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A preliminary checklist of scale insects (Hemiptera: Coccoidea) intercepted in Korea on dracaena and ficus plants (Asparagales: Asparagaceae, Rosales: Moraceae) imported from southern Asia

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Abstract. The checklist revealed 40 species of scale insects (Hemiptera: Coccoidea) intercepted at Korean ports of entry on dracaena and ficus plants from southern Asia from 1996 to 2014. Brief diagnostic criteria and related information of the intercepted species are given to assist in the identification of specimens of scale insects intercepted from these plant hosts. Additionally, this preliminary checklist of scale insects could be utilized as a basis for preventive measures in quarantine.

Key words. Invasive species, plant trade, quarantine.

Introduction

Scale insects (Hemiptera: Coccoidea) are sap-sucking insects and occur in every part of the world where plants grow. Therefore they are almost always found associated with plants and are commonly intercepted on imported plant materials. As a result, such species can easily be transported to new areas on the plants which they live via the plant trade. In Korea, the presence of exotic scale insects accompanying plant material from other countries has increased significantly in recent years. Ornamental plants comprise a large part of the plants which are imported; of the ornamental plants imported into Korea from 1996 to 2014, *Dracaena* (Asparagaceae) and *Ficus* (Moraceae) plants together constitute 37% (PIS 2015). Korea imports about 68% of the dracaena and 99% of the ficus plants from southern Asian countries such as Indonesia, Philippines and Malaysia which have subtropical and tropical climates. According to the ScaleNet database (2015), 78 species and 244 species of scale insects have been reported on dracaena and ficus in southern Asia respectively; of which 81% and 84% are not known to occur in Korea and may pose a threat to not only ornamentals but also to agricultural crops and forests if they escape detection and become established. To date, 23 species and 28 species of scale insects have been intercepted at Korean ports of entry on dracaena and ficus plants, respectively (Tab.1-2). Of the species of scale insects reported from dracaena and ficus plants in southern Asia, 29% and 11% were intercepted at Korean ports of entry (Tab. 3-4). The introduction and establishment of exotic species of scale insects could pose a potential threat to Korean agricultural ecosystems. This paper provides a preliminary checklist of 40 species of scale insects intercepted on dracaena and ficus plants from southern Asia imported into Korea during 1996 to 2014.

Materials and Methods

Data for scale insects intercepted on dracaena and ficus plants imported from southern Asia at Korean ports of entry from 1996 to 2014 were extracted from the Pest Information System (PIS) database of Animal and Plant Quarantine Agency (QIA) (PIS, 2015). In this work, China and Taiwan were

included in southern Asia contrary to the traditional concept since the ornamental plants that have been imported into Korea are usually produced in the areas of these countries belonging to the tropical climate zone. This checklist contains the identification of specimens to the level of species depending upon the quality of the sample and the life stage that was intercepted 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). The slide-mounted specimens which were examined are deposited in the collection of the Plant Quarantine Technology Center. Terminology for morphological structures used in the diagnoses follows Williams and Watson (1988a, 1988b, 1990). The taxonomic nomenclature used here for scale insects follows that of the ScaleNet database (Ben-Dov et al. 2015).

Results and Discussion

Coccidae

Ceroplastes ceriferus (Fabricius)

Diagnosis. Adult female wax test (or cover) white to pinkish white, round to oval or irregular in dorsal view, with an anteriorly projecting horn. Mediodorsal clear area absent; ventral tubular ducts present; legs well developed; stigmatic setae arranged in six irregular rows present discontinuously between anterior and posterior stigmatic furrows.

Korea quarantine notes. This species was intercepted four times; Vietnam, China (*Ficus*).

Coccus hesperidum Linnaeus

Diagnosis. Adult female body broadly oval to round, flat to slightly convex in lateral view; body yellow-green to yellow-brown, usually with small brown flecks scattered on dorsum; body turning brown with age. Dorsal setae enlarged, apically acute or slightly rounded, not capitate; ventral tubular ducts present medial between middle legs, with a few near base of hind legs; legs well developed; dorsal submarginal tubular ducts often present around body margin, same size or smaller than ventral ducts; spiracular setae number 3; submarginal tubercles with approximately 10 around body; multilocular pores usually with 10 loculi confined to vulvar area, one or two on abdominal segments VI or VII.

