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First record of *Sinoxylon anale* and *S. unidentatum* in Greece, with an updated account on their global distribution and host plants (Coleoptera: Bostrichidae)

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Abstract
Sinoxylon anale Lesne, 1897 and *S. unidentatum* (Fabricius, 1801) (Coleoptera, Bostrichidae), two almost cosmopolitan species most likely native of the Oriental Region, are recorded for the first time from Greece on the basis of several specimens intercepted in a consignment at the Piraeus harbor (Attica, Athens) in wood packaging material originating from China. The establishment of these species in Greece is briefly discussed, moreover, an updated list of their interceptions, countries of establishment and host plants, is provided.

Key words: saproxylic beetles, alien species, interceptions, host plants, Attica.

Introduction

Sinoxylon anale Lesne, 1897 (= *Apatodes macleayi* Blackburn, 1899; = *S. geminatum* Schilsky, 1899) and *S. unidentatum* (Fabricius, 1801) (= *S. conigerum* Gertstäcker, 1855) are two closely related species (Lesne 1906; Huang et al. 2001). Both are likely native of the Oriental Region, but were passively introduced in many countries. Currently they are widespread in the inter-tropical regions of the world and are almost cosmopolitan in distribution (cf. Bahillo de la Puebla et al. 2007; Borowski 2007; CABI/EPPO 2009; Price et al. 2011; Juárez 2014; Geis 2015; Nardi & Mifsud 2015; EPPO 2016a, 2016b; Plantwise 2016). Both species are easily transported since their xylophagous larvae live in timber and wood packaging material of a range of goods (cf. Stanaway et al. 2001; Geis 2002; Karnkowski 2002; Teixeira et al. 2002; Karnkowski 2006; Peres Filho et al. 2006; Bahillo de la Puebla et al. 2007; Zhong et al. 2007; Benker 2008; Savoldelli & Regalin 2009; Meleiro et al. 2014), and this is why both species have become established in other continents (cf. Binda & Joly 1991; Ivie, 2002; Teixeira et al. 2002; Bahillo de la Puebla et al. 2007; Causton et al. 2011; Price et al. 2011; Zhang et al. 2011; Plantwise 2016). In the Euro-Mediterranean area, *Sinoxylon anale* was recorded from Austria, Belgium, Finland (Borowski 2007), France (Brustel & Aberlenc 2014), Germany, Great Britain (Borowski 2007), Iran (Liu et al. 2016), Israel (Argaman 1987), The Netherlands (Schulten & Roorda 1984), Poland (Dominik 1970; Borowski 2007), NW Russia (Geis 2002), and Ukraine (Gumovsky 2010), while *S. unidentatum* was recorded from France, Germany, Great Britain, Italy, Malta, Poland, Russia, Spain and Ukraine (cf. Nardi & Mifsud 2015). According to some authors (cf. CABI/EPPO 2009; EPPO 2016b), *S. unidentatum* is established outdoors in some European countries, but this status for this species and also for *S. anale* (Singh & Srivastava 1998), was never confirmed (cf. Gumovsky 2010; Nardi & Mifsud 2015). This latter species was reported also from Oman (Geis 2015), Saudi Arabia (Amin et al. 1986), South Korea (Choo et al. 1983) and Venezuela (Joly et al. 1994), while *S. unidentatum* was recorded also from Perù (Juárez 2014), but these countries were later overlooked (cf. Argaman 1987; Borowski 2007; Park et al. 2015; EPPO 2016a, 2016b; Plantwise 2016).

Recent captures of *Sinoxylon anale* and of *S. unidentatum* in Greece, are discussed herein. These alien species are being recorded for the first time from this country.

Material and methods

These two species were intercepted (26 Nov 2015) by Mr

P. Kanellopoulos at the Piraeus harbor (Attica, Athens) in wood packaging material (palettes and spacers of heavy marble sheets) in a container. The consignment originated from China which included a great variety of other goods. Woods with fine dust and wood debris were observed and samples were collected in three different points of the consignment. Some wood planks were heavily eaten with numerous exit holes all over the surface (Fig. 1). These samples were sent to the Laboratory of Forest Entomology at Athens, where they were put separately in three different rearing boxes in order to collect the emerging insects. Large number of beetles emerged, but, by mistake, few specimens were later conserved.

The identification of the woods was based on their anatomical features according to InsideWood library (InsideWood 2004; Wheeler 2011); for this reason, specimens of all wood samples were cut (approximate dimensions of 2x2x2 cm) and then immersed in boiling water for 12 hours. Consequently these specimens were mounted on a sliding microtome (Jung, Heidelberg, Germany) equipped with a wedge-shaped blade and were used for the production of sections with a thickness of about 10μm. For all samples, cross, tangential and radial planes were sectioned, while the knife blade and the cutting surface formed an angle of approximately 15°. The sections were stained with safranin solution for 5 minutes, rinsed with distilled water, absolute ethanol and xylol and were finally mounted on glass microscope slides using Entellan. The observation was carried out with a Nikon Labophot 2 light transmission microscope equipped with a 5MP digital camera. Quantitative features were measured using ImageJ freeware software (http://rsb.info.nih.gov/ij/) and based on at least 25 counts.

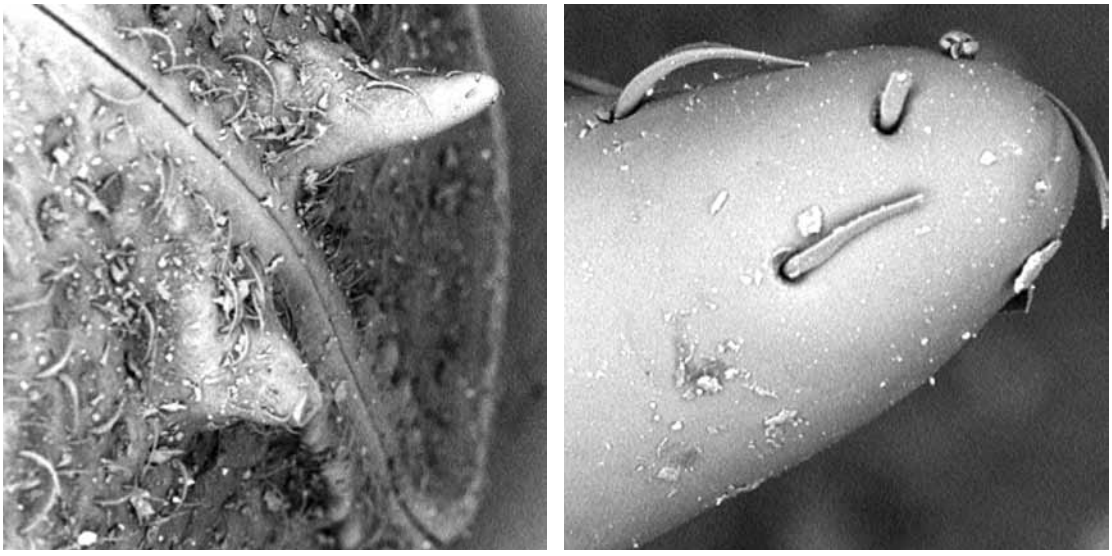
The beetles were identified using the work of Lesne (1906) and more recent illustrated keys (Mathew 1982; Binda & Joly 1991; Joly et al. 1994; Maes 1995; Walker 2005a, 2005b; Liu et al. 2006; Bahillo de la Puebla et al. 2007; Barriga & Cepeda 2009; Sittichaya & Beaver 2009a; Sittichaya et al. 2009). Their morphology was also examined (Figs 2–3) with a Phenom SEM (Priniotakis, Athens). Species nomenclature follows Borowski & Węgrzynowicz (2007).

