ภาคผนวก

ตารางภาคผนวกที่ 1 ชนิดของมอดขี้ขุยในวงศ์ Bostrichidae ที่มีรายงานการเข้าทำลายไม้ยางพาราแปรรูปในพื้นที่ภาคใต้และภาคตะวันออกของไทย และในประเทศมาเลเซีย

Taxa	Locations			
	Thailand[1]	Southern Thailand[2]	Eastern Thailand	Malaysia[3]
Bostrichinae				
Apoleon edax	/	-	-	-
Heterobostrychus aequalis	/	/	/	/
Heterobostrychus pileatus	/	-	-	-
Heterobostrychus unicornis	/	-	-	-
Sinaxylon ruficorne	/	-	-	-
Sinoxylon anale	/	/	/	/
Sinoxylon unidentatum	-	/	/	/
Xylopsocus capucinus	-	/	/	/
Xylopsocus ensifer	-	-	-	/
Xylothrips flavipes	/	/	/	/
Dinoderinae				
Dinoderus bifoveolatus	-	-	-	/
Dinoderus minutus	-	/	/	/
Lyctinae				
Cephalotoma tonkinea	-	/	-	-
Lyctoderma coomani	-	-	/	-
Lyctoxylon dentatum	-	/	/	-
Lyctus africanus	/	-	/	-
Lyctus brunneus	-	-	-	/
Lyctus tomentosus	-	-	/	-
Minthea reticulata	-	/	/	/
Minthea rugicallis	-	-	-	/

[1]/ Hutacharern และ Tabtim (1995) [2]/ Sittichaya และคณะ (unpublished) [3]/ Ho และ Hashim (1997) และ Hussein (1981)

ตารางภาคผนวกที่ 2 มอดเอมโบรเซีย (Ambrosia beetles) ที่รายงานเข้าทำลายไม้ยางพาราในพื้นที่ภาคใต้และภาคตะวันออกของไทย และในประเทศมาเลเซีย

Taxa	Locations		
	Southern Thailand	Eastern Thailand	Malaysia
Platypodinae			
Crossotarsus externedentatus	/	-	*
Crossotarsus wallacei	-	-	*
Dinoplatypus cupulatus	/	-	*
Dinoplatypus pseudocupulatus	/	-	*
Euplatypus parallelus	/*	/*	-
Platypus insularis	-	-	*
Platypus lucasi	-	-	*
Platypus solidus	-	-	*
Platypus westwoodi	-	-	*
Scolytinae	-	-	-
Arixyleborus malayensis	-	/	-
Dactilipalpus transversus	-	-	*
Eccopteropterus sexspinosus	-	/	*
Eccoptopterus spinosus	-	/	-
Euwallacea fornicatus	/	-	*
Euwallacea interjectus	/	-	*
Hypothenemus areccae	/	-	-
Hypothenemus birmanus	/	-	-
Hypothenemus eruditus	/	/	-
Hypothenemus parvulus	-	-	*
Hypothenemus setosus	-	-	/
Xyleborinus exiguus	-	/	-
Xyleborus affinis	/	/	-
Xyleborus parvulus	-	-	*
Xyleborus perforans	/	-	*
Xyleborus similis Ferrari	/	-	*
Xylosandrus crassiusculus	-	/	-
Xylosandrus mancus	-	/	-

/ แสดงชนิดของมอดเข้าทำลายไม้ยางพาราแปรรูป

* แสดงชนิดของมอดเข้าทำลายไม้ยางพาราท่อนบนลานไม้

ตารางภาคผนวกที่ 3 แสดงการคำนวณค่าดัชนีความหลากหลายทางชีวภาพของ Shanon-Weiner Index และดัชนีความสม่ำเสมอของการแพร่กระจายของชนิด (Shanon-Evenness Index) ของมอดทำลายไม้ยางพาราในพื้นที่ภาคตะวันออกรวมจังหวัดชุมพร

