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HOST RECORDS FOR TORTRICIDAE (LEPIDOPTERA) REARED FROM SEEDS AND FRUITS IN A THAILAND RAINFOREST

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Abstract.—A survey of insects reared from seeds and fruits in a rainforest in Thailand yielded 337 specimens of Tortricidae representing 16 species. Based on this material, we present host records for the following: *Hilarographa muluana* Razowski complex (Chlidanotini), *Archips machlopis* (Meyrick) (Archipini), *Cryptaspasma brachyptycha* (Meyrick) (Microcorsini), *Collogenes squamosa* (Diakonoff) (Microcorsini), *Gatesclarkeana idia* Diakonoff (Olethreutini), *Helictophanes prospera* (Meyrick) (Olethreutini), *Lobesia aelopa* (Meyrick) (Olethreutini), *Hoplitendemis* sp. A (Olethreutini), *Cryptophlebia rhynchias* (Meyrick) (Grapholitini), *Cryptophlebia ombrodelta* (Lower), *Cryptophlebia* sp. (undetermined) (Grapholitini), *Thaumatotibia* sp. (undetermined) (Grapholitini), *Andrioplecta shoreae* Komai (Grapholitini), *Andrioplecta subpulverula* (Obraztsov) (Grapholitini), *Andrioplecta* (?) species (undetermined) (Grapholitini), and *Cydia* (?) species (undetermined) (Grapholitini). Tortricids were reared from 30 plant species representing 12 plant families, with Sapindaceae and Annonaceae supporting the greatest number of species, seven and six, respectively. Consistent with other surveys of seed- and fruit-feeding tortricids, the tribe Grapholitini represented 50% of the total tortricid species and 73% of the total tortricid specimens in the Thailand survey.

Key Words: *Andrioplecta*, Annonaceae, barcodes, *Cryptophlebia*, Dipterocarpaceae, Fabaceae, Grapholitini, *Hilarographa*, Indo-Australia, Sapindaceae

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Large-scale insect rearing projects conducted in various tropical sites throughout the world, including Kenya (e.g., Copeland et al. 2002, 2009; Miller et al. 2014), New Guinea (e.g., Novotny et al. 2002, Sam et al. 2017), Ecuador (e.g., Bodner et al. 2010, 2012), Costa Rica (e.g., Janzen and Hallwachs 2009, 2016), Thailand (e.g., Basset et al. 2018), Panama (e.g., Gripenberg et al.

2019), and others, have contributed a remarkable amount of new host plant data for many groups of phytophagous insects including the large, and economically important lepidopteran family Tortricidae (e.g., Brown et al. 2014). During a recent three-year survey of seed- and fruit-feeding insects in Thailand (Basset et al. 2019), 1,970 samples were collected representing 39,252 seeds or fruits from 357 liana and tree species (and a few herbs) representing 66 plant families. Among the insects reared were 337 specimens of tortricid moths, representing 16 species. The purpose of this contribution is to present host records for these tortricids in the context of previously recorded larval food plants.

Materials and Methods

Study site.—The survey was conducted on a 24-ha permanent vegetation plot at Khao Chong Botanical Garden (KHC) and surrounding habitat, located in lowland seasonal evergreen rainforest of the Khao Ban Thad Wildlife Sanctuary in southern Thailand. The site supports at least 593 tree species, representing 285 genera and 82 families.

Sampling and rearing.—Methods of seed and fruit collection and insect rearing are detailed by Basset et al. (2019) and can be summarized as follows. In 2013, seeds and fruits were collected from locally abundant tree, shrub, and liana (more rarely herb) species. During 2014 and 2015, sampling was restricted to the 10 most common plant families at KHC: Annonaceae, Arecaceae, Ebenaceae, Euphorbiaceae, Fabaceae, Lauraceae, Meliaceae, Phyllanthaceae, Rubiaceae and Sapindaceae. Seeds and fruits still on plants or freshly fallen (without apparent decomposition) were collected and brought into the laboratory where they were kept under seminatural conditions in pots lined with tissue paper and covered with very fine netting for ventilation and to avoid subsequent colonization and/or contamination. The pots were checked twice a week, and any emerging insects were collected, preserved, and pinned. Seeds and fruits were kept for three months and then dissected to determine the presence of developing larvae. Those with live larvae were retained for an additional rearing period, and the remaining were discarded.