Korea quarantine notes. This species was intercepted four times; Indonesia (*Dracaena*); China (*Ficus*).

Coccus longulus (Douglas)

Diagnosis. Adult female body usually elongate oval; moderately convex in lateral view; body yellow with brown mottling in young females, becoming completely brown at maturity. Dorsal setae short, curved, pointed, scattered over surface; ventral tubular ducts absent; legs well developed with tibiotarsal sclerites; spiracular setae number 3; submarginal tubercles with approximately 10 around body; multilocular pores usually with six to seven loculi confined to vulvar area.

Korea quarantine notes. This species was intercepted once; Malaysia (*Ficus*).

Coccus viridis (Green)

Diagnosis. Adult female body oval to elongate; pale green, slightly transparent, flat to slightly convex; usually with an irregular internal U-shaped gut with black spots. Dorsal setae short, cylindrical to clavate, scattered over surface; ventral tubular ducts present; legs well developed with tibiotarsal

scleroses; spiracular setae number 3; submarginal tubercles with approximately 10 around body; multilocular pores usually with seven loculi present on all abdominal segments.

Korea quarantine notes. This species was intercepted once; Philippines (*Dracaena*).

Saissetia oleae (Olivier)

Diagnosis. Mature adult female dark brown to blackish brown, nearly round to oval, very convex with H-shaped ridges. Dorsal setae robust, spiniform, slightly blunt at apex, scattered over surface; submarginal tubercles with 10 to 12 around body; each anal plate with large discal seta; ventral tubular ducts with slender inner filaments in submarginal band; legs with weak tibiotarsal scleroses; spiracular setae number 3; multilocular pores usually with 12 loculi present on all abdominal segments.

Korea quarantine notes. This species was intercepted twice; Malaysia (*Ficus*).

Diaspididae

Aonidiella aurantii (Maskell)

Diagnosis. Adult female cover brown to blackish brown, flat, circular; shed skins central or subcentral, translucent. Body turbinate with three pairs of well-developed lobes; pores near the spiracles absent; with four conspicuous scleroses associated with apophysis anterolaterad of the vulva; perivulvar pores absent.

Korea quarantine notes. This species was intercepted once; Malaysia (*Dracaena*).

Aonidiella citrina (Coquillett)

Diagnosis. Adult female cover yellow, flat, circular; shed skins central or subcentral, translucent. Body turbinate with three pairs of well-developed lobes; pores near the spiracles absent; with two sclerotized areas associated with apophysis anterolaterad of the vulva; perivulvar pores absent.

Korea quarantine notes. This species was intercepted three times; China (*Ficus*).

Aspidiotus destructor Signoret

Diagnosis. Adult female cover translucent, flat, circular; shed skins central or subcentral, yellow or yellowish brown. Body turbinate with three pairs of well-developed lobes; pores near the spiracles absent; second lobes normally protruding beyond media lobes; about 38 pygidial macroducts on dorsum extending posterior apex of anal opening; perivulvar pores present in 4 groups.

Korea quarantine notes. This species was intercepted once; Taiwan (*Ficus*).

Chrysomphalus aonidum (Linnaeus)

Diagnosis. Adult female cover slightly convex, circular, dark brown to black; shed skins central, reddish brown. Body turbinate with three pairs of well-developed lobes; pores near the spiracles absent; paraphyses conspicuous, most as long as or longer than the length of the median lobes; with one cluster of macroducts on submarginal areas of prepygidial segments; perivulvar pores present in 4 groups.

Korea quarantine notes. This species was intercepted eight times; Indonesia, Philippines, Sri Lanka, China (*Dracaena*); Taiwan (*Ficus*).

