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Scale insects (Hemiptera: Coccoidea) found on dracaena and ficus plants (Asparagales: Asparagaceae, Rosales: Moraceae) from southeastern Asia

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Scale insects (Hemiptera: Coccoidea) found on dracaena and ficus plants
(Asparagales: Asparagaceae, Rosales: Moraceae) from southeastern
Asia

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Abstract: A collaborative survey of the scale insects (Hemiptera: Coccoidea) found on dracaena and ficus plants in Cambodia, Laos, Thailand and Vietnam conducted in 2015 identified 49 species of scale insects belonging to 36 genera in six families (25 species on dracaena, 42 species on ficus). Of the species of scale insects that have been reported on dracaena and ficus plants in southeastern Asia in the ScaleNet database (Ben-Dov et al. 2015), 32% and 17% were species collected in this survey, respectively. Twenty-three species (47%) of scale insects have been intercepted at Korean ports of entry on imported dracaena and ficus plants from southeastern Asia from 1996 to 2014 (PIS 2015). Additionally, this list of species collected on these plants from exporting countries could be utilized as a basis for possible preventive measures in quarantine and inspection of traded products.

Key words: Cambodia, coccids, *Dracaena*, *Ficus*, Laos, Thailand, Vietnam

Introduction

Scale insects (Hemiptera: Coccoidea) are one of the pest groups commonly transported on plant products by travelers and commercial trade. Many of these species are regularly introduced and dispersed among countries as a consequence of international plant trade. Through these means, they are one of the most successful groups in terms of invading new geographical areas (Pellizzari and Dalla Montá 1997), and an increasing number of species have become cosmopolitan due to such anthropogenic activities.

In Korea, the amount of plant material imported from other countries has increased markedly in recent years. Ornamental plants comprise about 37% of the plants that are imported into Korea (PIS 2015). Shipments of *Dracaena* Vand. ex L. (Asparagaceae) and *Ficus* L. (Moraceae) plants are most frequently imported from southeastern Asia, which has a subtropical and tropical climate, and many of these plants serve as hosts for scale insects. Therefore, researchers and quarantine inspectors need to be aware of which species occur on dracaena and ficus plants from southeastern Asia imported into Korea. In 2015, a collaborative survey was conducted by researchers from Laos and Korea at places such as botanical gardens and public parks in Cambodia, Laos, Thailand and Vietnam, where dracaena and ficus plants are grown. As a result, 49 species of scale insects belonging to 36 genera and six families were identified (Tab. 1).

To date, 25 species and 42 species of scale insects have been found on dracaena and ficus plants, respectively, in these four countries. Based on a 2015 query of the ScaleNet database (Ben-Dov et al. 2015) of all the species of scale insects reported on dracaena and ficus plants in southeastern Asia, 32% and 17% of these species were collected during this survey (Tab. 2–3). Once exotic species of scale insects are introduced and become established in a country, they can be impossible to eradicate, and the collateral environmental and economic implications are substantial as well. Accordingly, a possible preventive measure is required to prevent the introduction of exotic pests into Korea.

This paper provides a list of 49 species of scale insects collected on dracaena and ficus plants from Cambodia, Laos, Thailand and Vietnam.

Materials and Methods

The specimens used in this study were collected from leaves, twigs, roots and fruits of dracaena and ficus plants from January to July 2015. Some of the specimens of the species reported in this paper were mounted on microscope slides in Canada balsam mounting medium for identification and the others were stored in alcohol. The specimens that were studied are deposited in the Collection of Plant Quarantine Technology Center, QIA at Korea. This list presents the identifications of the specimens to species level, depending upon the quality of the sample and the life stage that was collected and the current available taxonomic knowledge of the taxon (Williams and Watson 1988a, 1988b, 1990; Williams 2004; Miller and Davidson 2005; Ben-Dov et al. 2015). Also these publications were used to identify Coccoidea specimens. The taxonomic nomenclature used here for the scale insects follows those in the ScaleNet database (Ben-Dov et al. 2015). The material examined was collected by the following people; Soo-Jung Suh (SS), Sang-Il Gim (SG) and Phokaothong Sykaisone (PS). Photographs were taken using an AxioCam MRc5 camera mounted on a ZEISS Axio Imager M2 Microscope and a Leica M165C microscope with a Delta pix camera.

Results

The following is a list of the scale insects collected on dracaena and ficus plants in Cambodia, Laos, Thailand and Vietnam from the survey conducted in 2015.