DNA Barcoding.—Tissue samples (one leg of an adult moth) were used to amplify a ~650bp region of the mitochondrial gene cytochrome oxidase I (COI), commonly referred to as the DNA barcode, using standard Sanger sequencing procedures employed at the Biodiversity Institute of Ontario, University of Guelph (Hebert et al. 2003, Craft et al. 2010, Wilson 2012). Barcode Index Numbers (BINs) using the RESL algorithm were used to help delineate species (Ratnasingham and Hebert 2013). Unfortunately, many of the specimens yielded poor or incomplete sequence data owing to their exposure to high humidity. Next-generation sequencing (NGS) (Hebert et al. 2018) yielded significantly improved results for a small sample of these.

Depositories.—Vouchers of adults are deposited in the Thai Department of National Parks, Wildlife and Plant Conservation, Bangkok, Thailand, and the National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA.

Results

The survey yielded 337 specimens of Tortricidae representing 16 species. We recorded tortricids from 30 plant species representing 12 plant families (Table 1). The reared species represent only a small percentage of the tortricid fauna of the site, but likely constitute a reasonable sample of the fruit- and seed-eating members of that fauna. Below we present host records for all specimens that could be identified at least to tribe. Using Sanger sequencing we obtained barcodes for only three species: *Hilarographa muluana* complex (n = 5), *Andrioplecta shoreae* (n = 7), and *Cryptophlebia rhynchias* (n = 7). Using NGS we were able to add two more species: *Hoplitendemis* sp. A (n = 2) and *Helictophanes prospera* (n = 1) (Table 2). Full specimen data (including host plants) for specimens sequenced (including those that failed) and images are available on BOLD (www.boldsystems.org), accessible from the dataset KHCFRUIT using a DOI (dx.doi.org/10.5883/DS-KHCFRUIT). Barcode data are deposited in GenBank (Table 2).

Chlidanotinae: Hilarographini *Hilarographa muluana* Razowski complex

Hilarographini is a small tribe in the primitive tortricid subfamily Chlidanotinae (Regier et al. 2012). The tribe is primarily pantropical in distribution (Heppner 1982), and its foodplants are poorly known. Species of *Thaumatographa* are reported to be internal borers in the stems and cambium of several plant families, including Lauraceae (Diakonoff 1982), Myrsinaceae (Diakonoff and Arita 1981), Pinaceae (Diakonoff and Arita 1981, Heppner 1982, Brown et al. 2008), Rubiaceae (Heppner 1982), and Zingiberaceae (Heppner 1982). *Idiothauma* near *africanum* Walsingham was reared from the fruit of *Maesa lanceolata* (Myrsinaceae) (Brown et al. 2014) in Kenya, and undetermined species of *Hilarographa* have been reared from *Costus* sp. (Costaceae) in Costa Rica (K. Nishida, personal communication), and Loganiaceae and Rubiaceae in Papua New Guinea (Sam et al. 2017). This fairly wide range of host families provides little evidence of host specificity at the tribal or generic levels; the only feature these records have in common is the internal feeding habit.

During the study in Thailand, 44 specimens of *Hilarographa muluana* Razowski complex were reared from three different hosts: *Pseuduvaria rugosa* (n = 40), *Mezzettia parviflora* (n = 3), and *Artabotrys* sp. (n = 1) (all Annonaceae).

The adult and male genitalia of our specimens are identical to those illustrated by Razowski (2009: figs. 29, 30, 80) for *Hilarographa muluana*, which he described from Sarawak. They are also identical to those of a species of *Hilarographa* reared from fruit in Papua New Guinea, listed by Sam et al. (2017) as *Hilarographa* nr *muluana*. However, barcodes show a 3.2% difference between the specimens from Thailand and those from Papua New Guinea; hence, it is uncertain which of these species, if either, is actually *H. muluana*. Therefore, we refer to all of them as "*H. muluana* complex." Specimens from Papua New Guinea were reared from the fruit of *Phrynium macrocephalum* and *P. pedunculatum* (Marantaceae) (Sam et al. 2017).

Tortricinae: Archipini *Archips machlopis* (Meyrick)

Archipini is one of the largest tribes in Tortricidae with over 2000 described species distributed worldwide (Brown 2005, Regier et al. 2012). The vast majority of Archipini are polyphagous leaf rollers, reported from numerous plant families. The occurrence of Archipini on fruit is usually "opportunistic," as larvae

Table 1. Herbivore utilization by host plant.

