

Sebertia acuminata: A Hyperaccumulator of Nickel from New Caledonia

Abstract. *Sebertia acuminata* (Sapotaceae) from New Caledonia has been shown to be a hyperaccumulator of nickel. The nickel content of the latex (25.74 percent on a dry weight basis) is easily the highest nickel concentration ever found in living material. The nickel is in the form of a low-molecular-weight, water-soluble organic complex.

In recent years a number of plant species have been discovered which have very high concentrations of nickel (1-5). Species containing over 1000 µg (0.1 percent) of this element per gram (dry weight basis) have been termed hyperaccumulators (5). The unusual aspect of these accumulators is that with the exception of *Hybanthus floribundus* from Western Australia (2) and *Alyssum bertolonii* from Italy (1) the species discovered so far are confined exclusively to New Caledonia and are mainly of the genera *Homalium* and *Hybanthus* (see Table 1).

The existence of these accumulators has caused considerable interest in the fields of mineral exploration and plant physiology because of the possible association of these plants with nickel mineralization and because of the interesting

problems in plant physiology posed by such high accumulations of an element normally toxic to plants.

We have recently discovered the unusually high nickel-accumulating ability of *Sebertia acuminata* Pierre ex Baill. (Sapotaceae). This species is a tree which reaches 10 m in height. It is well known in New Caledonia from the blue-green color of its latex and is therefore known locally as Sève bleue (blue sap). *Sebertia acuminata* is endemic to New Caledonia, is relatively rare, and has never been recorded away from ultrabasic substrates. It is found mainly in the Grand Massif du Sud and in the Tiebaghi Massif in the north of the island, is found more often in forested areas over peridotitic alluvia or colluvia relatively rich in nickel. A typical soil would contain (in approximate percentages) nickel, 0.85;

Table 1. Nickel concentrations in *Sebertia acuminata* compared with values for other hyperaccumulators.

Species	Organ	Locality	Conc. of nickel (percent dry weight)	References
<i>Sebertia acuminata</i>	Latex	New Caledonia	25.74 (11.20*)	This report
	Leaves		1.17	
	Trunk bark		2.45	
	Twig bark		1.12	
	Fruits		0.30	
	Wood		0.17	
<i>Hybanthus floribundus</i>	Leaves	Western Australia	0.71	(2, 6)
	Stems		0.26	
	Wood		0.15	
	Fruits		0.13	
	Flowers		0.48	
	Trunk bark		0.17	
<i>Alyssum bertolonii</i>	Leaves	Italy	0.80	(1)
<i>Homalium austrocaledonicum</i>	Leaves	New Caledonia	0.18	(5)
<i>H. deplanchei</i>	Leaves	New Caledonia	0.19	(5)
<i>H. francii</i>	Leaves	New Caledonia	1.45	(5)
<i>H. guillainii</i>	Leaves	New Caledonia	0.69	(3, 5)
<i>H. kanaliense</i>	Leaves	New Caledonia	0.94	(4, 5)
<i>H. mathieuanum</i>	Leaves	New Caledonia	0.17	(5)
<i>H. rubrocostatum</i>	Leaves	New Caledonia	0.12	(5)
<i>Hybanthus austrocaledonicus</i>	Leaves	New Caledonia	1.38	(3-5)
<i>H. caledonicus</i>	Leaves	New Caledonia	0.60	(3-5)
<i>Psychotria douarrei</i>	Leaves	New Caledonia	3.40	(3)
	Fruits		2.30	
	Trunk bark		5.24	
	Twig bark		5.52	
	Flowers		2.40	
	Wood		0.23	

*Value expressed on wet weight basis.

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iron, 45; aluminum, 8.5; silica, 6; chromium, 3; cobalt, 0.10; potassium, 0.02; calcium, 0.06; and magnesium, 2.

It should be noted that *S. acuminata* is the fourth hyperaccumulator of nickel [that is, after *Hybanthus austrocaledonicus*, *Homalium guillainii*, and *Psychotria douarrei* (3)] discovered in the same location. This area consists of dense humid forest over peridotitic humus-rich alluvia in the vicinity of the Rivière Bleue. It would therefore seem that, unlike the case of *Hybanthus floribundus* (6), accumulation of nickel is not a xerophytic adaptation.

Table 1 shows the nickel content of various organs of *S. acuminata*. The data are based on the analysis of three specimens (one from the Rivière Bleue area, one from the Tontouta area, and another from the Forêt Cachée).

The nickel content of leaves and of other organs is very high (~ 1 to 2 percent), although comparable with most other hyperaccumulators from New Caledonia. Of special significance, however, is the extremely high nickel content of the latex which has 11.20 percent nickel on a wet weight basis and 25.74 percent when the data are expressed on a dry weight basis. This nickel concentration is nearly five times higher than for any other part of any other species and is easily the highest nickel concentration ever reported for any other living material (see Table 1). The cobalt content of the latex (0.007 percent) is extremely low com-

pared with that of nickel. Values for other elements (in percentages: iron, 0.06; chromium, 0.004; potassium, 0.15; sodium, 0.11; magnesium, 0.052; and calcium, 0.52) are also relatively low.

The extremely high nickel content of the latex of *S. acuminata* poses interesting problems in plant physiology, since nickel contents as high as this would be fatal for most phanerogams. Preliminary experiments in our laboratory have resulted in the isolation of a low-molecular-weight, water-soluble organic complex of nickel whose composition has not yet been determined.

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