List of scale insects

Coccidae

1. *Ceroplastes ceriferus* (Fabricius)

Material examined. Laos: Bolikhamxay, Paksan, 2 ♀, on *Ficus* (leaf), 29-iv-2015, SS; Vientiane Capital, 1 ♀, on *Ficus* (leaf), 1-v-2015, SS; Vientiane Capital, Chanthabouly, 1 ♀, on *Dracaena* (leaf), 27-iv-2015, PS; same locality, 1 ♀, on *Ficus* (leaf), 27-iv-2015, SS; Vientiane Province, Nalao, 3 ♀, on *Ficus* (leaf), 28-iv-2015, SS.

2. *Ceroplastes rubens* Maskell

Material examined. Laos: Bolikhamxay, Paksan, 1 ♀, on *Dracaena* (leaf), 29-iv-2015, SS.

3. *Ceroplastes xishuangensis* Tang and Xie

Material examined. Vietnam: Ho Chi Minh, 5 ♀, on *Ficus* (twig), 6-iii-2015, SG; same locality, 1 ♀, on *Ficus* (leaf), 28-iii-2015, SG.

4. *Coccus hesperidum* Linnaeus

Material examined. Vietnam: Ho Chi Minh, 3 ♀, on *Dracaena* (leaf), 16-iii-2015, SG.

5. *Coccus viridis* (Green)

Material examined. Laos: Vientiane Capital, Chanthabouly, 5 ♀, on *Ficus* (leaf), 27-iv-2015, PS.

6. *Drepanococcus chiton* (Green) (Fig. 1)

Material examined. Laos: Bolikhamxay, Khamkeut, 3 ♀, on *Ficus* (leaf), 30-iv-2015, PS; Vientiane Capital, Sikhottabong, 2 ♀, on *Ficus* (leaf), 27-iv-2015, PS; Vientiane, Naxaythong, 2 ♀, on *Ficus* (leaf), 28-iv-2015, PS.

7. *Milviscutulus mangiferae* (Green)

Material examined. Laos: Champasak, Pakse, 2 ♀, on *Ficus* (leaf), 17-vi-2015, PS; Vientiane Capital, Sikhottabong, 13 ♀, on *Dracaena* (leaf), 27-iv-2015, PS; Xieng Kaung, Paek, 4 ♀, on *Dracaena* (leaf, twig), 14~15-vii-2015, PS; same locality, 14 ♀, on *Ficus* (leaf), 13~15-vii-2015, PS. Thailand: Khon Kaen, 2 ♀, on *Dracaena* (leaf), 6-i-2015, SG.

8. *Paralecanium quadratum* (Green) (Fig. 2)

Material examined. Laos: Bolikhamxay, Khamkeut, 4 ♀, on *Ficus* (leaf), 30-iv-2015, PS.

9. *Parasaissetia nigra* (Nietner) (Fig. 3)

Material examined. Vietnam: Ho Chi Minh, 3 ♀, on *Dracaena* (twig), 15-iii-2015, SG.

10. *Pulvinaria polygonata* Cockerell

Material examined. Laos: Vientiane Capital, Chanthabouly, 2 ♀, on *Ficus* (leaf), 1-v-2015, SS.

Conchaspididae**11. *Conchaspis angraeci* Cockerell**

Material examined. Laos: Vientiane Capital, Sikhottabong, 7 ♀, on *Ficus* (leaf), 27-iv-2015, PS.

Diaspididae**12. *Aonidiella aurantii* (Maskell)**

Material examined. Laos: Attapue, Samakkeexay, 2 ♀, on *Ficus* (leaf), 19-vi-2015, PS; Bolikhamxay, Paksan, 4 ♀, on *Ficus* (leaf), 29-iv-2015, PS; Vientiane Capital, Dansang, 2 ♀, on *Ficus* (leaf), 28-iv-2015, PS; Vientiane Capital, Nalao, 4 ♀, on *Ficus* (leaf), 27-iv-2015, SS; same data, except Vientiane Capital, Sikhottabong, 2 ♀, PS.

13. *Aonidiella inornata* McKenzie

Material examined. Cambodia: Stung Treng, 2 ♀, on *Dracaena* (leaf), 20-i-2015, SG. Vietnam: Ho Chi Minh, 2 ♀, on *Ficus* (leaf), 4-iv-2015, SG.

14. *Aspidiotus destructor* Signoret

Material examined. Laos: Bolikhamxay, Paksan, 5 ♀, on *Ficus* (leaf), 29-iv-2015, SS.