FAMILY Plant species	Hervibvore	# of specimens
ANNONACEAE		
Artabotrys sp.	*Hilarographa muluana*	3
Mezzettia parviflora	*Hilarographa muluana*	3
Polyalthia cauliflora	*Gatesclarkekana idia*	1
Pseuduvaria rugosa	*Hilarographa muluana*	40
Platymitra siamensis	*Hoplitendemis* species A	1
	Andrioplecta shoreae	1
unidentified Annonaceae sp. 14	*Collogenes squamosa*	1
	Hoplitendemis species	6
	Andrioplecta (?) sp.	1
ARECACEAE		
Arenga pinnata	*Cryptophlebia rhynchias*	1
Calamus godefroyi	*Andrioplecta shoreae*	1
Wodyetia bifurcata	*Cryptophlebia* species	1
CHRYSOBALANACEAE		
Maranthes corymbosa	*Hoplitendemis* species A	5
DIPTEROCARPACEAE		
Dipterocarpus grandiflorus	*Andrioplecta shoreae*	4
	Andrioplecta subpulverula	1
Dipterocarpus sp.	*Andrioplecta shoreae*	1
Parashorea stellata	*Hoplitendemis* species A	1
	Andrioplecta shoreae	47
Shorea roxburghii	*Andrioplecta shoreae*	9
Shorea hypochra	*Andrioplecta shoreae*	3
EUPHORBIACEAE		
Macaranga denticulata	*Andrioplecta shoreae*	3
Ptychopyxis sp. 1	*Thaumatotibia* species	1
	Andrioplecta shoreae	1
FABACEAE		
Entada sp. 1	*Cryptophlebia rhynchias*	59
Millettia atropurpurea	*Cryptophlebia rhynchias*	81
	Andrioplecta shoreae	1
Parkia speciosa	*Cryptophlebia* species	1
LAURACEAE		
unidentified Lauraceae sp. 1	*Cryptaspasma brachyptycha*	2
	Collogenes squamosa	6
	Cryptophlebia rhynchias	2
	Andrioplecta (?) species	7
MELIACEAE		
Aglaia sp. 14	*Andrioplecta shoreae*	1
Synoum glandulosum	*Helictophanes prospera*	1
MYRTACEAE		
Syzygium sp. 8	*Archips machlopis*	1
Syzygium sp. 3	*Hoplitendemis* species A	17
PHYLLANTHACEAE		
Baccaurea polyneura	*Hoplitendemis* species A	1

Table 1. Continued.

FAMILY Plant species	Hervibvore	# of specimens
RHAMNACEAE		
Ziziphus angustifolius	*Hoplitendemis* species A	1
SAPINDACEAE		
Lepisanthes rubinigosa	*Lobesia aelopa*	5
	Cryptophlebia ombrodelta	5
	Cryptophlebia species	6
Nephelium lappaceum	*Hoplitendemis* species A	1
Xerospermum noronhianum	*Gatesclarkeana idia*	1
	Andrioplecta shoreae	1
	Thaumatotibia species	1
UNKNOWN FAMILY		
Unknown host	*Cryptophlebia rhynchias*	6

feeding on leaves may also feed on adjacent fruit.

In the Thailand study a single specimen of the widespread *Archips machlopis* (Meyrick) (Tuck 1990) was reared from *Syzygium* species 8 (Myrtaceae). Yunus and Ho (1980) reported this moth species from Apiaceae, Bombaceae, Convolvulaceae, Fabaceae, Lauraceae, Liliaceae, Malvaceae, Marantaceae, Oleaceae, Oxalidaceae, Rubiaceae, Rutaceae, Sapindaceae, Theaceae, and few others. Other authors (e.g., Tuck 1990, Bhumannavar et al. 1991, Kuroko and Lewvanich 1993) reported many of the same host families.

Table 2. Specimens successfully sequenced using Sanger and NGS (*) sequencing.

