2006-019: Draft Annex to ISPM 27 - *Dendroctonus ponderosae*

Comm. no.	Para. no.	Comment type	Comment	Explanation	Country	SC's Response
1.	*G*	Substantive	I support the document as it is and I have no comments		PPPO, Kenya, Uruguay, Guyana	Noted
2.	*G*	Technical		It should be emphasized that any suspect D. ponderosae must be submitted to a taxonomic authority for confirmation. It seems that the existing taxonomic treatments are inadequate to support reliable identification even to Dendroctonus. There are over 75 genera of Scolytinae in North America, and Thomas (1957) only treated 15 genera. We are concerned that two genera of Hylurgini exotic to North America (both of which attack pines), one of which is widespread (Tomicus) were not included in that treatment. It seems the potential for "false larval positives" is high. Also, from experience with identification of larvae in other beetle families, these characters are often very challenging to interpret without reference material. We suggest that it be considered that larval scolytine identification should be left to scolytinists with such expertise.	United States of America	MODIFIED A sentence has been added to para 41 stating larvae cannot be used to identify Dendroctonus to genus or species level with confidence. Added text to para 103 stating the use of larvae identification. "While adult specimens (in good condition) are the only way to confirm the identification of *D. ponderosae*.using morphological methods, it is useful to examine the larvae (in the absence of an adult specimen) to help narrow down the identification. However, there is potential for confusion amongst Scolytinae species which may appear very similar at the larval stage. *Dendroctonus ponderosae* share morphologies with other species in the genus *Dendroctonus* and with species in other genera. Identification of larvae is useful in determining if a specimen is consistent with known morphology of the species. Methods for larval identification are provided to support diagnosis of a specimen as either not *D. ponderosae* or suspected/ possible *D. ponderosae*. "
3.	*2*	Editorial	**Status box** *This is not an*	Grammar	Philippines	INCORPORATED. Corrected.

			official part of the standard and will be modified by the IPPC Secretariat after adoption			
			Date of this document	2016-01-18		
			Document category	Draft annex to ISPM 27 (*Diagnostic protocols for regulated pests)*		
			Current document stage	*To* member consultation		
			Major stages	2006-05 SC added original subject: *Dendroctonus ponderosae* syn. *Scolytus scolytus* (2006-019) 2015-03 Expert Consultation (EC) 2015-05 Revised draft after EC with new title: *Dendroctonus ponderosae* (2006-019) 2015-06 Technical Panel on Diagnostic Protocols (TPDP) meeting review 2015-09 Revised		

				draft with TPDP and EC comments addressed 2015-11 SC noted title change from "*Dendroctonus ponderosae* syn. *Scolytus scolytus* (2006-019)" to "*Dendroctonus ponderosae* (2006-019)" 2015-12 SC approved draft DP for member consultation (2016_eSC_May_02)			
			Discipline leads history	2012-11 Norman BARR (US, discipline lead) 2012-11 Géraldine ANTHOINE (FR, referee)			
			Consultation on technical level	The first draft of this protocol was written by (lead author and drafting team): - Ms Linda Semeraro (Australia) (lead author) - Mr Edson Tadeu Iede			

				(Brazil) - Ms Brigitta Wessels-Berk (Netherlands) - Mr Hume Douglas (Canada) - Mr Jean-Francois Germain (France) In addition, the draft has been subjected to expert review and the following international experts submitted comments: - Ms Ramona Vaitkevica (State Plant Protection Service of Latvia) - Mr Christopher H.C. Lyal (Natural History Museum, United Kingdom) - Mr Muchemi Samuel (International Centre of Insect Physiology and Ecology (Icipe),			

				Kenya) - Mr Jiri Hulcr (APHIS Plant Protection and Quarantine (PPQ), United States) - Mr Masaaki Genka (Yokohama Plant Protection Station, The Ministry of Agriculture, Forestry and Fisheries of Japan) - Mr Guilherme Schnell E. Schuhli (Empresa Brasileira de Pesquisa Agropecuaria, EMBRAPA, Brazil)			
			Main discussion points during development of the diagnostic protocol	· Title of protocol changed to not include syn. *Scolytus scolytus*, as *S. scolytus* is a different species. . DNA barcode method is not included because no publication on *D. ponderosae* barcode identification exists and only one record of			

				D. jeffreyi is available. This is the TPDP recommendation. · Use of Bouchard (2011) classification of tribe Hylurgini instead of tribe Tomicini as used by Bright (2014) · Revision of figures to include consistent and accurate labels · Length of Introduction exceeds one-page limit · Separate adult from larvae diagnosis in protocol · The order of the figures do not match order of occurrence in text			
				Notes	This is a draft document. 2015-10 Edited			
4.	*2*	Editorial	**Status box** *This is not an official part of the standard*		Mr Hulcr is not employed but APHIS but the Univeristy of Florida see [137]	United States of America	MODIFIED. Address corrected to “University of Florida, Institute of Food and Agriculture Sciences, Gainesville, Florida, USA”.

			and will be modified by the IPPC Secretariat after adoption			
			Date of this document	2016-01-18		
			Document category	Draft annex to ISPM 27 (*Diagnostic protocols for regulated pests)*		
			Current document stage	*To* member consultation		
			Major stages	2006-05 SC added original subject: *Dendroctonus ponderosae* syn. *Scolytus scolytus* (2006-019) 2015-03 Expert Consultation (EC) 2015-05 Revised draft after EC with new title: *Dendroctonus ponderosae* (2006-019) 2015-06 Technical Panel on Diagnostic Protocols (TPDP) meeting review 2015-09 Revised draft with TPDP and EC comments addressed 2015-11 SC noted		

				title change from "*Dendroctonus ponderosae* syn. *Scolytus scolytus* (2006-019)" to "*Dendroctonus ponderosae* (2006-019)" 2015-12 SC approved draft DP for member consultation (2016_eSC_May_02)			
			Discipline leads history	2012-11 Norman BARR (US, discipline lead) 2012-11 Géraldine ANTHOINE (FR, referee)			
			Consultation on technical level	The first draft of this protocol was written by (lead author and drafting team): - Ms Linda Semeraro (Australia) (lead author) - Mr Edson Tadeu Iede (Brazil) - Ms Brigitta Wessels-Berk (Netherlands) - Mr Hume Douglas (Canada) - Mr Jean-Francois Germain			

				(France) In addition, the draft has been subject to expert review and the following international experts submitted comments: - Ms Ramona Vaitkevica (State Plant Protection Service of Latvia) - Mr Christopher H.C. Lyal (Natural History Museum, United Kingdom) - Mr Muchemi Samuel (International Centre of Insect Physiology and Ecology (Icipe), Kenya) - Mr Jiri Hulcr (University of Florida~~A PHIS Plant Protection and Quarantine (PPQ)~~, United States) - Mr Masaaki Genka (Yokohama Plant Protection Station, The Ministry of Agriculture, Forestry and				

				Fisheries of Japan) - Mr Guilherme Schnell E. Schuhli (Empresa Brasileira de Pesquisa Agropecuaria, EMBRAPA, Brazil)			
			Main discussion points during development of the diagnostic protocol	· Title of protocol changed to not include syn. *Scolytus scolytus*, as *S. scolytus* is a different species. · DNA barcode method is not included because no publication on *D. ponderosae* barcode identification exists and only one record of *D. jeffreyi* is available. This is the TPDP recommendation. · Use of Bouchard (2011) classification of tribe Hylurgini instead of tribe Tomicini as used by Bright (2014) · Revision of figures to include consistent and accurate labels · Length of Introduction exceeds			