15. *Chrysomphalus bifasciculatus* Ferris

Material examined. Laos: Vientiane Capital, Chanthabouly, 4 ♀, on *Ficus* (leaf), 27-iv-2015, PS; same data, except Vientiane Capital, Sikhottabong, 2 ♀, Vientiane Province, Nalao, 2 ♀, on *Ficus* (leaf), 28-iv-2015, SS.

16. *Chrysomphalus dictyospermi* (Morgan)

Material examined. Laos: Vientiane Capital, Saythany, 3 ♀, on *Ficus* (leaf), 27-iv-2015, PS.

17. *Fiorinia coronata* Williams and Watson (Fig. 4)

Material examined. Laos: Attapue, Samakkeexay, 9 ♀, on *Ficus* (leaf), 19-vi-2015, PS; Vientiane Capital, Chanthabouly, 4 ♀, on *Dracaena* (leaf), 27-iv-2015, SS. Thailand: Nong Kahi, 1 ♀, on *Ficus* (leaf), 7-i-2015, SG.

18. *Gymnaspis ficus* Ramakrishna Ayyar (Fig. 5)

Material examined. Cambodia: Phnom Penh, 6 ♀, on *Ficus* (leaf), 30-iv-2015, SG; same data, except 4 ♀, 28-v-2015.

Notes. The material of this species was identified by Dr. Sadao Takagi (Hokkaido University, Japan).

19. *Hemiberlesia palmae* (Cockerell)

Material examined. Laos: Vientiane Province, Viengkham, 5 ♀, on *Ficus* (leaf), 28-iv-2015, PS.

20. *Lepidosaphes chinensis* Chamberlin

Material examined. Laos: Vientiane Capital, Sikhottabong, 3 ♀, on *Dracaena* (leaf), 27-iv-2015, SS and PS; same data, except 3 ♀, on *Ficus* (leaf), SS; Vientiane Province, Nalao, 2 ♀, on *Dracaena* (leaf), 28-iv-2015, SS. Thailand: Khon Kaen, 2 ♀, on *Dracaena* (leaf), 6-i-2015, SG.

21. *Lepidosaphes laterochitinsa* Green

Material examined. Laos: Attapue, Samakkeexay, 3 ♀, on *Ficus* (leaf), 19-vi-2015, PS; Vientiane Capital, 3 ♀, on *Dracaena* (leaf), 27-iv-2015, SS; same data, except 2 ♀, 1-v-2015; Vientiane Province, Viengkham, 2 ♀, on *Dracaena* (leaf), 28-iv-2015, SS; same locality, 3 ♀, on *Ficus* (leaf), 28-iv-2015, PS. Thailand: Khon Kaen, 5 ♀, on *Dracaena* (leaf), 6-i-2015, SG.

22. *Lepidosaphes tokionis* (Kuwana)

Material examined. Laos: Champasak, Pakse, 3 ♀, on *Ficus* (leaf), 17-vi-2015, PS; Vientiane Province, Nalao, 5 ♀, on *Dracaena* (leaf), 28-iv-2015, SS. Thailand: Khon Kaen, 3 ♀, on *Dracaena* (leaf), 6-i-2015, SG.

23. *Lindingaspis rossi* (Maskell)

Material examined. Laos: Vientiane Capital, 2 ♀, on *Ficus* (leaf), 1-v-2015, SS.

24. *Microparlatoria fici* (Takahashi)

Material examined. Cambodia: Stung Treng, 9 ♀, on *Ficus* (leaf), 20-i-2015, SG. Laos: Champasak, Pakse, 10 ♀, on *Ficus* (leaf), 17-vi-2015, PS; Vientiane Capital, Chanthabouly, 12 ♀, on *Ficus* (leaf), 27-iv-2015, SS. Thailand: Nong Khai, 5 ♀, on *Ficus* (leaf), 7-i-2015, SG. Vietnam: Ho Chi Minh, 9 ♀, on *Ficus* (leaf), 6-iii-2015, SG; same data, except 10 ♀, 8-iii-2015.

25. *Oceanaspidiotus spinosus* (Comstock)

Material examined. Laos: Vientiane Province, Viengkham, 1 ♀, on *Dracaena* (leaf), 28-iv-2015, SS.

26. *Octaspidiotus stauntoniae* (Takahashi)

Material examined Vietnam: Ho Chi Minh, 3 ♀, on *Ficus* (leaf), 7-iii-2015, SG.

