

A new specific plant host for the agave snout weevil, *Scyphophorus acupunctatus* Gyllenhal, 1838 (Coleoptera: Curculionidae) in South Africa: a destructive pest of species of *Agave* L. (Agavaceae)

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Summary: The widely distributed agave snout weevil, *Scyphophorus acupunctatus* Gyllenhal, is for the first time recorded from *Agave salmiana* Otto ex Salm-Dyck subsp. *salmiana* in South Africa. In its native habitat in Mexico, this new host plant species is one of the most important sources of pulque, a fermented alcoholic beverage. With efforts underway at Bothaville in the Free State Province, South Africa, to establish an agave nectar industry, commercial farmers should be made aware of the destruction that the agave weevil can cause, especially in concentrated populations and plantations of *Agave* L. species.

Zusammenfassung: Der weit verbreitete Agaven-Rüsselkäfer *Scyphophorus acupunctatus* Gyllenhal wird zum ersten Mal für *Agave salmiana* Otto ex Salm-Dyck subsp. *salmiana* in Südafrika nachgewiesen. Die Heimat des Käfers ist Mexiko, und die neu nachgewiesene Wirtspflanze ist eine der wichtigsten Grundlagen für die Herstellung des alkoholischen Getränkes Pulque. Mit Blick auf die Versuche, in Bothaville in der Free State-Provinz, Südafrika, eine Agavensaft-Industrie aufzubauen, müssen die kommerziellen Pflanzler für die Schäden sensibilisiert werden, die der Käfer vor

allem in dichten Populationen und Plantagen von *Agave*-Arten anrichten kann.

Introduction

Until recently, a tequila-like drink was distilled from the fermented hearts of *Agave americana* L. var. *americana* at Graaff-Reinet in the Eastern Cape (Stiemie, 1997; Biggs, 2004). This fledgling industry seemed to prosper, until the death of its director at the beginning of 2008, which ultimately resulted in its liquidation (Property24, 2008; Anon., 2009). It is anticipated that Karoo-based plants of *Agave* L., targeted previously for the production of this alcoholic beverage, will continue to be harvested for their ‘pinas’ or central stem cores, from which a fructose-rich syrup is extracted and sold as a low GI food additive (sweetener). This natural sweetener is seen with increasing frequency in health shops in South Africa.

For more than a century Agavaceae species, especially *A. sisalana* Perrine ex Engelm., have also been commercially cultivated in South Africa for their fibres (Sutherland, 1900). As natural products have become increasingly popular, interest in this industry has been renewed



Figure 1. *Agave salmiana* subsp. *salmiana* is a large growing species of century plant from Mexico. Photo: Gideon F. Smith. **Figure 2.** The pyramid-shaped inflorescence of *A. salmiana* subsp. *salmiana* is carried on a thick robust pole. Photo: Gideon F. Smith. **Figure 3.** Lateral (a) and dorsal (b) view of the agave weevil (*Scyphophorus acupunctatus* Gyllenhal, Curculionidae). Voucher specimen [G.F. Smith & E. Figueiredo 10] deposited at the Ditsong; National Museum of Natural History (formerly the Transvaal Museum), Pretoria. Photos: Charlene Janion.

(Slabbert, 2007). It is likely that the genetic base of naturalized subpopulations of *A. americana* and *A. sisalana* is very narrow, such that effective pests in plantation situations could have severe impacts (see for example Smith & Mössmer, 1996 on *Agave americana* in South Africa).

Several representatives of the families Agavaceae and Dracaenaceae are commonly used in ornamental and amenity horticulture, especially in countries that experience tropical, subtropical and mild-temperate climates. Material of these families is usually imported from tropical or subtropical countries in both the Old and New Worlds. Together with these imports often come unwelcome pests, particularly borers – insects that can significantly damage fibrous stems and trunks, as well as fleshy leaves. This is the case, for example, with the beetle *Xyleborus ferrugineus* Fabricius, 1801 (Coleoptera: Scolytidae) on *Dracaena* Vand. ex L. and *Yucca* L. and the yucca weevil, *Yuccaborus frontalis* LeConte, 1874 (Coleoptera: Curculionidae), on *Yucca* and *Beaucarnea* Lem. Both these pests have been recorded from plants imported to the Netherlands (EPPO, 2002).