			one-page limit · Separate adult from larvae diagnosis in protocol · The order of the figures do not match order of occurrence in text			
			Notes	This is a draft document. 2015-10 Edited		
5.	*8*	Editorial	There are 20 *Dendroctonus* species that have been recognized worldwide and described in the literature (Armendáriz-Toledano *et al*., 2015). These beetles are phloeophagous (bark-feeding) insects that live beneath the bark layer of trees where the adults and larvae form characteristic galleries (Wood, 1982). The galleries may be engraved in both the inner bark layer and the wood. ~~Most *Dendroctonus* species are present only in North and Central America, but two species have been recorded from Europe and Asia (Table 1).~~Most of the species are present only in North and Central America and only two species have been reported in Europe and Asia.	minor rewording	Philippines	MODIFIED. Sentence rephrased following suggestions here in part and comment 6 below.
6.	*8*	Technical	There are 20 *Dendroctonus* species that have been recognized worldwide and described in the literature (Armendáriz-Toledano *et al*., 2015). These beetles are phloeophagous (bark-feeding) insects that live beneath the bark layer of trees where the adults and larvae form characteristic galleries (Wood, 1982). The galleries may be engraved in both the inner bark layer and the wood. Most *Dendroctonus* species are present only in North and Central America, but two species are native in ~~have been recorded from~~ Europe and Asia (Table 1).	Here it should be "are native in" instead of "have been recorded from". If we say recorded from in a broader sense, then we should for example also mention D. valens, which is a native species in North America and introduced in Asia (China).	EPPO, European Union	INCORPORATED. Accepted suggestion and included additional change added "are native or endemic to Europe and Asia". According to CABI 2016, it is difficult to determine the native range of *D. micans* although it is thought to originate from Asia and has since spread Westward. Therefore wording has been changed to "native or endemic". Information is based on CABI 2016 datasheet – this reference has been included in the bibliography (Para 154). Also added reference to Hulcr *et al*. 2015 in relation to D. armandi distribution in Asia,
7.	*8*	Techni	There are 20 *Dendroctonus* species that have	With regards to Table 1, perhaps comment on	United States of	MODIFIED. See response to comment 6. Added

		cal	been recognized worldwide and described in the literature (Armendáriz-Toledano *et al*., 2015). These beetles are phloeophagous (bark-feeding) insects that live beneath the bark layer of trees where the adults and larvae form characteristic galleries (Wood, 1982). The galleries may be engraved in both the inner bark layer and the wood. Most *Dendroctonus* species are present only in North and Central America, but two species ~~have been recorded from~~ are native to Europe and Asia (Table 1).	how D. valens is established in China?	America	comment to Table 1 *D. valens* present inAsia. Did not specify China as other countries are not included in table. Also included sentence: "The species *Dendroctonus valens* LeConte is recently introduced to Asia (CABI 2016)."
8.	*9*	Editorial	*Dendroctonus ponderosae* Hopkins, 1902 (Coleoptera: Curculionidae: Scolytinae) is a destructive pest of pine trees (Keeling *et al*., 2013). ~~Adults and larvae kill pine trees by girdling the tree when feeding and by acting as a vector of the blue stain fungus *Ceratocystis montia* (Figure 1), which blocks nutrient and water flow, contributing to the decline of tree health of infected trees~~ Adults and larvae affects the trees by directly feeding, during feeding the beetle girdles around the tree and interrupts the flow of water and nutrients. In addition, D.ponderosae acts as vector of the blue stain fungus, Ceratocystis montia contributing to the decline of the tree. (CABI 2015, Amman and Cole, 1983).	Re phrasing	Philippines	MODIFIED. Wording re-phrased following combined suggestions from Comments 8 and 9.
9.	*9*	Technical	*Dendroctonus ponderosae* Hopkins, 1902 (Coleoptera: Curculionidae: Scolytinae) is a destructive pest of pine trees (Keeling *et al*., 2013). Adults and larvae kill pine trees by girdling the tree when feeding and by acting as a vector of three species of blue stain fungi~~us~~ *Ceratocystis montium, Grosmannia clavigera* and *Leptographium longiclavatum*~~a~~ (Figure 1), which block~~s~~ nutrient and water flow, contributing to the decline of tree health of infected trees (CABI 2015, Amman and Cole, 1983, Rice et al. 2008).	Ceratocystis montia is Ceratocystis montium http://www.speciesfungorum.org/Names/SynSpecies.asp?RecordID=535049 There are three blue stain fungi associated with Dendroctonus ponderosae: Grosmannia clavigera (Robinson-Jeffery and Davidson) Zipfel, de Beer and Wingfield [=Ophiostoma clavigerum (Robinson-Jeffery and David-son) Harrrington], Ceratocystis montium (Rumbold) J. Hunt and Leptographium longiclavatum Lee, Kim and Breuil. (Rice et al. 2008) These three blue stain fungi are also mentioned in Six and Bracewell (2015). References: Rice, A.V., Thormann, M.N., Langor, D.W., 2008. Mountain pine beetle-associated blue-stain fungi are differentially adapted to boreal temperatures.	Australia	MODIFIED. Wording included following combined suggestions from Comments 8 and 9. Additional references included in protocol. The references: Rice *et al*. (2008) and Six and Bracewell (2015) have been added as references in paragraph 10. Also added to references list (Para 166).

				Forest Pathology 38, 113-123. Six, D.L., Bracewell, R. 2015. Dendroctonus. In F. Vega & R. Hofstetter, eds. Bark beetles: Biology and ecology of native and invasive species, pp. 305–350. London/San Diego, CA/Waltham, MA/Oxford, UK, Academic Press. 640 pp.		
10.	*10*	Editorial	~~During an outbreak period~~ *D. ponderosae* has been known to cause up to 85% tree mortality in pine tree stands and can kill many healthy pine trees (CABI 2015). Serious outbreaks can cause millions of hectares of damage to pine forests and have a devastating ecological and economic impact (Keeling *et al*., 2013; Janes *et al*., 2014). *D. ponderosae* spreads within its native range by flight; each generation ~~of the beetles~~ can migrate several miles. The beetles usually attack ~~Trees attacked include~~ older trees or weakened pines, but during epidemics, *D. ponderosae* may attack trees with rapid growth rates and non-*Pinus* coniferous species. Janes *et al*. (2014) identified four oscillating phases of *D. ponderosae* population dynamics: (1) small population size and restricted to "low-quality hosts" or trees of poor health; (2) incipient epidemics, during which the beetles mainly attack trees with a large diameter; (3) epidemics, during which beetles attack healthy trees; and (4) post-epidemic collapse. Historically cycles of these phases occur every 20–40 years in areas where *D. ponderosae* is endemic with epidemics lasting on average for 5 years.	Re wording	Philippines	INCORPORATED. Paragraph re-worded following suggestions.
11.	*11*	Editorial	*D. ponderosae* is known to be present in North America (CABI, 2015). Major tree hosts for this pest include *Pinus contorta* (lodgepole pine), *Pinus lambertiana* (~~big~~sugar pine), *Pinus monticola* (western white pine) and *Pinus ponderosa* (ponderosa pine). Other minor host species from which *D. ponderosae* has been collected include *Picea engelmannii* (Engelmann spruce), *Pinus aristata* ~~[~~(Rocky Mountain bristle ~~comb~~cone pine~~]~~), *Pinus albicaulis* (whitebark pine), *Pinus balfouriana*	To correct the common names	United States of America	INCORPORATED. Common names corrected following suggestions.

