



Two New Species of Gall-like Scale Insects on Oaks from the Nearctic Region (Homoptera: Coccoidea: Kermesidae)

Author(s): R. G. Baer and M. Kosztarab

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TWO NEW SPECIES OF GALL-LIKE SCALE INSECTS
ON OAKS FROM THE NEARCTIC REGION
(HOMOPTERA: COCCOIDEA: KERMESIDAE)

R. G. BAER¹ AND M. KOSZTARAB²

Delta States Research Center, USDA, SEA-AR
Southern Weed Science Laboratory, Biological Weed Control Research
P.O. Box 225, Stoneville, MS 38776
in cooperation with the
Department of Entomology
Mississippi State University
Mississippi State, MS 39762 USA

ABSTRACT

The first instars of *Kermes iselini* and *K. prinus* new species are described and illustrated. Keys are provided to separate closely related Nearctic species based on first instar morphology.

RESUMEN

Se describen y se presentan dibujos de los primeros instares de *Kermes iselini* y *K. prinus*, nuevas especies. Se presentan claves basadas en la morfología de los primeros instares para separar las especies neárticas cercanas en relación.

The Kermesidae or gall-like scale insects are found throughout the Nearctic Region on oaks (*Quercus*) and chinquapins (*Castanopsis*) in the family Fagaceae. There are 2 genera in the family Kermesidae: *Kermes*

¹Research Associate, Department of Entomology, Mississippi State University, Mississippi State, MS 39762.

²Professor of Systematic Entomology, Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061.

Boitard (1828) and *Olliffiella* Cockerell (1896). The genus *Olliffiella* consists of 2 leaf-gall forming species found in the southwestern United States and Mexico. Twenty-nine species have been included in the genus *Kermes*.

Ferris (1955) stated that, "The genus *Kermes* presents to the student an almost impossible situation" when referring to the external morphology and classification of the group. The difficulty stems from the fact that early descriptions were based on the external appearance of mature, sclerotized adult females. The characters (i.e. size, shape and color patterns) used in the descriptions are subject to excessive intraspecific variations and are unreliable for species determination.

Hamon et al. (1976) and Bullington (1978) determined that post-reproductive females do not provide much information even after they are slide mounted. However, the morphology of the 1st instars provides useful characters for identification of *Kermes* species. Kuwana (1931) and Balachowsky (1950) separated 10 species in the Palearctic Region based on this stage. Baer (1980) described the 1st instar of *Kermes kozstarabi* Baer and presented a key to separate the 1st instars of 4 species in the *K. galliformis* Riley group. With the 2 species described here, 11 species or species complexes comprising 3 species groups can now be distinguished based on 1st instars in the Nearctic Region.

In concurrent studies, Bullington (1978) and Baer (1978) found that certain *Kermes* species can only be separated at certain stages of development. *Kermes iselini* and *K. prinus* new species can be separated morphologically in the 1st instar.

Each description is based on the holotype and 9 paratype 1st instars. The holotype measurements are followed in parentheses by the average and the range of the 9 paratype specimens. Measurements are given in microns. The descriptions and illustrations include only half the dorsum and venter and should be doubled for a complete view of each surface. A key to separate closely related species follows each description. Sexual differentiation was not apparent among the 1st instars.

Kermes iselini Baer and Kosztarab, NEW SPECIES
(Fig. 1 a-t)

TYPE MATERIAL STUDIED: On leaves, petioles and buds of *Quercus mohriana* Buckl., Mohrs oak. Holotype and 74 paratype 1st instars, 15 mi. N. of El Paso Gap, Otero Co., New Mexico, 15-VI-1976, coll. W. A. Iselin.

TYPE DEPOSITION: Holotype 1st instar with 4 paratypes on same slide and 20 other paratypes on 4 slides deposited in the United States National Museum of Natural History, Washington, D.C. Other paratype 1st instars deposited in the following collections: 20 specimens on 4 slides in the British Museum (Natural History), London; 20 specimens on 4 slides in the University of California at Davis; and 10 specimens on 2 slides in the Virginia Polytechnic Institute and State University, Blacksburg (VPI). Additional dry material curated at VPI.

ETYMOLOGY: *Kermes iselini* was named for Mr. William A. Iselin, Agricultural Biologist for the State of California, whose diligent collecting efforts in southwestern United States resulted in the discovery of this species.

