A new Asca (Acari: Mesostigmata: Ascidae) from Costa Rica

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Abstract

Asca nelsoni sp. nov. is described from Costa Rica, from within domatia on leaves of coffee plants, Coffea arabica L. (Rubiaceae), and compared with morphologically similar species A. brachychaeta Hurlbut, A. citri Hurlbut and A. elongata (Berlese).

Key words: arboreal predator, Asca, Ascidae, coffee, domatia, fungal spores, Rubiaceae

Introduction

A new species of Asca von Heyden (Acari: Mesostigmata: Ascidae) was discovered during a survey of mites occurring in the domatia of Coffea species at the International Coffee Germplasm Center of the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) in Turrialba, Costa Rica (Vega et al. 2007). Members of this genus are predatory on other mites (Moutia 1958), eggs of insects (Moussa 1956), nematodes and other arthropods (Walter 1988; Epsky et al. 1988), and Collembola (Karg 1961; Hurlbutt 1963). They have been reported on the leaf domatia of several plants (Walter & O’Dowd 1992; Walter 1996), as inhabitants of the phylloplane (Walter et al. 1993), in bark beetle galleries (Stone & Simpson 1991), termite’s and bird’s nests (Ryke 1961), soil and moss (Ryke 1961), etc. Species of Asca are often abundant on the leaves of trees and lianas in subtropical to tropical rainforests, and several members of the genus truly prefer arboreal habitats (Walter et al. 1993; Lindquist et al. 2009).

One interesting aspect of the new species from the coffee domatia is the presence of germinated fungal spores on its cuticle (Vega et al. 2007). We have found no other reports of fungal spores on the body of other Asca species, although these have been reported on several other mites, including species of Tarsonemidae, e.g., Daidalotarsonemus deleoni (Smiley), Fungitarsonemus lodici (DeLeon), F. peregrinus (Beer), Tarsonemus floridanus (Attiah), T. scaurus Ewing, T. solengrandis Ochoa, and Xenotarsonemus vargasi Ochoa (Ochoa et al. 1991). We hereby present a description for the new Asca species, A. nelsoni.

Material and methods

Measurements in micrometres (μm) were made from specimens flattened on microscope slides using a stage-calibrated ocular micrometer, and are presented in parentheses as ranges (minimum to
maximum). Morphological features, unless stated otherwise, were measured as follows: inside edge of setal base to inside edge of setal base, i.e. the shortest distance between two setal bases; palps measured from base of trochanter to tip of tarsus; subcapitulum measured down midline from base to level with tip of corniculi; fixed digit of chelicera length measured from dorsal lyrifissure to tip, movable digit measured along maximum length down midline; spermadactyl shaft length measured from membranous juncture with movable digit to tip of shaft; setal length measured from midpoint of insertion to tip. The term ‘pore’ used in descriptions is applied to all pore-like structures, and includes both sense organs (lyrifissures, id1–x) and gland pores (gd1–9) (sensu Ragusa & Athias-Henriot 1983). Gland pores are slit-shaped and lyrifissures are generally ovoid. Adult idiosomal chaetotaxy follows that of Lindquist & Evans (1965), and our generic concept of *Asca* follows that of Lindquist & Evans (1965) and Lindquist *et al.* (2009).

List of Abbreviations
MICR: Mite Collection at Museo de Insectos, San Pedro, Universidad de Costa Rica, Costa Rica
USNM: United States National Mite Collection, US National Museum of Natural History (Smithsonian), Systematic Entomology Laboratory (SEL), Beltsville Agricultural Research Center West (BARC West), United States Department of Agriculture (USDA), Building 005, 10300 Baltimore Ave, Beltsville, Maryland, USA, 20705

**Genus *Asca* von Heyden**

*Asca* von Heyden, 1826: 610. Type species: *Gamasus aphidioides* Fabricius, 1805, by original designation (= *Acarus aphidioides* Linnaeus, 1758).
*Ceratozercon* Berlese, 1913: 204. Type species: *Zercon bicornis*, Berlese, 1887 (not *Gamasus* (*Sejus*) *bicornis* Canestrini & Fanzago 1876), by original designation (= *Acarus aphidioides* L., 1758).

