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A Key to Phoretic Mites Commonly Found on Long-Horned Beetles Emerging from Southern Pines

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INTRODUCTION

Long-horned beetles that attack conifers are usually considered secondary pests because they generally develop in dead and dying trees and are not the cause of tree mortality (Drooz 1985). Recently that status has changed with the realization that a number of species, especially those belonging to the genus *Monochamus*, are vectors of the pinewood nematode, *Bursaphelenchus xylophilus* (Steiner and Buhrer). This nematode is the causative agent of pine wilt disease. Most species of conifers endemic to North America are resistant to the wilt disease, but many exotic species are highly susceptible. The introduction of this nematode into Japan had devastating effects on the native pines in that country (Mamiya 1972), and trade restrictions now exist to prevent the introduction of this pathogen into Europe.

It has been suggested that several mite species associated with the principal vector in Japan, *Monochamus alternatus* Hope, may prey upon this nematode (Enda and Tamura 1977). Cursory observations of some of the mites associated with species of long-horned beetles attacking southern pines also indicate that some of these mites are nematophagous (Kinn 1986).

A first step in the determination of possible natural enemies of either the nematode or its insect vector is to survey the associated fauna. In regard to the acarine fauna, this step has been taken (Kinn 1986). The next step is to identify these mites, a difficult task for researchers unfamiliar with mites. To facilitate identification of mites commonly found associated with adult cerambycids emerging from southern pines, a key to the phoretic and/or parasitic forms has been prepared. Only one stage in the life cycle of each mite species is phoretic. In some cases this may be an adult stage, but it is often an immature stage such as the second nymphal stage, termed a deutonymph or the larval stage. The key is limited to the mite species found in our samples.

METHODS

Eleven loblolly pine trees (*Pinus tuedu* L.) were felled beginning in the spring of 1982 and ending in June 1985. These trees remained in the field from 10 days to several months until numerous oviposition pits of long-horned beetles were present and larval activity could be heard. Billets were then cut from these trees and transported to a greenhouse where they were placed in rearing containers for 3 to 8 months, depending on the season. Beetles emerging from these billets were collected daily as they emerged and the mites removed and identified as to species.

RESULTS AND DISCUSSION

Five cerambycid species emerged from the field-collected bolts (table 1). *Monochumus titillator* (F.) and *Neucunthocinus obsoletus* (Olivier) were the most numerous. Of these two species, *M. titillator* appears to be a more efficient vector of the pinewood nematode (Kinn 1986). *Monochumus carolinensis* (Olivier) is also an efficient vector (Linit and others 1983). *Neucunthocinus obsoletus* and *M. curolinensis* have fewer mite associates than *M. titillator*. This may be due to behavioral differences among these species. *Neucunthocinus obsoletus* pupates at the phloem-xylem interface, whereas *Monochumus* spp. pupate within the xylem. *Monochumus curolinensis* tends to oviposit on thin-bark trees or on the thin bark sections of trees (Linit and others 1983). This may also account for the low numbers of *M. curolinensis* reared from our bolts, since most were taken from the lower, thicker barked section of the trees. Thirteen species of mites were associated with the long-horned beetles collected (appendix).

The mite species commonly found associated with scolytids, such as *Dendrolaelaps neodisetus* (Hurlbutt), *Trichouropoda australis* Hirschmann, and *Histiostomu*

Table 1.—*Phoretic mites found on cerambycid beetles emerging from field-collected bolts*

Mites	Cerambycid beetles*				
	Monochamus titillator (F.) (278)	*Monochamus carolinensis* (Olivier) (23)	*Neacanthosinus obsoletus* (Olivier) (203)	*Xyloterus sagittatus* (Get-mar) (134)	*Tylocerina nodosa* (F.) (8)
Mucroseius monochami (Adult female)	X				
Longoseius cuniculus (Dnym)†	X				
Dendrolaelaps isodentatus (Dnym)	X				
Dendrolaelaps varipunctatus (Dnym)	X	X	X	X	
Dendrolaelaps neodisetus (Dnym)	X	X	X		
Trichouropoda lamellosa (Dnym)	X	X	X	X	
Trichouropoda hirsuta (Dnym)	X	X	X	X	
Trichouropoda australis (Dnym)			X		
Eutogenes vicinus (Adult female)			X		
Tarsonemus subcorticalis (Adult female)	X	X			
Neotrombidium tricuspidurn (Lar)	X	X		X	X
Histiogaster arborsignis (Dnym)	X	X	X	X	
Histiostoma varia (Dnym)	X				

