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A new species of *Toumeyella* Cockerell (Hemiptera: Coccoidea: Coccidae) on coffee roots, *Coffea arabica* L. (Rubiaceae), from Colombia and Venezuela

Una nueva especie de *Toumeyella* Cockerell (Hemiptera: Coccoidea: Coccidae) en raíces de café, *Coffea arabica* L. (Rubiaceae) en Colombia y Venezuela

Takumasa Kondo[1]

[1] Entomologist PhD. Corporación Colombiana de Investigación Agropecuaria (Corpoica), Centro de Investigación Palmira, Calle 23, Carrera 37, Palmira, Valle, Colombia, tkondo@corpoica.org.co

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ABSTRACT

A new species of soft scale insect from Colombia and Venezuela, *Toumeyella coffeae* Kondo sp. nov., is described and illustrated based on the adult female. A taxonomic key to the genera of scale insects of the Toumeyella-group and a list of 49 soft scale insect (Coccidae) species recorded from *Coffea* spp. worldwide are provided.

Key words: coccid, scale insect, soft scales, *Toumeyella coffeae*.

RESUMEN

Una nueva especie de escama blanda de Colombia y Venezuela, *Toumeyella coffeae* Kondo sp. nov., se describe e ilustra con base en la hembra adulta. Se proveen una clave taxonómica para separar los géneros de escamas blandas del grupo-Toumeyella y una lista de 49 especies de escamas blandas (Coccidae) registradas sobre *Coffea* spp., en el mundo.

Palabras claves: cóccido, insecto escama, escama blanda, *Toumeyella coffeae*.

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INTRODUCTION

Williams and Kondo (2008) gave an overview of 16 species in the genus *Toumeyella* Cockerell, providing information about the distribution, host plants and comments on the morphology of some species. Later, Kondo & Williams (2009) erected the genus *Neotoumeyella* into which they transferred *Toumeyella cerifera* Ferris and *T. sonorensis* Ckll. & Parrott as *Neotoumeyella cerifera* (Ferris) and *N. sonorensis* (Ckll. & Parrott), and more recently Kondo & Pellizzari (2011) described *Toumeyella fontanai* from Mexico. Currently, there are 15 named species of soft scale insects included in the genus *Toumeyella*, distributed in Brazil (2 spp.), Cuba (1 sp.), Mexico (5 spp.) and the United States (9 spp.) (Kondo & Pellizzari, 2011). There are further undescribed species recorded from Cuba on *Adelia ricinella* L. (Euphorbiaceae), *Casearia sylvestris* Sw. (Salicaceae), *Coffea arabica* (Rubiaceae) and *Eugenia foetida* Pers. (Myrtaceae) (Mestre *et al*., 2011) and from Colombia on avocado, *Persea americana* L., on Booth 7, Booth 8, Choquette, Lorena, Santana and Trinidad cultivars (Kondo *et al*., 2011). There is another undescribed species of *Toumeyella*, known in the literature as *Toumeyella* sp. that has been considered for a long time as a pest of coffee in Venezuela, where it affects the roots and root crown of its host (Barrera, 2008; Fernández, 1957; Le Pelley, 1968; Murphy, 1997). The species described here from specimens from Colombia and Venezuela, collected also from coffee roots may correspond to the species reported above as a pest of coffee in Venezuela, however, this needs confirmation. On the other hand, the species reported on coffee in Cuba comes from the aerial parts of the plant and the morphology is different from the new species herein described (N. Mestre-Novoa, personal communication).

The main purpose of this paper is the description of a new species of *Toumeyella* collected from the roots of *Coffea arabica* plants. The adult female of this new species is described and illustrated. A taxonomic key to separate the genera included in the Toumeyella-group (excluding *Neolecanium* that is considered a synonym of *Toumeyella* (Kondo, 2004b, 2009) is provided for easy identification of closely related genera that occur in Central and South America. Furthermore, a list of soft scale insects (Hemiptera: Coccoidea: Coccidae) reported on *Coffea* spp. (Rubiaceae) worldwide is provided as an aid to quarantine personnel and researchers working on scale insect pests.

MATERIALS AND METHODS

Specimens were slide-mounted following the procedure described by Williams & Granara de Willink (1992). The terminology of morphological features follows mostly that of Kondo & Williams (2008) and Kondo & Pellizzari (2011). Measurements are given as a range and were taken from 10 specimens (the best two slide-mounted specimens for each of the five collecting sites, including the holotype). Measurements of the holotype are given in parenthesis. The range of body size was determined by selecting the smallest and the largest specimens in the material studied. The illustration of the adult female (Fig. 2) shows the dorsum on the left side and the venter on the right side with enlargements of important features around the margin. The material studied is deposited in the following institutions:

UNAB: Museo Entomológico Facultad de Agronomía, Universidad Nacional de Colombia, sede Bogotá, Bogotá, Cundinamarca, Colombia.
UVCO: Museo de Entomología, Universidad del Valle, Cali, Valle del Cauca, Colombia.