No.	Taxa	n	pi	ln(pi)	(pi)(lnpi)
1	*Heterobostrychus aequalis*	170	0.125	-2.083	-0.259
2	*Sinoxylon anale*	320	0.234	-1.451	-0.340
3	*Sinoxylon conigerum*	554	0.406	-0.902	-0.366
4	*Xylothrips flavipes*	2	0.001	-6.526	-0.010
5	*Dinoderus minutus*	160	0.117	-2.144	-0.251
6	*Lyctoxylon dentatum*	2	0.001	-6.526	-0.010
7	*Lyctus africanus*	1	0.001	-7.219	-0.005
8	*Lyctus tomentosus*	36	0.026	-3.635	-0.096
9	*Minthea reticulata*	26	0.019	-3.961	-0.075
10	*Lyctoderma coomani*	2	0.001	-6.526	-0.010
11	*Crossotarsus externedentatus*	20	0.015	-4.223	-0.062
12	*Euplatypus parallelus*	15	0.011	-4.511	-0.050
13	*Hypothenemus eruditus*	2	0.001	-6.526	-0.010
14	*Arixyleborus malayensis*	1	0.001	-7.219	-0.005
15	*Eccoptopterus spinosus*	4	0.003	-5.833	-0.017
16	*Xyleborinus exiguus*	1	0.001	-7.219	-0.005
17	*Xyleborus affinis*	37	0.027	-3.608	-0.098
18	*Xyleborus perforans*	3	0.002	-6.120	-0.013
19	*Xyleborus similes* Ferrari	7	0.005	-5.273	-0.027
20	*Xylosandrus crassiusculus*	1	0.001	-7.219	-0.005
21	*Xylosandrus mancus*	1	0.001	-7.219	-0.005
					H = 1.72
			S=21	**N=1365**	**E = 0.56**

ตารางภาคผนวกที่ 4 แสดงการคำนวณค่าดัชนีความหลากหลายทางชีวภาพของ Shanon-Weiner Index และดัชนีความสม่ำเสมอของการแพร่กระจายของชนิด (Shanon-Evenness Index) ของมอดทำลายไม้ยางพาราในพื้นที่ภาคตะวันออกไม่รวมจังหวัดชุมพร

No.	Taxa	n	pi	ln(pi)	(pi)(lnpi)
1	*Heterobostrychus aequalis*	168	0.1417	-1.9544	-0.2768
2	*Sinoxylon anale*	235	0.1981	-1.6188	-0.3207
3	*Sinoxylon conigerum*	554	0.4671	-0.7612	-0.3556
4	*Xylothrips flavipes*	2	0.0017	-6.3852	-0.0108
5	*Dinoderus minutus*	151	0.1273	-2.0611	-0.2624
6	*Lyctoxylon dentatum*	2	0.0017	-6.3852	-0.0108
7	*Lyctus africanus*	1	0.0008	-7.0783	-0.0060
8	*Lyctus tomentosus*	36	0.0304	-3.4948	-0.1061
9	*Minthea reticulata*	26	0.0219	-3.8202	-0.0837
10	*Lyctoderma coomani*	2	0.0017	-6.3852	-0.0108
11	*Euplatypus parallelus*	1	0.0008	-7.0783	-0.0060
12	*Hypothenemus eruditus*	2	0.0017	-6.3852	-0.0108
13	*Arixyleborus malayensis*	1	0.0008	-7.0783	-0.0060
14	*Eccoptopterus spinosus*	4	0.0034	-5.6920	-0.0192
15	*Xyleborus affinis*	1	0.0008	-7.0783	-0.0060
			S = 15	**N=1186**	**H = 1.49**
					E = 0.55

ตารางภาคผนวกที่ 5 แสดงการคำนวณค่าดัชนีความหลากหลายทางชีวภาพของ Shanon-Weiner Index และดัชนีความสม่ำเสมอของการแพร่กระจายของชนิด (Shanon-Evenness Index) ของมอดทำลายไม้ยางพาราในพื้นที่ภาคใต้

No.	Taxa	n	pi	ln(pi)	(pi)(lnpi)
1	*Heterobostrychus aequalis*	234	0.1424	-1.9490	-0.2776
2	*Sinoxylon anale* Lesne	235	0.1430	-1.9447	-0.2782
3	*Sinoxylon conigerum*	280	0.1704	-1.7695	-0.3016
4	*Xylothrips flavipes*	118	0.0718	-2.6336	-0.1891
5	*Xylopsocus capucinus*	150	0.0913	-2.3936	-0.2185
6	*Dinoderus minutus*	45	0.0274	-3.5976	-0.0985
7	*Lyctoxylon dentatum*	155	0.0943	-2.3609	-0.2227
8	*Minthea reticulata*	81	0.0493	-3.0098	-0.1484
9	*Cephalotoma tonkinea*	7	0.0043	-5.4584	-0.0233
10	*Euplatypus parallelus*	180	0.1096	-2.2113	-0.2423
11	*Xyleborus perforan*	119	0.0724	-2.6252	-0.1901
12	*Xyleborus affinis*	39	0.0237	-3.7407	-0.0888
			S=12	**N=1643**	**H= 2.28**
					E = 0.92

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Rubberwood-destroying beetles in the eastern and gulf areas of Thailand (Coleoptera: Bostrichidae, Curculionidae: Scolytinae and Platypodinae)

