met from internal sources. The dynamics of nitrogen and phosphorus in the aquatic environment of the Caprivi Strip probably determine the success of the plant. A better understanding of these dynamics is needed to assess the potential for spread of the plant.

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TABLE 1: Average composition of *Salvinia molesta* from the eastern Caprivi.

Source	Condition	Percent dry matter N	P	K	Na	Ca	Mg
Chobe River	Healthy	1,841	0,174	1,393	0,945	0,473	0,540
	Dying	1,242	0,094	0,607	0,786	0,980	0,849
	Dead	1,307	0,108	0,197	0,395	0,932	0,684
Kwando River	Healthy	1,282	0,062	1,804	0,654	0,350	0,429
	Dying	1,148	0,059	1,357	0,826	0,442	0,507
	Dead	1,016	0,060	0,375	0,242	0,496	0,366
Liambezi Lake	Healthy	1,449	0,086	1,072	0,939	0,625	0,603
	Dying	1,487	0,081	0,482	0,720	1,023	0,717
	Dead	1,398	0,086	0,304	0,567	0,863	0,651

TABLE 2: Comparison of the chemical composition (% of dry matter) of *Salvinia molesta* from the Caprivi Strip with that of wetland plants (Boyd, 1978).

Constituent	*Salvinia molesta* Healthy	Dying	Dead	Wetland Plants
N	1,28 — 1,84	1,15 — 1,49	1,02 — 1,40	1,46 — 3,59
P	0,062 — 0,174	0,059 — 0,094	0,060 — 0,108	0,08 — 0,63
Na	0,65 — 0,94	0,72 — 0,83	0,24 — 0,57	0,07 — 1,52
K	1,07 — 1,80	0,48 — 0,61	0,20 — 0,38	0,42 — 4,56
Ca	0,35 — 0,63	0,44 — 1,02	0,50 — 0,93	0,20 — 8,03
Mg	0,43 — 0,60	0,51 — 0,85	0,37 — 0,68	0,08 — 0,95

TABLE 3: The average (± standard deviation) ionic concentrations of *S. molesta* from eastern Caprivi.

Site	Milliequivalent/kg N	P	K	Na	Ca	Mg
Chobe	1045 ± 241	40 ± 16	187 ± 140	308 ± 81	397 ± 127	568 ± 128
Kwando	820 ± 115	19 ± 1	302 ± 169	250 ± 137	214 ± 62	357 ± 60
Liambezi	1032 ± 276	27 ± 5	158 ± 96	323 ± 79	417 ± 117	540 ± 67
Condition						
Healthy	1088 ± 216	35 ± 19	364 ± 88	368 ± 77	241 ± 66	431 ± 71
Dying	922 ± 231	25 ± 9	208 ± 112	338 ± 77	407 ± 154	568 ± 138
Dead	885 ± 240	27 ± 7	75 ± 27	174 ± 64	381 ± 129	466 ± 140

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