A list of soft scale insects (Hemiptera: Coccoidea: Coccidae) reported on *Coffea* spp. worldwide was compiled mostly from information found in the scale insect database ScaleNet (Ben-Dov *et al*., 2013) with additional information from the literature. The valid name of each species was checked in ScaleNet.

RESULTS AND DISCUSSION

Taxonomy

Key to genera of the Toumeyella-group based on adult females (adapted from Kondo, 2010a; Kondo & Williams, 2009):

1. Anal plates located near mid-dorsum; anterior spiracular pore band incomplete, not extending to margin (posterior spiracular pore band extending to margin); marginal setae cylindrical, peg-like .... *Cyclolecanium* Morrison
– Anal plates not located near mid-dorsum, usually found at about 1/5 to 1/4 of body length from posterior margin; anterior and posterior spiracular pore bands complete, both pore bands extending to margin; marginal setae variable, not peg-like 2

2. Dorsal microducts around body margin conspicuously larger than rest of microducts on dorsum ..... *Octolecanium* Kondo
– Dorsal microducts around body margin not conspicuously larger than rest of microducts on dorsum 3

3. Preopercular pores absent; dorsum with dense pattern of invaginated bilocular microducts; stigmatic spines absent ..... *Pseudophilippia* Cockerell
– Preopercular pores present; dorsal microducts variable, generally without dense pattern of invaginated bilocular microducts; stigmatic spines usually present 4

4. Ventral tubular ducts absent..... 5
– Ventral tubular ducts present at least around perivulvar area 6

5. Dorsum of slide-mounted specimens with a dense pattern of microducts. Young adult females in life covered by a white cottony to powdery wax, although this powdery wax disappears in old specimens. Perivulvar pores mostly with 5 loculi and one central loculus ..... *Bombacoccus* Kondo
– Dorsum of slide-mounted specimens without a dense pattern of microducts. Adult females in life covered by a thin layer of glassy wax. Perivulvar pores mostly with 7 or 8 loculi and with 2 or 3 central loculi .... *Akermes* Cockerell

6. Ventral tubular ducts present at least in a submarginal band on abdominal region and reaching area around posterior spiracular pore band .... *Neotoumeyella* Kondo and Williams
– Ventral tubular ducts not distributed as above 7

7. Ventral tubular ducts located around vulva and extending anteriorly in a medio-lateral line up to about abdominal segment V; dorsal setae lanceolate; stigmatic clefts deep..... *Megasaissetia* Cockerell
– Ventral tubular ducts located around vulva and often also on posterior abdominal segments, but not extending anteriorly in a medio-lateral line; dorsal setae generally sharply spinose, rarely lanceolate; stigmatic clefts shallow or absent .... *Toumeyella* Cockerell

Toumeyella coffeae Kondo, sp. nov. (Figures 1 & 2)

Proposed common name: English: Coffee-root scale. Spanish: Escama blanda de la raíz del café.

Material studied. Holotype. Adult female (UNAB). Colombia: Norte de Santander: municipio de Cucutilla, Vereda Pedregal Bajo, Finca Buenos Aires, 2.v.2013, coll. Manuel Alexis Leal, ex roots of *Coffea arabica*. **Paratypes.** Same data as holotype 31 slides (28 adult females + 3 third-instar nymphs) (UNAB). Municipio Arboledas, vereda Aguadas, Finca El Porvenir, 2.v.2013, coll. Fabio Alonso Jáuregui, ex roots of *Coffea arabica*, 36 (28 adult females + 28 first-instar nymphs + 8 male second-instar nymphs + 4 female second-instar nymphs + 3 female third-instar nymphs) (UNAB). Municipio Cucutilla, Finca La Dalia, 07,34513 °N, 072,47227 °W, 1,497 m a.s.l., 10.iv.2013, coll. María Fernanda Díaz Niño, ex café Canastilla, 20 (26 adult females + 8 first-instar nymphs) (UNAB). Municipio Arboledas, vereda La Rinconada, Finca El Cedro, 1,526 m a.s.l., 25.xi.2012, coll. Clemencia Villegas G., ex roots of *Coffea arabica* var. Colombia, 20 (15 adult females + 17 first-instar nymphs + 1 female third-instar nymph) (UVCO).