The known host plants for these two beetles were summarized in Table 1 (alive plants, death wood or wood in packaging material). The systematic and botanic nomenclature (Table 1) follow The Plant List (2013); families and, within each family, species are listed alphabetically. Records for "Bamboo/s" (without further data), were listed (Table 1) as "Bambusoideae spp." (Poaceae). Moreover, *Sinoxylon anale* was recorded (cf. Archibald & Chalmers 1983) from *Coffea* sp. (without further details) but very probably this interception was made in a consignment, since no commercial use of any *Coffea* wood is known (Lykidis, unpublished data).

Some literature records of *Sinoxylon* sp. (Cotes 1889, 1893, 1894; Ratti & Rampini 1977), are attributed to *S. anale* (cf. Lesne 1906; Ratti 2004). The papers listed for *S. unidentatum* in the following pages (Table 1 included), refer, with few exceptions (Borowski 2007; Borowski & Węgrzynowicz 2007; Savoldelli & Regalin 2009; Sittichaya & Beaver 2009a, 2009b; Beaver et al. 2011; Kangkamanee et al. 2011; Sittichaya et al. 2009, 2013; Juárez 2014; EPPO 2016b), to *S. conigerum*.

The acronyms used in the text are: CGN = private collection G. Nardi, Cisterna di Latina (Latina), Italy; CNB-FVR = Centro Nazionale per lo Studio e la Conservazione

Fig. 1 – A spacer plank (sample 1) heavily infested by *Sinoxylon anale*. An adult beetle is visible in the white circle area (Photograph by Panos V. Petrakis).



Figs 2-3 – SEM pictures of the elytral declivity spines of *Sinoxylon unidentatum* collected in a gallery: **2**. Spines at both elytral sides (wood debris was not removed) (magnification 325X); **3**. A spine at higher magnification (2700X). Scale bars: Fig. 2 = 100 μm; Fig. 3 = 10 μm (Photograph by V. Roussis).

della Biodiversità Forestale "Bosco Fontana" di Verona, Sede di Bosco Fontana, Marmirolo (Mantua), Italy; es. = specimen/s; IMFE = collection of the Institute for Mediterranean Forest Ecosystems, Laboratory of Forest Entomology, Athens, Greece.

Results

Material examined. ***Sinoxylon anale*.** Greece: Attica, Piraeus harbor, 26 Nov 2015, Samples 1 and 2, P. Kanellopoulos leg., 11 es. (CGN, CNBFVR, IMFE). ***Sinoxylon unidentatum***. Greece: Attica, Piraeus harbor, 26 Nov 2015, Sample 3, P. Kanellopoulos leg., 1 es. (IMFE).

The identifications of the wood samples are as follows:

Sample 1. Wood diffuse-porous, with indistinct or absent growth ring boundaries. Mean tangential diameter of vessel lumina was 100–200 μm and larger than 200 μm. Axial parenchyma bands more than three cells wide were also reported. Rays were 10-seriate with 4–12 rays per millimeter and ray height of less than 1 mm. This sample belongs to *Ficus* sp. (Moraceae).

Sample 2. Wood diffuse-porous with indistinct growth ring boundaries. Alternate intervessel pits of 2–4 μm were recognized having in some cases polygonal shape. Concerning vessels, the mean tangential diameter of vessel lumina was 50–200 μm and there were 4–20 vessels per square millimeter. Mean vessel element length was 350–800 μm. Scanty paratracheal axial parenchyma was identified. In terms of rays, their height was less than 1mm, width from 1 to 4 cells and 4–12 rays per millimeter were measured. According to these anatomical characteristics, this sample belongs to *Chionanthus* sp. (Oleaceae). Further genera of this family are recorded as hosts of other *Sinoxylon* species (Frediani 1961; Chararas & Balachowsky 1962; Pollini 1998).

Sample 3. Wood diffuse-porous with indistinct or absent growth ring boundaries. Intervessel pits were alternate with polygonal shape and dimension of less than 4 μm up to 5 μm. Vasicentric axial parenchyma was detected. Mean tangential diameter of vessel lumina was 170–420 μm. In terms of rays, their height was 200–650 μm, width from 1 to 3 cells and 7–9 rays per millimeter were measured. According to these anatomical characteristics, this sample belongs to Leguminosae Mimosoideae but species identification was not possible. Genera (e.g. *Leucaena*, *Piptadenia*, *Pithecellobium*, etc.) of this subfamily are recorded as hosts of *S. anale* and/or *S.unidentatum* also by other authors (Tab. 1).

The SEM examination of an adult of *S. unidentatum* showed that on the elytral declivity spines there are some hairs that likely are sensory connected to a proprioreceptor (Figs 2–3).

Discussion

The species of the family Bostrichidae use at least 70 plant families as hosts (cf. Beeson & Bhatia 1937; Frediani 1961; Chararas & Balachowsky 1962; Pollini 1998; Liu et al. 2008; Tonkel et al. 2014); all families detected in the above mentioned consignment belong to this set of hosts, moreover importations of *S. anale* and *S. unidentatum* with stone tiles were observed also in Canada (Allen et al. 1997).