<table>
<tr><td></td><td></td><td></td><td>(foxtail pine), Pinus coulteri (big-cone pine), Pinus edulis (pinyon pine), Pinus flexilis (limber pine), Pinus monophylla (single-leaf pinyon pine), Pinus strobiformis (southwestern white pine) and Pinus sylvestris (Scots pine) (CABI/EPPO, 1997). Some of those records are incidental.</td><td></td><td></td><td></td></tr>
<tr><td>12.</td><td>13</td><td>Technical</td><td><table>
<tr><th>Species</th><th>Author</th><th>Distribution</th></tr>
<tr><td>Dendroctonus adjunctus</td><td>Blandford</td><td>North America</td></tr>
<tr><td>Dendroctonus approximatus</td><td>Dietz</td><td>North America</td></tr>
<tr><td>Dendroctonus armandi</td><td>Tsai and Li</td><td>Asia</td></tr>
<tr><td>Dendroctonus brevicomis</td><td>LeConte</td><td>North America</td></tr>
<tr><td>Dendroctonu</td><td>Zimmerman</td><td>North and</td></tr>
</table></td><td>to be consistent with the comment made on paragraph 8</td><td>EPPO, European Union</td><td>MODIFIED. Added “Asia” to distribution Table 1 for D. valens but did not include “China” as none of the other species of details about the country distribution (all distribution is presented at a general regional level).</td></tr>
</table>

			s frontalis	n	Central America			
			Dendroctonus jeffreyi	Hopkins	North America			
			Dendroctonus mesoamericanus	Armendáriz-Toledano and Sullivan	Central America			
			Dendroctonus mexicanus	Hopkins	North and Central America			
			Dendroctonus micans	Erichson	Europe and Asia			
			Dendroctonus murrayanae	Hopkins	North America			
			Dendroc	Chapuis	North			

			tonus parallelocollis		America		
			Dendroctonus ponderosae	Hopkins	North America		
			Dendroctonus pseudotsugae	Hopkins	North America		
			Dendroctonus punctatus	LeConte	North America		
			Dendroctonus rhizophagus	Thomas and Bright	North America		
			Dendroctonus rufip	(Kirby)	North America		

			ennis				
			Dendroctonus simplex	LeConte	North America		
			Dendroctonus terebrans	(Olivier)	North America		
			Dendroctonus valens	LeConte	North America and Asia (China)		
			Dendroctonus vitei	Wood	North America		
13.	*13*	Technical	**Species**	**Author**	**Distribution**	Note that D. valens is established in China. Perhaps denote this as exotic?	United States of America	MODIFIED. As per comment above. New sentence added to former paragraph [8].
			Dendroctonus adjunctus	Blandford	North America		
			Dendroctonu	Dietz	North Ame		

			s approximatus		rica			
			Dendroctonus armandi	Tsai and Li	Asia			
			Dendroctonus brevicomis	LeConte	North America			
			Dendroctonus frontalis	Zimmerman	North and Central America			
			Dendroctonus jeffreyi	Hopkins	North America			
			Dendroctonus mesoamericanus	Armendáriz-Toledano and Sullivan	Central America			

			Dendroctonus mexicanus	Hopkins	North and Central America		
			Dendroctonus micans	Erichson	Europe and Asia		
			Dendroctonus murrayanae	Hopkins	North America		
			Dendroctonus parallelocollis	Chapuis	North America		
			Dendroctonus ponderosae	Hopkins	North America		
			Dendroctonus pseudotsug	Hopkins	North America		

			ae					
			Dendroctonus punctatus	LeConte	North America			
			Dendroctonus rhizophagus	Thomas and Bright	North America			
			Dendroctonus rufipennis	(Kirby)	North America			
			Dendroctonus simplex	LeConte	North America			
			Dendroctonus terebrans	(Olivier)	North America			
			Dendroctonus	LeConte	North America,			

			valens		Asia	
			Dendroctonus vitei	Wood	North America	
14.	*16*	Substantive	Attack on the pine tree is initiated by unmated adult females which release releasing pheromones to attract males (CABI, 2015), who it then help build the galleries by removing frass and later plug the entrance with frass. Females bore straight vertical egg galleries along the phloem or inner bark. Egg laying occurs during summer up to early autumn in North America (CABI 2015). Females commence egg laying about seven days after the initial attack and cease when temperatures becomes too cold to continue. Eggs are laid individually or in clusters along a gallery, surrounded by tightly packed frass, and hatch 7 to 14 days after laying (CABI/EPPO, 1997). D. ponderosae has four larval instars (CABI, 1997). The larvae feed on phloem and constructing feeding galleries.InfestationColonization usually occurs over a five week period, but may happen in as little as three or four days. In most cases the adults reamin within the galleries and die after the production of one brood (CABI 1997). However, it may take only one generation of *D. ponderosae* to kill a healthy tree. Adult beetles may re-emerge after the completion of one egg gallery to begin a new attack. ~~However, in most cases the adults remain within the galleries and die after the production of one brood (CABI 1997).~~	Re-construction of the text for clarity	Philippines	MODIFIED. Re-worded first sentence of para 17 but changed to "Attack on a pine tree is initiated by unmated adult female *D. ponderosae* which release pheromones to attract males (CABI, 2015). The male beetles help build the galleries…." Paragraph 17, sentences 7 - 9 re-worded as suggested but order of sentences 10 – 12 slightly re-arranged and paragraph reads as follows: *"Dendroctonus ponderosae* has four larval instars (CABI 1997)." The larvae feed on phloem, together constructing a radiating series of feeding galleries (Figure 3). Infestation usually occurs over a five week period, but may happen in as little as three or four days. In most cases the adults remain within the galleries and die after the production of one brood (CABI 1997). However, some adult beetles may instead re-emerge to begin a new gallery. It sometimes take only one generation of *D. ponderosae* to kill a healthy tree.
15.	*17*	Substantive	*D. ponderosae* is typically univoltine (one generation per year; but can be semivoltine one generation every two years) where the climate is cooler, such as at higher elevations (Bentz *et al*., 2013). Mitton and Ferenberg (2012) reported that up to two generations per year in	Specific line has been transferred to paragraph 16 because the sentence was supposed to be under the discussion on biology. Rephrasing for clarity	Philippines	MODIFIED. Accepted changes suggested but in second sentence added "there are"….reads as: "Mitton and Ferenberg (2012) reported that there are up to two generations per year…" and in the last sentence changed the word "larva" to "larvae".

			warmer climates ~~and~~ on certain pine species. Adults can be found on or under bark or once emerged from the tree ~~can be found~~ in flight searching for a new host. Eggs, larvae and pupae are found internally in ~~stems (above ground),~~ under bark of shoots, branches and trunks. ~~*D. ponderosae* has four larval instars (CABI, 1997).~~ This species usually overwinters as ~~a~~ second or third instar larva but occasionally other life stages can ~~will~~ be found along with larvae in colder months.			Also a few other slight changes made (see tracked changes – Para 18 now reads: "*D. ponderosae* is typically univoltine (one generation per year); but can be semivoltine (one generation pertwo years) where the climate is cooler, such as at higher elevations (Bentz *et al*., 2013). Mitton and Ferenberg (2012) reported that there were up to two generations per year in warm climates on certain pine species. Adults can be found on or under bark or in flight searching for a new host. Eggs, larvae and pupae are found internally under bark of shoots, or in branches and trunks. This species usually overwinters as second or third instar larvae but occasionally other life stages can be found along with larvae in colder months."
16.	*21*	Substantive	**Taxonomic position:** Insecta; Coleoptera; Curculionidae; Scolytid~~n~~ae; Hylurgini	It is a controversial problem about the taxonomic degree of this group. However, Scolytidae is more widely used than Scolytinae internationally.	China	CONSIDERED, BUT NOT INCORPORATED. In this protocol we decided to retain the subfamily classification "Scolytinae" based on more recent research/ evidence and papers which support this classification. For example see phylogeney of Classification of weevils Jordal *et al*. 2014. There are really no results supporting Scolytidae as separate from Curculionidae unless Curculionidae were broken into many pieces.
17.	*23*	Editorial	The Scolytinae Latreille, 1804, the group to which *Dendroctonus* Erichson, 1836 belongs, has at times, ~~since its description~~, been treated as a family of Curculionoidea and a subfamily of Curculionidae *since*~~since~~ *its description*~~its description~~. Most recently Bright (2014) referred to the group as the Scolytidae following Wood (1982, 1986), while Jordal *et al*. (2014) made a case for retaining the subfamily status for the group based on phylogenetic evidence.	For clarity	Singapore	MODIFIED. Changed sentences to read more clearly. : "The Scolytinae Latreille, 1804, the subfamily to which *Dendroctonus* Erichson, 1836 belongs, was long treated as a family of Curculionoidea. Most recently Bright (2014) continued to refer to the group as the family Scolytidae following Wood (1982, 1986), while Jordal *et al*. (2014) presented phylogenetic evidence for subfamily status for the Scolytinae. In Hulcr *et al*. (2015) and Alonso-Zarazaga & Lyal (2009), *Dendroctonus* belongs to the tribe Hylurgini. Diagnostic characters for adult Hylurgini (=Tomicini) are presented in Wood (1986). "
18.	*26*	Editorial	It is useful when examining wood to look for evidence of circular holes (1.5–3.5 mm in	Grammar	Philippines	INCORPORATED. Change accepted.