Other material studied. Venezuela: Estado de Lara: Sanare, Sabana Redonda Arriba, 1,100 m a.s.l., vi.2010, coll. Radamés Urtiaga, #1255, 2 (2 adult females + 1 first-instar nymph + 1 female second-instar nymph + 1 female third-instar nymph) (UNAB).

Description. Adult female (Figures 1 & 2)

Unmounted material. Body convex. Derm orange, brown to greyish green in color, with dark tesselations, but usually with mid-dorsum very lightly or not mottled; anal plates dark to reddish brown. Mature insects 1.5–4.2 mm in diameter (Figure 1).

Mounted material. Body outline oval to elongate oval, often narrowing anteriorly; body 1.7–5.3 (1.8) mm long, 1.1–4.1 (1.4) mm wide (Figure 2).

Dorsum. Derm membranous on young adult females, becoming heavily sclerotized in older specimens. Dorsal setae (dset) sharply spinose, straight or slightly curved, each 8.6–20.0 (9–17) µm long, rather scarse, more or less scattered evenly. Dorsal microducts (dmic) each 2.0–2.5 µm wide, with a long terminal filament, evenly scattered. Simple pores (sp) each about 2.2–3.0 µm

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Figure 1. *Toumeyella coffeae* Kondo on roots of *Coffea arabica* (Norte de Santander, Colombia). **Upper inset.** Young adult females. **Lower inset**. Old adult female. Main photo by C. Villegas; upper and lower inset photos by M. F. Díaz Niño.

wide, evenly scattered. Dorsal tubular ducts absent. Preopercular pores (prop) present on mid-dorsum anterior to anal plates, extending anteriorly up to area just dorsad to labium, each pore 5–14 (6–11) µm wide. Dorsal tubercles and pocket-like sclerotizations absent. Anal plates (aplt) together quadrate, plates located at about 1/5 to 1/4 of body length from posterior margin, each plate 167–203 (183–191) µm long, 93–118 (98–110) µm wide, anterolateral margin 123–164 (125–142) µm long, posterolateral margin 113–147 (140–142) µm long, with 1 or 2 setae on dorsal surface, plus 1 pair of long fringe setae, about 7 ventral subapical setae and 5 pairs of hypopygial setae. Anal ring with 10 setae (setae represented by dark dots). A small sclerotic area often present just anterior to anal plates.

Margin. Marginal setae (mset) sharply spinose, straight to slightly bent, each 12–50 (17–30) µm long, arranged in a single, often irregular row, with 5–10 (6 on holotype) on each side between anterior and posterior stigmatic areas. Stigmatic clefts well developed, usually with 3 spines per stigmatic area; stigmatic spines (stgsp) bluntly to sharply spinose, median stigmatic spine usually longest, 29–44 (27–42) µm long, lateral spines 15–22 (13–36) µm long. Eyes not detected.

Venter. Derm entirely membranous. Ventral setae slender, straight or slightly bent, each 6–27 µm long; also 3 pairs of long median setae, each 23–70 µm long, a pair on last segment (VII) longest. Ventral microducts (vmic) scattered evenly throughout, each about 3 µm wide. Ventral tubular ducts scarce, present around vulvar region, each tubular duct with a terminal filament ending in a small, branched terminal gland, duct opening 4–5 µm wide. Perivulvar pores (pvp) rather scarce, small, about same size as spiracular pores, each 5–6 µm wide, with 4–6 loculi (mostly with 5 loculi), rarely a few up to 8 loculi or more, present around vulvar area, a few on abdominal segment VII, and in small groups of about 1–6 pores submedially on each abdominal segment and lateral to metathoracic leg. Spiracular pores (spp) each 5–6 µm wide, with 4–6 loculi, mostly with 5 loculi, rarely a few pores with more loculi, present in a narrow band 1–3 pores wide, rarely up to 6 in some sections, extending laterally from each spiracle to body margin. Spiracles well developed, anterior spiracular peritremes each 56–78 (61–65) µm wide, posterior peritremes each 66–88 (70–71) µm wide. Legs greatly reduced, segments not discernible, fused, except for claw, total length of all legs including claw, each 59–105 (80–102) µm long, metathoracic legs usually largest; claws well developed, without a denticle, claw digitules, slender, knobbed; tarsal digitules knobbed, longer than claw digitules.