Wood packaging material (WPM), such as pallets, is

Table 1 – Host plants of *Sinoxylon anale* and *S. unidentatum*. Abbreviations: hp = host plant (without further details); hwpm = hard wood packaging material; lct = logs and cut branches; ldst = debarked logs and sawn timber; psw = primarily sapwood of logs; Sa = *S. anale*; Su = *S. unidentatum*; sw = sapwood; ti = stored timber; t&f = stored timbers and finished products; unr = unresolved name (cf. The Plant List 2013); ! = this paper.

N.	Species	Family	Plant part attacked	Sa	Su	Source
1	*Anacardium occidentale* L.	**Anacardiaceae**	wood	+	+	Beeson & Bhatia 1937
	"	"	cashew timber	+		Gnanaharan et al. 1982
	"	"	stored logs and planks	+		Mathew 1982
	"	"	nuts		+	cf. Archibald & Chalmers 1983
	"	"	wood stored	+		Gnanaharan et al. 1985
	"	"	t&f	+		Mathew 1987
	"	"	cashew wood	+		Stanaway et al. 2001
	"	"	ti	+		Nair 2007
	"	"	hp		+	Brasil 2008
2	*Astronium fraxinifolium* Schott	"	timber		+	Peres Filho et al. 2006
3	*Buchanania cochinchinensis* (Lour.) M.R. Almeida (= *latifolia* Roxb.)	"	psw	+		Beeson 1941
4	*Choerospondias axillaris* (Roxb.) B.L. Burtt & A.W. Hill	"	hp	+		Hutacharern & Tubtim 1995
5	*Lannea coromandelica* (Houtt.) Merr. (= *grandis* Engl.)	"	psw	+		Beeson 1941
6	*Mangifera* sp.	"	lct	+		Kalshoven 1963
	"	"	hp		+	Maes 1995
7	*Mangifera indica* L.	"	psw	+		Beeson 1941
	"	"	hp		+	Beeson 1941; Vrydagh 1957; Brasil 2008; Veenakumari & Prashanth 2009; Plantwise 2016
	"	"	branches		+	Vrydagh 1957; Binda & Joly 1991
	"	"	stem			Binda & Joly 1991
	"	"	ldst used in construction works	+		Mathew 1982
	"	"	ldst used for making brush handles, matches	+		Mathew 1982
	"	"	ldst used for packing cases	+		Mathew 1982
	"	"	wood		+	Poggi et al. 1994
	"	"	dead and dry trunk		+	Masood et al. 2012
8	*Sclerocarya birrea* subsp. *caffra* (Sond.) Kokwaro	"	wood		+	Poggi et al. 1994
9	*Polyalthia fragrans* (Dalz.) Bedd.	**Annonaceae**	psw	+		Mathew 1982
10	*Areca catechu* L.	**Arecaceae**	hp	+		Hutacharern & Tubtim 1995
11	*Agave sisalana* Perrine	**Asparagaceae**	hp		+	cf. Archibald & Chalmers 1983
12	*Cordia myxa* L.	**Boraginaceae**	psw	+		Beeson 1941
13	*Ananas comosus* (L.) Merr.	**Bromeliaceae**	hp		+	cf. Archibald & Chalmers 1983
14	*Canarium album* (Lour.) DC. (= *album* Raeusch.)	**Burseraceae**	timber	+		Le-Van-Nong 1975
15	*Canarium pimela* K.D. Koenig (= *nigrum* (Lour.) Engl.)	"	timber	+		Le-Van-Nong 1975

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
16	*Carica papaya* L.	**Caricaceae**	trunk		+	Binda & Joly 1991
17	*Casuarina equisetifolia* L.	**Casuarinaceae**	psw	+		Beeson 1941
	"	"	hp	+		Hutacharern & Tubtim 1995
	"	"	small stems (about 1 cm in diameter)	+		Pinyopusarerk et al. 1996
18	*Casuarina junghuhniana* Miq.	"	hp	+		Hutacharern & Tubtim 1995
19	*Calophyllum* sp.	**Clusiaceae**	lct	+		Kalshoven 1963
20	*Garcinia loureiroi* (Pierre)	"	timber	+		Le-Van-Nong 1975
21	*Garcinia tonkinensis* (Vesque)	"	timber	+		Le-Van-Nong 1975
22	*Anogeissus acuminata* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	**Combretaceae**	psw	+		Beeson 1941; Hutacharern & Tubtim 1995
	"	"	hp	+		Hutacharern & Tubtim 1995
23	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	"	posts	+		Stebbing 1914
	"	"	psw	+		Beeson 1941
24	*Combretum ovalifolium* Roxb.	"	psw	+		Beeson 1941
25	*Getonia floribunda* Roxb. (= *Calycopteris floribunda* (Roxb.) Lam. ex Poir.)	"	psw	+		Beeson 1941
26	*Terminalia* spp.	"	hp	+	+	Moutia 1944 [su]; Geis 2002 [su]; FAO 2007 [sa]
27	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	"	psw	+		Beeson 1941
28	*Terminalia bellirica* (Gaertn.) Roxb. (= *belerica* [sic!] = *bellerica* [sic!])	"	wood	+		Cotes 1893, 1894, cf. Lesne 1906
	"	"	psw	+		Beeson 1941; Mathew 1982
	"	"	wood		+	Stebbing 1914; Plantwise 2016
29	*Terminalia bialata* (Roxb.) Steud.	"	wood		+	Beeson & Bhatia 1937; Poggi et al. 1994
	"	"	psw; ornamental timber		+	Beeson 1941
	"	"	hp		+	Vrydagh 1957
30	*Terminalia chebula* Retz.	"	hp	+		Stebbing 1914; Hutacharern & Tubtim 1995
31	*Terminalia microcarpa* Decne [unr]	"	hp		+	Plantwise 2016
32	*Terminalia myriocarpa* Van Heurck & Mull. Arg.	"	wood		+	Beeson & Bhatia 1937; Poggi et al. 1994
	"	"	ornamental timbers		+	Beeson 1941
	"	"	hp		+	Vrydagh 1957
33	*Terminalia tomentosa* Wight & Arn.	"	wood	+		Stebbing 1914
	"	"	psw	+		Beeson 1941
	"	"	sw only	+		Mathew 1982
34	*Dipterocarpus gracilis* Blume (= *pilosus* Roxb.)	**Dipterocarpaceae**	wood	+		Sen-Sarma & Thakur 1994
		"				
35	*Dipterocarpus indicus* Bedd.	"	wood	+		Sen-Sarma & Thakur 1994
36	*Dipterocarpus retusus* Blume (= *macrocarpus* Vesque)	"	wood	+		Sen-Sarma & Thakur 1994
37	*Dipterocarpus tuberculatus* Roxb.	"	wood	+		Beeson 1941