*Number in parentheses is the number of beetles examined.
†Dnym=deutonymph.

varia (Woodring and Moser), are rarely associated with long-horned beetles. The reverse is also true. Most of the mites commonly found on long-horned beetles are rarely found associated with scolytids. *Histioguster arborsignis* Woodring is the only mite commonly found associated with both bark beetles and long-horned beetles. Several mite species were found only on *N. obsoletus.* This may be due to the habit of N. *obsoletus* pupating at the phloem-xylem interface rather than within a pupal cell excavated from the xylem.

Additional sampling would probably reveal additional acarine species associated with long-horned beetles present in southern pines. Therefore, it would be prudent to have an acarologist confirm identifications made with the following key. The mite species listed here may or may not be present on other species of long-horned beetles attacking pines in other areas of North America.

AN ARTIFICIAL KEY TO PHORETIC MITES COMMONLY FOUND ON LONG-HORNED BEETLES EMERGING FROM SOUTHERN PINE BOLTS

1. Usually large mites (over 0.3 mm); often with distinctive tanned dorsal and ventral shields (figs. 1-5); with a pair of median pincerlike and toothed mouthparts (chelicerae) (fig. 5B); respiratory openings (stigmata) located at level of legs II to IV (fig.l), and surrounded by a sclerotized groove (peritreme) that often extends anteriorly (fig. 3); a hairlike or forked structure (tritosternum) present between or beneath bases of leg I (fig. 1) [Parasitiformes] 2

1'. Small mites (0.3 mm or smaller); usually whitish in color; shields, if present, not as above; median mouthparts absent or needlelike; respiratory openings not located between legs II to IV, tritosternum absent [Acariformes] 9

2. Turtle-shaped; shielded margin of body with numerous scallops, most of which have a single hair; bases of legs I contiguous (figs. 1, 2); attachment to beetle is by means of an anal stalk. [Uropodoidea] 3

2'. Not turtle-shaped; bases of legs I well separated; attachment to host is by mouthparts and/or claws on the legs **5**

3. Ventral shield with five pairs of hairs; depressed spots present on sternogenital shield (fig. 1) .... ***Trichouropoda hirsutu***

3'. Ventral shield with six or seven pairs of hairs; depressed spots absent on sternogenital shield 4

4. Sternogenital shield with five pairs of hairs; ventral shield with six pairs of hairs (fig. 2A) .... ***Trichouropoda lamellosa***

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4'. Sternogenital shield with six pairs of hairs; ventral shield with seven pairs of hairs (fig. 2B) .... *Trichouropoda australis*

5. Dorsum covered by one shield; genital shield separated from sternal shield (fig. 3) .... ***Mucroseius*** *monochami*

5'. Dorsum covered by two shields (figs. 4-6); genital shield not separated from sternal shield (fig. 6A [Digamasellidae] 6

6. Body elongate, about four times longer than wide (fig. *4)* .... *Longoseius cuniculus*

6'. Body not elongate, about two times longer than wide 7

7. With four equally long posterior body hairs; middle tine of epistome (dorsal covering of mouthparts) broader and longer than lateral tines (fig. 5) .... *Dendrolaelaps isodentatus*

7'. With two or four long posterior body hairs; if four, then one pair is at least twice the length of the other; middle tine of epistome shorter than lateral tines **8**

8. With two long posterior body hairs; without platelets between dorsal shields (fig. 6B); inner border of peritreme not wavy .... *Dendrolaelaps neodisetus*

8'. With four long posterior body hairs, outer pair longer than inner pair; with two platelets between dorsal shields; inner border of peritreme wavy (fig. 6C) .... *Dendrolaelaps varipunctatus*

9. Mouthparts apparent; anal suckers absent (figs. **7A,** B; **8C)** 10

9'. Mouthparts not apparent; special anal suckers present (fig. **8A,** B) **12**