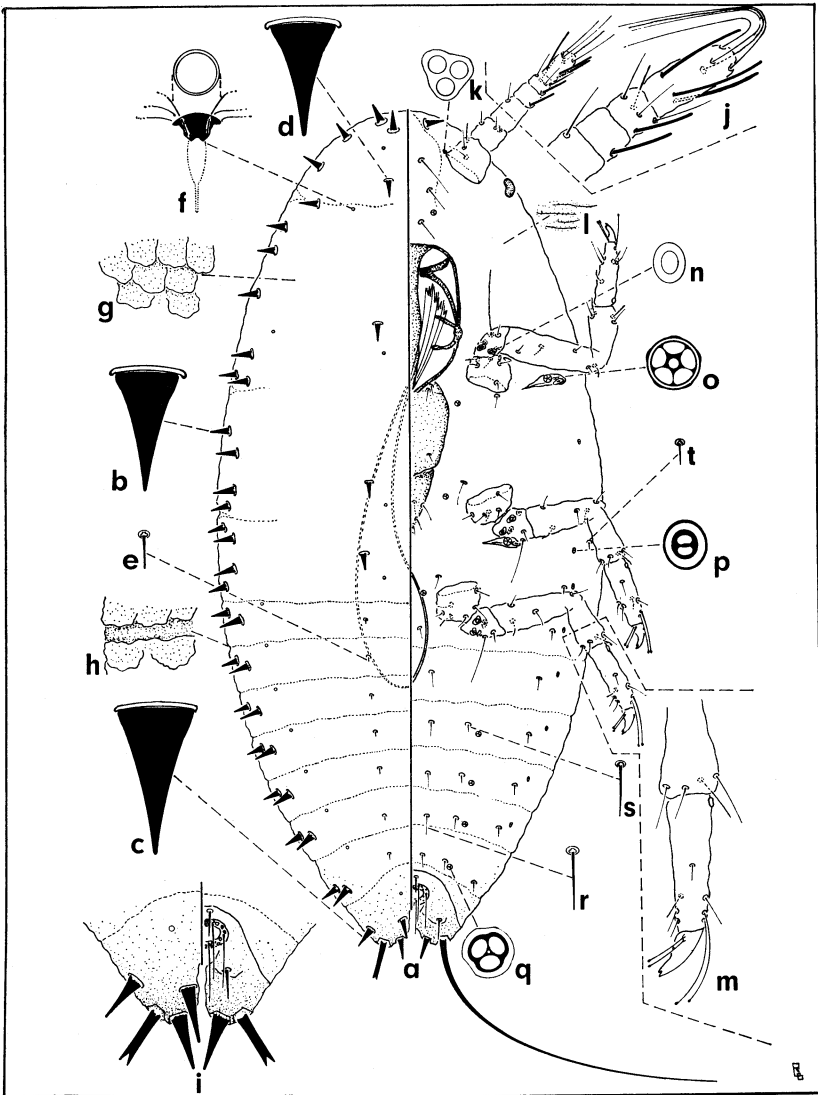


Fig. 1a-t. *Kermes iselini* Baer and Kosztarab, n. sp. first instar; a, dorso-ventral view of body. Dorsum: b,c, marginal setae; d,e, submedial setae; f, simple pore; g, derm; h, intersegmental membrane; i, anal lobes. Venter: j, antenna; k, trilocular pore; l, derm; m, enlargement of tibia, tarsus and claw of metathoracic leg; n, sensory pore; o, quinquelocular pore laterad of spiracle; p, bilocular pore; q, submedial trilocular pore; r-t, body setae.

DESCRIPTION

BODY (Fig. 1a). Oblong, widest at mesothorax, tapering posteriorly,

antennae, legs and anal lobes well developed, with long apical setae. Length 423 (483,408-544), width 181 (191,166-227).

DORSUM: *Marginal setae* (Fig. 1b). Conical, 33-35, 16 (16,12-23) long, 8 (8,5-9) wide. Each abdominal segment with 2 pr.

Marginal setae on anal lobe (Fig. 1c). Slightly longer and thicker than other marginal setae, 18 (18,16-24) long, 9 (8,8-9) wide.

Submedial setae on head and thorax (Fig. 1d). Conical, 4 pr. on head and thorax, similar to marginal setae but different from submedial setae on abdomen, 14 (14,12-16) long, 9 (7,6-9) wide.

Submedial setae on abdomen (Fig. 1e). Thin, elongate, 7 pr., 4 (5,4-6) long, ca. 1 wide.