**Diagnosis**

Dorsal shield divided, with pair of posterior projections (horns) on opisthosomal shield usually bearing setae Z4 and S5 (Figs 1, 6). Female with expanded ventrianal shield incorporating 5–6 pairs of ventral setae (usually JV2–5, ZV2–3) in addition to circumanal setae (Fig. 2); genu I lacks ventral setae av-2 (i.e. 12 rather than 13 setae); third pair of sternal pores (stp3) on the sternal shield; fourth pair of sternal setae (st4) free on soft cuticle; movable digit of chelicerae usually bidentate (Fig. 3).

**Asca nelsoni** sp. nov. Beard, Ochoa & Vega (Figs 1–9)

**Material Examined**

**Types.** Holotype. ♀. **Costa Rica.** Cartago, Turrialba, February 2005, ex. domatia on leaves of *Coffea arabica* L. (Rubiaceae) accession T.01997, International Coffee Germplasm Center, Centro Agronómico Tropical de Investigación y Enseñanza (N 09°54.012, W 083° 39.702), Fernando E. Vega (USNM).

**Paratypes.** Same data as holotype except ex. domatia on leaves of seven different accessions of *Coffea arabica* L. (Rubiaceae) (T.01994, T.01997, T.02248, T.02255, T.02268, T.02307, T.04492) (all on separate slides): 5 ♀♀, 2 ♂♂, deutonymph, 2 protonymphs, pharate larva (USNM); 2 ♀♀, 2 ♂♂, 2 protonymph (MICR).
FIGURE 1. *Asca nelsoni* sp. nov. adult female dorsum. Scale bar = 100 μm.
FIGURE 2. *Asca nelsoni* sp. nov. adult female venter, with detail of tritosternum and peritreme.
Diagnosis
Anterior margin of tectum denticate with 9–13 small teeth. Subcapitulum with 6–8 rows of 2–3 of deutosternal denticles (most commonly 7 rows of 2 denticles). Dorsal shields colliculate anteriorly; all dorsal setae inserted on small tubercles. Podonotal shield with 18–20 pairs of thick, densely spiculate setae; setae j1 similar in size to j2; setae r2 captured by shield, setae r3–r4 inserted in soft cuticle or rarely captured by shield. Opisthonomal shield with 15 pairs of densely spiculate setae (except Z4, J5 short, smooth) on raised insertions; J1–J1 = J2–J2 = J3–J3 = J4–J4; setae Z4 significantly shorter than S5; J4+J3; UR2, UR4 present. Female ventrianal shield with six pairs of ventral setae (JV2–5, ZV2–3); setae JV4 and JV5 (inserted on posterior margin shield) and postanal seta longer, thick, barbed. Male ventrianal shield with seven pairs of setae (JV1–5, ZV1–2); setae ZV3 absent. Leg setae short, blunt.