10. With three pairs of legs; dorsum with one pair of long sensory hairs; other dorsal hairs moderately long, thick, and **pilose,** each set on an individual platelet (fig. 7A) ....".............................. *Neotrombidium tricuspidum*

10'. With four pairs of legs; legs IV may bear claws or appear hairlike; dorsum without long sensory hairs; dorsal hairs not set on individual platelets 11

11. All legs similar in size; legs IV with claws; dorsal hairs **fanlike;** mouthparts large, with elaborate appendages (fig. 7B); ventral body apodemes (ridges) absent .... *Eutogenes vicinus*

11'. Legs IV smaller then others, without claws, terminating in **whiplike** hairs; dorsal hairs not **fanlike,** but one pair prominently club-shaped; mouthparts indistinct, without elaborate appendages (fig. SC); a series of ventral body apodemes present .... *Tarsonemus subcorticalis*

12. All legs similar in form; legs III and IV directed backwards, their distal segments short (fig. 8A) ....*...................... *Histiogaster arborsignis*

12'. Leg III and IV more slender than legs I and II, directed forwards, their distal segments elongate (fig. **8B)** .... *Histiostoma varia*

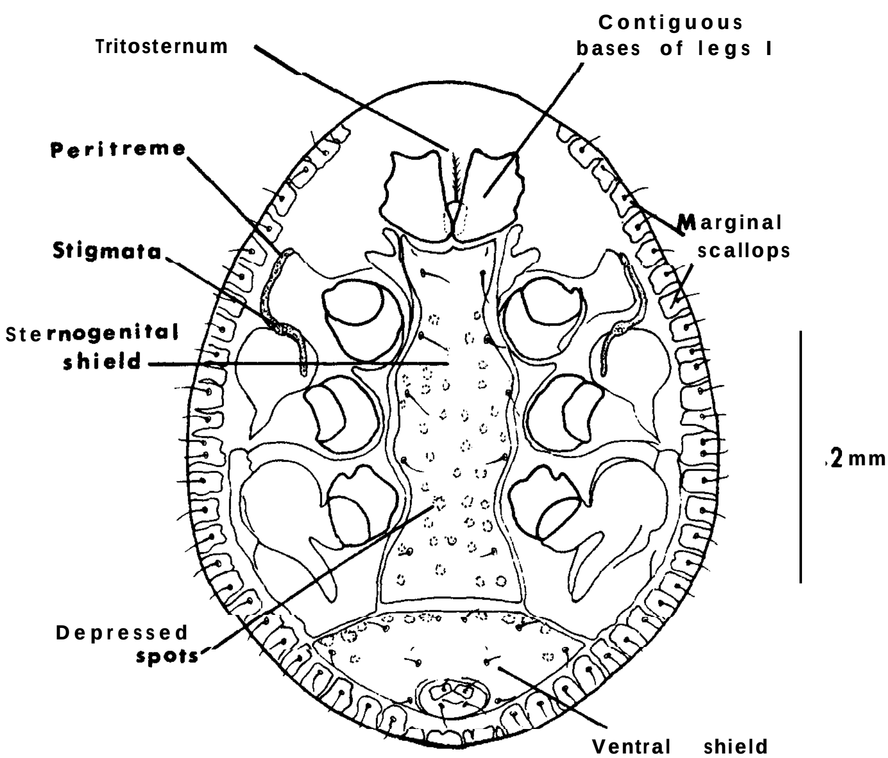

Figure **1.**—*Ventral body view* **of Trichouropoda hirsuta** *deutonymph.*

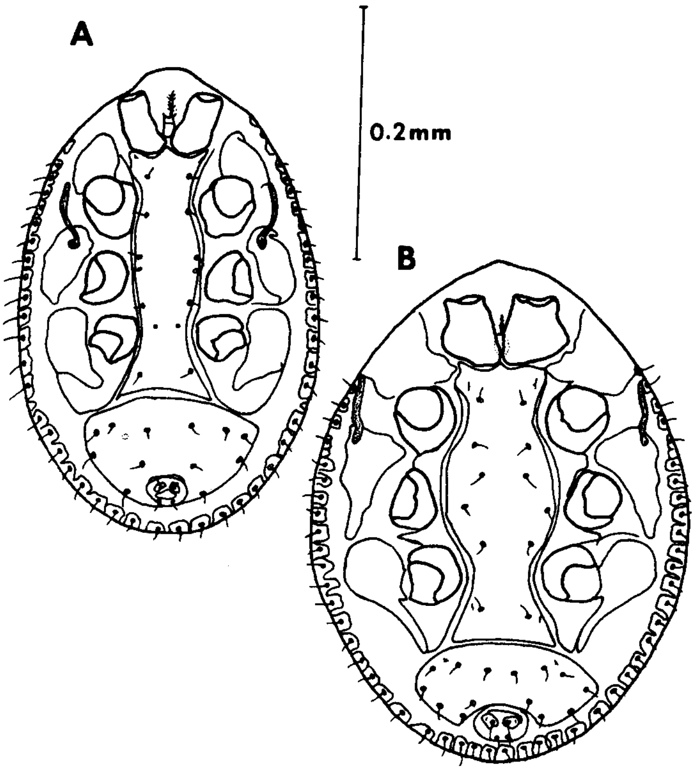

Figure 2.— *Ventral* body *view* of: *(A)* Trichouropoda lamellosa *deutonymph; (B)* Trichouropoda australis *deutonymph.*