Simple pores (Fig. 1f). Composed of a membranous duct opening into a sclerotized ring, arranged in 1 longitudinal row along submargin of body, several irregularly spaced pores in submedial area, 13-15 pores.

Derm (Fig. 1g). Composed of overlapping plate-like areas.

Intersegmental membrane (Fig. 1h). Apparent, due to type of derm.

Anal lobes (Fig. 1a,i). Sclerotized. Conical seta on inner margin of each lobe, 16 (21,16-23) long, another at apex, 19 (19,16-21) long; apical seta 106 (124,91-196) long.

VENTER: *Antennae* (Fig. 1j). Six segmented. Total length 84 (90,80-102). Scape 12 (13,12-14) long, 26 (26,23-33) wide. Segments II to VI: 16 (17, 16-21), 16 (18,16-19), 9 (11,9-12), 12 (11,9-14), 19 (21,16-26) long, respectively. One trilocular pore at each scape base (Fig. 1k). Segment I with 3 slender setae, II with 2 slender setae and 1 sensory pore, III with 1 slender seta, IV with 1 fleshy seta, V with 4 slender setae and 1 fleshy seta and VI with 4-6 slender setae and 3 fleshy setae.

Clypeolabral shield. Sclerotized, length 74 (74,74-95), width 58 (59,51-70). Stylet loop extending to the 1st abdominal segment.

Labium. Sclerotized, triangular, composed of 3 segments. Basal segment small, with 2 pr. of setae, the middle segment with 1 pr. of setae and apical segment with 4 pr. of setae. Length 65 (73,58-86), width 46 (49,44-53).

Derm (Fig. 1l). Membranous.

Legs (Fig. 1m). Numerous, slender elongate setae on each segment. Four sensory pores on each trochanter (Fig. 1n). Sensory pore on proximal lateral margin of each tarsus. Tarsal digitules long, enlarged at apices; claw digitules longer than claw, enlarged at apices; claw notched apically.

Leg Segments and Claw	Lengths		
	Prothoracic	Mesothoracic	Metathoracic
Coxa	19 (21,19-23)	19 (20,16-23)	19 (20,16-23)
Trochanter	19 (25,19-30)	23 (26,23-30)	23 (27,23-35)
Femur	44 (49,44-53)	44 (47,37-53)	46 (50,44-58)
Tibia	33 (30,23-35)	33 (33,26-35)	30 (33,26-37)
Tarsus	49 (42,35-49)	39 (45,39-46)	42 (48,42-53)
Claw	9 (14,9-19)	9 (15,9-21)	14 (15,9-21)
Entire leg	173 (182,160-200)	167 (189,162-202)	174 (193,167-218)

Spiracles and associated pores (Fig. 1o). Each anterior and posterior spiracle with 1 quinquelocular pore; diam. ca. 4. Anterior spiracle 14 (15, 12-19) long, 5 (5,5-7) wide, atrium ca. 2 wide. Posterior spiracle 13 (13, 12-17) long, 5 (5,5-6) wide, atrium ca. 2 wide.

Bilocular pores (Fig. 1p). Located near bases of submarginal setae; 7-10 along each margin.

Submedial pores (Fig. 1q). Four pr. in 1 submedial longitudinal row on abdomen, 4 pr. on head and thorax, mostly triloculars but occasionally several quinqueloculars in each row, diam. ca. 4.

Body setae (Fig. 1 r-t). In 3 longitudinal rows on abdomen and partly on thorax: medial 6 (7,5-11) long, ca. 1 wide (Fig. 1r); submedial 7 (7,5-9) long, ca. 1 wide (Fig. 1s); submarginal 6 (7,5-9) long, 2 (1,1-2) wide (Fig. 1t). One long elongate seta near base of each coxa and 3 setae submedial to antennal base. One pair of setae similar morphologically to dorsal marginal setae on anterior margin of head.

Anal lobes and anal ring (Fig. 1a,i). Lobes sclerotized, with 1 submedial seta on each lobe, 10 (10,9-12) long. Anal ring oval, 14 (12,9-19) long, 16 (18, 16-21) wide, with 16-22 translucent cells, 6 anal ring setae 16 (19,14-23) long; 1 pr. of thick setae slightly anterior to anal ring 7 (9,7-14) long.