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
38	*Shorea* spp.	"	hp		+	FAO 2007
	"	"	hwpm		+	Savoldelli & Regalin 2009
39	*Shorea bracteolata* Dyer [unr]		log/timber		+	Choi et al. 2003
40	*Shorea lepidota* Blume [unr]		log/timber	+		Choi et al. 2003
41	*Shorea robusta* Gaertn.	"	dead wood	+		Stebbing 1899; Lesne 1906
	"	"	beams	+		Stebbing 1914
	"	"	timber	+		Stebbing 1914
	"	"	hp		+	Stebbing 1914; Beeson 1941; Vrydagh 1957; Plantwise 2016
	"	"	logs	+		Stebbing 1914
	"	"	wood		+	Beeson & Bhatia 1937; Poggi et al. 1994
	"	"	psw	+		Beeson 1941
	"	"	debarked pillets	+		Mathur et al. 1971
42	*Shorea stellata* (Kurz) Dyer (= *Parashorea stellata* Kurz)	"	psw	+		Beeson 1941
43	*Vateria indica* L. (= *malabarica* Blume)		wood	+		Sen-Sarma & Thakur 1994
	"	"	debarked timber	+	+	Mathew 1982
44	*Diospyros* sp.	**Ebenaceae**	logs		+	Fisher 1950
45	*Hevea brasiliensis* (Willd. ex A. Juss.) Müll.Arg.	**Euphorbiaceae**	hp	+	+	Kamnerdratana et al. 1970 [sa]; Hussein 1981 [sa]; Jose et al. 1989 [su]; Hutacharern & Tubtim 1995 [sa]; FAO 2007 [sa]; Brasil 2008 [su]; CABI/ EPPO 2009 [su]; EPPO 2016b [su]; Plantwise 2016 [su]
	"	"	ti	+	+	Tisseverasinghe 1970 [su]; Nair 2007 [sa, su]
	"	"	freshly-sawn planks	+	+	Gnanaharan & Mathew 1982
	"	"	sawn timber used for packing cases	+	+	Mathew 1982
	"	"	sawn timber and logs	+	+	Gnanaharan et al. 1983
	"	"	t&f	+	+	Mathew 1987
	"	"	dead wood	+		cf. Jayarathnam 1992
	"	"	wood	+	+	Tomimura 1993 [su]; Stanaway et al. 2001 [sa]; Tarasin & Rattanapun 2013 [sa]
	"	"	unseasoned and seasoned wood	+	+	Ho & Hashim 1997
	"	"	hwpm		+	Geis 2002
	"	"	air-dried and seasoned sawn timber	+	+	Sittichaya & Beaver 2009a, 2009b
	"	"	debarked logs	+	+	Beaver et al. 2011
	"	"	sawn timber	+	+	Kangkamanee et al. 2011
	"	"	wood from trunks and branches	+		Sittichaya et al. 2012

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
46	*Hura crepitans* L.	"	cut branches; wood		+	Binda & Joly 1991
	"	"	hp		+	Maes 1995; Plantwise 2016
47	*Mallotus* spp.	"	hp	+		FAO 2007
48	*Mallotus philippensis* (Lam.) Müll. Arg. (= *philippinensis* [sic!])	"	psw	+		Beeson 1941
49	*Mallotus roxburghianus* Mueil.	"	wood	+		cf. Lesne 1906; Gumovsky 2010
	"		psw	+		Beeson 1941
50	*Manihot esculenta* Crantz (= *utilissima* Pohl)	"	roots or dry roots	+	+	Fleutiaux 1902 [su]; Lesne 1906 [su]; Vrydagh 1954 [sa], 1955 [su]; cf. Horion 1961 [sa]; Kalshoven 1963 [sa]; Aitken 1975 [su]; Pollini 1998 [su]
	"	"	hp		+	Frappa 1938; Maes 1995; Brasil 2008; CABI/EPPO 2009; EPPO 2016b; Plantwise 2016
	"	"	rhizomes		+	Ratti & Rampini 1977; Ratti 2004
	"	"	death plants	+		Hutacharern & Choldumrongkul 1989
	"	"	stems		+	Binda & Joly 1991
	"	"	wood		+	Poggi et al. 1994
51	*Castanea sativa* Mill. (= *vesca* Gaertn)	**Fagaceae**	psw	+		Beeson 1941
52	*Castanopsis argyrophylla* King ex Hook.f.	"	psw	+		Beeson 1941
53	*Quercus* sp.	"	psw	+		Beeson 1941
54	*Quercus lamellosa* Sm.	"	psw	+		Beeson 1941
55	*Calophyllum elatum* Bedd.	**Guttiferae**	sw	+		Mathew 1982
	"	"	t&f	+		Mathew 1987
56	*Gmelina arborea* Roxb.	**Lamiaceae**	psw	+		Beeson 1941
57	*Tectona grandis* L.f.	"	psw	+		Beeson 1941
	"	"	dry branches of standing trees	+		Kalshoven 1963
	"	"	poles	+		Kalshoven 1963
	"	"	young tree stuck by lighting	+		Kalshoven 1963
	"	"	sw	+		Mathew 1982
	"	"	furniture	+		Geis 2002
	"	"	logs and cut wood		+	Peres Filho et al. 2006
	"	"	hp		+	Brasil 2008
	"	"	small wooden planks		+	Quiroz-Gamboa & Sepúlveda-Cano 2008
	"	"	sapwood of logs		+	Mehl Lunz et al. 2010
58	*Persea americana* Mill.	**Lauraceae**	hp		+	Zimmerman 1941; Plantwise 2016
	"	"	wood		+	Poggi et al. 1994
59	Leguminosae spp.	**Leguminosae**	sw of logs	+		Jha & Sen Sarma 2008
60	*Adenanthera pavonina* L.	"	debarked trunk	+		Kalshoven 1963