27. *Parlatoria pergandii* Comstock

Material examined. Laos: Bolikhamxay, Khamkeut, 3 ♀, on *Ficus* (leaf), 30-iv-2015, PS; Vientiane Capital, Chanthabouly, 3 ♀, on *Ficus* (leaf), 27-iv-2015 (SS); same data, except 4 ♀, on *Dracaena* (leaf); Vientiane Province, Nalao, 5 ♀, on *Ficus* (leaf), 27~28-iv-2015, SS and PS. Thailand: Nong Khai, 4 ♀, on *Ficus* (leaf), 7-i-2015, SG.

28. *Parlatoria proteus* (Curtis)

Material examined. Laos: Bolikhamxay, Khamkeut, 9 ♀, on *Dracaena* (leaf), 30-iv-2015, SS; same data, except 10 ♀, on *Ficus* (leaf), PS; Champasak, Pakse, 8 ♀, on *Dracaena* (leaf), 17~18-vi-2015, PS; same data, except 5 ♀, on *Ficus* (leaf), 17-vi-2015; Vientiane Capital, 8 ♀, on *Dracaena* (leaf), 27-iv-2015, SS; same data, except 7 ♀, 1-v-2015; Vientiane Capital, Chanthabouly, 5 ♀, on *Dracaena* (leaf), 27-iv-2015, SS and PS; same data, except 6 ♀, on *Ficus* (leaf), PS; Vientiane Capital, Sikhottabong, 5 ♀, on *Dracaena* (leaf), 27-iv-2015, PS; Vientiane Province, Nalao, 5 ♀, on *Dracaena* (leaf), 28-iv-2015, SS; same data, except 7 ♀, on *Ficus* (leaf), PS. Thailand: Nong Khai, 5 ♀, on *Ficus* (leaf), 7-i-2015, SG.

29. *Pinnaspis buxi* (Bouché)

Material examined. Laos: Vientiane Capital, 10 ♀, on *Dracaena* (leaf), 1-v-2015, SS; Vientiane Capital, Sikhottabong, 6 ♀, on *Dracaena* (leaf), 27-iv-2015, PS; Vientiane Province, Viengkham, 1 ♀, on *Ficus* (leaf), 28-iv-2015, PS.

30. *Pseudaonidia trilobitiformis* (Green)

Material examined. Laos: Vientiane Capital, Sikhottabong, 2 ♀, on *Ficus* (leaf), 27-iv-2015, PS.

31. *Pseudaulacaspis cockerelli* (Cooley)

Material examined. Laos: Bolikhamxay, Paksan, 16 ♀, on *Ficus* (leaf), 29-iv-2015, SS and PS; Vientiane Province, Nalao, 3 ♀, on *Dracaena* (leaf), 28-iv-2015, SS. Vietnam: Ho Chi Minh, 11 ♀, on *Dracaena* (leaf), 16-iii-2015, SG.

32. *Pseudaulacaspis pentagona* (Targioni-Tozzetti)

Material examined. Laos: Vientiane Capital, Sikhottabong, 12 ♀, on *Ficus* (twig), 27-iv-2015, PS. Vietnam: Ho Chi Minh, 4 ♀, on *Dracaena* (leaf), 14-iii-2015, SG.

33. *Unaspis acuminata* (Green) (Fig. 6)

Material examined. Laos: Bolikhamxay, Khamkeut, 11 ♀, on *Ficus* (leaf), 30-iv-2015, SS and PS; Bolikhamxay, Paksan, 9 ♀, on *Ficus* (leaf), 29-iv-2015, SS and PS; Vientiane Capital, Canthabouly, 5 ♀, on *Ficus* (leaf), 27-iv-2015, SS and PS; Vientiane Capital, Dansang, 2 ♀, on *Ficus* (leaf), 28-iv-2015, PS; same data, except Vientiane Capital, Naxaythong, 7 ♀; Vientiane Province, Nalao, 3 ♀, on *Ficus* (leaf), 28-iv-2015, PS. Thailand: Nong Kaen, 5 ♀, on *Ficus* (leaf), 6-i-2015, SG.

Monophlebidae**34. *Icerya aegyptiaca* (Douglas)**

Material examined. Laos: Vientiane Capital, Chanthabouly, 5 ♀, on *Ficus* (leaf), 27-iv-2015, PS. Vietnam: Ho Chi Minh, 2 ♀, on *Dracaena* (leaf), 13-iii-2015, SG; same data, except 1 ♀, on *Ficus* (leaf), 28-iii-2015.

35. *Icerya seychellarum* (Westwood)

Material examined. Laos: Vientiane Capital, Sikhottabong, 1 ♀, on *Ficus* (leaf), 27-iv-2015, PS.