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ABSTRACT

Beetles boring in the wood of cut rubber trees (*Hevea brasiliensis* Muell. Arg.) at sawmills in the eastern region of Thailand and the area around the Gulf of Thailand were investigated. Ten species of powder post beetles in the family Bostrichidae, and eleven species of bark and ambrosia beetles belonging to the curculionid subfamilies Platypodinae and Scolytinae were captured. *Sinoxylon unidentatum (F.)* and *Sinoxylon anale* Lesne (Bostrichidae) were the dominant species in air-dried and seasoned rubberwood sawn timber, while *Euplatypus parallelus* (Fabricius) (Platypodinae) was the dominant species in piled rubberwood logs. *Lyctoderma coomani* Lesne and *Lyctus tomentosus* Reitter (Bostrichidae: Lyctinae) are recorded for the first time from Thailand.

Keywords: *Hevea brasiliensis*, rubberwood borers, powder post beetles, ambrosia beetles

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INTRODUCTION

Rubber (*Hevea brasiliensis* Muell. Arg.) forms the major non-forest tree plantations in Thailand, with around 2.46 million hectares devoted to this purpose, mainly in southern Thailand (1.78 million hectares). The north-eastern, eastern and northern parts of Thailand have 0.35, 0.27 and 0.06 million hectares respectively (Rubber Research Institute of Thailand, 2006). The trees are initially grown for rubber tapping, but after 25-30 years a decline in latex production makes further tapping of the trees uneconomic. The trees are then removed and replaced with new seedlings (FAO, 2000). Previously the felled rubber trees were burned as fuel wood in various industries, but since the mid-1980s rubberwood has become one of the most popular timbers for making furniture, furniture components, wood panelling and other wood-based products (FAO, 2000; Hong, 1996). Rubberwood is now an important timber resource not only in Thailand but also in other South and Southeast Asian countries, such as Malaysia, Indonesia, India and Sri Lanka (Edwin and Pillai, 2004; Hong, 1996; Royal Forest Department of Thailand, 2005). Rubberwood production is estimated in Thailand at about 8 million m^3 per year. About 85% of this (6.73 m^3/yr.) is used in Thailand, and the remaining 15% (1.27 m^3/yr.) is exported, mainly to China, Hong Kong and Malaysia (FAO, 2000; Royal Forest Department of Thailand, 2006)

Rubberwood is a nondurable wood, and is very susceptible to fungi, wood borers and termites (CIRAD, 2003; Wong et al., 2005). Insect borers (Bostrichidae, Curculionidae: Platypodinae and Scolytinae) attack the wood at all stages from log to seasoned wood and finished products (Findlay, 1985). These insects can be divided into two groups, ambrosia beetles and powder post beetles, depending on their biology and the properties of the infested wood. The fungus-eating ambrosia beetles, belonging to the subfamilies Scolytinae and Platypodinae, prefer high moisture wood (Beaver, 1989; Farrell et al., 2001) such as rubberwood logs and unseasoned sawn timber. The powder post beetles of the families Bostrichidae prefer wood with high starch content (Akhter, 2005; Allen, 2005; Creffield, 1991, Peters, et al. 2002) with relatively low moisture, or dried wood (Cookson, 2004; Gerberg, 1957; Ivie, 2005) such as seasoned timber and wood artefacts.

In Malaysia, Browne (1961), Hussein (1981), and Ho and Hashim (1997) reported sixteen species of ambrosia beetles, eight each in the subfamilies Scolytinae and Platypodinae, infesting felled trees and unseasoned rubberwood, while nine powder post beetles (Bostrichidae) and one ambrosia beetle (Scolytinae) infested seasoned sawn timber. In India, according to Nair (2007), Mathew (1982) reported six powder post beetles infested stored rubberwood sawn timber. In Thailand, Kamnerdratana et al. (1970) reported two powder post beetles, *Sinoxylon anale* Lesne and *S. crassum* Lesne, infesting rubberwood logs in southern Thailand. Hutacharern and Tubtim (1995) reported eleven powder post beetles and one platypodid ambrosia beetle infesting rubber wood, namely *Apoleon edax* Gorham, *Dinoderus* sp., *Heterobostrychus aequalis* (Waterhouse), *H. pileatus* Lesne, *H. unicornis* Waterhouse, *Sinoxylon anale* Lesne, *S. ruficorne* Fahraeus, *Xylothrips flavipes* (Illiger), *Lyctus africanus* Lesne, *Lyctus* sp., *Minthea rugicollis* (Walker), and one ambrosia beetle, *Platypus piniperda* Schedl. Sittichaya et al. (in press) reported seven bostrichids infesting rubberwood sawn timber in southern Thailand, *H. aequalis*, *Sinoxylon anale*, *S. unidentatum* (F.) (=*S.conigerum* Gerstaecker), *Xylothrips flavipes* Illiger, *Cephalotoma tonkinea* Lesne, *Lyctoxylon dentatum* (Pascoe), and *Minthea reticulata* Lesne. An older study found that powder post beetles of the genera *Sinoxylon* and *Heterobostrychus* were the dominant rubberwood destroying pests in Thailand (Lekuthai, 1981).