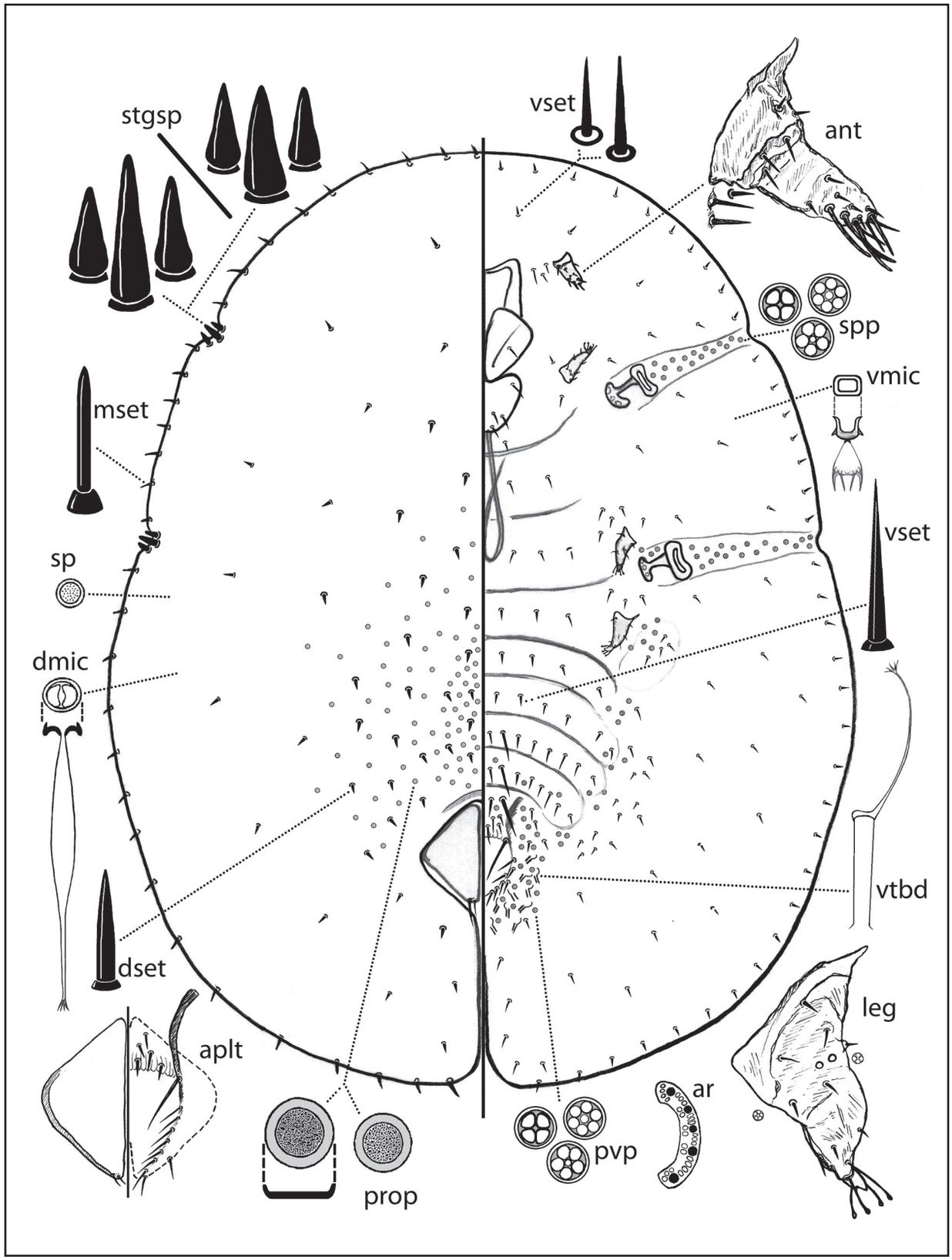

Figure 2. *Toumeyella coffeae* Kondo, adult female

Abbreviations: aplt = anal plate; ant = antenna; ar = anal ring; dmic = dorsal microduct; dset = dorsal setae; mset = marginal setae; prop = preopercular pores; pvp = perivulvar pore; sp = simple pore; spp = spiracular pore; stgsp = stigmatic spine; vmic = ventral microduct; vset = ventral setae; vtbd = ventral tubular duct.

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Antennae (ant) short, each 44–100 (73–84) μm long, segmentation poorly developed, 2–4 (2) segmented, with fleshy setae present on apex of antennae. With 3 pairs of interantennal setae, each 5–32 (5–20) μm long. Mouthparts well developed, clypeolabral shield 167–240 (240) μm wide; labium 1 segmented, with 4 pairs of labial setae.

Etymology. The species is named after its Type host: coffee.