***Fiorinia coronata* Williams and Watson**

Diagnosis. Adult female cover pupillarial, scale pale brown, elongate, flat, exuviae terminal. Body wide sub-rectangular, narrowing abruptly to triangular pygidium, with two pairs of lobes; interantennal process present, rounded with spicules; with 2-4 pores each near the anterior spiracles, posterior spiracles without pores; pygidial marginal macroducts on dorsum numbering four pairs; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted twice; Thailand (*Ficus*).

***Hemiberlesia palmae* (Cockerell)**

Diagnosis. Adult female cover round to oval, white; shed skins subcentral, dark. Body round with three pairs of lobes; median lobes well developed, separated by a space equal to the width of one of them; second and third lobes unsclerotized; fringed or branched plates present anterior of lobe III; space between the base of median lobes and posterior of anus shorter than diameter of anus; pores near the spiracles absent; perivulvar pores present in 4 groups.

Korea quarantine notes. This species was intercepted once; Taiwan (*Ficus*).

***Howardia biclavis* (Comstock)**

Diagnosis. Adult female cover white, circular; shed skins subcentral, light brown. Body oval to circular with two pairs of lobes; pores near the posterior and anterior spiracles present; pygidium with an elongate, club-shaped, internal, sclerotized process arising from the base of each median lobes; perispiracular pores present, anterior spiracles with about nine pores each, posterior with about three pores each; perivulvar pores absent.

Korea quarantine notes. This species was intercepted once; Indonesia (*Ficus*).

***Lepidosaphes beckii* (Newman)**

Diagnosis. Adult female cover oyster-shell shaped, slightly to moderately convex, yellowish brown to purplish brown; shed skins marginal, brown. Body elongate fusiform with four pairs of lobes, third and fourth lobes represented by small points; with about five pores each near the anterior spiracles, posterior spiracles without pores; pigmented cicatrices usually on abdominal segments I, II and IV; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted three times; Indonesia, China (*Dracaena*).

***Lepidosaphes laterochitinsa* Green**

Diagnosis. Adult female cover oyster-shell shaped, brown with lighter periphery; shed skins marginal, light brown. Body elongate, fusiform with two defined pairs of lobes, third and fourth lobes represented by series of small points; dorsal submarginal macroducts present on segment seven, distinctly smaller

than other dorsal pygidial macroducts; cuticle of head with numerous tiny spines; with four pores near each anterior spiracles, posterior spiracles without pores; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted 32 times; Indonesia, Malaysia, Philippines, Vietnam, Taiwan (*Dracaena*).

***Lepidosaphes tokionis* (Kuwana)**

Diagnosis. Adult female cover oyster-shell shaped, slightly convex, brown; shed skins marginal, light brown. Body slender, fusiform, pygidium rather broad, trapezoidal with two defined pairs of lobes, third and fourth lobes represented by small points; head lightly sclerotized, expanded laterally to form lobes or projections; with two pores near each anterior spiracles, posterior spiracles without pores; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted four times; Indonesia, China (*Dracaena*).

***Microparlatoria fici* (Takahashi)**

Diagnosis. Adult female cover yellowish brown, elongate oval, convex dorsally; shed skins brown. Body subcircular with three pairs of well-developed lobes; with one pore each near the anterior spiracles, posterior spiracles without pores; about 25 fringed or branched plates present anterior of lobe III; perivulvar pores present in 5 groups, each with four pores.

Korea quarantine notes. This species was intercepted twice; Indonesia, Taiwan (*Ficus*).

***Parlatoria proteus* (Curtis)**

Diagnosis. Adult female cover flat or slightly convex, elongate oval, translucent yellow or brown; shed skins marginal, yellow to light brown with dark longitudinal stripe. Body circular with three defined pairs of lobes; eye spur-like, apically pointed; with three pores near each anterior spiracles, posterior spiracles without pores; dermal pockets present between posterior spiracle and body margin; perivulvar pores present in 4 groups.

Korea quarantine notes. This species was intercepted five times; Malaysia, Vietnam, Taiwan (*Dracaena*).