MATERIALS AND METHODS

The study was conducted mainly in rubber sawmills in four eastern provinces (Trat, Chantaburi, Rayong and Chonburi) of Thailand, and in Samutsongkram Province just west of this area; some samples from a province in the southern area of Thailand, Chumporn, where an earlier study was conducted (Sittichaya et al., in press) are also included. The locations of the study sites are shown in Figure 1. The entire Gulf of Thailand area from May to October is under the influence of the southwest monsoon, which brings westerly winds and high rainfall during these six months. The average annual rainfall is 2,300 mm, and the mean annual temperature is 26-29°C, warmest in April and coolest in January (Thai Meteorological Department, 2007).

Two rubberwood sawmills in different districts of each selected province were randomly selected for examination. In each sawmill we looked for two categories of rubberwood pests, those which infect sawn timber and those which infest piled lumber. For the first category, in each sawmill ten rubberwood sawn timbers 5x100x3 cm^3 or equivalent volume, which were already infested by wood boring beetles, were examined. For the second category, we inspected piled rubber logs for 15 minutes looking for beetle attacked logs and collected the beetles which were attacking the cut ends of the piled logs. Most logs are left in piles for only 1-4 days before being sawn, and most of the attacking beetles had not yet bored deeply into the wood, and could be easily removed with forceps or chisel. Related data such as the time the rubber logs lay in piles, wood moisture (assessed with a Ligno-Scanner D, Lignomat USA Ltd. USA), sawmill sanitation and the presence of a kiln in the sawmill were noted.

Each wood sample was cut in half transversely and kept in a container to collect the insects which emerged. The container consisted of a cardboard box (25x50x25 cm) with a hole cut in one end to which was attached a silicone tube (50 mm diameter, 50 mm long). A transparent plastic cup (basal diameter 55 mm, 70 mm high), with a fine mesh cover was attached to the tube. Each sample was kept in the container for three months and the emerging, positively phototropic beetles were trapped in the cup. They were collected daily and preserved in 95% ethanol.

The captured insects in the families Bostrichidae and Curculionidae: Scolytinae and Platypodinae were identified by RAB. Bostrichid identifications were checked by Dr. Liu Lan Yu, Department of Entomology, Chung Hsing University, Taiwan or Dr. Jerzy Borowski, Department of Forest Protection and Ecology, Faculty of Forestry, Warsaw Agricultural University, Poland. Photographs of the more important species are shown in Figure 2.

RESULTS

Twenty-one species of wood boring beetles were identified: ten species of Bostrichidae, including two species previously unrecorded in Thailand, *Lyctoderma coomani* Lesne (Bostrichidae: Lyctinae: Trogoxylini) and *Lyctus tomentosus* Reitter (Bostrichidae: Lyctinae: Lyctini), nine species of Scolytinae, two species of Platypodinae. The full species lists for sawn timber and logs, with numbers and percentages of individuals caught, are given in Tables 1 and 2 respectively.

The beetles infesting rubberwood sawn timber were dominated by the powder post beetles, with two dominant species, *Sinoxylon unidentatum* (37.99%) and *Sinoxylon anale* (26.43%), and two sub-dominant species, *Dinoderus minutus* (13.50%) and *Heterobostrychus aequalis* (6.52%) (Table 1). Other members of these families, and ambrosia beetles (Platypodinae and Scolytinae) had only unimportant roles in sawn timber infestation, except in Chumporn province where a high number of ambrosia beetles were captured. In contrast to

the rubber sawn timber, platypodine ambrosia beetles had an important role in the infestation of rubber logs in piles, dominating rubber log infestation with 91.5% of counted insects (Table 2). A high number of one particular invasive species, *Euplatypus parallelus*, was found in most rubber log infestations, with 85.9% of all beetles caught. The shortest exposure times before which the wood was infested by *E. parallelus* were 24 hours in newly sawn timber and 48 hours in piled rubber logs.