Notes. First-instar nymphs of *T. coffeae* have five-segmented antennae and resemble other species of *Toumeyella* (Kondo & Williams, 2002; Sheffer & Williams, 1996; Williams, 1993).

Biology. This species is sexual because second-instar males have been found in one infestation. These coccids live and feed on roots and on underground parts of stems. In the collection from Finca Buenos Aires at Vereda Pedregal Bajo, Norte de Santander, Colombia, on 2.v 2013, *Toumeyella coffeae* was found together with the mealybug *Dysmicoccus brevipes* (Cockerell) (Pseudococcidae).

Soft scale insects (Coccidae) on coffee, *Coffea* spp. in the world

According to the scale insect database ScaleNet (Ben-Dov *et al*., 2013) there are 47 species of soft scale insects recorded on *Coffea* spp. worldwide, excluding species identified only to genus level and *Lecanium mercarae* Ramakrishna Ayyar, which is a *nomen nudum* (Ben-Dov, 1993). A total of 49 species of soft scale insects on *Coffea* spp., including the new species, *T. coffeae*, are listed here. Table 1 gives the country or countries from which each species has been recorded on *Coffea* spp., additional country records not listed in ScaleNet (Ben-Dov *et al*., 2013) and the validation source. *Toumeyella liriodendri* (Gmelin) listed by Barrera (2008) on the roots of coffee in Guatemala was omitted from Table 1 because this is likely a misidentification since *T. liriodendri* is a North American species that feeds on the aerial parts of its host (Kondo & Williams, 2008; Gill, 1988; Hamon & Williams, 1984). *Coccus asiaticus* Lindinger recorded by Le Pelley (1968) and cited by Murphy (1997) is a synonym of *Parasaissetia nigra* (Nietner), thus its distribution is listed under *P. nigra*

Table 1. Species of Coccidae recorded on *Coffea* spp. worldwide

Species	Country of record	References
Alecanochiton marquesi Hempel	Brazil	Le Pelley (1968); Murphy (1997)
Avricus amoenus (De Lotto)	Zimbabwe	Ben-Dov *et al*. (2013); De Lotto (1958); Hodgson (1969a)
Avricus arborescens (Laing)	Angola, Ethiopia, Ghana, Kenya, Sao Tome, Sudan, Tanzania, Uganda, Zimbabwe	Almeida (1973); Ben-Dov *et al*. (2013); De Lotto (1968); Laing (1929); Le Pelley (1968); Murphy (1997)
Ceroplastes brevicauda Hall	Angola, Kenya, Uganda	Almeida (1973); Ben-Dov *et al*. (2013); De Lotto (1955, 1965; 1967); Le Pelley (1968); Murphy (1997)
Ceroplastes destructor Newstead	Angola, Cameroon, Democratic Republic of the Congo, Republic of the Congo, Uganda	Almeida (1973); Ben-Dov *et al*. (2013); De Lotto (1965); Le Pelley (1968); Murphy (1997)
Ceroplastes floridensis Comstock	Brazil (Espiritu Santo), India, Israel	Ben-Dov (1970); Ben-Dov *et al*. (2013); Culik *et al*. (2007); Hodgson (1994)
Ceroplastes galeatus Newstead	Uganda	Le Pelley (1968); Murphy (1997)
Ceroplastes giganteus Dozier	Guatemala	Ben-Dov *et al*. (2013); Williams (2010)