***Pinnaspis aspidistrae* (Signoret)**

Diagnosis. Adult female cover oyster-shell shaped, light to dark brown; shed skins marginal, yellow to brown. Body elongate, fusiform with two defined pairs of lobes; yoked median lobes closely appressed together, protruding less than or about the same distance as second lobes; preanal sclerosis lacking or represented only by faint sclerotized patches; perispiracles pores present, each anterior spiracles with about 16 pores, posterior spiracles with about four pores; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted twice; Taiwan (*Dracaena*).

***Pinnaspis buxi* (Bouche)**

Diagnosis. Adult female cover oyster-shell shaped, light brown, semitransparent; shed skins marginal, yellow. Body elongate, fusiform with two defined pairs of lobes; yoked median lobes closely appressed together, protruding less than or about the same distance as second lobes; submarginal ducts on dorsum of abdominal segment V absent; perispiracles pores present, each anterior spiracles with about eight pores, posterior spiracles with about two pores; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted once; Sri Lanka (*Dracaena*).

***Pseudaonidia trilobitiformis* (Green)**

Diagnosis. Adult female cover circular brown to dark brown; shed skins subcentral to submarginal, yellowish brown. Body turbinate with four pairs of lobes; dorsum of pygidium with conspicuous areolate pattern; second lobe protruding posteriorly beyond the median lobes; with approximately 15 pores each near the anterior spiracles, posterior spiracles without pores; perivulvar pores arranged in 4 groups.

Korea quarantine notes. This species was intercepted twice; China, Taiwan (*Ficus*).

***Pseudaulacaspis cockerelli* (Cooley)**

Diagnosis. Adult female cover oyster-shell shaped, white; shed skins marginal, yellow to brown. Body elongate fusiform with three pairs of lobes; medial margin of median lobes much longer than the lateral margin; antennae each with one distinct seta usually close together, width between antennae narrower than that between median lobes; with macroducts on abdominal segment VI; with approximately 10 pores near each anterior spiracles, posterior spiracles without pores; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted seven times; China (*Dracaena*, *Ficus*); Indonesia (*Ficus*).

***Pseudaulacaspis pentagona* (Targioni-Tozzetti)**

Diagnosis. Adult female cover circular, white; shed skins subcentral, yellow to light brown. Body oval to turbinate with four pairs of lobes; third space usually with one gland spine, at least one bifurcate or trifurcate gland spine in second, third, or fourth space; antennae with sclerotized projections apically; with about 10 small macroducts on each side of the metathorax and abdominal segment I; with approximately 17 pores near each anterior spiracles, posterior spiracles without pores; perivulvar pores present in 5 groups.

Korea quarantine notes. This species was intercepted twice; Indonesia (*Dracaena*).

***Selenaspidus articulatus* (Morgan)**

Diagnosis. Adult female cover circular, gray to light brown, semitransparent; shed skins subcentral, yellow. Body turbinate with three pairs of lobes; with a distinct indentation between the mesothorax and metathorax; sclerotized spur present at indentation of mesothorax and metathorax; pores near the spiracles absent; perivulvar pores present in two groups; vulva with conspicuous V-shaped flap.

Korea quarantine notes. This species was intercepted once; China (*Ficus*).

Pseudococcidae***Dysmicoccus brevipes* (Cockerell)**

Diagnosis. Body broadly oval; setae on dorsomedial area of abdominal segment VIII longer than on segments VI and VII; ventral multilocular pores restricted to abdominal segments VI, VII and VIII; translucent pores on hind femur and tibia; cerarii numbering 17 pairs; discoidal pores present near eye.

Korea quarantine notes. This species was intercepted twice; Indonesia (*Dracaena*); Malaysia (*Ficus*).

***Dysmicoccus nesophilus* Williams and Watson**

Diagnosis. Body broadly oval; each cerarii on anal lobe conspicuously larger than anal ring; ventral tubular ducts present on abdomen and around margins forward to head; multilocular disc pores present on venter of thorax; translucent pores present on hind femur and tibia; cerarii numbering 17 pairs.