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
61	*Acacia* spp.	"	wood	+	+	Lesne 1906 [su]; Stebbing 1914 [sa]; Vrydagh 1957 [su]; Poggi et al. 1994 [su]
	"	"	hp	+		FAO 2007
62	*Acacia auriculiformis* Benth.	"	wood	+		Beeson & Bhatia 1937
	"	"	hp	+		Hutacharern 1987; Dell et al. 2012
	"	"	small stems and branckes	+		Hutacharern & Choldumrongkul 1989
63	*Acacia catechu* (L.f.) Willd.	"	branch	+		Stebbing 1914
	"	"	trees felled	+		Stebbing 1914
	"	"	psw	+		Beeson 1941
64	*Acacia gageana* Craib.	"	psw	+		Beeson 1941
65	*Acacia koa* A.Gray	"	wood		+	Fullaway 1961
66	*Acacia koaia* Hillebr.	"	branches		+	Vrydagh 1957
	"	"	hp		+	Plantwise 2016
67	*Acacia leucophloea* (Roxb.) Willd.	"	lct	+		Kalshoven 1963
68	*Acacia mangium* Willd.	"	wood; branches; twigs	+		Beeson & Bhatia 1937
			branches and twigs			Nair 2001
	"	"	hp	+		Hutacharern & Choldumrongkul 1989; FAO 2007
	"	"	on branches	+		Nair 2007
69	*Acacia modesta* Wall.		hp	+		Stebbing 1914
	"	"	psw	+		Beeson 1941
	"	"	sw	+		Chaudhry 1962, 1965
	"	"	stems	+		Nair 2007
70	*Acacia nilotica* (L.) Delile (= *arabica* (Lam.) Willd.)	"	psw	+		Beeson 1941
	"	"	stem boring	+		Nair 2007
71	*Acacia tortilis* (Forssk.) Hayne	"	wood	+		Beeson & Bhatia 1937
	"	"	felled timber	+		Singh & Bhandari 1987; Orwa et al. 2009
	"	"	timber a few weeks after felling	+		cf. Elrasoul 1991
	"	"	timber	+		Stanaway et al. 2001
72	*Acrocarpus fraxinifolius* Arn.	"	psw	+		Beeson 1941
73	*Albizia amara* (Roxb.) Steud. (= *cimara* [sic!])	"	wood	+	+	Stebbing 1914 [su]; Beeson & Bhatia 1937 [sa, su]; Poggi et al. 1994 [su]
	"	"	psw	+		Beeson 1941
	"	"	hp		+	Beeson 1941; Vrydagh 1957; Plantwise 2016
74	*Albizia chinensis* (Osbeck) Merr. (= *stipulata* (DC.) Boivin)	"	psw	+		Beeson 1941
75	*Albizia lebbeck* (L.) Benth.	"	branches		+	Paoli 1934
	"	"	hp		+	Beeson 1941

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
	"	"	psw	+		Beeson 1941
	"	"	branches		+	Vrydagh 1957
	"	"	wood		+	Poggi et al. 1994
	"	"	through the bark in to the inner sw	+		Bajpai 2007
76	*Albizia lebbekoides* (DC.) Benth.	"	hp	+		Hutacharern & Tubtim 1995
77	*Albizia odoratissima* (L.f.) Benth.	"	psw	+		Beeson 1941
	"	"	sw	+		Mathew 1982
	"	"	ti	+		Mathew 1982; Nair 2007
	"	"	t&f	+		Mathew 1987
78	*Albizia procera* (Roxb.) Benth.	"	psw	+		Beeson 1941
	"	"	twigs of living trees	+		cf. Kalshoven 1963
79	*Albizia saman* (Jacq.) Merr. (= *Samanea saman* (Jacq.) Merr.)	"	hp		+	Spilman 1959; Binda & Joly 1991
	"	"	cut sampling	+		Beaver et al. 2011
80	*Butea monosperma* (Lam.) Taub. (= *frondosa* Roxb.)	"	psw	+		Beeson 1941
81	*Caesalpinia decapetala* (Roth) Alston (= *sepiaria* Roxb.)	"	psw	+		Beeson 1941
82	*Cajanus cajan* (L.) Millsp.	"	hp		+	Zimmerman 1941; Binda & Joly 1991; Maes 1995; Plantwise 2016
83	*Cassia* sp.	"	wood	+	+	Vrydagh 1954 [sa]; Poggi et al. 1994 [su]
	"		branches and death branches		+	Vrydagh 1957
84	*Cassia fistula* L.	"	psw	+		Beeson 1941
	"		sw		+	Mathew 1982
85	*Ceratonia siliqua* L.	"	hp		+	Plantwise 2016
86	*Dalbergia* spp.	"	lct	+		Kalshoven 1963
	"	"	hp	+		Baker & Berry 1978; Khan 1995; FAO 2007
		"				
87	*Dalbergia cochinchinensis* Pierre	"	hp	+		Hutacharern & Tubtim 1995
88	*Dalbergia lanceolaria* L.f.		round logs	+		Mathew 1982
	"	"	light packing cases	+		Mathew 1982
	"	"	temporary construction works	+		Mathew 1982
89	*Dalbergia latifolia* Roxb.	"	death trees, under the bark into the wood not completly dry	+		Lesne 1897
		"				
	"	"	death wood	+		Stebbing 1902; Lesne 1906
	"		death wood not quite dry	+		Stebbing 1914
	"		hp	+		Stebbing 1914
	"	"	psw	+		Beeson 1941
	"	"	twigs of living trees	+		cf. Kalshoven 1963
	"	"	sw in round logs	+		Mathew 1982
	"	"	sw in finished products	+		Mathew 1982

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
	"	"	t&f	+		Mathew 1987
	"	"	ti	+		Nair 2007
90	*Dalbergia sissoo* DC.	"	death wood	+		Stebbing 1902; Lesne 1906
	"	"	hp	+		Stebbing 1914; Sharma 1992, 1993; Hutacharern & Tubtim 1995
	"	"	psw	+		Beeson 1941
	"	"	sw	+		Chaudhry 1962, 1965
		"	twigs of living trees	+		Kalshoven 1963
	"	"	bark and stems of unhealthy or dying trees	+		cf. Lenne & Karki 1994
	"	"	timber	+		Stebbing 1914; Stanaway et al. 2001
91	*Delonix* spp.	"	hp	+		Maes 2005; FAO 2007
92	*Delonix regia* (Hook.) Raf.	"	logs	+		Argaman 1987
	"	"	fallen trunk		+	Binda & Joly 1991
	"	"	dry branches	+		Joly et al. 1994
	"	"	timber	+		Stanaway et al. 2001
	"	"	hp		+	Brasil 2008; Plantwise 2016
93	*Derris* sp.	"	roots	+	+	Tanaka 1941 [sa]; Downes & Williams 1950 [sa]; Fisher 1950 [sa, su];Vrydagh 1954 [sa]; Breny 1957 [sa, su]; Vrydagh 1957 [su]; cf. Kalshoven 1963 [su]; Aitken 1975 [sa]
	"	"	wood		+	Poggi et al. 1994
94	*Derris elliptica* (Wall.) Benth.	"	roots	+		Corbett 1926; Miller 1934; Fisher 1950
	"	"	psw	+		Beeson 1941
	"	"	hp		+	Plantwise 2016
95	*Derris scandens* (Roxb.) Benth.	"	hp		+	Plantwise 2016
96	*Desmodium oojeinense* (Roxb.) H. Ohashi (= *Ougeinia dalbergioides* Benth.)	"	psw	+		Beeson 1941
97	*Erythrina variegata* L. (= *indica* Lam.)	"	outer sw	+	+	Mathew 1982
	"	"	t&f		+	Mathew 1987
	"	"	ti	+		Nair 2007
	"	"	hp		+	Plantwise 2016
98	*Falcataria moluccana* (Miq.) Barneby & J.W.Grimes (= *Albizia falcataria* (L.) Fosberg)	"	ti (psw)	+		Mathew 1982
	"	"	t&f	+		Mathew 1987
99	*Indigofera tinctoria* L.	"	psw	+		Beeson 1941
100	*Koompassia malaccensis* Maingay ex Benth.	"	hp	+		Bhot & Lila 1978; Hutacharern & Tubtim 1995; FAO 2007
101	*Lablab purpureus* (L.) Sweet (= *Dolichos lablab* L.)	"	grains	+		Cotes 1889