Species	Country of record	References
Ceroplastes luteolus De Lotto	Kenya	Ben-Dov *et al*. (2013); De Lotto (1955, 1965; 1967)
Ceroplastes personatus Newstead	Ghana, Nigeria, Sudan, Uganda, Zimbabwe	Ben-Dov *et al*. (2013); Hodgson & Peronti (2012); Le Pelley (1968); Murphy (1997); Newstead (1917)
Ceroplastes rubens Maskell	Western Samoa	Ben-Dov *et al*. (2013); Brimblecombe (1956); Williams & Watson (1990)
Ceroplastes stellifer (Westwood)	Ghana	Le Pelley (1968); Murphy (1997)
Ceroplastes vinsonioides Newstead	Angola, Ghana, Guinea-Bissau, Kenya, Nigeria, Tanzania, Uganda, Zimbabwe	Almeida (1973); Ben-Dov *et al*. (2013); Boboye (1971); De Lotto (1965, 1968); Hodgson (1969b); Le Pelley (1968); Murphy (1997); Newstead (1911)
Coccus africanus (Newstead)	Kenya, Nigeria	Ben-Dov *et al*. (2013); De Lotto (1957); Le Pelley (1968); Murphy (1997); Newstead (1917)
Coccus alpinus De Lotto	Angola, Brazil (Bahia), Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Tanzania, Uganda, Zimbabwe	Almeida (1973); De Lotto (1960, 1965, 1968); Granara de Willink *et al*. (2010); Hodgson (1967); Le Pelley (1968); Murphy (1997)
Coccus brasiliensis Fonseca	Brazil	Ben-Dov *et al*. (2013); Fonseca (1957); Granara de Willink *et al*. (2010); Le Pelley (1968); Murphy (1997)
Coccus celatus De Lotto	Brazil, Kenya, Malaysia, Papua New Guinea, Philippines, Sudan, Tanzania, Uganda, Vietnam	Ben-Dov *et al*. (2013); Buckley & Gullan (1991); Danzig & Konstantinova (1990); De Lotto (1969; 1969); Granara de Willink *et al*. (2010); Le Pelley (1968); Murphy (1997); Williams (1982)
Coccus colemani Kannan	India	Ali (1971); Avasthi & Shafee (1991); Ben-Dov *et al*. (2013); Le Pelley (1968); Murphy (1997); Ramakrishna (1919, 1930); Shafee *et al*. (1989)
Coccus hesperidum L.	Angola, Guatemala, Guyana, Mexico, Peru, Tanzania	Almeida (1973); Barrera (2008); Ben-Dov *et al*. (2013); González & Atkinson (1984); Le Pelley (1968); Murphy (1997); Newstead (1911)
Coccus lizeri (Fonseca)	Brazil	Ben-Dov *et al*. (2013); Fonseca (1957); Granara de Willink *et al*. (2010); Le Pelley (1968); Murphy (1997
Coccus longulus (Douglas)	Vanuatu	Ben-Dov *et al*. (2013); Williams & Watson (1990)
Coccus subacutus (Newstead)	Uganda	Ben-Dov *et al*. (2013); De Lotto (1957); Le Pelley (1968); Murphy (1997); Newstead (1920)
Coccus subhemisphaericus (Newstead)	Angola, Ghana, Kenya, Tanzania, Uganda	Ben-Dov *et al*. (2013); De Lotto (1957, 1967); Le Pelley (1968); Murphy (1997); Newstead (1917)

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Species	Country of record	References
Coccus viridis (Green)	Bolivia, Brazil, Burma, Cape Verde, Colombia, Costa Rica, Cuba, Democratic Republic of the Congo, Dominican Republic, Ecuador, El Salvador, Egypt, Ethiopia, Fiji, Ghana, Guatemala, Guadeloupe, Guyana, Haiti, Hawaii, Honduras, India, Indonesia (Java, Irian Jaya), Jamaica, Kenya, Madagascar, Malaysia, Mariana Islands, Mauritius, Mexico, New Caledonia, Panama, Papua New Guinea, Philippines, Puerto Rico, Reunion, Sao Tome, Seychelles, South Africa, Sri Lanka, Surinam, Taiwan, Tanzania, Tonga, Uganda, Vanuatu, Venezuela, Vietnam, Western Samoa	Aitken-Soux (1985); Avasthi & Shafee (1991); Barrera (2008); Ballou (1926); Ben-Dov *et al*. (2013); Chazeau, 1981; Culik *et al*. (2010); De Lotto (1978); Ghosh, 1925; Granara de Willink *et al*. (2010); Green (1889, 1896, 1916); Hall (1924); Ihering (1897); Le Pelley, 1968; Mamet (1959); Nakahara (1981); Shafee *et al*. (1989); Squire, 1972; Williams & Watson (1990)
Coccus viridulus De Lotto	Kenya, Uganda	Ben-Dov *et al*. (2013); De Lotto (1960, 1969); Le Pelley (1968)
Cryptostigma inquilinum (Newstead)	El Salvador, Puerto Rico	Ben-Dov *et al*. (2013); Le Pelley (1968); Murphy (1997); Wolcott (1941)
Eucalymnatus tessellatus (Signoret)	Seychelles	Ben-Dov *et al*. (2013); Green (1907)
Hemilecanium imbricans (Green)	India	Ben-Dov *et al*. (2013); Green (1903)
Kilifia acuminata (Signoret)	Puerto Rico	Ben-Dov *et al*. (2013); Nakahara & Miller (1981)
Kilifia americana Ben-Dov	Mexico	Ben-Dov (1979); Ben-Dov *et al*. (2013)
Megapulvinaria maxima (Green)	Vietnam	Ben-Dov *et al*. (2013); Danzig & Konstantinova (1990)
Paralecanium marianum Cockerell	Brazil	Le Pelley (1968); Murphy (1997)
Parasaissetia nigra (Nietner)	Cameroon, Canary Islands, Democratic Republic of the Congo, El Salvador, Guatemala, India, Jamaica, Kenya, Malaysia, New Caledonia, Papua New Guinea, Puerto Rico, Reunion, Sri Lanka, Tanzania, Uganda, Vanuatu, West Indies, Zimbabwe	Ali (1968); Barrera (2008); Ben-Dov *et al*. (2013); Carnero & Perez (1986); Green (1896, 1904a, 1937); Hodgson (1967); Le Pelley (1968); Murphy (1997); Newstead (1917); Shafee *et al*. (1989); Williams & Watson (1990)
Protopulvinaria longivalvata Green	Guadeloupe, Lesser Antilles	Ali (1968); Barrera (2008); Ben-Dov *et al*. (2013); Carnero & Perez (1986); Green (1896, 1904a, 1937); Hodgson (1967); Le Pelley (1968); Murphy (1997); Newstead (1917); Shafee *et al*. (1989); Williams & Watson (1990)
Pseudocribrolecanium andersoni (Newstead)	Angola	Ben-Dov *et al*. (2013); Brink (1992); Kondo (2006)
Pulvinaria aethiopica (De Lotto)	Angola, Zambia	Almeida (1973); Ben-Dov *et al*. (2013); De Lotto (1965); Le Pelley (1968); Murphy (1997)
Pulvinaria mammeae Maskell	Hawaii	Ben-Dov *et al*. (2013); Le Pelley (1968); Kirkaldy (1902); Murphy (1997)