			diameter) or frass in suspected material.			
19.	*27*	Editorial	Larvae and pupae are found in the host plant or wood products only under bark or in the phloem, not in the wood or xylem. Trees can be examined externally for symptoms of infestation while pine or other coniferous wood products, particularly unprocessed logs, dunnage, crates or pallets with bark should be examined for galleries and beetles (adults and larvae).	to add a spacing between "infestation" and "while"	Singapore	INCORPORATED. Space added.
20.	*28*	Editorial	The entrance tunnel of galleries created by this pest is short and perpendicular to the trunk. The egg gallery, which ascends diagonally from the entrance tunnel, is vertical and linear and only slightly wider than the adult beetle. The egg tunnel may be 32 to 50 cm long. The egg niche pattern is characteristic for *D. ponderosae* but similar to that of *D. jeffreyi*, alternating between groups of one to five niches (CABI/EPPO, 1997). Larvae mine tunnels that begin more or less parallel to the egg gallery and then widen and diverge from it, ~~and that are 1–4 cm long~~. These 1-4 cm long tunnels terminate in a pupal chamber.	For better sentencing	Singapore	INCORPORATED. Change accepted. Also, the word "initially" is added to the sentence "The egg gallery, which initially ascends diagonally from the entrance tunnel…." to clarify that the tunnels may start of diagonally but are then vertical. Further slight amendment made to the final sentence in paragraph as follows: "These tunnels are 1–4 cm long, terminating in a pupal chamber and eventually the beetles exit the tunnel through the bark to the outside."
21.	*28*	Technical	The entrance tunnel of galleries created by this pest is short and perpendicular to the trunk. The egg gallery, which ascends diagonally from the entrance tunnel, is vertical and linear and only slightly wider than the adult beetle. The egg tunnel may be 32 to 50 cm long. ~~The egg niche pattern is characteristic for *D. ponderosae* but similar to that of *D. jeffreyi*, alternating between groups of one to five niches (CABI/EPPO, 1997)~~. Larvae mine tunnels that begin more or less parallel to the egg gallery and then widen and diverge from it, and that are 1–4 cm long. These tunnels terminate in a pupal chamber.	Instead of making a sentence comparing the egg niche patern of D. ponderosae to D. jeffreyi, we suggest that we just directly describe the egg niche of D. ponderosae, because there is no reference of D. jeffreyi on this document.	Philippines	MODIFIED. Deleted part of fourth sentence "…but similar to that of *D. jeffreyi* …" but retained the rest of the sentence as it describes the egg tunnels of *D. ponderosae*.
22.	*34*	Technical	- linear, vertical J-shaped maternal galleries ~~up to 50 cm~~ range from 10 to 122cm long (averaging about 25cm) and lateral larval galleries under the outer bark layer (Figures 3 and 4).	This description may be more reasonable.	China	MODIFIED. In paragraph 35, included suggested wording "ranging from 10 to 122cm long (averaging about 25cm)" as in CABI 2015 datasheet for *Dendroctonus ponderosae*. Removed the word "linear" from the start of the sentence.
23.	*37*	Editorial	The bark can be removed from affected plant or	grammar	Philippines	MODIFIED

		al	wood product using a sharp, strong knife or a small axe (Kelley and Farrell, 1998). The wood underneath the bark layer and the inner bark should be visually examined with a 40× magnifying lens. It is important to look for evidence of linear, vertical J-shaped galleries and for beetles of all life stages (but particularly adults and larvae). If gallery engravings are present, some of the bark or affected material should be collected and, ideally, photographed. Transportation of materials collected from an infested site can be accomplished using a well-sealed bag or container. Double bagging is advisable.			Corrected as suggested. Also, paragraph further minor modifications: "The bark can be removed from affected plant or wood product using a sharp, strong knife or a small axe (Kelley and Farrell, 1998). The wood underneath the bark layer and the inner bark should be visually examined for vertical galleries. A 40× magnifying lens can be used to inspect for galleries and for adults, larvae and eggs. If gallery engravings are present, some of the bark or affected material should be collected and, if possible, photographed. Infested materials can be transported using a sealed bag or container. Double bagging is advisable to prevent escape."
24.	*38*	Editorial	Detected adults, larvae, pupae or eggs can be removed using forceps. Sample ~~A few~~ specimens should be placed into a glass vials ~~specimen tube~~ containing 70% to 80% ethanol, or adults can be placed into a dry tube and then in a freezer at –20 °C for at least 24 h or –80 °C for at least 6 h before card mounting on to a pin. Doing so will preserve the reference material well for morphological identification (see Section 4.1).	Minor corrections	Philippines	MODIFIED. Using the word "Sample" could be confusing here because it may refer to the plant material examined, so this word is not used. Instead the second sentence is changed to start with "Specimens should be placed into …" The "glass specimens tubes" are changed to "glass vials"..
25.	*38*	Technical	Detected adults, larvae, pupae or eggs can be removed using forceps. A few specimens should be placed into a glass specimen tube containing 70% to 80% ethanol and 0.5%-1% glycerol to keep the specimen' body soft, or adults can be placed into a dry tube and then in a freezer at –20 °C for at least 24 h or –80 °C for at least 6 h before card mounting on to a pin. Doing so will preserve the reference material well for morphological identification (see Section 4.1).	If directly save the specimen with 70% to 80% alcohol, it is easy to cause the specimen's body become harder and black, and it is not conducive to identification later, so suggest adding 0.5% - 1% glycerol to keep the specimen' body soft.	China	MODIFIED. An additional sentence has been included following the first "Larvae can be placed in boiling water to fix." This is included rather than glycerol as it is more common practice to prevent brittleness in body.
26.	*39*	Editorial	It is important to collect any adults that are present because adults have more reliable characters for identification; it is not possible to identify juveniles to species based on morphology alone. In the laboratory, adult specimens should be pinned for examination	Grammar for clarity	Philippines	INCORPORATED.

			while ~~but it is best to leave~~ larvae, pupae and ~~or~~ eggs should be placed in ethanol. See section 4.1 for details on preparation of specimens for identification.			
27.	*41*	Editorial	*D. ponderosae* *can be* ~~is~~ identified by examination of the adult external morphological characters. Features of the adult body are illustrated and labelled in Figures 5 and 6 (source Hopkins 1902). Descriptions and keys of bark beetle species based on adult life stage are available. Generic keys of Scolytinae larvae are available in Thomas (1957, 1965) but juvenile stages are difficult to identify as there are fewer distinct characters to differentiate between the species. The shape and form of the galleries may be useful in detection and identification but are not sufficient for identification without adult specimens for confirmation.	Grammar	Philippines	MODIFIED. Changed as per suggestion. Additionally, genus name is written in full at the start of the sentence.
28.	*42*	Editorial	As yet, no reliable molecular tests can be recommended to distinguish between *D. ponderosae* and other *Dendroctonus* species with similar morphology. ~~There are, a~~At present, there are no protocol~~universally adapted~~ polymerase chain reaction (PCR) methods for the identification of *D. ponderosae* to the exclusion of the closely related species *D. jeffreyi*. Hence there remains the need to rely on morphological identification.	Grammar	Philippines	MODIFIED. Accepted change to Para 43, in-part to read…. "At present, there are no protocols using universally adapted polymerase chain reaction (PCR) methods for the identification of *D. ponderosae* …"
29.	*45*	Editorial	The ethanol preserved specimens (section 3.2) are transferred to a small Petri dish filled with 70% to 80% ethanol to be cleaned from dirt, debris and frass.~~..~~ Specimens can be cleaned by gently brushing with a fine camel-hair brush. Adult specimens preserved in ethanol to be card-mounted on a pin should first be dried by removing the specimen from ethanol, blotting it with paper towel and allowing it to air-dry for 2–5 min. Specimens removed from minus 20 or 80 ° C freezers should be placed on blotting paper and thawed for 10 to 20 minutes or until any visible condensation evaporates from the specimen. A triangular card mount is most appropriate for small beetles and attaching the	remove additional ","	Singapore	INCORPORATED.