Species	sequence code	# of bp	BIN	GenBank #
Hilarographa muluana complex	KHCSP062-16	603 [0n]	ADA7980	MN036536
Hilarographa muluana compex	KHCSP060-16	668 [0n]	ADA7980	MN036538
Hilarographa muluana complex	KHCSP061-16	668 [0n]	ADA7980	MN036542
Hilarographa muluana complex	KHCSP068-16	624 [0n]	ADA7980	MN036540
Hilarographa muluana complex	KHCSP063-16	651 [0n]	ADA7980	MN036548
**Hoplitendemis* n. sp.	LNAUW4057-18	658 [200n]		MN036551
**Hoplitendemis* n. sp.	LNAUW4058-18	658 [380n]		MN036546
**Helictophanes prospera*	LNAUW4055-18	540 [200n]		MN036549
Andrioplecta shoreae	KHCSP101-16	622 [0n]	ACG1185	MN036543
Andrioplecta shoreae	KHCSP070-16	617 [0n]	ACG1185	MN036550
Andrioplecta shoreae	KHCSP079-16	675 [0n]	ACG1185	MN036541
Andrioplecta shoreae	KHCSP071-16	675 [0n]	ACG1185	MN036535
Andrioplecta shoreae	KHCSP085-16	678 [0n]	ACG1185	MN036547
Andrioplecta shoreae	KHCSP087-16	680 [0n]	ACG1185	MN036539
Andrioplecta shoreae	KHCSP082-16	683 [0n]	ACG1185	MN036555
Cryptophlebia rhynchias	KHCSP077-16	674 [0n]	AAV7917	MN036553
Cryptophlebia rhynchias	KHCSP074-16	675 [0n]	AAV7917	MN036552
Cryptophlebia rhynchias	KHCSP076-16	676 [0n]	AAV7917	MN036537
Cryptophlebia rhynchias	KHCSP073-16	677 [0n]	AAV7917	MN036554
Cryptophlebia rhynchias	KHCSP098-16	677 [0n]	AAV7917	MN036544
Cryptophlebia rhynchias	KHCSP078-16	677 [0n]	AAV7917	MN036556
Cryptophlebia rhynchias	KHCSP099-16	678 [0n]	AAV7917	MN036544

Olethreutinae: Microcorsini
Cryptaspasma and *Collogenes*

Microcorsini includes two genera: the pantropical *Cryptaspasma* Walsingham (37 species) and the Indo-Australian *Collogenes* Meyrick (seven species). The few species of *Cryptaspasma* for which larval hosts have been recorded feed on the hard kernels or large seeds of a variety of different plant families (Brown and Brown 2004, Dugdale et al. 2005, Horak 2006, Gilligan et al. 2011), suggesting that seed morphology rather than plant chemistry determines host choice. At least two species have apparently expanded their host range from native to cultivated plants and are now considered pests: *C. querula* (Meyrick) on *Syzygium* (Myrtaceae) and stone fruits (Rosaceae) in New Zealand (Dugdale et al. 2005) and *C. perseana* Gilligan and Brown on avocado (*Persea americana*; Lauraceae) in Central America (Gilligan et al. 2011). In Kenya, four species of *Cryptaspasma* were reared from fruit of native Apocynaceae, Clusiaceae, Connaraceae, Euphorbiaceae, Myrtaceae, Podocarpaceae, and Rosaceae, with little evidence of host fidelity within species (Brown et al. 2014). Horak (2006) reported *Collogenes loricata* from *Endiandra sieberi* (Lauraceae) in Australia.

Two specimens of a species of *Cryptaspasma* that appears to be *C. brachyptycha* (Meyrick) were reared from unidentified Lauraceae species 1. The adults are in very poor condition, but the male and female genitalia are very similar to those illustrated by Diakonoff (1959) and Horak (2006) for this species. *Cryptaspasma brachyptycha* was reported by Sam et al. (2017) from the fruit of *Cryptocarya depressa* (Lauraceae), *Syzygium amplum* (Myrtaceae), and *Syzygium trivene* (Myrtaceae) in Papua New Guinea. These combined records suggest a preference for Lauraceae (Laurales) and Myrtaceae (Myrtales). Although in different plant orders, trees in these two families are often superficially similar.

We reared seven specimens of *Collogenes squamosa* (Diakonoff) from two different hosts: unidentified Lauraceae sp. 1 (n = 6) and unidentified Annonaceae sp. 14 (n = 1).