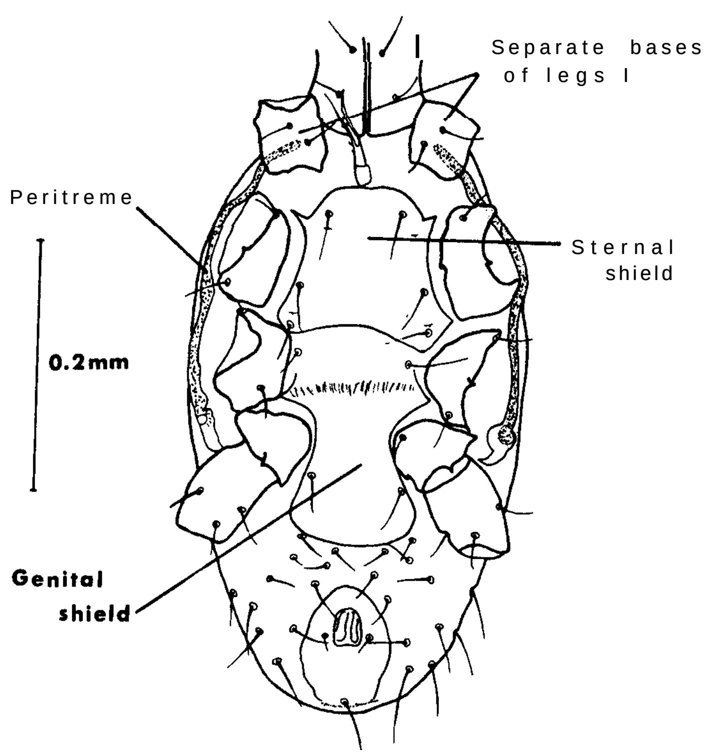

Figure 3.—*Ventral body view of* Mucroseius monochami *adult female.*

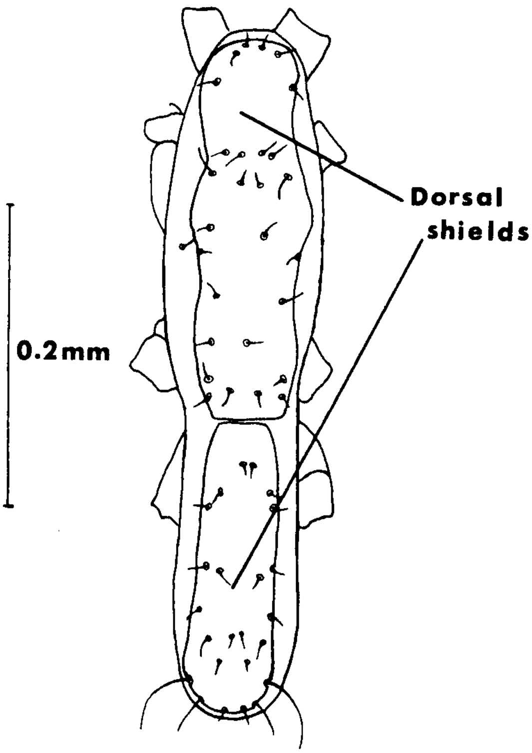

Figure 4.-Dorsal *body view of* Longoseius cuniculus *deutonymph*

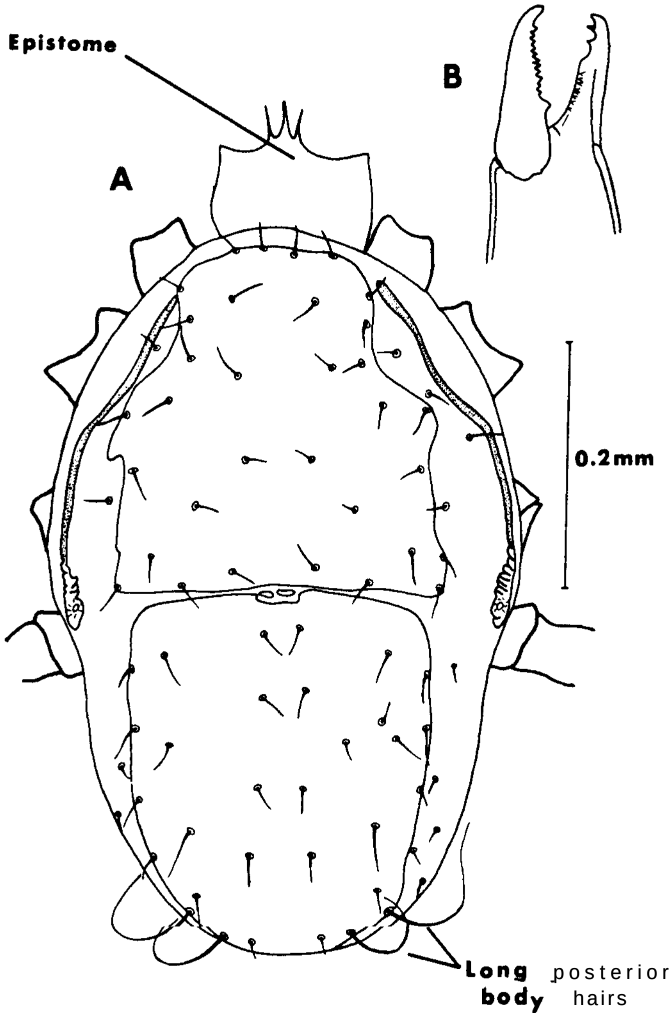

Figure 5.—**Dendrolaelaps** isodentatus ***deutonymph:*** *(A) dorsal body view; (B) chelicera.*