			beetle to the card along the right lateral side of its thorax is common practice. Ideally the left lateral, dorsal and ventral aspects should be free and visible to facilitate comparison with other pinned specimens and images. Once adults are pinned, they may be examined under a dissecting microscope of at least 40× (a higher magnification may be preferable). Strong, diffuse lighting is very important for examination of adult bark beetles as their surface sculpturing is characteristic. As adult bark beetles can be very shiny, light reflected from specimens may sometimes interfere with examination of characters. The sheen can be reduced by placing tracing paper or drafting film over the microscope's light source.			
30.	*45*	Editorial	The ethanol preserved specimens (section 3.2) are transferred to a small Petri dish filled with 70% to 80% ethanol to be cleaned from dirt, debris and frass~~.~~. Specimens can be cleaned by gently brushing with a fine camel-hair brush. Adult specimens preserved in ethanol to be card-mounted on a pin should first be dried by removing the specimen from ethanol, blotting it with paper towel and allowing it to air-dry for 2–5 min. Specimens removed from minus 20 or 80 ° C freezers should be placed on blotting paper and thawed for 10 to 20 minutes or until any visible condensation evaporates from the specimen. A triangular card mount is most appropriate for small beetles and attaching the beetle to the card along the right lateral side of its thorax is common practice. Ideally the left lateral, dorsal and ventral aspects should be free and visible to facilitate comparison with other pinned specimens and images. Once adults are pinned, they may be examined under a dissecting microscope of at least 40× (a higher magnification may be preferable). Strong, diffuse lighting is very important for examination of adult bark beetles as their surface sculpturing is characteristic. As adult bark beetles can be very shiny, light reflected	Extra period	United States of America	INCORPORATED.

			from specimens may sometimes interfere with examination of characters. The sheen can be reduced by placing tracing paper or drafting film over the microscope's light source.			
31.	*45*	Substantive	The ethanol preserved specimens (section 3.2) are transferred to a small Petri dish filled with 70% to 80% ethanol to be cleaned from dirt, debris and frass.. Specimens can be cleaned by gently brushing with a fine ~~camel~~ hair brush. Adult specimens preserved in ethanol to be card-mounted on a pin should first be dried by removing the specimen from ethanol, blotting it with paper towel and allowing it to air-dry for 2–5 min. Specimens removed from minus 20 or 80 ° C freezers should be placed on blotting paper and thawed for 10 to 20 minutes or until any visible condensation evaporates from the specimen. A triangular card mount is most appropriate for small beetles and attaching the beetle to the card along the right lateral side of its thorax is common practice. Ideally the left lateral, dorsal and ventral aspects should be free and visible to facilitate comparison with other pinned specimens and images. Once adults are pinned, they may be examined under a dissecting microscope of at least 40× (a higher magnification may be preferable). Strong, diffuse lighting is very important for examination of adult bark beetles as their surface sculpturing is characteristic. As adult bark beetles can be very shiny, light reflected from specimens may sometimes interfere with examination of characters. The sheen can be reduced by placing tracing paper or drafting film over the microscope's light source.	There is no need to specify the type of brush - any fine haired brush should suffice.	Singapore	INCORPORATED.
32.	*46*	Technical	**4.1.2 Diagnostic characters of adults of the subfamily Scolytinae**	4.1.2 is a list of characters supposedly diagnostic for Scolytinae. Not only are many of these shared by other families, some are inaccurate. For instance, "tarsi with four visible segments" is not correct. Tarsomere 4 is visible, it is just very small and largely set within the lobes of tarsomere 3. With adequate magnification, clean specimens, and familiarity with the character, it is perfectly visible. This	United States of America	CONSIDERED, BUT NOT INCORPORATED. Not all general insect diagnosticians will be familiar with characteristics of Scolytinae and knowing the combination of key features of the subfamily could help to narrow down the identification.

				"laundry list" approach of 4.1.2, 4.1.3, and 4.14 is more in the style of a truncated treatise on Scolytinae taxonomy, which is not the intent of the document. Presumably, the document is to enable reliable identification of suspect D. ponderosae in a concise and clear manner. "Laundry lists" are difficult even for professional taxonomists to use, because they consist of somewhat random characters without a functional framework. It should be considered whether to avoid this approach. Furthermore, in the current state, four separate tiers of identification are required: subfamily, tribe, genus, and species. This can be cumbersome, inefficient, and generates taxonomic exhaustion and confusion in the user. A single key, incorporating whatever taxonomic categories may be more appropriate (see below). If this approach is taken, many of the current figures are unnecessary. It is a reasonable expectation that users of the protocol are already capable of recognizing Scolytinae. There are many beetles with a superficial resemblance to Scolytinae and we wonder whether a user without basic knowledge of beetle family boundaries would be able to use a D. ponderosae protocol. If the decision is to include identification protocols for Scolytinae, these should be in the form of a truncated world key to families incorporated with a key to Dendroctonus and D. ponderosae. That approach would be much more concise, reliable, and usable.		
33.	*47*	Editorial	The main diagnostic features of Scolytinae are presented below and are based on key characters highlighted in Wood (1982, 1986), ~~Anderson (2002),~~ Rabaglia (2002) and Hulcr *et al*. (2015). Anderson (2002) also provides a key to the world genera of Scolytinae.	First sentence: Anderson does not have a key to world genera, we think this was supposed to be Wood 1986 or Rabaglia 2002 (the scolytine key in American beetles was written by Rabaglia). Regarding the second sentence, this statement is incorrect. The only key to the world scolytine genera is Wood 1986. Anderson 2002 covers weevil genera of North America only.	United States of America	MODIFIED. Changed second sentence of paragraph 48 "Wood (1986) also provided a key to the world genera of Scolytinae and Anderson (2002) included a key to the Scolytinae genera of North America".
34.	*52*	Technical	- antennae geniculate with a single to seven-segmented funicle; ~~the compressed three-~~	Antennal club of Scolytidae could be three or four segments, not all species have three–	China	MODIFIED. Deleted the word "compressed" as suggested but added "three or four segmented

			~~segmented~~antennel club has apical sutures (Figure 8), which may be transverse, sinuate, recurved or procurved	segmented club. And the shape of the club varies from conical to flat.		antennal club….." – spelling of antennal corrected.
35.	*55*	Technical	~~- at least one pair of tibiae with stout spines or denticles (teeth) along the lateral outer margins (Figure 10), lateral denticles on foretibiae usually socketed~~	Not all species belonging to Scolytidae have at least one pair of tibia with spines or teeth. For instance, tibiae of the species of Scolytinae are without spines or teeth on the lateral margin, but with a long and incurved spine apically.	China	MODIFIED. Instead of deleting this character it has been Changed to read "at least one pair of tibiae usually with stout spines or denticles (teeth) along the lateral outer margins".
36.	*57*	Technical	- Length of the first tarsal segment not more than that of the second or third tarsal segment ~~tarsal segment one about equal in length to tarsal segments two or three~~ (Figure 10).	Generally, The first tarsal segment of the species belonging to Scolytidae is not longer than the second or third tarsal segment.	China	INCORPORATED.As in key to subfamilies of Curculionoidea as in Wood 1982.
37.	*58*	Technical	**4.1.3 Diagnostic characters of adults of the tribe Hylurgini**	4.1.3 is not very useful because keying to tribe is not a fruitful taxonomic exercise in this context. The intent is not to present a full-fledged course in Scolytinae systematics. A few relevant tribal characters can be incorporated in a single key to Dendroctonus and D. ponderosae (see previous U.S. comments).	United States of America	INCORPORATED Sub-section 4.1.3 (Diagnostic characteristics of the Hylurgini) has been removed as suggested by the reviewer and relevant tribal characteristics have been incorporated into the *Dendroctonus* diagnosis. 1) Deleted Section 4.1.3 as suggested. Tribal characters are incorporated in the *Dendroctonus ponderosae* key. 2) Moved comment "anterolateral margins without asperities" from Para 63 to section 4.1.3 (Para 73.) 3) Added "(in dorsal view)" to section 4.1.3.1 (Para 83).
38.	*59*	Technical	Following the classification in Hulcr *et al*. (2015) and Alonso-Zarazaga and Lyal (2009), *Dendroctonus* belongs to the tribe Hylurgini. According to Wood (1986), a~~A~~dult characters that are diagnostic~~characters~~ for the tribe Hylurgini are:	To clarify	United States of America	MODIFIED. Section 4.1.3. has been deleted and the comment re: diagnostic characters of this tribe (Hylurgini) is moved to Para 24.
39.	*62*	Technical	- pronotum punctate (Figure 13 (a and b), ~~-~~or asperate (Figure 14) and anterolateral margins with~~out~~ asperities	to clarify	United States of America	MODIFIED. Para 63 deleted here but feature incorporated in Para 73. However, anterolateral margins are considered to be unarmed Paragraph 73 relating to asperities changed to "pronotum punctate, without asperities to micro-asperate."
40.	*69*	Editorial	- body length ~~between~~ 2.5 ~~-and~~ 9.0 mm	Length unit should be noted.	China	INCORPORATED. Corrected - "mm" added.
41.	*69*	Technical	- body length between 2.5 and 9.0mm	To clarify	United States of America	INCORPORATED. As in Comment 40.
42.	*70*	Editori	- male frons	The common description in insect taxonomy.	China	INCORPORATED. Para 71 re-worded as per