ADDITIONAL MATERIAL STUDIED: On *Quercus grisea* Liebm., gray oak, Tex Canyon, about 18 mi. N. from Rt. 80, Arizona, 20-VI-1976, colls. M. and M. Kosztarab, VPI; On *Q. rugosa* Née, near Portal, 1.5 mi. up on S. Fork Rd., Arizona, 19-VI-1976, colls. M. Kosztarab, D. Hanna, and I. Storks, VPI; Coronado National Forest, New Mexico, 20-VI-1976, colls. M. and M. Kosztarab, VPI.

AFFINITIES: Based on 1st instar morphology, *Kermes iselini* n. sp. is closely allied with *K. pubescens* Bogue (1898). *Kermes pubescens* is designated to represent a group containing the 2 species. Both species have conical dorsal marginal setae (with 2 pr. on each abdominal segment) and trilocular submedial pores on the venter. They can be separated with the following key:

Key to the First Instars of *Kermes pubescens* Group

1. Dorsal submedial setae conical on abdomen; 2 or 3 quinquelocular pores laterad of each anterior spiracle *Kermes pubescens* Bogue
- 1'. Dorsal submedial setae elongate on abdomen; 1 quinquelocular pore laterad of each anterior spiracle
..... *Kermes iselini* Baer and Kosztarab, n. sp.

CHARACTERISTIC INJURY: Old sclerotized females of this southwestern species were found attached to the leaf petiole and midvein, causing distortion. Damage was similar to that caused by *K. pubescens* found in central and eastern United States (McConnell and Davidson 1959).

Kermes prinus Baer and Kosztarab, NEW SPECIES (Fig. 2 a-v)

TYPE MATERIAL STUDIED: On twigs near bud regions of *Quercus prinus* L., chestnut oak. Holotype and 63 paratype 1st instars, at overlook, near tennis courts of Pipestem Lodge, Pipestem State Park, West Virginia, 27-VI-1978, colls. M., M. and E. Kosztarab and D. and M. Suhayda.