Pseudococcidae**36. *Dysmicoccus neobrevipes* Beardsley (Fig. 7)**

Material examined. Laos: Bolikhamxay, Paksan, 2 ♀, on *Ficus* (leaf), 29-iv-2015, SS; Vientiane Capital, Chanthabouly, 2 ♀, on *Ficus* (leaf), 27-iv-2015, PS; Vientiane Province, Viengkham, 2 ♀, on *Ficus* (leaf), 28-iv-2015, SS; Xieng Kaung, Paek, 2 ♀, on *Ficus* (leaf), 15-vii-2015, PS. Vietnam: Ho Chi Minh, 2 ♀, on *Dracaena* (leaf, twig), 15-iii-2015, SG; same data, except on *Ficus* (fruit), 30-iii-2015.

37. *Exallomochlus liti* Williams

Material examined. Laos: Vientiane Province, Viengkham, 2 ♀, on *Ficus* (leaf), 28-iv-2015, PS. Vietnam: Ho Chi Minh, 2 ♀, on *Ficus* (twig), 7-iii-2015, SG.

38. *Ferrisia virgata* (Cockerell) (Fig. 8)

Material examined. Laos: Bolikhamxay, Khamkeut, 5 ♀, on *Dracaena* (leaf), 30-iv-2015, SS; Xieng Kaung, Paek, 4 ♀, on *Dracaena* (leaf, twig), 13~15-vii-2015, PS; same data, except 5 ♀, on *Ficus* (leaf, twig). Thailand: Khon Kaen, 5 ♀, on *Dracaena* (leaf), 6-i-2015, SG. Vietnam: Ho Chi Minh, 4 ♀, on *Dracaena* (leaf), 7~8-iii-2015, SG; same data, except 2 ♀, 14-iii-2015; same data, except 4 ♀, 16~17-iii-2015; same data, except 2 ♀, on *Ficus* (leaf), 19-iii-2015; Longan, 3 ♀, on *Dracaena* (leaf), 25-iv-2015, SG.

39. *Maconellicoccus hirsutus* (Green)

Material examined. Vietnam: Ho Chi Minh, 2 ♀, on *Ficus* (twig), 8-iii-2015, SG.

40. *Nipaecoccus viridis* (Newstead)

Material examined. Laos: Vientiane Capital, Sikhottabong, 2 ♀, on *Ficus* (leaf), 27-iv-2015, SS. Vietnam: Ho Chi Minh, 2 ♀, on *Ficus* (leaf), 19-iii-2015, SG.

41. *Paracoccus interceptus* Lit

Material examined. Cambodia: Phnom Penh, 3 ♀, on *Ficus* (leaf), 29-iv-2015, SG. Laos: Xieng Kaung, Paek, 3 ♀, on *Dracaena* (leaf), 13~15-vii-2015, PS; same data, except 12 ♀, on *Ficus* (leaf). Vietnam: Ho Chi Minh, 3 ♀, on *Dracaena* (leaf), 14-iii-2015, SG; Ho Chi Minh, Hong Phat, 2 ♀, on *Ficus* (twig), 12-iii-2015, SG.

42. *Phenacoccus solani* Ferris

Material examined. Cambodia: Phnom Penh, 2 ♀, on *Dracaena* (leaf), 28-v-2015, SG. Laos: Bolikhamxay, Paksan, 2 ♀, on *Dracaena* (leaf), 29-iv-2015, PS.

43. *Phenacoccus solenopsis* Tinsley

Material examined. Laos: Vientiane Capital, Saythany, 2 ♀, on *Ficus* (leaf), 27-iv-2015, PS.

44. *Planococcus minor* (Maskell)

Material examined. Laos: Bolikhamxay, Khamkeut, 2 ♀, on *Dracaena* (leaf), 30-iv-2015, SS; Vientiane Capital, Sikhottabong, 2 ♀, on *Dracaena* (leaf), 27-iv-2015, PS; same data, except 2 ♀, on *Ficus* (leaf); Vientiane Province, Nalao, 2 ♀, on *Ficus* (leaf), 28-iv-2015, PS; Xieng Kaung, Paek, 2 ♀, on *Dracaena* (leaf), 15-vii-2015, PS; same locality, 4 ♀, on *Ficus* (leaf, twig), 14~15-vii-2015, PS. Thailand: Khon Kaen, 2 ♀, on *Dracaena* (leaf), 6-i-2015, SG. Vietnam: Ho Chi Minh, 2 ♀, on *Dracaena* (leaf), 7~8-iii-2015, SG.

45. *Pseudococcus baliteus* Lit

Material examined. Vietnam: Ho Chi Minh, 1 ♀, on *Dracaena* (leaf), 19-iii-2015, SG.