		al	evenly convex but slightly impressed medially ~~c onvex to weakly impressed~~ (Figure 16)			suggestion "evenly convex but slightly impressed medially ".
43.	*72*	Technical	- pronotum punctate, without spines (Figures 2, 13 (a and b)	No scolytines have spines on the pronotum. Do you mean without asperities/ denticles or just unarmed?	United States of America	MODIFIED. Para 72 – added "…bearing crenulations". Deleted "without spines" and added "anterolateral margins without asperities " to Para 73. Further modification to Para 73 -
44.	*75*	Technical	- procoxae only narrowly separated (Figure 15(b))	Wood states that "procoxae are contiguous". Please correct this as the figure also states that they are contiguous.	United States of America	MODIFIED. Para 76 - Changed wording to "Procoxae contiguous".
45.	*76*	Technical	- lateral precoxal prothoracic ridge poorly or not at all developed (Figure 15(b))	According to Wood 1982 it is absent and the figure states that it is absent as well.	United States of America	MODIFIED. Para 77 changed to "lateral precoxal prothoracic ridge not developed"
46.	*78*	Editorial	- antennal club symmetrical, strongly flattened, subcircular, with three sutures that are transverse to slightly procurved (Figures? (a) and 8).	The number of the Figure is lost.	China	MODIFIED. Changed to (Figure 8).
47.	*78*	Editorial	- antennal club symmetrical, strongly flattened, subcircular, with three sutures that are transverse to slightly procurved (Figures ??(a) and 8).	We only see a club photo in figure 8	United States of America	MODIFIED. As in comment 46.
48.	*79*	Editorial	**4.1.4.1 Key to distinguish Dendroctonus adults in Scolytinae**	Request clarity in this paragraph since there is no (a)in the diagnostic annex; suggest providingthe correct reference and/or figure for clarity purposes as may be appropriate	South Africa	MODIFIED. Response as for Comment 46 and 47 above.
49.	*93*	Technical	Male 3.5–6.8 mm (average male: 5.5 mm). Approximately 2.2 times as long as wide. Mature adults black, pterothorax brown, some teneral stages light brown. Females appear externally similar to males except epistomal process less distinct and crenulations on elytra and granulations on declivity larger. Frons: convex with a narrow median line only lightly impressed, not deeply grooved (Figure 16). Epistomal process half as wide as width between the eyes (measured between posterior inner lateral margin of eye), epistomal process with oblique lateral arms; brush of yellow setae present beneath (Figure 16). Pronotum widest at the base, constricted anteriorly, with surface shining between closely spaced granulose punctures (Figure 13a). Pronotum without callus. Elytral declivity dull with interstria~~um~~ 1 strongly elevated; interstria~~um~~ 2 flat or	Wood (1982), on which this text is based, incorrectly uses the pleural term interstriae in reference to a singular interstria. The author may have recognized this and attempted to correct it. However, interstria (not interstrium) is the standard terms used throughout Coleoptera literature. Note: interstria is also synonymous with interval or interstice, so those terms are also available to use here.	Australia	INCORPORATED. Changed "interstrium" to "interstria".

			depressed; interstriae bear granules in one row (not random) (Figure 17).			
50.	*93*	Technical	Male 3.5–6.8 mm (average male: 5.5 mm). Approximately 2.2 times as long as wide. Mature adults black, pterothorax brown, some teneral stages light brown. Females appear externally similar to males except epistomal process less distinct and crenulations on elytra and granulations on declivity larger. Frons: convex with a narrow median line only lightly impressed, not deeply grooved (Figure 16). Epistomal process half as wide as width between the eyes (measured between posterior inner lateral margin of eye), epistomal process with oblique lateral arms; brush of yellow setae present beneath (Figure 16). Pronotum widest at the base, constricted anteriorly, with surface shining between closely spaced granulose punctures (Figure 13a). Pronotum without callus. Elytral declivity dull with interstrium 1 strongly elevated; interstrium 2 flat or depressed; interstriae bear granules in one row (not random) (Figure 17).	Regarding "interstrium 2 flat or depressed": Wood 1982 states that interstriae 2 is "rather strongly impressed". Strongly impressed is also used in the key below.	United States of America	MODIFIED. Para 94 – wording changed to "interstria 2 impressed".
51.	*95*	Editorial	*D. ponderosae* is morphologically similar to *D. jeffreyi* (Table 1) (Figure 18) and the two are difficult to distinguish. The pronotal punctures are separated by a distance not greater than the diameter of the puncture in *D. ponderosae* while *D. jeffreyi* has finer pronotal punctures more widely separated (at least twice the diameter of one puncture), and they are not as deep. The body length of *D. ponderosae* is slightly less~~smaller~~ (average male body length is 5.5 mm) than that of *D. jeffreyi* (male average body lengthis 6 mm) and the latter species has a distribution range only from South Oregon to North Baja California, United States while *D. ponderosae* is present throughout the middle and western parts of North America. The host plant range of *D. jeffreyi* is more restricted than that of *D. ponderosae*, with *D. jeffreyi* usually attacking only *Pinus jeffreyi* and rarely *P. ponderosa*. *D. ponderosae* is distinguished from *D. frontalis* by its larger size; the latter	Less sounds more appropriate when referring to length than smaller. Inserting 'that of' makes it clear that the comparision is beween respective lengths, not the length of D. ponderosae with the species D. jeffreyi (I know this is obvious, but descriptive text should be concise)	Australia	INCORPORATED. Accepted changes.

			species has males that are only 2.0–3.2 mm (average 2.8 mm) long. Unlike *D. frontalis*, specimens of *D. ponderosae* lack a female pronotal callus and distinct groove in the middle of the frons.			
52.	*95*	Editorial	*D. ponderosae* is morphologically similar to *D. jeffreyi* (Table 1) (Figure 18) which makes them ~~and the two are~~ difficult to distinguish. The pronotal punctures are separated by a distance not greater than the diameter of the puncture in *D. ponderosae* while *D. jeffreyi* has finer pronotal punctures more widely separated (at least twice the diameter of one puncture), and they are not as deep. The body length of *D. ponderosae* is slightly smaller (average male body length is 5.5 mm) than *D. jeffreyi* (male average body lengthis 6 mm) and the latter species has a distribution range only from South Oregon to North Baja California, United States while *D. ponderosae* is present throughout the middle and western parts of North America. The host plant range of *D. jeffreyi* is more restricted than that of *D. ponderosae*, with *D. jeffreyi* usually attacking only *Pinus jeffreyi* and rarely *P. ponderosa*. *D. ponderosae* is distinguished from *D. frontalis* by its larger size; the latter species has males that are only 2.0–3.2 mm (average 2.8 mm) long. Unlike *D. frontalis*, specimens of *D. ponderosae* lack a female pronotal callus and distinct groove in the middle of the frons.	Grammar	Philippines	INCORPORATED. Change accepted.
53.	*95*	Editorial	*D. ponderosae* is morphologically similar to *D. jeffreyi* (Table 1) (Figure 18) and the two are difficult to distinguish. The pronotal punctures are separated by a distance not greater than the diameter of the puncture in *D. ponderosae* while *D. jeffreyi* has finer pronotal punctures more widely separated (at least twice the diameter of one puncture), and they are not as deep. The body length of *D. ponderosae* is slightly smaller (average male body length is 5.5 mm) than *D. jeffreyi* (male average body lengthis 6 mm) and the latter species has a	This is Mexico, not the United States	United States of America	MODIFIED. Changed wording to “distribution range only from South Oregon (United States) to North Baja California (Mexico)”.