TYPE DEPOSITION: Holotype and 3 paratypes on same slide and 12 other

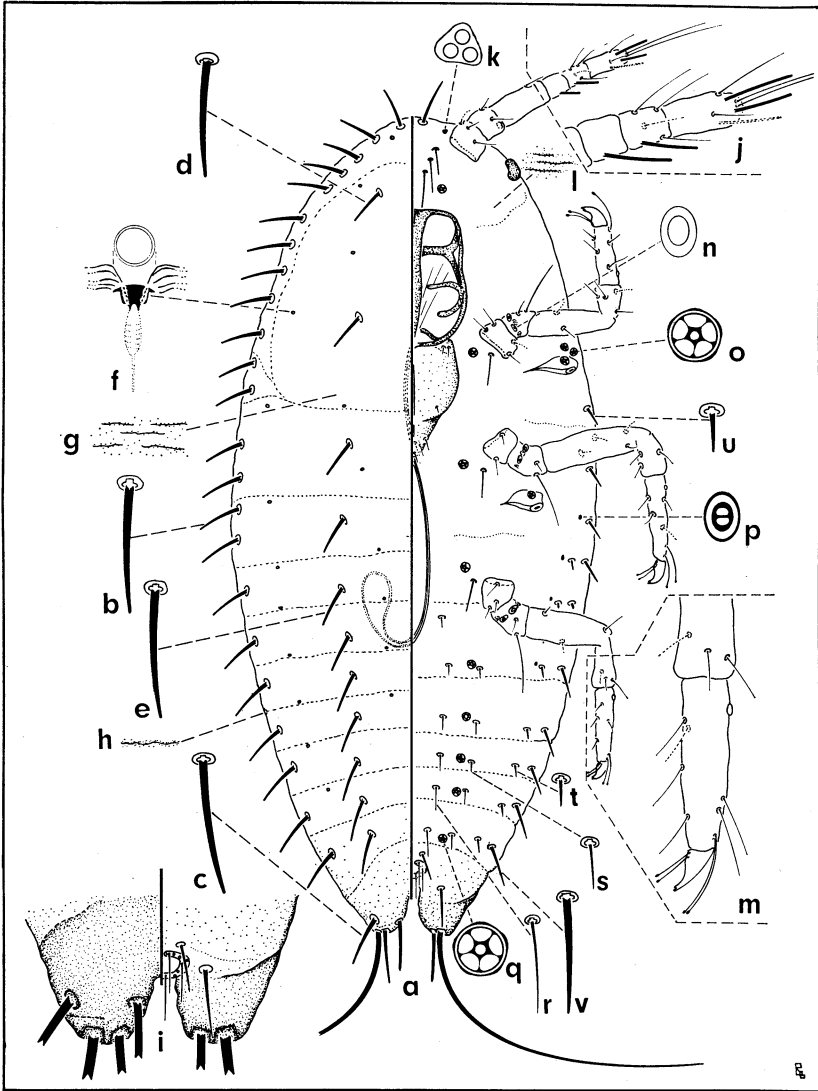


Fig. 2a-v. *Kermes prinus* Baer and Kosztarab, n. sp. first instar; a, dorso-ventral view of body. Dorsum: b,c, marginal setae; d,e, submedial setae; f, simple pore; g, derm; h, intersegmental membrane; i, anal lobes. Venter; j, antenna; k, trilocular pore; l, derm; m, enlargement of tibia, tarsus and claw of metathoracic leg; n, sensory pore; o, quinquelocular pore laterad of spiracle; p, bilocular pore; q, submedial quinquelocular pore; r-v, body setae.

paratypes on 3 slides deposited in the United States National Museum of Natural History, Washington, D.C. Other paratype 1st instars deposited in the following collections: 16 specimens on 5 slides in the British Museum

(Natural History), London; 16 specimens on 4 slides in the University of California at Davis; and 12 specimens on 4 slides in the Virginia Polytechnic Institute and State University, Blacksburg.

ETYMOLOGY: *Kermes prinus* was named after *Quercus prinus*, which was its first and only recorded host.

DESCRIPTION

BODY (Fig. 2a). Oblong, widest at mesothorax, tapering posteriorly, antennae, legs and anal lobes well developed, with long apical setae. Length 550 (539,513-563), width 250 (244,225-263).

DORSUM: *Marginal setae* (Fig. 2b). Elongate, thick, 21-24, 26 (25,23-33) long, 4 (4,3-4) wide. Each abdominal segment with 1 pr.

Marginal setae on anal lobe (Fig. 2c). Longer and thicker than other marginal setae, 37 (29,28-39) long, 5 (4,4-5) wide.

Submedial setae on head and thorax (Fig. 2d). Elongate, thick similar to abdominal submedial setae, 4 pr., 25 (24,15-26) long, 3 (3,3-4) wide.

Submedial setae on abdomen (Fig. 2e). Elongate, thick, 7 pr., 22 (24, 17-26) long, 2 (3,3-4) wide.

Simple pores (Fig. 2f). Composed of a membranous duct opening into a sclerotized ring, arranged in 2 longitudinal rows, 17-23 pores.

Derm (Fig. 2g). Simple, membranous.

Intersegmental membrane (Fig. 2h). Apparent, due to type of derm.

Anal lobes (Fig. 2a.i.). Sclerotized. One thick seta on inner margin of each lobe, 32 (28,27-33) long; another at apex, 36 (35,32-37) long; apical seta 166 (142,125-168) long.

VENTER: *Antennae* (Fig. 2j). Six-segmented. Total length 101 (97,88 106). Scape 13 (13,12-15) long, 37 (28,27-37) wide. Segments II to VI: 15 (16,15-19), 25 (25,23-25), 9 (9,9-12), 13 (13,12-14), 26 (27,24-28) long, respectively. One trilocular pore at each scape base (Fig. 2k). Segment I with 3 slender setae, II with 2 slender setae and one sensory pore, III with 1 slender seta, IV with 1 fleshy seta, V with 4 slender setae and 1 fleshy seta and VI with 4-5 slender setae and 3 fleshy setae.

Clypeolabral shield. Sclerotized, length 101 (98,97-110), width 71 (70, 68-72). Stylet loop extending to 1st or 2nd abdominal segments.

Labium. Sclerotized, triangular, composed of 3 distinct segments. Basal segment with 2 pr. of setae, the middle segment with 1 pr. of setae and the apical segment with 4 pr. of setae. Length 81 (79-78-83), width 58 (60, 48-62).

Derm (Fig. 2l). Membranous.

Legs (Fig. 2m). Numerous, slender elongate setae on each segment. Four sensory pores on each trochanter (Fig. 2n). Sensory pore on proximal lateral margin of each tarsus. Tarsal digitules long, enlarged at apices; claw digitules longer than claw, enlarged at apices; claw notched apically.