46. *Pseudococcus cryptus* Hempel

Material examined. Thailand: Khon Kaen, Mueang, 2 ♀, on *Ficus* (leaf), 6-i-2015, SG. Vietnam: Ho Chi Minh, 2 ♀, on *Ficus* (leaf), 16-iii-2015, SG; same data, except 1 ♀, 30-iii-2015.

47. *Pseudococcus jackbeardsleyi* Gimpel and Miller

Material examined. Laos: Champasak, 3 ♀, on *Ficus* (leaf), 18-vi-2015, PS. Vietnam: Ho Chi Minh, 2 ♀, on *Dracaena* (leaf), 8-iii-2015, SG; same data, except 2 ♀, 14-iii-2015; same data, except 2 ♀, 17-iii-2015; same locality, 2 ♀, on *Ficus* (leaf), 19-iii-2015, SG; same locality, except 3 ♀, on *Ficus* (twig), 28-iii-2015, SG; Longan, 2 ♀, on *Dracaena* (leaf), 25-iv-2015, SG.

48. *Rastrococcus invadens* Williams

Material examined. Laos: Vientiane Province, Viengkham, 1 ♀, on *Ficus* (leaf), 28-iv-2015, PS.

Rhizoecidae**49. *Ripersiella americanus* (Hambleton) (Fig. 9)**

Material examined. Laos: Vientiane capital, Chanthabouly, 2 ♀, on *Dracaena* (root), 27-iv-2015, SS.

Discussion

Forty-nine species of scale insect belonging to 36 genera in six families are recorded from dracaena and ficus plants grown in Cambodia, Laos, Thailand and Vietnam, based on specimens collected during the Laos-Korea collaborative survey in 2015. The following families form the main groups: Diaspididae (22 species), Pseudococcidae (13 species) and Coccidae (10 species). The other scale insect families are each represented by only one or a few species. Of the 49 species, *Ferrisia virgata* (Cockerell), *Plano-*

coccus minor (Maskell) and *Pseudococcus jackbeardsleyi* Gimpel and Miller are common on dracaena and ficus plants. In addition, heavy infestations of some armored scales such as *Microparlatoria fici* (Takahashi), *Parlatoria proteus* (Curtis) and *Unaspis acuminata* (Green) were found on ficus plants.

Twenty-three species (47%) of scale insects found during this survey were intercepted at Korea ports of entry on imported dracaena and ficus plants from southeastern Asia through 1996 to 2014 (PIS 2015). Of the remaining species, 26 are considered as potentially invasive to Korea, although they have not yet been found on plants imported into Korea. The volume and diversity of ornamental plants imported into Korea has increased markedly, and they often harbor scale insects. In addition, the minute size, cryptic behavior and immature stages such as eggs and crawlers of scale insect species infesting leaves and twigs may not be detected during import inspections. It is inevitable that an increase in the international trade of ornamental plants will lead to an increase in the number of potentially invasive species encountered during inspection. Therefore, a faunistic study of scale insects in exporting countries is considered as the most effective approach to block potentially invasive species.

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Table 1. List of scale insects collected on *Dracaena* and *Ficus* in Cambodia, Laos, Thailand and Vietnam in 2015 [Abbreviations: D, *Dracaena*; F, *Ficus*; IKPE, Interceptions in Korean inspections of imported dracaena or ficus plants from southeastern Asia (1996–2014)].