Korea quarantine notes. This species was intercepted once; Indonesia (*Ficus*).

***Exallomochlus hispidus* (Morrison)**

Diagnosis. Body broadly oval; discoidal pores peg like; cerarian setae with acute apices; ventral multilocular disc pores situated around vulvar area in small numbers; cerarii numbering 18 pairs, most cerarii with three or more conical setae; some dorsal setae longer than cerarian setae; circulus present and rectangular or hour-glass shaped; translucent pores on hind coxa and tibia; anal lobes well developed with large dorsal sclerotized area; venter of each lobes with a heavily sclerotized bar-like structure, not arising from apical seta.

Korea quarantine notes. This species was intercepted once; Indonesia (*Dracaena*).

***Ferrisia virgata* (Cockerell)**

Diagnosis. Adult female covered by white mealy wax, with two submedial longitudinal bare areas on dorsum. Body broadly oval; dorsal oral collar tubular ducts elongate, each with the orifice surrounded by a circular sclerotized rim with 2-4 setae near the margin; ventral multilocular disc pores present on abdominal segments VI-VIII; with one pair of anal lobe cerarii.

Korea quarantine notes. This species was intercepted 10 times; Indonesia (*Dracaena*, *Ficus*); Philippines, China, Taiwan (*Dracaena*).

***Maconellicoccus hirsutus* (Green)**

Diagnosis. Body broadly oval; oral rim tubular ducts numerous over dorsum; oral rim tubular ducts numerous, fairly evenly distributed across the segments, each duct with a sclerotized rim, outer edge of rim often obscure; cerarii numbering five pairs on posterior abdominal segments; anal bar present; antennae 9-segmented.

Korea quarantine notes. This species was intercepted four times; Vietnam, China (*Ficus*).

***Phenacoccus solenopsis* Tinsley**

Diagnosis. Body broadly oval, about 5mm long (full-grown female); without quinquelocular pores; without dorsal multilocular pores or oral collar tubular ducts; ventral multilocular pores normally present on abdominal segments VI or VII to VIII; normally with 9-segmented antennae; circulus usually large and flaccid; translucent pores present on apex of femur and on tibia; with denticle on claw.

Korea quarantine notes. This species was intercepted twice; Indonesia (*Dracaena*); China (*Ficus*).

***Planococcus citri* (Risso)**

Diagnosis. Adult female covered by white mealy wax, with dorsomedial longitudinal bare area on dorsum. Body broadly oval; more than six ventral oral collar tubular ducts present between antennae; with more than three ventral oral collar tubular ducts on lateral of middle coxa; translucent pores present on hind coxa and tibia; cerarii numbering 18 pairs, without auxiliary setae; anal bar present.

Korea quarantine notes. This species was intercepted 9 times; Malaysia, Philippines, Taiwan (*Dracaena*); Vietnam, China (*Ficus*).

***Planococcus kraunhiae* (Kuwana)**

Diagnosis. Body oval; dorsal oral collar tubular ducts in submarginal areas of abdomen, with more than one associated with each abdominal cerarius; translucent pores present on hind coxa and tibia; usually without multilocular pores posterior of front coxa; cerarii numbering 18 pairs, without auxiliary setae; anal bar present.

Korea quarantine notes. This species was intercepted once; Philippines (*Dracaena*).

***Planococcus lilacinus* (Cockerell)**

Diagnosis. Body broadly oval, with stout legs; dorsum with long flagellate setae present, usually as long as anal ring setae; translucent pores present on hind coxa and tibia; without dorsolateral oral collar tubular ducts; with ventral oral collar tubular ducts laterad of thorax; with ventral oral collar tubular ducts between antennae; without multilocular pores posterior of front coxa; cerarii numbering 18 pairs, without auxiliary setae; anal bar present.

Korea quarantine notes. This species was intercepted five times; Vietnam, China (*Ficus*).

***Planococcus minor* (Maskell)**

Diagnosis. Body oval; less than five ventral oral collar tubular ducts present between antennae; with 1-2 ventral oral collar tubular ducts on lateral of middle coxa; translucent pores present on hind coxa and tibia; cerarii numbering 18 pairs, without auxiliary setae; anal bar present.