New records for Thailand:

***Lyctoderma coomani* Lesne**
(Coleoptera: Bostrichidae: Lyctinae: Trogoxylini)
Material examined: 2 adults: Thailand: Rayong Province, Krang District, 14.v.2008. W. Sittichaya. Recorded distribution: Vietnam (neighbourhood of Hoa Binh) (Lesne, 1932). Only the type series of three specimens was previously recorded. The specimens have been compared with photographs taken by L-Y. Liu of a syntype in the Muséum National d'Histoire Naturelle in Paris, and with specimens or photographs of the three other species of *Lyctoderma*. The species, with its small size and strongly flattened form, is probably a commensal in the galleries of other larger bostrichid species (Lesne, 1932).

***Lyctus tomentosus* Reitter**
(Coleoptera: Bostrichidae: Lyctinae: Lyctini)
Material examined: 29 adults: Thailand: 6 Adults, Rayong Province, Wang Chan District, 14.v.2008. W. Sittichaya. 23 Adults, Samut Songkhram Province, Mueang District, 15.v.2008. W. Sittichaya. Recorded distribution: Central America (Mexico, Guatemala).
Specimens have been compared by L-Y.Liu to specimens identified by Lesne and Vrydagh in the Paris Museum. The types appear to have been lost (L-Y.Liu, pers. comm. 2008).
The species is very similar to *Lyctus caribeanus* Lesne but can be distinguished by the following characters: At the base of the elytra, *L.caribeanus* has small punctures which are not separated by rugosities; in *L.tomentosus*, the punctures are large and separated by fine rugosities. In *L.tomentosus*, the vestiture is dense and of only one type of hairs - broad and white; in *L.caribeanus* the vestiture is a little less dense, and there are two types of hairs, one is short and thick and more abundant in 2-3 rows along the interstriae, the other is long and fine, and much less abundant amongst the thicker hairs.

DISCUSSION

The findings regarding bostrichid wood boring beetles from this study are more similar to the results of a recent study by Sittichaya et al. (in press) than earlier reports by Kamnerdratana et al. (1970) and Hutacharern and Tubtim (1995). Only four species, namely, *H.aequalis, S. anale, X.flavipes* and *L.africanus* were also included in the reports of Kamnerdratana et al. (1970) and Hutacharern and Tubtim (1995); other species including all the ambrosia beetles are reported here for the first time as rubberwood pests from Thailand. The powder post beetles destroying rubberwood found in this study were similar to reports from Malaysia (Ho and Hashim, 1997; Hussein, 1981), except that *Dinoderus bifoveolatus* (Wollaston), *Xylopsocus ensifer* Lesne and *Minthea rugicollis* (Walker) were not found.

The powder post beetles belonging to the family Bostrichidae are the dominant insect pest of rubberwood sawn timber. This result agrees with reports of insects infesting seasoned and dry rubber sawn timber in India (Nair, 2007) and Malaysia (Ho and Hashim, 1997; Hussein; 1981). The rubberwood sawn timber in sawmills of the studied areas, which is available for beetles as a food source, is generally air dried or seasoned but otherwise

untreated dry wood, which has been shown to be very suitable for powder post beetle infestation. (Akhter, 2005; Allen, 2005; Cookson, 2004; Creffield, 1991; Ivie, 2005; Peters et al, 2002). The exception was Chumporn province in southern Thailand, where high-moisture air dried pallet-wood is the normal way of storing wood, and where a high number of ambrosia beetles were captured. The moisture of this pallet wood was high enough (59%) for fungi associated with beetles to infest the pile also (Allen, 1995; Kobayashi et al., 2005). The preference of wood boring beetles for different rubberwood usage-stages was the same in this study as in previous reports (Browne, 1961; Hussein, 1981; Hutacharern and Tubtim, 1995; Nair, 2007). Ambrosia beetles prefer to infest unseasoned or partly seasoned rubber sawn timber, whilst powder post beetles prefer seasoned rubber sawn timber. The results show that two species in the genus *Sinoxylon* (*S.unidentatum, S.anale)* are dominant in destroying air dried and seasoned sawn timber in the eastern region and areas around the Gulf of Thailand, a result slightly different from previous reports from Thailand and Malaysia. Lek-utai (1981) and Ho and Hashim (1997) reported that the dominant rubberwood-destroying species in Thailand were from the genus *Heterobostrychus,* but in this study we found only *H.aequalis*, and then only in lower numbers.

The sawn timbers in sawmills in the study sites were primarily seasoned and preserved wood, which is immune to wood borer infestation. The woods which were susceptible to insect infestation were lower quality air dried or seasoned but untreated wood. The supply of this food source determined the number of insects found in each sawmill. The results from this survey showed that a good sanitary program in sawmills can prevent the accumulation of wood borers in each sawmill due to lack of breeding materials. Sawmills with kilns had a lower infestation rate, because in such mills the wood had only a short exposure to insect infestation, and the wood was generally preserved and kiln dried shortly after it was sawn.