Adult female
Dorsal idiwsoma (Fig. 1). Body measurements: j1–j5 (275–294), r2–r2 (120–125), s6–s6 (104–125), J1–J1 (10–14), J2–J2 (20–24), J3–J3 (16–20), J4–J4 (15–19), S1–S1 (115–123), S4–S4 (87–96). Two dorsal shields; all dorsal setae inserted on small tubercles. Anterior podonotal shield (j1–j6 114–129) colliculate-reticulate with 18–20 pairs of thick, densely spiculate setae; j1 14–16, j2 13–17, j3 18–21, J4 19–23, j5 17–23, j6 19–26, z2 20–27, z3 18–20, z4 19–23, z5 18–23, z6 21–25, s1 10–15, s2 18–25, s3 18–25, s4 19–23, s5 22–27, s6 23–29, r2 18–21, r3 17–21, r4 17–21. Setae r2 captured by shield; setae r3–r4 inserted in soft cuticle or captured by shield; setae r5 (18–24) in soft cuticle laterad shield. Podonotal shield (J1–J5 122–126) with nine pairs of discernable pore-like structures, of which five appear secretory (gland pores: gd1 laterad j3; gd2 mesad z4; gd4 on shield margin lateral s5; gd5 posteromesad z5; gd6 lateral j6) and four appear non-secretory (lyrifissures: id1 lateral j2; id1a anterad J4; id4 on shield margin lateral s5; id6 lateral j6). Posterior opisthonomal shield ornamentation less pronounced than anterior shield, light reticulations anterolateral from level with setae J1–S1 to J3–Z2; with 15 pairs of densely spiculate setae (except Z4, J5 short, smooth) on raised insertions: J1 22–28, J2 25–30, J3 28–34, J4 32–39, J5 8–10, Z1 19–28, Z2 26–36, Z3 32–37, Z4 8–9, Z5 30–35, S1 23–29, S2 25–32, S3 27–32, S4 26–35, S5 24–33. Setae R1 inserted in soft cuticle laterad junction of two shields, setae R2–R6 and UR1, UR4 in soft cuticle laterad posterior shield: R1 19–25, R2 18–23, R3 18–21, R4 17–19, R5 20–27, R6 27–31, UR1 10–12, UR4 15–19. Opisthosomal setae gradually increasing in length towards posterior, posterior setae less spiculate than anterior setae. Opisthosmal shield with pairs of discernable pore-like structures, of which two appear secretory (gland pores: gd6 mesad Z1; gd9 distally on seta-bearing horn) and nine appear non-secretory (lyrifissures: idm1 mesad Z1; idm2 posterald J1; idm3 posterald J2; idx mesad Z2; idm4 mesad Z3; idm5 distal on seta-bearing horn; idm6 anterald J5; is1 anterald S1 on shield margin; idl2 laterad Z1 on shield margin; idl4 at base of seta-bearing horn). Two pores in soft cuticle laterad shield (posterald R3, posterald UR4). Peritreme extends to setae j1; peritremetal shield fused to dorsal shield from j1 to level with j1 anterolaterally.

Ventral idiwsoma (Fig. 2). Sternal shield with three pairs of setae (st1–st3) and three pairs of pores (stp1–3); shield measurements: st1–st1 38–41, st2–st2 42–50, st3–st3 51–57, st1–st3 50–56; posterior margin with small medial expansion; setae st4 in soft cuticle posterald shield. Epignyal shield truncate posteriorly, membranous anterior margin crenulate, st5–st5 43–48, anterior margin to posterior margin 70–76. Single pair metapodal platelets broadly triangular-oval. Ventrianal shield with light reticulate pattern, six pairs of ventral setae (JV2–5, ZV2–3); setae JV4 (21–29), JV5 (27–35) and postanal seta (21–23) thick, barbed; postanal seta longer than paranal setae (12–14); two pairs of pores visible. Peritremetal shield (see Fig. 2) with five pores visible along length (one level with dorsal seta st1, one level with seta r3, three distally surrounding stigma). Shield measurements:

Spermathecal apparatus indistinct.

Gnathosoma. Movable digit (25–26) of chelicerae (Fig. 3) with two large teeth. Fixed digit (18–20) with short dorsal seta (6–7), row of 5–6 serrations, short setiform pilus dentilis, and subapical off-set bifid tooth (Fig. 3). Palps (85–102) (Fig. 4A,B) less than twice the length of subcapitulum (72–76); palp setation tr–ti 2–5–6–12; setae simple, except for genu with setae al1 thick blunt (5–6), al2 thick spatulate (8); femur with setae al1 thick spatulate seta (9–10); palp apotele two-tined. Subcapitulum (Fig. 4A) with 6–8 rows of 2–3 of deutosternal denticles (most commonly 7 rows of 2 denticles). Tritosternum (see Fig. 2A) 68–72 long, length from base to fork 28–36; base with a few faint transverse striations. Tectum (Fig. 4C) anterior medial margin denticulate, with 9–13 fine teeth.