Olethreutinae: Olethreutini
Gatesclarkeana idia Diakonoff

Gatesclarkeana includes ten described species restricted to the Indo-Australian region, with host plants recorded for four of the ten. *Gatesclarkeana domestica* has been reared from Fabaceae, Euphorbiaceae, Lauraceae, Theaceae, and Urticaceae (Diakonoff 1973); *G. erotias* from Anacardiaceae, Boraginaceae, Fabaceae, Loranthaceae, Oxalidaceae, Sterculiaceae, Sapindaceae, and Verbenaceae (Fletcher 1921, 1932, Simon Thomas 1962, Diakonoff 1971, 1982); *G. idia* Diakonoff from Euphorbiaceae, Lamiaceae, Malvaceae, Myrtaceae, Theaceae, and Verbenaceae (Diakonoff 1973, Kawabe 1989); and *G. senior* from Euphorbiaceae, Fabaceae, Theaceae, and Verbenaceae (Diakonoff 1968, 1973). In Thailand, *G. idia* (n = 2) was reared from *Polyalthia cauliflora* (Annonaceae) (n = 1) and *Xerospermum noronhianum* (Sapindaceae) (n = 1). Species in this genus show little or no host specificity at the plant family level.

Helictophanes prospera (Meyrick)

Helictophanes includes nine described species ranging from India to Thailand, south to Australia and east to New Caledonia, Guam, and Fiji (Brown 2005). Sam et al. (2017) provided numerous records for six undetermined species of

Helictophanes from Papua New Guinea, where the vast majority were reared from the fruit of Meliaceae, with many fewer records from Malvaceae, Lamiaceae, and Euphorbiaceae. Citing records from Turner (1946), Horak (2006) mentioned that three species have been reared in Australia, once each from Apocynaceae, Euphorbiaceae, and Meliaceae. Most of these plant families are recognized for their considerable pharmacological properties. During the Thailand survey, one specimen of *H. prospera* was reared from *Synoum glandulosum* (Meliaceae).

Although male genitalia are virtually indistinguishable among specimens identified as *H. prospera*, barcodes form two distinct clusters that almost certainly represent two species (>4% difference). Our Thailand specimen clusters with one individual from Vietnam and one from Australia. The second cluster includes two specimens from Papua New Guinea and two from Australia. We are uncertain which cluster is conspecific with the holotype of *prospera*, that is from India.

Lobesia aelopa (Meyrick)

Lobesia is nearly worldwide in distribution, occurring on all continents except Antarctica (Brown 2005). The majority of the species for which host plants are known appear to be polyphagous (e.g., Nasu, 1993, Royals et al. 2018). For example, *Lobesia aelopa* has been recorded from Actinidiaceae, Apocynaceae, Aquifoliaceae. Asteraceae, Ebenaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Malvaceae, Myrtaceae, Rosaceae, Rubiaceae, Rutaceae, Sapindaceae, Sterculiaceae, Theaceae, Ulmaceae, and Vitaceae (e.g., Diakonoff 1982, Kodama 1988, Bae and Komai 1991, Nasu 1993). In Thailand, *Lobesia aelopa* (n = 5) was reared from a single host, *Lepisanthes rubinigosa* (Sapindaceae).

Hoplitendemis species A

Hoplitendemis is a small genus (four described species) that is restricted to Southeast Asia, ranging from Vietnam and Thailand to Java and the Celebes (Brown 2005). The only published life history information was presented by Diakonoff (1973), who described *H. erebodes* from a small series of adults reared from psyllid galls on leaves of *Syzygium* (probably *S. polyanthum*) (Myrtaceae).

During the survey in Thailand, an undescribed species of *Hoplitendemis* (n = 33) was reared from the fruit of eight different hosts: *Syzygium* species 3 (n = 17) (Myrtaceae), unidentified Annonaceae species 14 (n = 6), *Maranthes corymbosa* (Chrysobalanaceae) (n = 5), *Baccaurea polyneura* (Phyllanthaceae) (n = 1), *Nephelium lappaceum* (Sapindaceae) (n = 1), *Parashorea stellata* (Dipterocarpaceae) (n = 1), *Platymitra siamensis* (Annonaceae) (n =1), and *Ziziphus angustifolius* (Rhamnaceae) (n = 1). The male genitalia of our adults match perfectly those illustrated by Pinkaew (2006) for "*Hoplitendemis* sp. A" from Thailand. Like *Andrioplecta* (discussed below), it appears that the larvae of *Hoplitendemis* may be predaceous or phytophagous, potentially a species-specific life history feature.