The results indicated that *Sinoxylon unidentatum* is dominant in the study area. Surprisingly this insect was first recorded in Thailand in 1999 by Thomas (1999) from specimens intercepted with mango fruits exported to the USA. Previous studies (Kamnerdratana et al., 1970; Hutacharern & Tubtim, 1995) did not report this species. *S. unidentatum* (often recorded as its synonym, *Sinoxylon conigerum* Gerstaecker) is a species which may be of either Oriental or African origin, but is now almost cosmopolitan. It has recently been unintentionally introduced to North and South America. It was first reported in Florida in 1999, and in Brazil in 2006 (Thomas, 1999; Peres Filho, 2006). We believe that this species has been long established and is widely dispersed in Thailand. The results of this study and our previous work show that *Sinoxylon unidentatum*, in common with *S. anale* and *H. Aequalis*, are the major pests of air dried and seasoned rubber sawn timber in Thailand.

Lyctus tomentosus Reitter is a neotropical species which is native to Central America (Gerberg, 1957; Borowski and Wegrzynowicz, 2007). It was probably introduced to Thailand via global shipping and is established in the eastern region and areas surrounding the Gulf of Thailand. It has been found in areas around the main ports of Thailand, Bangkok and Laem Chabang in Chonburi province. In Samutsongkram, near Bangkok, a high number of newly flying adults were captured.

Euplatypus parallelus (Fabricius) is dominant in high moisture rubberwood log infestations in both this study area and in southern Thailand (Sittichaya et al., in press). *E. parallelus* is an extremely polyphagous and pantropical species of neotropical origin, which has recently invaded the Oriental region (Beaver, 1999). It has recently been implicated as an important fungus-wilt disease vector (Boa and Kirkendall, 2004; Bumrungsri et al., 2008; Sanderson, 1997). In Malaysia, Singapore and Southern Thailand, *E. parallelus* is known to be an important insect vector for *Fusarium*-angsana wilt by *Pterocarpus indicus*, currently a

serious disease in this region (Bumrungsri et al., in press; Sanderson, 1997). Our study indicates that this invasive species not only infests living trees but also rubber logs in piles and newly sawn timber. *E. parallelus* was the only species of Platypodinae found in the rubber logs. The reasons for the absence of other species are uncertain.

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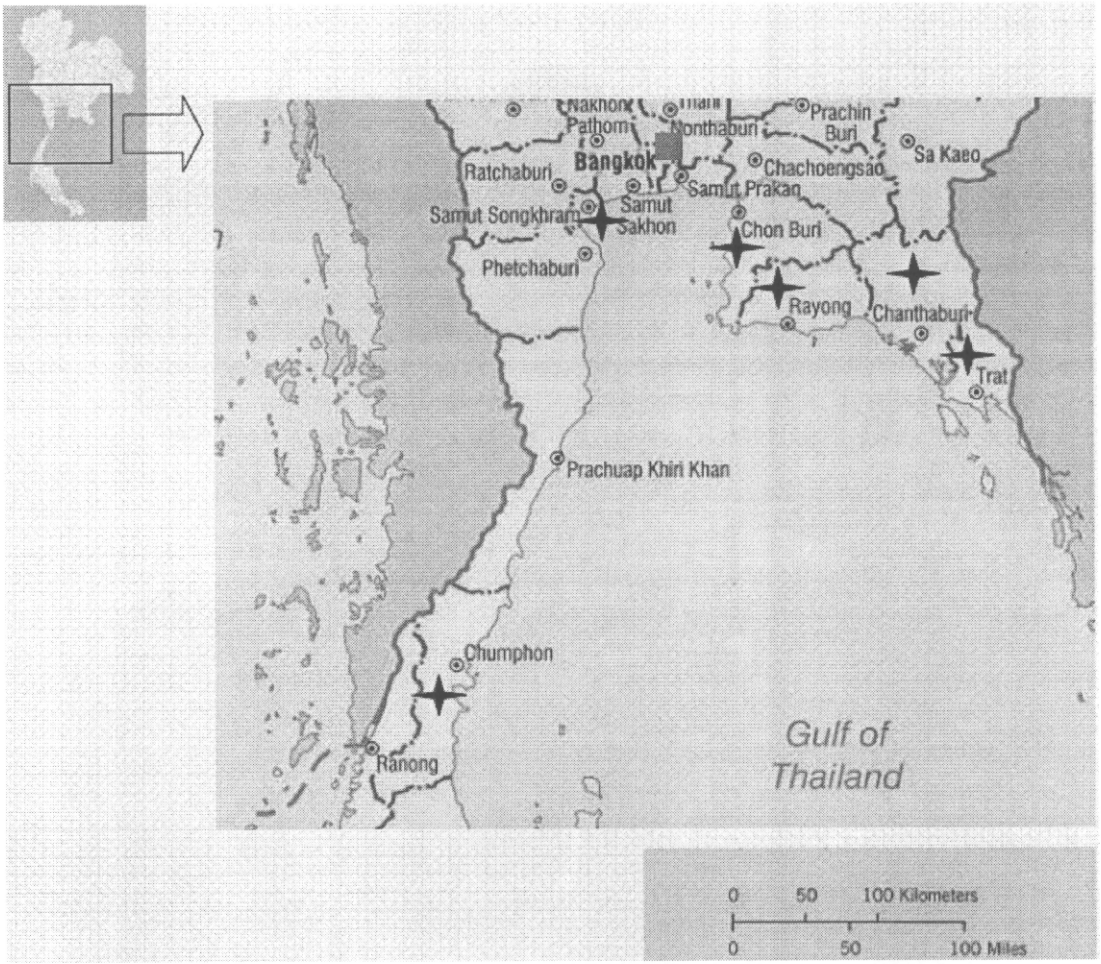