One of the most damaging borers that attack plants of these families is the agave snout weevil, *Scyphophorus acupunctatus* Gyllenhal, 1838, a species that has spread from its original area of occurrence in Central America to other areas with tropical or subtropical climates. For instance, it was recently reported in the Guánica Dry Forest Reserve in southwestern Puerto Rico (Setliff & Anderson, 2011), in Saint-Tropez, France (EPPO, 2008a; Germain *et al.*, 2008), and previously in Italy (EPPO, 2008b). It has been known to occur on *A. sisalana* in South Africa and eastern Africa for some time (Verbeek, 1976; Hill, 1983). It is here reported for the first time feeding on a new plant host in South Africa, namely *Agave salmiana* Otto ex Salm-Dyck subsp. *salmiana*. This species of agave has been reported as a host for *Scyphophorus acupunctatus* in its native Mexico (e.g. Hernández *et al.*, 2006), though only within the last four decades (Vaurie, 1971). As far as could be ascertained *A. salmiana* has not been reported as a host for the pest elsewhere.

The South African sisal industry experiences fairly regular and occasional serious outbreaks of *S. acupunctatus*, where this pest is known in Afrikaans as the 'sisalsnuitkewer' or 'sisalkalander' (Walters *et al.*, 1989). Despite the severity of infections on sisal, no pesticides have yet been registered in South Africa against this pest (Anneck & Moran, 1982; Krause *et al.*, 1996; Anon., 2007). As a pest management alternative, recent work on pheromones produced by males of

S. acupunctatus indicates the potential use of these aggregation-inducing volatiles and also other chemical attractants obtained from agaves in mass-trapping programmes (Altuzar *et al.*, 2007; Ruiz-Montiel *et al.*, 2008).

The plant host

Agave salmiana Otto ex Salm-Dyck subsp. *salmiana* (Agavaceae) is a slow-growing century plant from Mexico that will in time produce a massive rosette consisting of large, dark green, boat-shaped leaves (Figure 1). It is a monocarpic, multi-annual that usually flowers after between 10 to 15 years. The species suckers freely from the base, but much more slowly than the better known and locally naturalized *Agave americana* L. (Smith & Mössmer, 1996). The inflorescence consists of a thick, robust pole that supports a fairly short, branched inflorescence that is pyramidal in shape (Figure 2). This at once separates it from *A. americana* which has a tall, elongated inflorescence.

Taxonomically, *A. salmiana* is widely regarded as consisting of three subspecies, two of which [the typical one and subspecies *ferox* (K.Koch) Gentry] are cultivated in South Africa. Although not known to be naturalized in southern Africa, this species has invaded elsewhere, for example the Iberian Peninsula, which has a Mediterranean climate similar to that of South Africa's southwestern Cape (Smith & Figueiredo, 2007).

The weevil

The genus *Scyphophorus* Schönherr, 1838 (Coleoptera: Curculionidae) originates from the New World. It has two species that are commonly known as 'yucca weevil' (*Scyphophorus yuccae* Horn, 1873) and 'sisal weevil', 'sisal snout weevil', or 'agave snout weevil' (*Scyphophorus acupunctatus* Gyllenhal, 1838) (Vaurie, 1971). The two are distinguished on several characters (see Walker, 2008a, 2008b) of which the most easily observed is the shorter and stouter snout of *S. acupunctatus* (Figure 3) as opposed to the longer, narrower snout of *S. yuccae*. Adult agave snout weevils are large, up to 15 mm long, and black.

Scyphophorus acupunctatus is native to the southwestern U.S.A., Mexico, including Baja California, and Central America (Pott, 1975). It has been widely introduced to many parts of the world, including South Africa and eastern Africa, where *Agave sisalana* is grown as a source of natural fibres (Woodruff & Pierce, 1973; Hill, 2008).

In South Africa, *S. acupunctatus* was collected on a cultivated specimen of *Agave salmiana* subsp. *salmiana* in a domestic garden in Pretoria,

Gauteng Province. The garden has about 50 different species of *Agave* in cultivation, but *S. acupunctatus* was collected on *Agave salmiana* only. The weevil infected suckers of the specimen and not the mother plant, which is about eight years old, with leaves to 1.2 m in length.