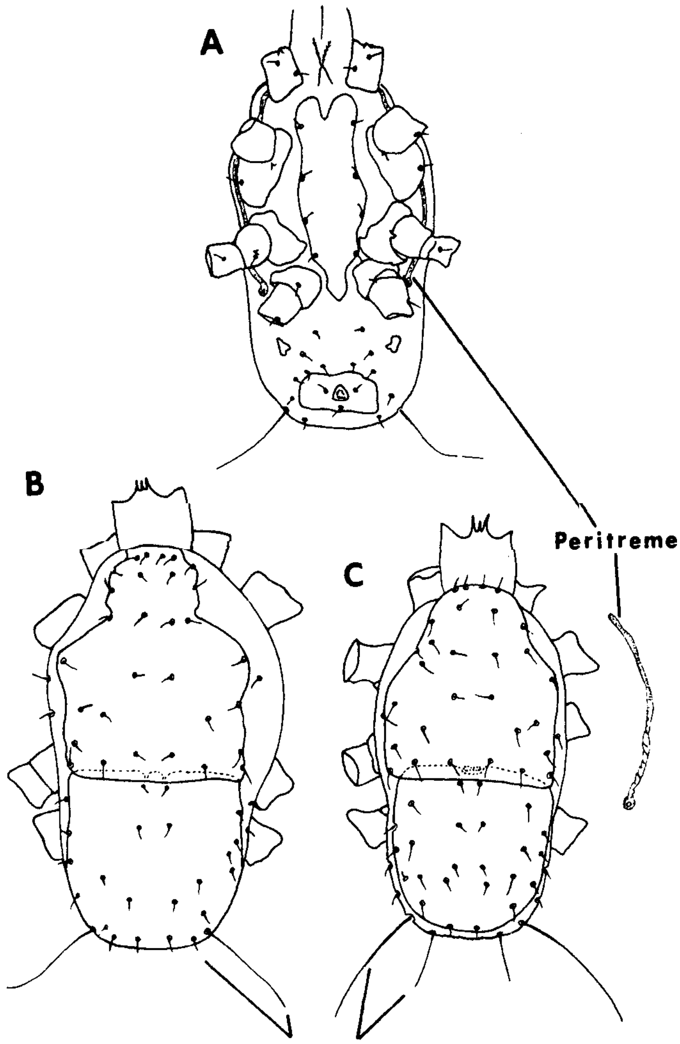

Figure *of:(A)* Dendrolaelaps neodisetus ***deutonymph, venter; (B)*** Dendrolaelaps neodisetus ***deutonymph, dorsum;*** (C) Dendrolaelaps varipunctatus ***deutonymph, dorsum.***

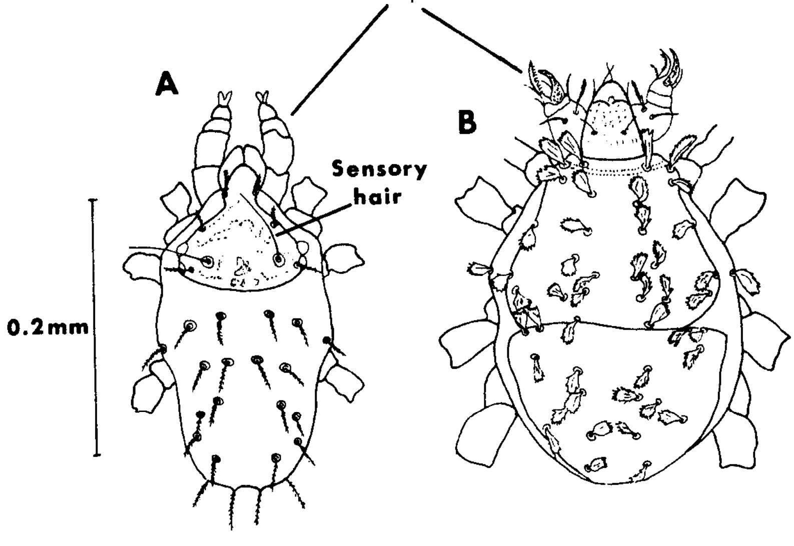

Figure **7.—** ***Body view*** of {A) Neotrombidium tricuspidum ***larva, dorsum; (B)*** Eutogenes **vicinus** ***adult female, dorsum.***