Figure 1 Map of study sites; the investigated provinces are marked with a star; provinces not investigated have no rubber plantations or rubberwood sawmills (modified from U.S. Central Intelligence Agency, n.d.)

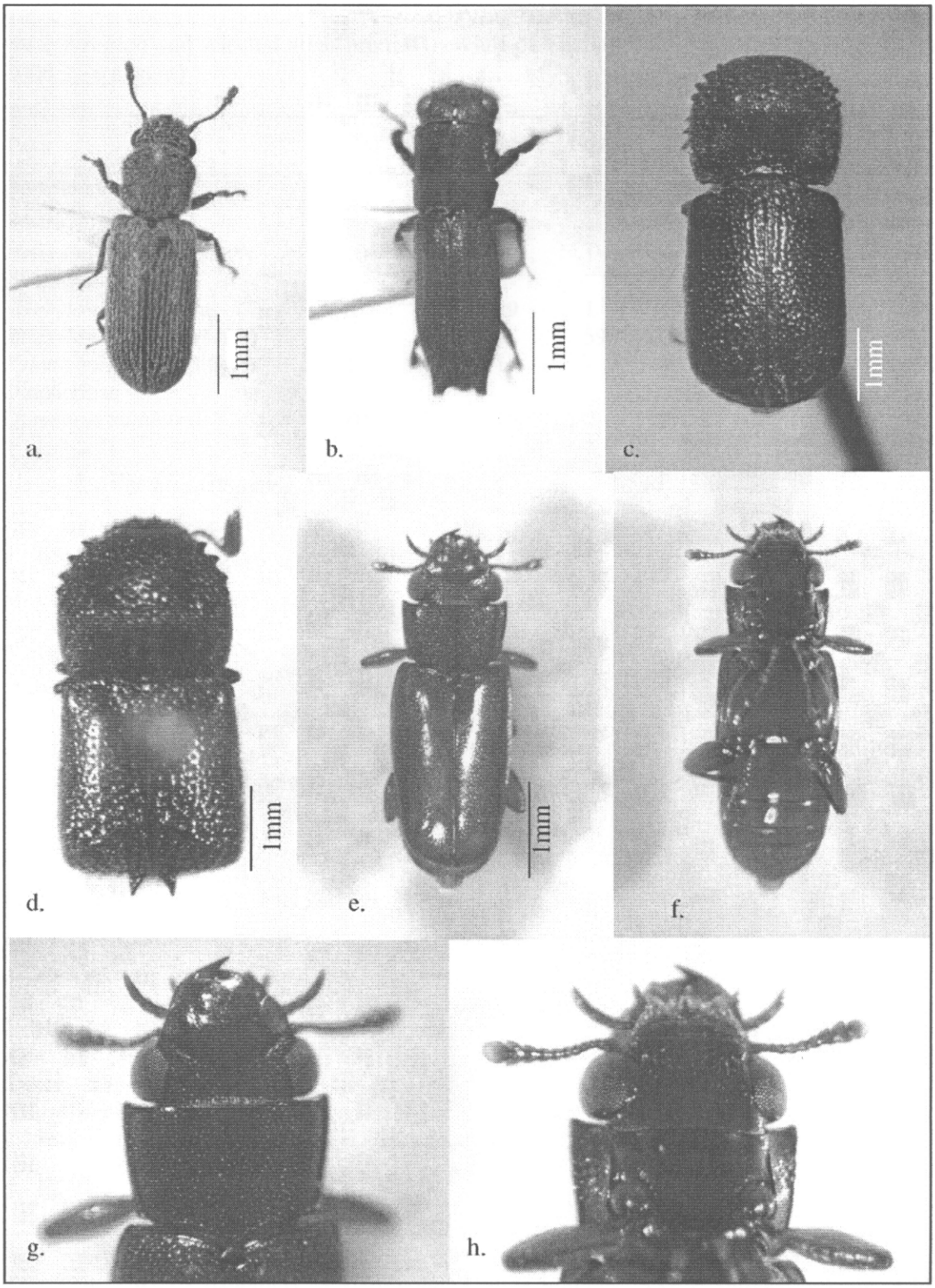

Fig. 2 Wood boring beetles, a. *Lyctus tomentosus*, b. *Euplatypus parallelus*, c. *Sinoxylon unidentatum, d. S. anale, e. Lyctoderma coomani* dorsal view, f. *L. coomani* ventral view, g. *L. coomani*, head and pronotum dosal view, h. *L. coomani* head and pronotum ventral view.

Table 1 Numbers and percentages of wood boring beetles infesting rubber sawn timber in the eastern region and selected areas around the Gulf of Thailand; investigation from 10-18 June 2008. (- = absent)

Taxa	Tr	ChT	RY	CB	SSK	ChP	Total	%
Bostrichidae								
Bostrichinae								
Heterobostrychus aequalis (Waterhouse)	10	1	40	1	5	-	57	6.52
Sinoxylon anale Lesne	87	53	29	1	19	42	231	26.43
Sinoxylon unidentatum (F.)	-	-	7	59	266	-	332	37.99
Xylothrips flavipes (Illiger)	1	-	1	-	-	-	2	0.23
Dinoderinae								
Dinoderus minutus (F.)	80	7	16	2	9	4	118	13.50
Lyctinae								
Lyctoxylon dentatum (Pascoe)	-	-	2	-	-	-	2	0.23
Lyctus africanus Lesne	1	-	-	-	-	-	1	0.11
Lyctus tomentosus Reitter	-	-	6	-	23	-	29	3.32
Minthea reticulata Lesne	11	-	-	-	-	-	11	1.26
Lyctoderma coomani Lesne	-	-	2	-	-	-	2	0.23