The larvae of *S. acupunctatus* burrow into the heart of an agave plant, ingesting plant tissue *en route*. This destructive process is difficult to detect as only small entry holes provide initial evidence of snout weevil presence. These apertures are usually situated towards the base of the spear-like central cluster of unopened leaves in the agave rosette. Adults bore into the fleshy centre of the plant above the crown, where eggs are laid (Waring & Smith, 1986). Detection usually occurs only after the plants lose vigor, by which time the host has been severely mined internally. Secondary fungal or bacterial rots occur in addition to feeding damage (Waring & Smith, 1986; Solís-Aguilar *et al.*, 2001). If such a plant is dissected, infestation is evidenced by galleries made by larval and adult weevils in the fleshy leaves (Figure 4) and bole of the plant (Waring & Smith, 1986). Each female beetle can lay on average between 25 and 50 eggs, with as many as 60 eggs produced during a three month period (Harris, 1936; Hill, 2008). After the eggs hatch, larvae

feed on the fleshy inner parts of the plant and when ready to pupate they tunnel down into the roots, within which they construct cocoons using host plant fibers (Pott, 1975). Cocoons are also readily found at the bases of leaves of certain agave species (Waring & Smith, 1986). The next generation of weevil adults eventually exits the plant to infect other plants. When first reported in the fields of blue agave (*Agave tequilana* F.A.C.Weber 'Azul'), this plague was called 'gangrene of the blue agave' (Solís-Aguilar *et al.*, 2001; Valenzuela-Zapata & Nabhan, 2003).

Voucher specimen: South Africa. Gauteng Province, Pretoria. 2528 (-CB); 25°44'01.04" S 28°16'09.74" E. Domestic garden in Weavind Park. 29 December 2008. *G.F. Smith & E. Figueiredo 10*. Voucher specimen [*G.F. Smith & E. Figueiredo 10*] deposited at the Ditsong: National Museum of Natural History (formerly the Transvaal Museum), Pretoria.

Agave salmiana is one of the main sources of the drink pulque (Gonçalves de Lima, 1990). After the emerging inflorescence is removed early on, pulque is obtained from fermenting the juice obtained from the centres of the rosettes of *A. salmiana*, *A. atrovirens* Karw. ex Salm-Dyck



Figure 4. Damage to the basal parts of the leaves of *Agave salmiana* following infestation of *Scyphophorus acupunctatus*. Photo: Gideon F. Smith.

and *A. mapisaga* Trel. *Agave salmiana* hearts are also used for the distillation of mescal, of which the commercially popular and widely consumed tequila is one type (Valenzuela-Zapata, 1994; Aguirre Rivera *et al.*, 2001). It is noteworthy that the maguey 'worm' or red 'worm' often found at the bottom of bottles of commercially available mescal – tequila never contains a worm – is the caterpillar of *Hypopta agavis* Blázquez (Lepidoptera: Cossidae), another pest of *Agave* species (Quiroz Márquez, 1997).

Other plant hosts

Scyphophorus acupunctatus is known as a pest of several species of Agavaceae and Dracaenaceae (Vaurie, 1971; Solís-Aguilar *et al.*, 2001; Ruiz-Montiel *et al.*, 2003; Aquino Bolaños *et al.*, 2007; Hill, 2008; Valdéz *et al.*, 2010). It attacks many useful species of *Agave*, such as those used for fibre production (*A. sisalana*, sisal; *A. fourcroydes* Lem., henequen), beverages (*A. tequilana* F.A.C.Weber, tequila) or ornamental purposes (*A. americana*) (EPPO, 2002). It is also found in species of the related genera *Furcraea* Vent., *Yucca* [e.g. *Y. aloifolia* L., *Y. elephantipes* Regel ex Trel., *Y. glauca* Nutt.], *Beaucarnea*, *Dasylyrion* Zucc. (*D. longissimum* Lem.) (EPPO, 2002) and recently on *Polianthes tuberosa* L., which is sometimes treated as a species of *Agave* (Lavin *et al.*, 2002). That it is also known to infest members of *Dracaena* Vand. ex L. [*D. draco* L.] (Vaurie, 1971; EPPO, 2002) is unsurprising, given the quite close affinity of the Dracaenaceae to the Agavaceae (Bogler & Simpson, 1996). To date the weevil has been reported from eastern and South Africa, South America, Europe (including its Mediterranean Basin), northern Asia, south and south-east Asia, Australia, Hawaii, mainland U.S.A. and Canada (Vaurie, 1971; Hill, 2008; Walker, 2008b; Setliff & Anderson, 2011).

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Note added in proof:

Agave salmiana has since been recorded as established in South Africa. See Smith, G.F. & Figueiredo, E. (2012). A further species of *Agave* L., *A. salmiana* Otto ex Salm-Dyck (subsp. *salmiana*) var. *salmiana* (Agavaceae), naturalised in the Eastern Cape Province of South Africa. *Bradleya* **30**: 179–186.