			distribution range only from South Oregon to North Baja California, ~~United States~~Mexico while *D. ponderosae* is present throughout the middle and western parts of North America. The host plant range of *D. jeffreyi* is more restricted than that of *D. ponderosae*, with *D. jeffreyi* usually attacking only *Pinus jeffreyi* and rarely *P. ponderosa*. *D. ponderosae* is distinguished from *D. frontalis* by its larger size; the latter species has males that are only 2.0–3.2 mm (average 2.8 mm) long. Unlike *D. frontalis*, specimens of *D. ponderosae* lack a female pronotal callus and distinct groove in the middle of the frons.			
54.	*96*	Technical	In the United States, *Ips pini* (Say) is often found in the same tree with *D. ponderosae* during non-outbreak periods but these two species are not easily confused as they have different parent galleries and adult *Ips* have distinct teeth around the lateral margin of elytral declivity~~large elytral spines~~. However, larvae of these species and their galleries may appear very similar. Confirmation of beetle species should be specimen-based and for morphological identification, adult specimens should be examined.	The distinctly different character between Ips and Dendroctonus is that elytral declivity is with obviously teeth around with the lateral margin in the species of Ips. The form and size of these teeth vary greatly. The very long and acute tooth is called as "spine".	China	INCORPORATED. Accepted suggested change and deleted "large elytral spines".
55.	*97*	Editorial	**4.1.5.3 Simplified key to adults of *Dendroctonus* ~~Dendroctonus~~ species**	The name of genus should be used italic type.	China	INCORPORATED. Genus name italicized.
56.	*101*	Technical	**2.** Coarse granulation around the episternal area; coarse pronotal punctures separated by a distance less than the diameter of one puncture and some punctures bearing a small granule; elytral declivity with relatively large granules forming a single line (uniserial) along each interstria~~um~~, elytral interstria~~um~~ 2 strongly impressed, interstria~~um~~ 1 strongly elevated, interstri~~u~~a~~m~~ 3 weakly elevated, surface of declivity dull and minutely rugulose (Figure 17).....***Dendroctonus ponderosae***	See above (4.1.5.1)	Australia	INCORPORATED. Corrected word to "interstria" as suggested.
57.	*105*	Substantive	The ethanol preserved specimens (section 3.2) are transferred to a small Petri dish filled with 70% ethanol for morphological examination.	There is no need to specify the type of brush as long as any fine haired brush.	Singapore	INCORPORATED. Removed "camel".

			Specimens should be clean of dirt, debris and frass for examination. Specimens can be cleaned by gently brushing with a fine ~~camel~~ hair brush. They may be examined under a dissecting microscope of at least 40× (a higher magnification may be preferable).			
58.	*107*	Editorial	Larvae of this subfamily have no legs. The body is C-shaped and subcylindrical (Figure 21) with three thoracic and ten abdominal segments. ~~The l~~Larvae have white bodies with dark brown chewing mouthparts (mandibles). The head capsule is lightly sclerotized, usually amber or light brown, and as long as broad; the antennae have only one segment; and the cranium has a Y-shaped ecdysial suture (Figure 22(a and b)4). The thorax bears three pairs of pedal lobes that each have two to four setae. Each abdominal segment bears two or three tergal folds. The prothorax and the first eight segments of the abdomen bear spiracles (Bright, 1991). Eggs are "smooth, oval, white, translucent" (CABI/EPPO, 1997) (Figure 23).	Grammar	Philippines	INCORPORATED. Changed as suggested.
59.	*107*	Technical	There are four larval instars and mature larvae are 4-6mm long. Larvae of this subfamily have no legs. The body is C-shaped and subcylindrical (Figure 21) with three thoracic and ten abdominal segments. The larvae have white bodies with dark brown chewing mouthparts (mandibles). The head capsule is lightly sclerotized, usually amber or light brown, and as long as broad; the antennae have only one segment; and the cranium has a Y-shaped ecdysial suture (Figure 22(a and b)4). The thorax bears three pairs of pedal lobes that each have two to four setae. Each abdominal segment bears two or three tergal folds. The prothorax and the first eight segments of the abdomen bear spiracles (Bright, 1991). Eggs are "smooth, oval, white, translucent" (CABI/EPPO, 1997) (Figure 23).	Adding this description could be more comprehensive.	China	MODIFIED. Did not include "There are four larval instars…" as this information has been included in Para 17 and is not really considered to be part of the diagnostic larval characters. However, the comment relating to the length of the mature larvae and size is included as suggested.
60.	*110*	Technical	The general appearance of these larvae is as for other Scolytinae. They are C-shaped, white or cream coloured larvae with lightly sclerotized	Though there is a figure to refer to, the description triangular in configuration is ambiguous without reference to the figure.	Australia	INCORPORATED. Comment accepted and description included as suggested.

			heads. Mature specimens are large (2–9 mm). The diagnostic characters of *Dendroctonus* larvae include having head free (almost entirely visible dorsally), anterior margin of frons without tubercles, and mandibles with three incisorial teeth (Figure 24). The postlabium has a posterior pair of setae closer together than the median pair (Figure 25(a)), ~~triangular in configuration~~each lateral cluster of post-labial setae triangular in configuration, and the shape of the premental sclerite is triangular and proximally abruptly narrowed – it appears as a distinct projection from the main body of the sclerite (Figure 25(a)). The pedal lobes are smooth but may be surrounded by spinules (but not inside the pedal lobe area), with three or four setae on each lobe (Figure 26).	Regardless of inclusion of figures, descriptive text should ideally be just that – descriptive.		
61.	*111*	Editorial	**4.2.3.1 Key to distinguish *Dendroctonus* ~~Dendroctonus~~ larvae in Scolytinae**	Italicize	United States of America	INCORPORATED. Genus name italicized.
62.	*115*	Editorial	**4.2.4~~5~~ Identification of larvae of *Dendroctonus ponderosae***	error number	China	MODIFIED. Corrections to document require numbering to be checked and changed throughout the document.
63.	*116*	Editorial	**4.2.5~~4~~.1 Diagnostic characters**	error number	China	MODIFIED. Corrections to document require numbering to be checked and changed throughout the document.
64.	*119*	Editorial	**4.2.4~~5~~.2 Key to distinguish larvae of Dendroctonus ponderosae from the larvae of other Dendroctonus species**	error number	China	MODIFIED. Corrections to document require numbering to be checked and changed throughout the document.
65.	*119*	Editorial	**4.2.5.2 Key to distinguish larvae of *Dendroctonus ponderosae* ~~Dendroctonus ponderosae~~ from the larvae of other *Dendroctonus*~~Dendroctonus~~ species**	Italicize	United States of America	INCORPORATED. Genus and species names italicized.
66.	*142*	Editorial	We also thank the reviewers of this protocol: Mark Blacket (DEDJTR, Australia), Jiri Hulcr (University of Florida~~APHIS Plant Protection and Quarantine (PPQ)~~, United States), Christopher Lyal (Natural History Museum, United Kingdom), Dorothy Opondo (Kenya Plant Health Inspectorate Service) , Robert Rabaglia (USDA US Forest Service, United States), and Ramona Vaitkevica (State Plant Protection Service of Latvia).	This is not correct. Jiri Hulcr is at the University of Florida. See [137] for correct information.	United States of America	INCORPORATED. Corrected as suggested.
67.	*147*	Editorial	~~**Anderson, R.S.** 2002. Family 131.~~	Delete this reference if not using in paragraph	United States of	CONSIDERED BUT NOT INCORPORATED