Olethreutinae: Grapholitini
Cryptophlebia species

Cryptophlebia is a large genus (55 described species) with a pantropical distribution, occurring in Asia, Africa, Australia, and South America, and on many Pacific Islands (Komai 1999). The genus includes several notorious pests of fruit and nuts including the koa seedworm (*Cryptophlebia illepida* (Butler)) and the macadamia or litchi nutborer (*Cryptophlebia ombrodelta* (Lower)). Host plants encompass numerous species in about 15 fruit- and nut-bearing families, with a preponderance of Fabaceae.

During the survey in Thailand, *Cryptophlebia rhynchias* (Meyrick) (n = 149) was reared from five different hosts: *Millettia atropurpurea* (Fabaceae) (n = 81), *Entada* species 1 (Fabaceae) (n = 59), *Arenga pinnata* (Arecaceae) (n = 1), undetermined Lauraceae species 1 (n = 2), and an unknown host (n = 6). *Cryptophlebia rhynchias* was the most commonly reared tortricid during the survey. It previously was reported from Fabaceae (Meyrick 1912, Clarke 1976, Ghesquiere 1940) with a single record on Rosaceae from the rearing files of the late I. F. B. Common (Australian National Insect Collection, Canberra).

In Thailand, *Cryptophlebia ombrodelta* (n = 5) was reared from a single host, *Lepisanthes rubinigosa* (Sapindaceae). This species has been reared numerous times from many different genera of Fabaceae, with a few scattered records of Oxalidaceae (Ho 1985), Polygonaceae (Clarke 1976, Zimmerman 1978), Proteaceae (Zimmerman 1978, Jones 1994, Hung et al. 1998, Horak 2006), Rutaceae (Bradley 1953, Diakonoff 1968, Clarke 1976), and Sapindaceae (Clarke 1976, Zimmerman 1978, Horak 2006). According to CABI (1976), this species is widely distributed throughout southeastern Asia (Japan, India, Sri Lanka, Thailand, Cambodia, Vietnam, Philippines, Indonesia, New Guinea) and northern Australia.

During the study in Thailand, an undetermined species of *Cryptophlebia* (n = 8) was reared from three different hosts: *Lepisanthes rubinigosa* (Sapindaceae) (n = 6), *Wodyetia bifurcata* (Arecaceae) (n = 1), and *Parkia speciosa* (Fabaceae) (n = 1). Our records agree with previously documented findings - species of *Cryptophlebia* have a strong preference for Fabaceae but also feed on the fruit of a wide range of plant families.

Thaumatotibia species

Thaumatotibia includes about 25 described species occurring primarily in the tropical regions of Asia, Australia, and Africa (Komai 1999). The genus includes a number of fruit pests, most notably the false codling moth, *Thaumatotibia leucotreta* (Meyrick). Whereas most species of *Thaumatotibia* appear to be fairly host specific, at least at the family level, *T. leucotreta* has a host range that encompasses 23 different plant families in Kenya alone (Brown et al. 2014).

During the study in Thailand, we reared two specimens of an unidentified species of *Thaumatotibia* from *Ptychopyxis* species 1 (Euphorbiaceae) (n = 1) and *Xerospermum noronhianum* (Sapindaceae) (n = 1). The genitalia of our dissected male are very similar but not identical to those illustrated by Pinkaew (2006) for "*Thaumatotibia* sp. C" from Thailand.

Andrioplecta species

Andrioplecta includes ten species restricted to Southeast Asia (Komai 1992, Brown 2005). According to Komai (1999), the larvae of three related species (i.e., *A. subpulverula* (Obraztsov) *A. shoreae* Komai, and *A. dierli* Komai) bore into the seed or seedlings of *Anisoptera*, *Dipterocarpus*, *Parashorea*, and *Shorea* (all Dipterocarpaceae). Similar findings were reported by Komai (1992) and Nakagawa et al. (2003). Komai (1999) also reported that three other related congeners are entomophagous, with observations of *A. leucodora* (Meyrick) feeding on scale insects on *Pithecellobium* (Fabaceae) (Diakonoff 1968, Komai 1992); *A. pulverula* (Meyrick) feeding on cynipid gall wasp larvae on *Castanea* and *Quercus* (Fagaceae) (Park 1983, Abe 1990, 1995, Komai 1992, Abe and Sanari 1992); and an undescribed species from Malaysia feeding on immatures of Beesoniidae in galls on a species of Dipterocarpaceae (Komai 1999).