Korea quarantine notes. This species was intercepted 28 times; Indonesia, Taiwan (*Dracaena*, *Ficus*); Philippines, Vietnam, China (*Ficus*).

***Pseudococcus baliteus* Lit**

Diagnosis. Body broadly oval; dorsal setae long, normally as long as ventral setae; translucent pores on hind coxa, femur and tibia; ventral oral collar tubular ducts present in clusters between antennae and laterad of front and middle coxae; oral rim tubular ducts usually sparse on dorsum, most abundant marginally; without discoidal near eye.

Korea quarantine notes. This species was intercepted four times; China (*Ficus*).

***Pseudococcus comstocki* (Kuwana)**

Diagnosis. Body broadly oval; dorsal setae long, almost as long as ventral setae; translucent pores present on hind coxa, femur and tibia; oral rim ducts usually sparse on dorsum, most abundant on marginal, submedial and medial areas of abdomen; with more than 100 multilocular disc pores on ventral abdomen; without discoidal pores near eye.

Korea quarantine notes. This species was intercepted 13 times; Philippines (*Dracaena*); Indonesia, China, Taiwan (*Ficus*).

***Pseudococcus cryptus* Hempel**

Diagnosis. Body broadly oval; dorsal oral rim ducts absent or, if present, numbering 4-6; dorsal setae long, almost as long as ventral setae; translucent pores present on hind coxa, femur and tibia; dorsal oral collar tubular ducts nearly always present near cerarii; ventral oral collar tubular ducts few, forming narrow band on thorax and head; ventral oral rim ducts present in marginal groups of 3-5 on mesothorax and abdominal segment I; without discoidal pores near eye.

Korea quarantine notes. This species was intercepted 10 times; China (*Ficus*).

***Pseudococcus jackbeardsleyi* Gimpel and Miller**

Diagnosis. Body broadly oval; with approximately 21 dorsal oral rim ducts on abdomen; discoidal pores numbering 4-9, situated in a sclerotized rim adjacent to each eyes; translucent pores on hind femur and tibia; ventral oral collar tubular ducts in clusters between antennae and laterad of front and middle coxae.

Korea quarantine notes. This species was intercepted five times; Indonesia (*Dracaena*, *Ficus*); Taiwan (*Dracaena*); Vietnam(*Ficus*).

***Pseudococcus longispinus* (Targioni-Tozzetti)**

Diagnosis. Adult female covered by white mealy wax, with 17 lateral wax filaments, posterior pairs conspicuously longer than others, posterior pairs as long as or longer than body. Slide mounted female: body broadly oval; dorsal marginal oral rim ducts present in groups of two or three of different sizes, usually one duct larger than other; ventral multilocular disc pores restricted to abdominal segments VII and VIII; penultimate and anal lobe cerarii (C_{16} and C_{17}) with conspicuous basal sclerotization.

Korea quarantine notes. This species was intercepted 265 times; Indonesia, Malaysia, Philippines, China, Taiwan (*Dracaena*, *Ficus*); Singapore, Sri Lanka (*Dracaena*); Vietnam (*Ficus*).

***Rastrococcus invadens* Williams**

Diagnosis. Body broadly oval; anterior ostioles absent; cerarii numbering 17 pairs, with more than five truncate setae; cerarii on anterior thorax and head separate; without long dorsal setae adjacent to anal ring; quinquelocular pores present on venter; large-type quinquelocular pores present on margins of venter; multilocular disc pores restricted to abdomen, absent from lateral areas.

Korea quarantine notes. This species was intercepted twice; Indonesia (*Ficus*).