**FIGURE 3.** *Asca nelsoni* sp. nov. adult female chelicerae, abaxial and adaxial aspects presented.


**Male**

Dorsal idiosoma (Fig. 6) Body measurements: j1–J5 (222–231), j1–j6 (94–104), J1–J5 (94–97), r2–r2 (105–114), s6–s6 (97–103), S1–S1 (97–101), S4–S4 (69–70). All dorsal setae inserted on small tubercles. Two dorsal shields: anterior podonotal shield lightly colliculate-reticulate medially with 19 pairs of thick, spiculate setae: j1 12–13, j2 13–14, j3 14–17, j4 14–16, j5 15–16, j6 17–18, z2 18–19, z3 16–17, z4 17–18, z5 16–17, z6 18–19, s1 12, s2 16–17, s3 12–19, s4 20–22, s5 17–19, s6 18–20, r2 15–19, r3 15–16. Setae r4 16–18, r5 17–18 in soft cuticle laterad shield. Podonotal shield with nine pairs of discernable pore-like structures, of which five appear secretory (gland pores: gd1 lateral j3; gd2 mesad z4; gd4 on shield margin laterad s5; gd5 posteromesad z5; small circular pore gdx anterolateral j6) and four appear non-secretory (lyrifissures: id1 lateral j2; id1a anterad j4; id4 on shield margin laterad s5; id6 lateral j6). Posterior opisthosomal shield
ornamentation less pronounced than anterior shield, light reticulations between the J-series and Z-setae to level with J3; with 15 pairs of thick, spiculate setae on small tubercles, setae gradually increasing in length towards posterior and becoming increasingly spiculate: J1 18–20, J2 18–22, J3 20–24, J4 24–28, J5 6–10, Z1 18–21, Z2 19–24, Z3 21–29, Z4 6–12, Z5 25–29, S1 17–19, S2 21–22, S3 23–21, S4 21–24, S5 21–25. Setae R1 15–16, R2 14–15, R3 16–17, R4 14–16, R5 13–18, R6 19–20. Setae UR1 9, UR2 8 (often absent on males) inserted in soft cuticle laterad shield. Podonotal shield with 12 pairs of discernable pore-like structures, of which two appear secretory (gland pores: gd6 mesad Z1; gd9 distally on seta-bearing horn) and 10 appear non-secretory (lyrifissures: idm1 mesad Z1; idm and idm2 laterad J1; idm3 posterad J2; idm4 laterad J4; idm5 distally on seta-bearing horn; is1 anterior corner of shield; idl2 laterad Z1; idl3 posterad S3; idl4 at base of horn). Two pores in soft cuticle laterad shield (posterad R3, posterad R5). Peritreme extends to setae j1.

Ventral idiosoma (Fig. 7) Sternitogenital shield smooth (rarely with faint longitudinal striae visible); shield measurements: st1–st1 (32–34), st3–st3 (40–45), st5–st5 (28–30), st1–st5 (95–96); three pairs pores on shield (stp1–3), pair pores in soft cuticle posterolaterad st5 (stp5). Ventrianal shield reticulate, broadly ovate, ZV1–ZV1 (48–52), JV4–JV4 (90–99), ZV1–paranal seta (59–62),
with seven pairs of setae (JV1–5, ZV1–2); setae ZV3 absent. Setae JV4 (13–14), JV5 (20–26) and postanal seta (18–19) thick barbed; postanal seta longer than paranal setae (10–11); three pairs of pores visible. Cribrum narrow, finely speculate, in 2 rows.

FIGURE 5. Asca nelsoni sp. nov. adult female legs I–IV (tarsus I not drawn).

Gnathosoma. Movable digit (18–19) with one tooth; fixed digit (13) with short dorsal seta (5–6), row of three serrations, short setiform pilus dentilis, and subapical off-set bifid tooth (Fig. 8A). Spermatodactyl short (11–12), slightly longer than fixed digit, truncate (Fig. 8A,B). Palps (84–87) less than twice the length of subcapitulum (60–63); palp setation tr–ti same as adult female; palp setae simple except for genu setae al1 thick blunt (5), al2 thick spatulate (8), femur setae all thick spatulate (9); palp apotele two-tined. Subcapitulum with 7 rows of 1–4 deutosternal denticles (most often 2 denticles). Tectum (Fig. 8C) anterior medial margin denticulate, with approximately 7–8 fine teeth. Tritosternum (see Fig. 7) 52–58 long, length from base to fork 21–34.