Family	Species	Collection data				IKPE
		Cambodia	Laos	Thailand	Vietnam	
Coccidae	<i>Ceroplastes ceriferus</i> (Fabricius)		D,F			yes(F)
	<i>Ceroplastes rubens</i> Maskell		D			
	<i>Ceroplastes xishuangensis</i> Tang and Xie				F	
	<i>Coccus hesperidum</i> Linnaeus				D	yes(D,F)
	<i>Coccus viridis</i> (Green)		F			yes(D)
	<i>Drepanococcus chiton</i> (Green)		F			
	<i>Milviscutulus mangiferae</i> (Green)		D,F	D		
	<i>Paralecanium quadratum</i> (Green)		F			
	<i>Parasaissetia nigra</i> (Nietner)				D	
	<i>Pulvinaria polygonata</i> Cockerell		F			
Conchaspidae	<i>Conchaspis angraeci</i> Cockerell		F			
Diaspididae	<i>Aonidiella aurantii</i> (Maskell)		F			yes(D)
	<i>Aonidiella inornata</i> McKenzie	D			F	
	<i>Aspidiotus destructor</i> Signoret		F			yes(F)
	<i>Chrysomphalus bifasciculatus</i> Ferris		F			
	<i>Chrysomphalus dictyospermi</i> (Morgan)		F			
	<i>Fiorinia coronata</i> Williams and Watson		D,F	F		yes(F)
	<i>Gymnaspis ficus</i> Ramakrishna Ayyar	F				
	<i>Hemiberlesia palmae</i> (Cockerell)		F			yes(F)
	<i>Lepidosaphes chinensis</i> Chamberlin		D,F	D		
	<i>Lepidosaphes laterochitnosa</i> Green		D,F	D		yes(D)
	<i>Lepidosaphes tokionis</i> (Kuwana)		D,F	D		yes(D)
	<i>Lindingaspis rossi</i> (Maskell)		F			
	<i>Microparlatoria fici</i> (Takahashi)	F	F	F	F	yes(F)
	<i>Oceanaspidotus spinosus</i> (Comstock)		D			
	<i>Octaspidotus stauntoniae</i> (Takahashi)				F	
	<i>Parlatoria pergandii</i> Comstock		D,F	F		
	<i>Parlatoria proteus</i> (Curtis)		D,F	F		yes(D)
	<i>Pinnaspis buxi</i> (Bouché)		D,F			yes(D)
	<i>Pseudaonidia trilobitiformis</i> (Green)		F			yes(F)
	<i>Pseudaulacaspis cockerelli</i> (Cooley)		D,F		D	yes(D,F)
	<i>Pseudaulacaspis pentagona</i> (Targioni-Tozzetti)		F		D	yes(D)
	<i>Unaspis acuminata</i> (Green)		F	F		
	<i>Icerya aegyptiaca</i> (Douglas)		F		D,F	
	<i>Icerya seychellarum</i> (Westwood)		F			
Pseudococcidae	<i>Dysmicoccus neobrevipes</i> Beardsley		F		D,F	
	<i>Exallomochlus liti</i> Williams		F		F	
	<i>Ferrisia virgata</i> (Cockerell)		D,F	D	D,F	yes(D,F)
	<i>Maconelliococcus hirsutus</i> (Green)				F	yes(F)
	<i>Nipaecoccus viridis</i> (Newstead)		F		F	
	<i>Paracoccus interceptus</i> Lit	F	D,F		D,F	
	<i>Phenacoccus solani</i> Ferris	D	D			
	<i>Phenacoccus solenopsis</i> Tinsley		F			yes(D,F)
	<i>Planococcus minor</i> (Maskell)		D,F	D	D	yes(D,F)
	<i>Pseudococcus balteus</i> Lit				D	yes(F)
	<i>Pseudococcus cryptus</i> Hempel			F	F	yes(F)
	<i>Pseudococcus jackbeardsleyi</i> Gimpel and Miller		F		D,F	yes(D,F)
	<i>Rastrococcus invadens</i> Williams		F			yes(F)
	<i>Rhizoecus americanus</i> (Hambleton)		D			
Rhizoecidae	<i>Rhizoecus americanus</i> (Hambleton)		D			