Rhizoecidae***Ripersiella multiporifera* Jansen**

Diagnosis. Body elongate oval; bitubular cerocores of two distinct sizes present, each with wide truncate tubes; large-type bitubular cerocores present on dorsum only, usually distributed singly on margins, on midline and submarginal areas; small-type bitubular cerocores present on venter only, distributed in single transverse rows, mainly in middle of abdominal segments; anal lobes sclerotized on dorsum, each lobe bearing one long ventral seta and 2-3 long dorsal apical setae; antennae 5-segmented; circuli present on abdominal segments II and III, shape truncate-conical, about same length as basal diameter; numerous multilocular disc pores present on dorsum and on venter; oral collar tubular ducts absent.

Korea quarantine notes. This species was intercepted 12 times; Indonesia, Malaysia, Philippines, Vietnam, China (*Dracaena*).

Discussion

Of the 40 species intercepted at Korean ports of entry on dracaena and ficus plants, *Pseudococcus longispinus* constituted 57% (265) of the interceptions and was the most common intercepted species followed by *Lepidosaphes laterochitinos*a with 7% (32 interceptions). The identification of *Planococcus citri* and *Planococcus minor* was difficult because of their similarity, specifically the variation in the number of ventral oral collar tubular ducts. Thus, the identification to species level of 20 specimens remains uncertain, and therefore they were not included in this work.

Many scale insects are of quarantine significance because they are exotic species and may pose a potential threat to Korean agricultural ecosystems if introduced. The volume of ornamental plants imported into Korea has increased and many of these plant species are known hosts for scale insects. 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. Also, due to the minute size, cryptic behavior and immature stages such as eggs and crawlers of scale insects, they may not be detected during import inspections. Therefore, preventive measures are required to overcome this challenge. One of the most effective approaches is to make a list of intercepted scale insects for inspectors and researchers related to quarantine works.

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Table 1. Collection details of species of scale insects intercepted in Korea on imported dracaena plants from southern Asia from 1996 to 2014 (Abbreviations: INT, Number of interceptions; Dis, Distributed; KO, the republic of Korea; ?, unknown, specimens not examined even though known as greenhouse species in Korea).

Scientific Name	INT	Dis. In KO	Indonesia	Malaysia	Philippines	Singapore	Sri Lanka	Vietnam	China	Taiwan
Coccidae										
<i>Coccus hesperidum</i> Linnaeus	1	yes	1							
<i>Coccus viridis</i> (Green)	1	no			1					
Diaspididae										
<i>Aonidiella aurantii</i> (Maskell)	1	no		1						
<i>Chrysomphalus aonidum</i> (Linnaeus)	6	?	2		1		1		2	
<i>Lepidosaphes beckii</i> (Newman)	3	no	2						1	
<i>Lepidosaphes laterochitinosus</i> Green	32	no	20	3	7			1		1
<i>Lepidosaphes tokionis</i> (Kuwana)	4	no	3						1	
<i>Parlatoria proteus</i> (Curtis)	5	?		3				1		1
<i>Pinnaspis aspidistrae</i> (Signoret)	2	yes								2
<i>Pinnaspis buxi</i> (Bouche)	1	?					1			
<i>Pseudaulacaspis cockerelli</i> (Cooley)	3	yes							3	
<i>Pseudaulacaspis pentagona</i> (Targioni-Tozzetti)	2	yes	2							
Pseudococcidae										
<i>Dysmicoccus brevipes</i> (Cockerell)	1	no	1							
<i>Exallomochlus hispidus</i> (Morrison)	1	no	1							
<i>Ferrisia virgata</i> (Cockerell)	8	no	2		3				1	2
<i>Phenacoccus solenopsis</i> Tinsley	1	no	1							
<i>Planococcus citri</i> (Risso)	4	yes		1	2					1
<i>Planococcus kraunhiae</i> (Kuwana)	1	yes			1					
<i>Planococcus minor</i> (Maskell)	4	no	3							1
<i>Pseudococcus comstocki</i> (Kuwana)	2	yes			2					
<i>Pseudococcus jackbeardsleyi</i> Gimpel and Miller	3	no	2							1
<i>Pseudococcus longispinus</i> (Targioni-Tozzetti)	236	?	75	9	143	1	2		3	3
Rhizoecidae										
<i>Ripsiella multiporifera</i> Jansen	12	no	8	1	1			1	1	

Table 2. Collection details of species of scale insects intercepted in Korea on imported ficus plants from southern Asia from 1996 to 2014 (Abbreviations: INT, Number of interceptions; Dis, Distributed; KO, the republic of Korea; ?, unknown, specimens not examined even though known as greenhouse species in Korea).