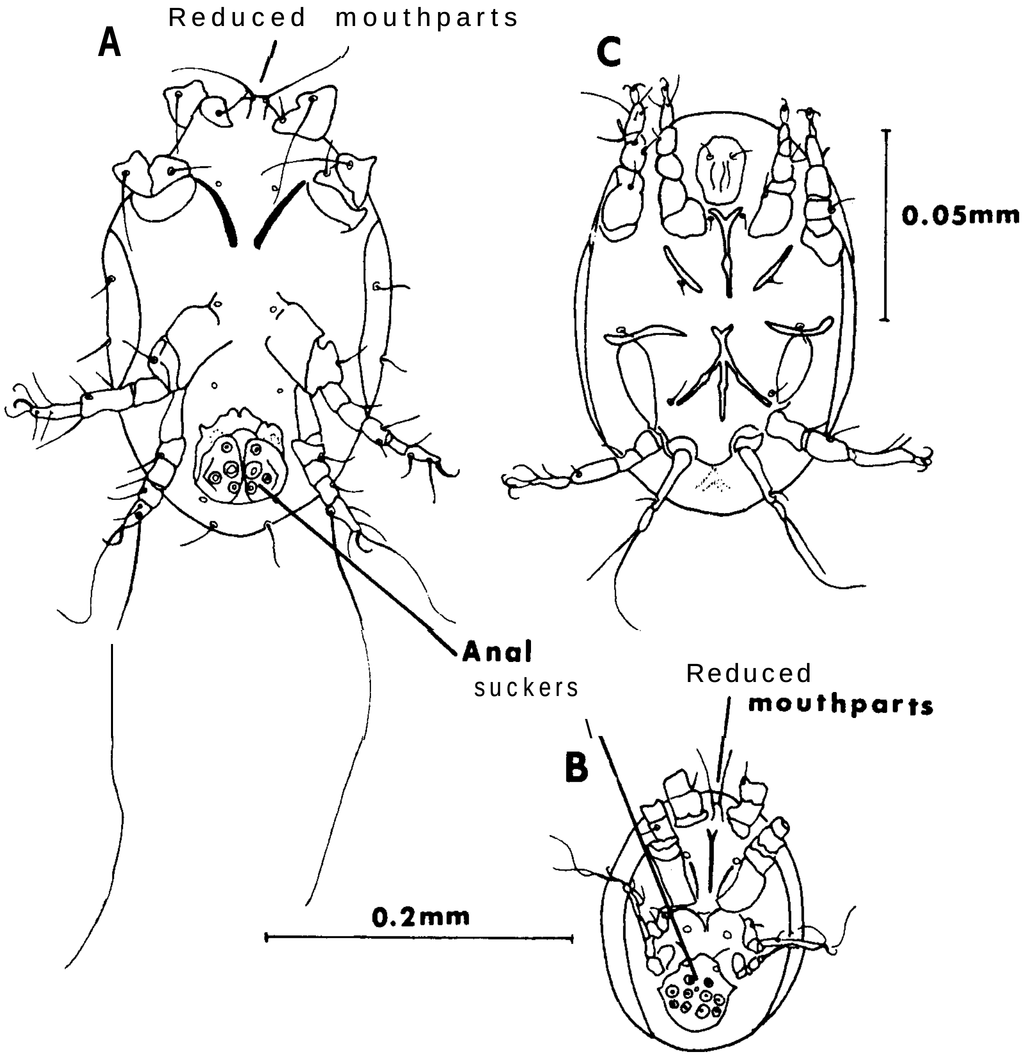

Figure 8.— *Body* view *of: (A)* Histiogaster arborsignis ***deutonymph,*** venter; (B) Histiostoma varia ***deutonymph, venter;*** (C) **Tarsonemus** subcorticalis ***adult female, venter.***

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Appendix

Species and instar of mites commonly phoretic on adult long-homed beetles associated with southern pines.

Order Parasitiformes
- Suborder Gamasida
  - Superfamily Ascoidea
    - Family Ascidae-adult females phoretic
      - *Mucroseius monochami* Lindquist 1962
  - Superfamily Rhodacaroidea
    - Family Digamasellidae-deutonymphs phoretic
      - *Dendrolaelaps varipunctatus* (Hurlbutt 1967)
      - *Dendrolaelaps isodentatus* (Hurlbutt 1967)
      - *Dendrolaelaps neodisetus* (Hurlbutt 1967)
      - *Longoseius cuniculus* Chant *1961*
  - Superfamily **Uropodoidea—deutonymphs** phoretic
    - Family Uropodidae
      - *Trichouropoda lamellosa* Hirschmann 1972
      - *Trichouropoda australis* Hirschmann 1972
      - *Trichouropoda hirsuta* Hirschmann 1972

Order Acariformes
- Suborder Actinedida
  - Superfamily Cheyletoidea
    - Family Cheyletidae-adult females phoretic
      - *Eutogenes vicinus* Summers and Price 1970
  - Superfamily Tarsonemoidea
    - Family Thrsonemidae-adult females phoretic
      - *Tarsonemus subcorticalis* Lindquist 1969
  - Superfamily “Ikombidioidea
    - Family Neotrombididae-larvae parasitic
      - *Neotrombidium tricuspidum* Borland 1956
- Suborder Acaridida
  - Superfamily Acaroidea
    - Family **Acaridae—deutonymphs** (hypopodes) phoretic
      - ***Histiogaster arborsignis* Woodring 1963**
  - Superfamily Anoetoidea
    - Family **Histiostomatidae—deutonymphs** (hypopodes) phoretic
      - *Histiostoma varia* (Woodring and Moser 1970)
  - Super family Anoetoidea
    - Family Histiostomatidae-deutonymphs (hypopodes) phoretic
      - *Histiostoma varia* (Woodring and Moser 1970)