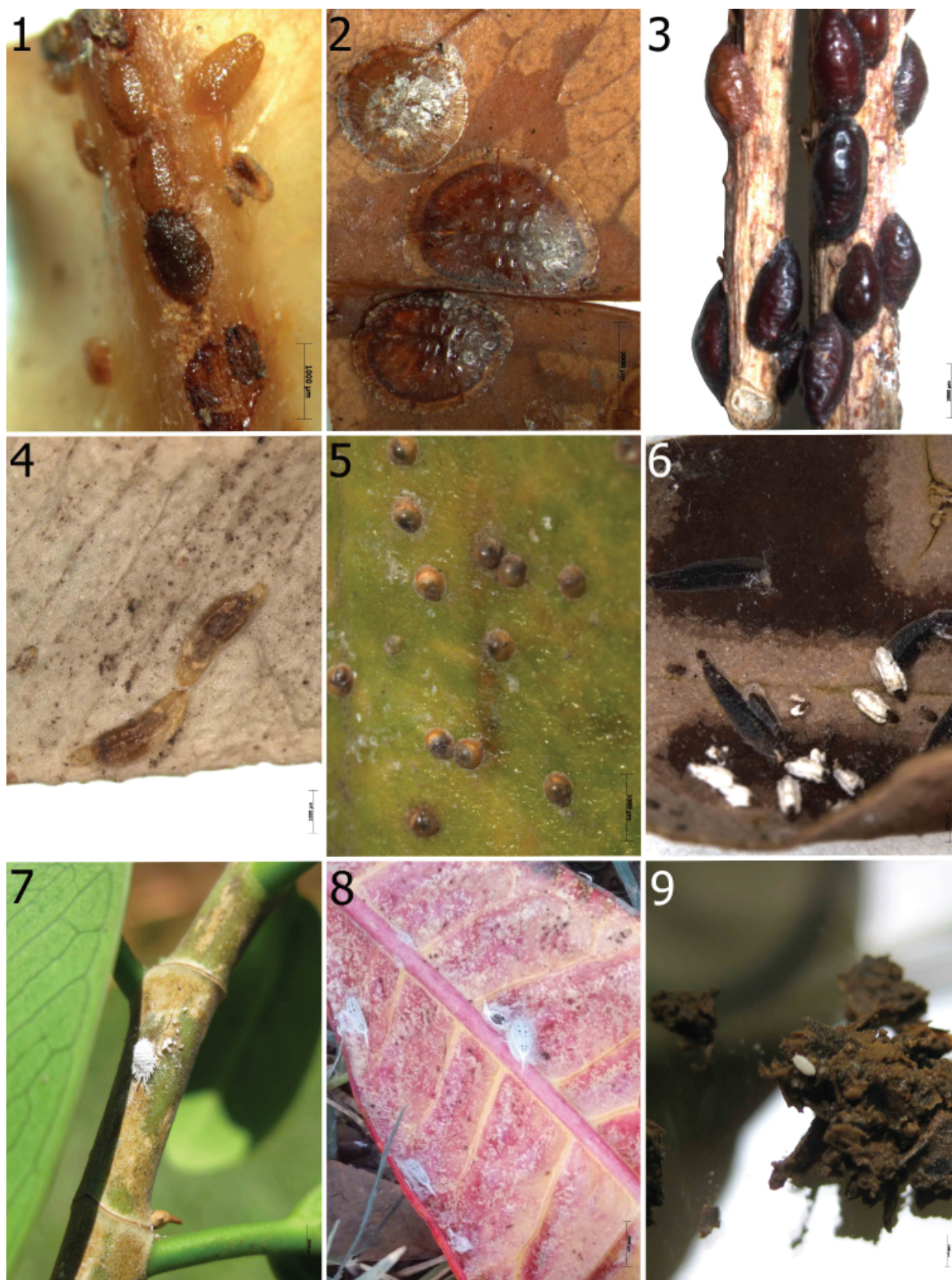
Table 2. Number of species (# sp.) and percent of total number of scale insect species (% sp.) collected on dracaena plants in Cambodia, Laos, Thailand and Vietnam (2015) by family and their distribution in southeastern Asia (SA).

Distribution in SA	Asterolecaniidae	Coccidae	Conchaspidae	Diaspididae	Monophlebidae	Ortheziidae	Pseudococcidae	Rhizoecidae	Total
Recorded in SA (# sp.)	2	11	1	41	1	1	18	3	78
Total # species collected (# sp.)	0	5	0	11	1	0	7	1	25
(% sp.)	0	45	0	27	100	0	39	33	32

Table 3. Number of species (# sp.) and percent of total number of scale insect species (% sp.) collected on ficus plants in Cambodia, Laos, Thailand and Vietnam (2015) by family and their distribution in southeastern Asia (SA).

Distribution in SA	Asterolecaniidae	Cerococcidae	Coccidae	Conchaspidae	Diaspididae	Eriococcidae
Recorded in SA (# sp.)	2	3	43	1	106	4
Total # species collected (# sp.)	0	0	7	1	21	0
(% sp.)	0	0	16	100	20	0

Distribution in SA	Kerriidae	Lecanodiaspididae	Monophlebidae	Pseudococcidae	Rhizoecidae	Total
Recorded in SA (# sp.)	17	2	11	51	4	244
Total # species collected (# sp.)	0	0	2	11	0	42
(% sp.)	0	0	18	22	0	17



Figures 1–9. Some scale insects collected on dracaena and ficus plants in Cambodia, Laos, Thailand and Vietnam. **1)** *Drepanococcus chiton* (Green). **2)** *Paralecanium quadratum* (Green). **3)** *Parasaissetia nigra* (Nietner). **4)** *Fiorinia coronata* Williams and Watson. **5)** *Gymnaspis ficus* Ramakrishna Ayyar. **6)** *Unaspis acuminata* (Green). **7)** *Dysmicoccus neobrevipes* Beardsley. **8)** *Ferrisia virgata* (Cockerell). **9)** *Rhizoecus americanus* (Hambleton).