Scientific Name	INT	Dis. In KO	Indonesia	Malaysia	Philippines	Thailand	Vietnam	China	Taiwan
Coccidae									
<i>Ceroplastes ceriferus</i> (Fabricius)	4	yes					1	3	
<i>Coccus hesperidum</i> Linnaeus	3	yes						3	
<i>Coccus longulus</i> (Douglas)	1	no		1					
<i>Saissetia oleae</i> (Olivier)	2	no		2					
Diaspididae									
<i>Aonidiella citrina</i> (Coquillett)	3	yes						3	
<i>Aspidiotus destructor</i> Signoret	1	yes							1
<i>Chrysomphalus aonidum</i> (Linnaeus)	2	?							2
<i>Fiorinia coronata</i> Williams and Watson	2	no				2			
<i>Hemiberlesia palmarum</i> (Cockerell)	1	no							1
<i>Howardia biclavata</i> (Comstock)	1	no	1						
<i>Microparlatoria fici</i> (Takahashi)	2	no	1						1
<i>Pseudaonidia trilobitiformis</i> (Green)	2	no						1	1
<i>Pseudaulacaspis cockerelli</i> (Cooley)	4	yes	3					1	
<i>Selenaspis articulatus</i> (Morgan)	1	no						1	
Pseudococcidae									
<i>Dysmicoccus brevipes</i> (Cockerell)	1	no		1					
<i>Dysmicoccus nesophilus</i> Williams and Watson	1	no	1						
<i>Ferrisia virgata</i> (Cockerell)	2	no	2						
<i>Maconellicoccus hirsutus</i> (Green)	4	no					1	3	
<i>Phenacoccus solenopsis</i> Tinsley	1	no						1	
<i>Planococcus citri</i> (Risso)	5	yes					1	4	
<i>Planococcus lilacinus</i> (Cockerell)	5	no					1	4	
<i>Planococcus minor</i> (Maskell)	24	no	7		1		2	11	3
<i>Pseudococcus balteus</i> Lit	4	no						4	
<i>Pseudococcus comstocki</i> (Kuwana)	11	yes	1					9	1
<i>Pseudococcus cryptus</i> Hempel	10	yes						10	
<i>Pseudococcus jackbeardsleyi</i> Gimpel and Miller	2	no	1				1		
<i>Pseudococcus longispinus</i> (Targioni-Tozzetti)	29	?	12	1	1		2	10	3
<i>Rastrococcus invadens</i> Williams	2	no	2						

Table 3. Number of species (# sp.) and percent of total number of scale insect species (% sp.) intercepted at Korean ports-of-entry (1996-2014) by family and their distribution in southern Asia (SA) on dracaena plants.

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 (# sp.)	0	2	0	10	0	0	10	1	23
intercepted (% sp.)	0	18	0	24	0	0	56	33	29

Table 4. Number of species (# sp.) and percent of total number of scale insect species (% sp.) intercepted at Korean ports-of-entry (1996-2014) by family and their distribution in southern Asia (SA) on ficus plants.

Distribution in SA	Asterolecaniidae	Cerococcidae	Coccidae	Conchaspidae	Diaspididae	Eriococcidae
Recorded in SA (# sp.)	2	3	43	1	106	4
Total # species (# sp.)	0	0	4	0	10	0
intercepted (% sp.)	0	0	9	0	9	0
Distribution in SA	Kerriidae	Lecanodiaspididae	Monophlebidae	Pseudococcidae	Rhizoecidae	Total
Recorded in SA (# sp.)	17	2	11	51	4	244
Total # species (# sp.)	0	0	0	14	0	28
intercepted (% sp.)	0	0	0	27	0	11