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
	"	"	hp	+		cf. Gumovsky 2010
102	*Leucaena* spp.		hp	+		FAO 2007
103	*Leucaena diversifolia* (Schltdl.) Benth.	"	wood	+		Beeson & Bhatia 1937; cf. Gumovsky 2010
	"	"	hp	+		Hutacharern & Choldumrongkul 1989; cf. Gumovsky 2010
104	*Leucaena leucocephala* (Lam.) de Wit	"	wood	+		Beeson & Bhatia 1937
		"	hp	+		Hutacharern & Choldumrongkul 1989; cf. Gumovsky 2010
	"	"	wooden logs	+		Deepthi & Remadevi 2012
105	*Leucaena leucocephala* (Lam.) de Wit x *L. diversifolia* (Schltdl.) Benth.		hp	+		Hutacharern & Choldumrongkul 1989
106	*Macrotyloma uniflorum* (Lam.) Verdc (= *Dolichos biflorus* L. sensu auct. = *D. uniflorus* Lam.)	"	grains	+		Cotes 1889; cf. Delobel & Tran, 1993
	"	"	wood	+		Beeson & Bhatia 1937
107	*Millettia brandisiana* Kurz.	"	psw	+		Beeson 1941
108	Mimosoideae gen. sp.	"	hwpm		+	!
109	*Myroxylon* sp.	"	hp		+	Maes 1995
110	*Myroxylon balsamum* (L.) Harms	"	cut branches; trunk		+	Binda & Joly 1991
	"	"	hp		+	Brasil 2008; Plantwise 2016
111	*Peltophorum pterocarpum* (DC.) K. Heyne (Benth) (= *ferrugineum* (Decne.) Benth.)	"	timber	+		Le-Van-Nong 1975
112	*Piptadenia flava* (Spreng ex DC.) Benth.	"	hp		+	Binda & Joly 1991; Maes 1995
113	*Pithecellobium* sp.	"	wood		+	Balasubramanya et al. 1991
	"	"	hp		+	Maes 1995
114	*Pongamia pinnata* (L.) Pierre (= *glabra* Vent.)	"	psw	+		Beeson 1941
	"	"	hp	+		Veenakumari & Prashanth 2009
115	*Prosopis cineraria* (L.) Druce (= *spicigera* L.)	"	hp	+		Stebbing 1914
	"	"	psw	+		Beeson 1941
116	*Prosopis juliflora* (Sw) DC. (= *uniflora* [sic!])	"	branches of a fallen tree		+	Swezey 1920
	"	"	psw	+		Beeson 1941
	"	"	hp		+	Zimmerman 1941
	"	"	wood		+	Binda & Joly 1991
117	*Prosopis pallida* (Willd.) Kunth	"	dead stems		+	Starr et al. 2004
	"	"	living trunks and dry trunks		+	Juárez 2014
118	*Pterocarpus indicus* Willd.	"	psw	+		Beeson 1941
119	*Pterocarpus macrocarpus* Kurz	"	hp	+		Hutacharern & Tubtim 1995
120	*Pterocarpus marsupium* Roxb.	"	wood	+		Stebbing 1914
	"	"	psw	+		Beeson 1941
121	*Senna multijuga* (Rich.) H.S.Irwin & Barneby (= *Cassia multijuga* Rich.)	"	twigs of living trees	+		cf. Kalshoven 1963

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
122	*Senna siamea* (Lam.) H.S. Irwin & Barneby (= *Cassia florida* Vahl = *C. siamea* Lam.)	"	branches, a little under the bark		+	Chiaromonte 1933
	"	"	psw	+		Beeson 1941
123	*Senna timoriensis (*DC.) H.S.Irwin & Barneby (= *Cassia timoriensis* DC.)	"	twigs of living trees	+		cf. Kalshoven 1963
124	*Tephrosia candida* (Roxb.) DC.	"	hp		+	Plantwise 2016
125	*Xylia* spp.	"	hp	+		FAO 2007
126	*Xylia xylocarpa* (Roxb.) Taub. (= *X. dolabrifornis* Benth.)	"	death trees, under the bark into the wood not completly dry	+		Lesne 1897
	"	"	death wood	+		Stebbing 1902
	"	"	death wood not quite dry	+		Stebbing 1914
	"	"	hp	+		Stebbing 1914
	"	"	psw	+		Beeson 194
127	*Loranthus* spp.	**Loranthaceae**	Feeding in stems	+		Mushtaque & Baloch 1979
128	*Lagerstroemia lanceolata* Wall.	**Lythraceae**	psw	+		Beeson 1941
129	*Lagerstroemia microcarpa* Wight	"	sw	+	+	Mathew 1982
	"	"	t&f		+	Mathew 1987
	"	"	ti		+	Nari 2007
	"	"	hp		+	Plantwise 2016
130	*Lagerstroemia reginae* Roxb.	"	sw	+		Mathew 1982
	"	"	t&f	+		Mathew 1987
	"	"	ti	+		Nair 2007
131	*Bombax ceiba* L. (= *malabaricum* DC.)	**Malvaceae**	psw	+		Beeson 1941
	"	"	hp		+	Beeson 1941; Plantwise 2016
	"	"	ti	+		Mathew 1982
132	*Bombax insigne* Wall.	"	psw	+		Beeson 1941
133	*Ceiba* sp.	"	hp		+	Zimmerman 1941
134	*Ceiba pentandra* (L.) Gaertn.	"	sw of stored logs	+		Mathew 1982
135	*Durio zibethinus* L. (= *zibethinus* Murray)	"	baited traps	+	+	Sittichaya et al. 2013
136	probably *Erinocarpus nimmonii* J.Graham (= *nimmoanus* Mast.)	"	wood	+		Cotes 1889
137	*Gossypium* sp.	"	hp		+	Maes 1995; Plantwise 2016
138	*Gossypium hirsutum* L.	"	hp		+	Zimmerman 1941; Binda & Joly 1991
	"	"	stored stalks		+	Balasubramanya et al. 1991
139	*Grewia tiliaefolia* Vahl (= *tiliifolia* [sic!] Vahl)	"	wood		+	Beeson & Bhatia 1937; Poggi et al. 1994
	"	"	psw	+		Beeson 1941
	"	"	hp		+	Beeson 1941; Vrydagh 1957; Plantwise 2016
	"	"	sw	+		Mathew 1982
140	*Hibiscus* sp.	"	lct	+		Kalshoven 1963
141	*Hibiscus rosa-sinensis* L.	"	hp		+	Zimmerman 1941
142	*Schoutenia* sp. (= *Actinophora* sp.)	"	lct	+		Kalshoven 1963