Species	Country of record	References
Pulvinaria psidii Maskell	Angola, Caroline Islands, Cuba, Democratic Republic of the Congo, Dominican Republic, Hawaii, India, Indonesia (Java, Sumatra), Jamaica, Kenya, Mariana Islands, New Caledonia, Papua New Guinea, Puerto Rico, Sri Lanka, Tanzania, Uganda	Almeida (1973); Ben-Dov *et al*. (2013); Green (1904b, 1909); Le Pelley (1968); Murphy (1997); Nakahara (1981); Shafee *et al*. (1989); Williams & Watson (1990)
Saissetia coffeae (Walker)	Angola, Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, El Salvador, Fiji, Guam, Guatemala, Guyana, Honduras, India, Indonesia (Java), Jamaica, Kenya, Madagascar, Mexico, Papua New Guinea, Puerto Rico, Reunion, Seychelles, Sri Lanka, St Helena, Surinam, Tanzania, Uganda, Venezuela, Vietnam	Abrahao & Mamprim (1958); Almeida (1973); Ballou (1926); Barrera (2008); Ben-Dov *et al*. (2013); Culik *et al*. (2010); De Lotto (1956, 1965); Green (1904b); Le Pelley (1968); Mamet (1950); Murphy (1997); Williams & Watson (1990)
Saissetia jocunda De Lotto	Kenya	Ben-Dov *et al*. (2013); De Lotto (1968)
Saissetia neglecta De Lotto	Fiji, Puerto Rico, Tonga	Ben-Dov *et al*. (2013); Nakahara & Miller (1981); Williams & Watson (1990); Murphy (1997)
Saissetia oleae (Olivier)	Brazil, Cuba, Dominican Republic, India, Jamaica, Kenya, Puerto Rico	Ali (1971); Ben-Dov *et al*. (2013); De Lotto (1956); Le Pelley (1968); Murphy (1997), Shafee *et al*. (1989)
Saissetia privigna De Lotto	India, Kenya	De Lotto (1965); Le Pelley (1968); Murphy (1997); Muzaffar & Ahmad (1977)
Saissetia zanzibarensis Williams	Tanzania	Le Pelley (1968); Murphy (1997)
Toumeyella coffeae Kondo	Colombia, Venezuela	Present study
Udinia catori (Green)	Nigeria	Adenuga & Adeboyeku (1987); Ben-Dov *et al*. (2013)
Udinia farquharsoni (Newstead)	Democratic Republic of the Congo, Sierra Leone	Ben-Dov *et al*. (2013); Hanford (1974)
Udinia glabra De Lotto	Uganda	Ben-Dov *et al*. (2013); De Lotto (1963); Le Pelley (1968); Murphy (1997)
Udinia paupercula De Lotto	Sudan	Ben-Dov *et al*. (2013); Hanford (1974)