Legs. Leg setation same as adult female. Length of legs from base of trochanter to tip of tarsus, excluding pretarsus: I 190, II 171, III 153, IV 187.
FIGURE 6. Asca nelsoni sp. nov. adult male dorsum. Scale bar = 100 μm.
**FIGURE 7. Asca nelsoni** sp. nov. adult male venter, with detail of tritosternum.

*Protonymph*

Dorsal idiosoma (Fig. 9). Body measurements: \( j1-j6 \ 91–97, J3-J5 \ 36–41, s6-s6 \ 86–88, S4-S4 \ 55–56. \) Most dorsal setae short, barbed (11–17), except \( J4 \ (21–22), Z4 \ (16–20), Z5 \ (24–26), S4 \ (20–22), S5 \ (18–21); 29 dorsal setae present. Podosomal shield \( (j1-j6 \ 91–97) \) with longitudinal band of colliculate ornamentation medially between setae \( j3-j6; \) setae \( j1 \ 9–10); 8 pairs of small pores visible. Setae \( r2, r3 \) inserted laterad shield. Seven small platelets and 3 pairs of small pores in soft cuticle.
between podosomal and pygidial shield. Pygidial shield (J3–J5 36–41) with 8 pairs of setae and 3 pairs of pores on anterior margin; setae Z4 inserted on seta-bearing horn; setae S5 inserted on pygidial shield separately to horn; setae Z4 barbed, longer than that of adult female; setae J5 lightly barbed; five pairs of small platelets or pores in soft cuticle posterolateral pygidial shield. Peritreme extends to setae r2.

**FIGURE 8.** *Asca nelsoni* sp. nov. adult male, A. cheliceral digits, abaxial and adaxial aspects; B. cheliceral digits, dorsal and ventral aspects; C. variation in tectum.


Gnathosoma. Moveable digit (16–17) with 2 teeth; fixed digit (13) with 5 teeth (4 teeth forming a row with one offset tooth distally); cheliceral seta short (5). Palps (75–77) less than twice as long as subcapitulum (52–59); palp setation tr-ri 1-4-5-10; palp setae simple except genu seta all short peg-like (4–5); femur all thick (6–8). Subcapitulum with 6 rows of 2 deutosternal denticles. Tectum small with 9–10 teeth (Fig. 4D).


**Etymology**

Named in honor of Robert F. Nelson, President and CEO of the National Coffee Association of the United States of America, for his strong support of coffee research at the U. S. Department of Agriculture, Agricultural Research Service.
FIGURE 9. Asca nelsoni sp. nov. protonymph dorsum; setae on left side of dorsum indicated by black dots.
Remarks

Relatively small species, body noticeably convex dorsally. Marginal setae r2 captured by the propodosomal shield, a character also shared by the North American species Asca brachychaeta Hurlbutt 1963, A. citri Hurlbutt 1963 and A. elongata (Berlese) 1910. Based on the description provided in Hurlbutt (1963), adult females of A. nelsoni sp. nov. can be separated from A. brachychaeta (A.b.), A. citri (A.c.) and A. elongata (A.e.) by having opisthosomal setae Z4 significantly shorter than S5 (more or less subequal in A.b., A.c. and A.e.), and the distance J4–J4 subequal to J1–J1 (J4–J4 > J1–J1 in A.b. (38 > 13), A.c. and A.e.). In addition, setae J4 (32–39) are much shorter on A. nelsoni than on A. brachychaeta (54). Some observed aberrations in the morphology of A. nelsoni: dorsal setae z6 are absent on one female; setae S1 are absent on one male.

Biology

All specimens were obtained from the leaf domatia of seven different C. arabica L. accessions maintained at the International Coffee Germplasm Center of the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) in Turrialba, Costa Rica. Asca species associated with domatia are predators of mites and other small invertebrates (Walter & Proctor 1999).

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References


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