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
143	*Sterculia villosa* Roxb. (= *ornata* Wall. ex Kurz)	"	psw	+		Beeson 1941
144	*Melia azedarach* L.	**Meliaceae**	psw	+		Beeson 1941
145	*Swietenia* sp.	"	lct	+		Kalshoven 1963
146	*Swietenia macrophylla* King (= *Switenia* [sic!] *macrophyla* [sic!])	"	hp			Brasil 2008
147	*Swietenia mahagoni* (L.) Jacq. (= *mahogani* DC)	"	hp		+	Binda & Joly 1991
148	*Toona* sp.	"	lct	+		Kalshoven 1963
149	*Toona ciliata* M.Roem. (= *Cedrela toona* Roxb. ex Rottler)	"	psw	+		Beeson 1941
150	*Artocarpus hirsutus* Lamk.	**Moraceae**	psw	+		Mathew 1982
	"	"	heartwood of timber used as door frames	+		Mathew 1982
151	*Ficus* sp.	"	hwpm	+		!
152	*Ficus altissima* Blume	"	hp		+	Beeson 1941; Plantwise 2016
153	*Ficus carica* L.		twigs and branches	+		Knopf 1971
154	*Ficus racemosa* L. (= *glomerata* Roxb.)	"	psw	+		Beeson 1941
155	*Ficus religiosa* L.	"	psw	+		Beeson 1941
156	*Morus indica* L.	"	psw	+		Beeson 1941
157	*Knema globularia* (Lam.) Warb. (= *corticosa* Lour.)	**Myristicaceae**	timber	+		Le-Van-Nong 1975
158	*Corymbia calophylla* (R.Br. ex Lindl.) K.D.Hill & L.A.S.Johnson	**Myrtaceae**	hp	+		Kliejunas et al. 2003
159	*Corymbia citriodora* (Hook.) K.D. Hill & L.A.S. Johnson (= *Eucalyptus citriodora* Hook.)	"	psw	+		Beeson 1941
	"	"	hp	+		Kliejunas et al. 2003
160	*Corymbia maculata* (Hook.) K.D.Hill & L.A.S.Johnson	"	hp	+		Kliejunas et al. 2003
161	*Corymbia torelliana* (F.Muell.) K.D. Hill & L.A.S. Johnson (= *Eucalyptus torelliana* F.Muell.)	"	bark	+		Mathew 1982
162	*Eucalyptus* sp.		hp		+	Lesne 1906; Moutia 1944
	"	"	wood		+	Poggi et al. 1994
163	*Eucalyptus amygdalina* Labill.	"	sw; heartwood	+		Kliejunas et al. 2003
164	*Eucalyptus cloeziana* F.Muell.	"	hp	+		Kliejunas et al. 2003
165	*Eucalyptus delegatensis* F.Muell. ex R.T.Baker	"	hp	+		Kliejunas et al. 2003
166	*Eucalyptus dunnii* Maiden	"	hp	+		Kliejunas et al. 2003
167	*Eucalyptus globulus* Labill.	"	hp	+		Kliejunas et al. 2003
168	*Eucalyptus grandis* W.Hill	"	sw	+		Mathew 1982
169	*Eucalyptus nitens* (H.Deane & Maiden) Maiden	"	hp	+		Kliejunas et al. 2003
170	*Eucalyptus obliqua* L'Hér.	"	hp	+		Kliejunas et al. 2003
171	*Eucalyptus ovata* Labill.	"	hp	+		Kliejunas et al. 2003