DISCUSSION

The soft scales of the genus *Toumeyella* belong to the subfamily Myzolecaniinae (Hodgson 1994) as well as the Toumeyella-group (Steinweden, 1929). The Myzolecaniinae was erected by Hodgson (1994) to include species that lack a number of structures of the cuticle and have reduced appendages. The adult females in the Myzolecaniinae can be differentiated from species in the other nine subfamilies known in the Coccidae by the following features: (1) lack of dorsal tubular ducts and eyespots; (2) presence of anal plates with numerous setae on the dorsal surface; (3) particularly large spiracles, with broad bands of spiracular pores between the margin and spiracles; (4) ventral tubular ducts of one type, frequently restricted to each side of the genital opening; (5) bands of (often rather spinose) setae replacing the normal pairs of long prevulvar setae; (6) reduced legs with fine claw digitules; (7) antennae of reduced size and often with fewer segments; and (8) a short anal tube (Hodgson, 1994). Currently, the Myzolecaniinae includes 20 genera, i.e., *Akermes* Cockerell, *Alecanium* Morrison, *Alecanopsis* Cockerell, *Aztecalecanium* Kondo & Williams, *Bombacoccus* Kondo, *Cribrolecanium* Green,

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Cryptostigma Ferris, *Cyclolecanium* Morrison, *Foldilecanium* Kondo, *Halococcus* Takahashi, *Houardia* Marchal, *Megasaissetia* Cockerell, *Myzolecanium* Beccari, *Neolecanium* Parrott, *Octolecanium* Kondo, *Paractenochiton* Takahashi, *Pseudophilippia* Cockerell, *Richardiella* Matile-Ferrero & Le Ruyet, *Toumeyella* Cockerell and *Torarchus* Gullan & Stewart (Gullan & Stewart, 1996; Kondo 2010a, 2011; Kondo & Williams 2004a, 2009; Kondo *et al*., 2005).

Steinweden (1929) postulated that New World species with reduced limbs formed a natural group, which he called the Toumeyella-group, in which he included the genera *Toumeyella*, *Neolecanium* and *Pseudophilippia*. Steinweden (1929) chiefly defined the Toumeyella-group by the following features: (1) legs and antennae greatly reduced, but retaining their parts; (2) marginal and stigmatic setae small and inconspicuous or absent; (3) anal region with hypopygial setae; and (4) presence of quinquelocular pores in the perivulvar region. Currently, the Toumeyella-group is composed of *Akermes*, *Bombacoccus Cyclolecanium*, *Megasaissetia*, *Neolecanium*, *Octolecanium*, *Pseudophilippia* and *Toumeyella* (Kondo 2010a; Kondo & Williams 2002; Kondo *et al*., 2005). It should be noted that *Neolecanium* is considered a synonym of *Toumeyella* by Williams & Kondo (2004b, 2009). It appears that soft scales with reduced limbs have evolved multiple times; based on the morphology of first-instar nymphs, Kondo and Williams (2002) suggested that the Myzolecaniinae is composed of several unrelated lineages. This hypothesis also is supported by a Bayesian phylogenetic analysis of the family Coccidae using DNA sequences based on 18S, 28S and partial CO1 data (T. Kondo & L.G. Cook, unpublished data).

The genus *Toumeyella* has a wide distribution in the New World with most species being described from the USA, suggesting that many more new species should be found in other countries in the Nearctic and Neotropical Regions (Kondo & Pellizzari, 2011). *Toumeyella coffeae* is the only species in the genus *Toumeyella* known to occur on the roots and root crown of its host, as all other known species are known from the aerial parts of their hosts. Morphologically, it differs from all its congeners by: (i) the small size of the perivulvar pores that are about the same size as the spiracular pores, (ii) the complete fusion of all segments of the legs except for the claw, and (iii) the poor segmentation of the antennae. The latter two are common features in the closely related genus *Akermes* Cockerell (T. Kondo, personal observation). Very few other coccids are known from the root system of their hosts. In the Myzolecaniinae, there are a couple of species that feed on the roots, i.e., *Cryptostigma silveirai* (Hempel), a species which appears to be restricted to the underground roots of grape vines and is an important pest of vines in Brazil (Hempel, 1900, Le Page & Piza, 1914), and *C. rhizophilum* Kondo from Colombia, Costa Rica, Ecuador and Panama is known from the root system of various hosts including *Anthurium* sp. (Araceae), *Elaeis guineensis* (Arecaceae), *Ananas* sp. (Bromeliaceae), *Musa sapientum, M. textilis* (Musaceae), *Peristeria elata* (Orchidaceae), *Theobroma* sp. (Sterculiaceae) and *Zingiber officinale* (Zingiberaceae) (Kondo, 2010b). The present paper should provide useful information for researchers working on coffee pests as well as quarantine personnel.

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