Curculionidae								
Platypodinae								
Crossotarsus externedentatus (Fairmaire)	-	-	-	-	-	20	20	2.29
Euplatypus parallelus (Fabricius)	-	-	1	-	-	13	14	1.60
Scolytinae								
Hypothenemus eruditus Westwood	-	-	1	-	-	-	1	0.11
Arixyleborus malayensis (Eggers)	-	-	1	-	-	-	1	0.11
Eccoptopterus spinosus (Olivier)	-	-	4	-	-	-	4	0.46
Xyleborinus exiguus Wood & Bright	-	-	-	-	-	1	1	0.11
Xyleborus affinis Eichhoff	-	-	-	-	-	36	36	4.12
Xyleborus perforans (Wollaston)	-	-	-	-	-	3	3	0.34
Xyleborus similes Ferrari	-	-	-	-	-	7	7	0.80
Xylosandrus crassiusculus (Motschulsky)	-	-	-	-	-	1	1	0.11
Xylosandrus mancus Wood & Bright	-	-	-	-	-	1	1	0.11
totol	190	61	110	63	322	128	874	
%	21.74	6.98	12.59	7.21	36.84	14.65		100

Tr= Trat, ChT= Chantaburi, RY=Rayong, ChB=Chonburi, SSK= Samutsongkram, ChP= Chumporn

Table 2 Numbers and percentages of wood boring beetles infesting rubber logs in piles (-= absent)

Taxa	Tr	ChT	RY	ChB	SSK	ChP	total	%
Bostrichidae								
Minthea reticulate	-	-	4	-	-	-	4	5.63
Xylothrips flavipes	-	2	-	-	-	-	2	2.82
Curculionidae								
Platypodinae								
Crossotarsus externedentatus	-	-	-	-	-	4	4	5.63
Euplatypus parallelus	-	15	24	15	6	1	61	85.92
Total	0	17	28	15	6	5	71	
%	0	23.94	39.44	21.13	8.45	7.04		100

Tr= Trat, ChT= Chantaburi, RY=Rayong, ChB=Chonburi, SSK= Samutsongkram, ChP= Chumporn