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
172	*Eucalyptus regnans* F.Muell.	"	hp	+		Kliejunas et al. 2003
173	*Eucalyptus saligna* Sm.	"	hp	+		Kliejunas et al. 2003
174	*Eucalyptus viminalis* Labill.	"	hp	+		Kliejunas et al. 2003
175	*Psidium guajava* L.	"	branches		+	Fisher 1950; Camacho et al. 2002
	"	"	hp; stems; wood		+	Binda & Joly 1991
176	*Syzygium cumini* (L.) Skeels (= *Eugenia jambolana* Lam.)	"	psw	+		Beeson 1941
177	*Chionanthus* sp.	**Oleaceae**	hwpm	+		!
178	*Flueggea virosa* (Roxb. ex Willd.) Royle (= *microcarpa* Blume)	**Phyllanthaceae**	psw	+		Beeson 1941
179	*Pinus* sp.	**Pinaceae**	bark and wood		+	EPPO 2003
180	Bambusoideae spp.	**Poaceae Bambusoideae**	basket-reeds	+		Cotes 1889
	"	"	stems	+		Cotes 1889; cf. Lesne 1906; Stebbing 1914; Beeson & Bhatia 1937
	"	"	hp	+		Hutacharern & Tubtim 1995
	"	"	drying bamboos	+		Panda 2011
181	*Bambusa* spp.	"	hp		+	CABI/EPPO 2009; EPPO 2016b
	"	"	hp		+	Planttwise 2016
182	*Dendrocalamus strictus* ? (Roxb.) Nees	"	stems	+		Stebbing 1914
183	*Dendrocalamus strictus* (Roxb.) Nees	"	psw	+		Beeson 1941
	"	"	hp	+		Hutacharern & Tubtim 1995
184	*Jacquinia arborea* Vahl (= *barbasco* Mez)	**Primulaceae**	stems		+	Fisher 1950; Aitken 1975
185	*Grevillea robusta* A.Cunn. ex R.Br.	**Proteaceae**	psw	+		Beeson 1941
186	*Ziziphus jujuba* Mill.	**Rhamnaceae**	psw	+		Beeson 1941
187	*Zizyphus rugosa* Lam.	"	psw	+		Beeson 1941
188	*Zizyphus xylopyrus* (Retz.) Willd.	"	psw	+		Beeson 1941
189	*Coffea* sp.	**Rubiaceae**	hp?	+		Richardson 1979; Keall 1981
190	*Haldina cordifolia* (Roxb.) Ridsdale (= *Adina cordifolia* (Roxb.) Bent. Hook. f.)	"	wood	+	+	Beeson & Bhatia 1937
	"	"	psw	+		Beeson 1941
	"	"	hp		+	Beeson 1941; Vrydagh 1957; Plantwise 2016
	"	"	round logs and converted timber	+		Mathew 1982
	"	"	wood		+	Poggi et al. 1994
191	*Citrus* sp.	**Rutaceae**	hp		+	Maes 1995
192	*Litchi chinensis* Sonn.	**Sapindaceae**	wood		+	Lu et al. 2012
193	*Camellia sinensis* (L.) Kuntze	**Theaceae**	stems and roots	+		Banerjee 1983
194	*Holoptelea integrifolia* (Roxb.) Planch.	**Ulmaceae**	wood		+	Beeson & Bhatia 1937; Poggi et al. 1994
	"	"	hp		+	Beeson 1941; Vrydagh 1957; Plantwise 2016

continued

N.	Species	Family	Plant part attacked	Sa	Su	Source
195	*Vitis vinifera* L.	**Vitaceae**	stems	+	+	Singh & Srivastava 1998 [sa]; Binda & Joly 1991 [su]; Mani et al. 2014 [sa]
196	*Elettaria cardamomum* (L.) Maton	**Zingiberaceae**	capsules	+		Cotes 1889; Lesne 1906
	"	"	grains	+		Delobel & Tran 1993
	Total	**30 Sa/24 Su**		**158**	**68**	

one of the high risk pathways for the introduction of wood pests, so standard treatments for WPM are used in international trade to "practically eliminate" the risk of international transport of most bark and wood pests via WPM (Haack & Cavey 2000; Haack & Petrice 2009; Haack et al. 2014). Table 1 summarizes the known hosts of *S. anale* and *S. unidentatum*; it is very likely that WPM made from wood of these plants is more easly colonized by these beetles if the wood is not treated with insecticides. So, in the consignments the WPM, other wooden articles – spacers for stone sheets, furnitures, picture frames, etnic handicrafts, fuel wood, etc. (cf. Weidner 1967; Sandhu 1975; Cymorek 1982; Poggi et al. 1994; Schillhammer 1995; Sellenschlo 1997; Haack & Cavey 2000; Stanaway et al. 2001; Geis 2002; Haack 2006; Iwata & Nakano 2006; Jabłoński et al. 2006; Westcott et al. 2006; Quiroz-Gamboa & Sepúlveda-Cano 2008) – and, of couse, logs and timber must be treated with insecticides to prevent the entry of exotic insect pests (cf. Gnanaharan & Mathew 1982; Elouard 1998; Stanaway et al. 2001; Benker 2008; Zhang et al. 2011); moreover in order to increase the probability of detecting alien wood-boring beetles soon after their arrival, monitoring programmes should be concentrated in harbors with large volumes of imports, in surrounding forests and in wood waste landfills (cf. Wylie et al. 2008; Rassati et al. 2015a, 2015b).

Table 1 shows that the larvae of both species are polyphagous, they occur in dying or dead wood, including seasoned dry wood. The larvae are eventually capable in detoxifying many chemicals of their host plants (cf. Breny 1957; Tomimura 2003), infact some of these plants are used by man for extraction of chemicals used in medicine, cosmetics, perfumery, or for the preparation of biopesticides (cf. Roark 1932; Karir 2004; Máthé 2015). The adults sometimes bore into green shoots and twigs for maturation feeding or hibernation, moreover they can girdle small stems (about 1 cm in diameter), causing them to break at the point of attack (cf. Stebbing 1914; Beeson & Bhatia 1937; Beeson 1941; Hutacharern & Choldumrongkul 1989; Pinyopusarerk et al. 1996; Ho & Hashim 1997; Jha & Sen Sarma 2008; Sittichaya & Beaver 2009a; Sittichaya et al. 2013).

On the basis of existing evidence (cf. Frediani 1958, 1961; Soro 1964; Sohi & Bindra 1969; Khalilov 1972; Viggiani 1974; Bournier 1976; Halperin & Damoiseau 1980; Filip 1986; Moleas 1988; Ciampolini et al. 1989; Ragazzini 1996; Pollini 1998; Fernández-Cano & Togores 2011; Mani et al. 2014), the Australian authority for agriculture (DAFF 2013) proposed restrictions to the importation into Australia of propagative material of *Vitis vinifera* from other countries, since *Sinoxylon* spp. and other alien insects as well can develop in the WPM of this propagative material or can occur on the branches of this material.

Considering the polyphagy of *S. anale* and *S. unidentatum* (Table 1), the high diversity of woody plants of Greece, the warm climate of this country, the climate change impacts on expansion of species' distributional ranges, and the increasing global transport networks (cf. Vitousek et al. 1996; Thuiller 2004; Dukes et al. 2009; Founda & Giannakopoulos 2009; Holmes et al. 2009; Hulme 2009; Walther et al. 2009; Leal et al. 2010; Robinet & Roques 2010; Roques 2010; Bjorkman & Niemela 2015; Lindström & Lehmann 2015; Martin 2015; Paine & Lieutier 2016), the establishment of *S. anale* and/or *S. unidentatum* in Greece, at least in indoor warehouses (cf. Benker 2008; Savoldelli & Regalin 2009), cannot be excluded. These new records further underline that to reduce the risk of importing exotic wood-boring beetles in the Euro-Mediterranean area, a greater emphasis must be placed on inspecting and treating WPM originating from tropical countries (cf. Rassati et al. 2014; Nardi & Mifsud 2015; Nardi et al. 2015; Rassati et al. 2015a; Paine & Lieutier 2016).

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