Spiracles and associated pores (Fig. 2o). Each anterior spiracle with 3 quinquelocular pores, rarely 1 of these a trilocular pore, each posterior spiracle with 1 quinquelocular pore; diam. ca. 4. Anterior spiracle 15 (14, 13-16) long, 5 (5,4-6) wide, atrium ca. 2 wide. Posterior spiracle 14 (13, 13-17) long, 5 (5,5-8) wide, atrium ca. 2 wide.

Bilocular pores (Fig. 2p). Located near bases of submarginal setae. Associated with anterior setae; 4-7 along each margin.

Leg Segments and Claw	Lengths		
	Prothoracic	Mesothoracic	Metathoracic
Coxa	26 (25,24-30)	26 (23,23-27)	26 (23,22-27)
Trochanter	26 (25,24-29)	30 (26,24-30)	31 (27,26-32)
Femur	70 (68,64-70)	68 (64,58-70)	70 (67,64-71)
Tibia	37 (35,30-37)	35 (33,32-39)	39 (36,34-40)
Tarsus	52 (49,47-53)	54 (54,53-58)	57 (57,56-59)
Claw	19 (19,19-20)	23 (20,19-23)	23 (20,19-23)
Entire leg	230 (219,210-237)	236 (225,215-245)	243 (239,231-253)

Submedial pores (Fig. 2q). Five pr. in 1 submedial longitudinal row on abdomen, 4 pr. on head and thorax, usually quinquelocular but sometimes several trilocular in each row, diam. ca. 4.

Body setae (Fig. 2r-v). In 4 longitudinal rows on abdomen and partly on thorax: medial 15 (14,9-19) long, ca. 1 wide (Fig. 2r); submedial 8 (8,7-10) long, ca. 1 wide (Fig. 2s); submarginal 9 (8,7-10) long, ca. 1 wide (Fig. 2t); marginal 15 (18,12-24) long, ca. 2 wide (Fig. 2u). Posteriormost seta in marginal row thicker than rest in row 20 (20,18-26) long (Fig. 2v). One very elongate seta near base of each coxa and 3 setae submedial of antennal base. One pair of setae similar morphologically to dorsal marginal setae on anterior margin of head.

Anal lobes and anal ring (Fig. 2a,i). Lobes sclerotized, with 1 submedial seta on each lobe 21 (17,13-23) long. Anal ring oval 12 (13,9-14) long, 20 (21,15-22) wide, with 14-20 translucent cells, 6 anal ring setae 19 (18,16-22) long; 1 pr. of thick setae slightly anterior to anal ring 19 (17,16-23) long.

AFFINITIES: *Kermes prinus* n. sp. is closely allied to *K. concinnulus* Cockerell (in Bogue 1898), *K. cockerelli* Ehrhorn (1898), *K. shastensis* Ehrhorn (1911) and *K. rimarum* Ferris (1955). *Kermes concinnulus*, the oldest described species, is designated to represent a group which includes all the above listed species. All species in this group have elongate or parallel-sided dorsal marginal setae and quinquelocular submedial pores on the venter. They can be separated with the following key:

Key to the First Instars of *Kermes concinnulus* Group

1. All or some dorsal submedial setae on head, pro- and mesothorax thickened and similar to dorsal marginal setae 2
- 1'. Dorsal submedial setae on head, pro- and mesothorax slender, small and different from dorsal marginal setae 4
- 2(1). Parallel-sided and blunt dorsal marginal setae; 1 7-locular pore laterad of each anterior spiracle *Kermes shastensis* Ehrhorn
- 2'. Elongate and pointed dorsal marginal setae; quinquelocular pore(s) laterad of each anterior spiracle 3
- 3(2). Dorsal submedial setae only on head, pro- and mesothorax similar to dorsal marginal setae; 1 quinquelocular pore laterad of each anterior spiracle *Kermes cockerelli* Ehrhorn
- 3'. Dorsal submedial setae along entire body, similar to dorsal

- marginal setae; 3 quinquelocular pores laterad of each anterior spiracle *Kermes prinus* Baer and Kosztarab, n. sp.
- 4(1). Four to 7 bilocular pores along each ventral body margin; terminal antennal segment 21-25 long *Kermes concinnulus* Cockerell
- 4'. Eight to 10 bilocular pores along each ventral body margin; terminal antennal segment 26-30 long *Kermes rimarum* Ferris

Information on the first, second and third instars and the adult females will be presented in the forthcoming revision of the Kermesidae in the Nearctic Region to be published as a Research Division Bulletin of the Virginia Polytechnic Institute and State University, Blacksburg.

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