		al	~~Curculionidae Latreille 1802. *In* R.H. Arnett, Jr, M.C. Thomas, P.E. Skelley & J.H. Frank, eds. *American beetles,* Vol. 2. Polyphaga: Scarabaeoidea through Curculionoidea, pp. 722–815. Boca Raton, FL, CRC Press. xiv + 861 pp.~~	47	America		Reference is used elsewhere in text.
68.	*150*	Editorial	**Bouchard, P., Bousquet, Y., Davies, A.E., Alonso-Zarazaga, M.A., Lawrence, J.F., Lyal, C.H.C, Newton, A.F., Reid, C.A.M., Schmitt, M., Ślipiński, S.A. & Smith, A.B.T.** 2011. Family-group names in Coleoptera (Insecta). *ZooK~~k~~eys,* 88: 1–972.	Should be ZooKeys	United States of America		INCORPORATED.
69.	*158*	Editorial	**Jordal, B.H., Smith, S.M. & Cognato, A.I.** 2014. Classification of weevils as a data-driven science: Leaving opinion behind. *ZooKeys,* 439: 1–18.	Should be S.M.	United States of America		INCORPORATED.
70.	*165*	Editorial	**Rabaglia, R.J.** 2002. XVII. Scolytinae Latrielle 1807. *In* R.H. Arnett, Jr, M.C. Thomas, P.E. Skelley & J.H. Frank, eds. *American beetles,* Vol. 2. Polyphaga: Scarabaeoidea through Curculionoidea, pp. 792 – 805 ~~XXX–XXX~~. Boca Raton, FL, CRC Press. xiv + 861 pp.	Editorial	United States of America		INCORPORATED.
71.	*171*	Technical	**9. Figures**	Regarding the U.S. comments on following a single key approach, if the single key approach is followed, it may be useful to include a few pages of characters typical of Dendroctonus in general, since this may enable users who are not scolytine experts to acquire a "gestalt" for this genus.	United States of America		CONSIDERED, BUT NOT INCORPORATED. A single key approach was not incorporated in this protocol as identification can be reached using the keys as already provided. It is useful to know the diagnostic characteristics. Diagnostic characteristics of *Dendroctonus* are provided and key features are depicted in photographs.
72.	*179*	Editorial	**Figure 3.** *Dendroctonus ponderosae* galleries in pine.	If retained, Figures 3 and 10 are too small.	United States of America		MODIFIED. Figures 3 and 10 enlarged on page. Resolution in Figure 3 is not high but alternative images are not accessible to authors. Figure 10 has been re-inserted so that captions are clearly visible (not truncated.
73.	*182*	Technical	**Figure 4.** *Dendroctonus ponderosae,* egg and larval galleries.	Figure 4 is probably not useful unless presented in the context of other Dendroctonus galleries. Along with several other figures, it raises the question of whether this protocol is likely to be used in confirming non-North American infestations in the field. Because those would need confirmation via adults (larval ID is too uncertain - see other U.S. comments),	United States of America		CONSIDERED BUT NOT INCORPORATED. While the galleries are not recommended for use in confirming the identification they may help either exclude species with very different gallery forms or lead to suspect the borers may be *D. ponderosae.* It is useful for the diagnostician to use all available evidence to help with identification including, if available galleries created by beetle larvae.

				we question whether inclusion of field signs is useful.		The steward believes that it is valuable to retain these gallery images..
74.	*185*	Technical	**Figure 5.** *Dendroctonus valens* showing adult beetle in dorsal aspect with features labelled.	Regardless of audience, Figures 5 and 6 should be reconsidered. Illustrations are inherently abstracts of organisms and are thus difficult for non-experts to use. Furthermore, most of the numerous features are irrelevant to the goal of identification of D. ponderosae, these are consequently superfluous and create taxonomic "noise". They should be replaced by images of Dendroctonus (it isn't important whether the species shown is D. ponderosae) and only those features labeled that are used in the key or perhaps a few extra that provide morphological context. The morphological images in the model key by Labonte could be suggested.	United States of America	CONSIDERED, BUT NOT INCORPORATED. The illustration showing *D. valens* with labels has been retained. It is considered that a good illustration of the *Dendroctonus* beetle (such as this one) avoids the need for a glossary. The image has been re-inserted into the word document as a cropped image to remove some text around illustration in Figure 5.
75.	*191*	Technical	**Figure 7**. *D. frontalis*, lateral head and pronotum	Figure 7 should be deleted. It shows a character (the pronotal callus) lacking in D. ponderosae and the presence or absence of this character is unnecessary for distinguishing D. ponderosae from other species of Dendroctonus. Furthermore, it is only found in females - characters present in only one gender are unreliable for identification unless that gender is the only one apt to be encountered (for instance, female characters in Xyleborina are appropriate as only females are likely to be found or trapped).	United States of America	CONSIDERED BUT NOT INCORPORATED. The pronotal callus is mentioned in the Para 96 to compare *D. frontalis* with *D. ponderosae*. The steward believes it is important to retain this image to depict what the callus feature looks like in *D. frontalis* and so the identifier can make certain it is not present in their female specimen.
76.	*211*	Technical	**Figures 13a – b.** (a) *Dendroctonus ponderosae,* dorsal aspect of head and pronotum. **b.** *Dendroctonus jeffreyi* Add more magnified and clear photos of pronotal surface of *D.ponderosae* and *D.jeffreyi* to compare density of punctures. Figures showed in Wood (1982: page 174) may be suitable. Wood, S.L. 1982. The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae), a taxonomic monograph. Great Basin Naturalist Memoirs,	Density of pronotal puncture is one of the important features to distinguish these species.	Japan	MODIFIED. An additional Figure of D. jeffreyi is added with greater resolution of pronotum is included as a replacement for Figure 13b.

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77.	*211*	Technical	**Figures 13a – b.** (a) *Dendroctonus ponderosae,* dorsal aspect of head and pronotum. **b.** *Dendroctonus jeffreyi*	Care should be taken with the character shown in Figure 13a. Other Hylurgini in North America (e.g., Hylurgus) have the anterior margin of the pronotum medially emarginate, albeit not as strongly expressed as in most Dendroctonus. Some individuals of Dendroctonus have this character less strongly expressed than normal. For these reasons, Labonte did not use this character in his model key. Figure 13b is too blurry to be useful.	United States of America	CONSIDERED, BUT NOT INCORPORATED. The Figures provide an example of a character needed in the identification process. The feature is not exclusive to the genus but is needed to complete a diagnosis using multiple characters. This emarginated anterior pronotum is characteristic of *Dendroctonus ponderosae* which is the main species to be identified using this protocol. Figure 13b has been replaced. (See comment 76)
78.	*227*	Technical	**Figure 18.** *Dendroctonus jeffreyi*, dorsal aspect, habitus.	Figure 18 is too blurry to be useful. Figure 18 may also be useless because Dendroctonus jeffreyi is so similar externally to D. ponderosae, unless the intent is to underscore that similarity.	United States of America	INCORPORATED. The intent of Figure 18 is to provide a general reference for *D. jeffreyi* and to how similarity with *D. ponderosae*. New images are provided as a substitute.
79.	*230*	Technical	**Figure 19.** *Dendroctonus frontalis*, dorsal aspect of head and pronotum.	Figures 19 and 20 will be confusing to those unfamiliar with Dendroctonus taxonomy, because they are of a representative of a different species group than that of D. ponderosae. They are only useful when compared to equivalent images of other Dendroctonus in a key.	United States of America	CONSIDERED BUT NOT INCORPORATED Response as in comment 77 - The steward believes it is useful to illustrate the characters listed as diagnostic and mentioned in the key. Photographs show features mentioned in the keys and are therefore retained.
80.	*240*	Editorial	**Figures 22a and b**. Larvae, dorsal aspect of head showing frons with (a) ~~with~~ paired elevations in *Dendroctonus ponderosae*, and (b) a single elevation in *D. frontalis*.	Delete one “with” of the sentence	China	INCORPORATED.