During the Thailand survey, *Andrioplecta shoreae* Komai (n = 73) was reared from 12 different hosts: *Parashorea stellata* (Dipterocarpaceae) (n = 47), *Shorea roxburghii* (Dipterocarpaceae) (n = 9), *Dipterocarpus grandiflorus* (Dipterocarpaceae) (n = 4), *Macaranga denticulata* (Euphorbiaceae) (n = 3), *Shorea hypochra* (Dipterocarpaceae) (n = 3), *Aglaia* species 14 (Meliaceae) (n = 1), *Calamus godefroyi* (Arecaceae) (n = 1), *Dipterocarpus* species (Dipterocarpaceae) (n = 1), *Millettia atropurpurea* (Fabaceae) (n = 1), *Platymitra siamensis* (Annonaceae) (n = 1), *Ptychopyxis* species 1 (Euphorbiaceae) (n = 1), and *Xerospermum noronhianum* (Sapindaceae) (n = 1). Although several plant families were documented as hosts, there is a strong preference for Dipterocarpaceae, with 88% of the specimens reared from this family.

One specimen of *Andrioplecta subpulverula* (Obraztsov) was reared from *Dipterocarpus grandifloras* (Dipterocarpaceae) in Thailand.

The survey also resulted in eight specimens of an undetermined species that may represent another species of *Andrioplecta* based on genital morphology, but the generic assignment is uncertain. Although the adult and male genitalia are similar to those of *A. pulverula*, the tiny signa of the female genitalia are dissimilar to those of all *Andrioplecta*. Also, the male has a distinct, dense, rounded patch of short black scales from the posterior margin of the dorsum of abdominal segment III that is absent in other species of *Andrioplecta*, but similar to some species of *Pammene* Hübner [1825]. Specimens were reared from unidentified Lauraceae species 1 (n = 7) and unidentified Annonaceae species 14 (n = 1). The strong preference for Dipterocarpaceae shown by three described species of *Andrioplecta* suggests that this undetermined species may not belong to that genus.

Cydia species

Cydia includes over 100 species distributed worldwide (Brown 2005); however, it is likely that the genus represents a polyphyletic assemblage of species with similarly plesiomorphic genitalia. We reared a single individual of an undetermined species that may represent a species *Cydia*. The larva was reared from the fruit of *Millettia atropurpurea* (Fabaceae).

Discussion

We recorded tortricids from 30 plant species representing 12 plant families (Table 1). Among the families, Sapindaceae was utilized by the greatest number of tortricid species (i.e., seven), but over half of these (i.e., four) were represented by single individuals. The next most utilized family was Annonaceae, with six tortricid herbivores, but again, with four of these represented by single specimens.

Fabaceae produced the greatest number of specimens (n = 142): 140 of *Cryptophlebia rhynchias*, one of *Cryptophlebia* species, and one of *Andrioplecta shoreae*. The next highest total was from Dipterocarpaceae, with 66 individuals, all but one of which is a species of *Andrioplecta*. Hence, plant families that produced the greatest number of individuals hosted very limited herbivore diversity.

From a taxonomic perspective, Hilarographini was represented by a single species that was fairly common (n = 44) and found only on Annonaceae. Archipini, likewise, was represent by a single species, but only a single individual. Members of this tribe are primarily leafrollers and are infrequently encountered on fruit. Two species of Microcorsini were recorded, and as mentioned previously, this tribe appears to be restricted to seeds and fruits with little regard to plant taxonomy/chemistry. Four species of Olethreutini were reared, along with eight species of Grapholitini. Larvae of the last tribe are well known for their fruit-feeding habits, and the tribe includes the most important tortricid fruit pests throughout the world, including codling moth (*Cydia pomonella* (Linnaeus)), false codling moth (*Thamatotibia leucotreata*), Oriental fruit moth (*Grapholita molesta* (Busck)), macadamia nutborer (*Cryptophlebia ombrodelta*), and many others. Hence, it is not surprising that in the Thailand survey, this tribe represented 50% of the total species and 73% of the total specimens. These findings are similar to those reported from surveys of seed- and fruit-feeding tortricids in Kenya (Brown et al. 2014) and Panama (Gripenberg et al. 2019).

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