MITE SPECIES FROM APPLE TREES IN CONNECTICUT

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Philip Garman [1]

During investigations of the European red mite, now almost a perennial pest of apples in this State, a number of species were collected with a view to obtaining a more complete picture of the mites occurring on the apple in this region. Of the 25 or more species found or known to inhabit the apple tree, nine or ten are obviously plant feeders, about eleven are predators and five are doubtful, some of them doubtless feeding on mosses or lichens rather than on the tree itself.

In view of the relatively large number of predator species, it is not surprising that pesticides used and known to destroy them should be followed by an upsurge of the plant feeders with high reproductive potential.

The species mentioned in this paper were collected before the outbreak of World War II, but have been supplemented by collections in 1947. Most of the collecting has been done by J. F. Townsend. It is not claimed that all species here described inhabit every apple tree or are even present whenever conditions become favorable. Some of them are accidental in their occurrence, but are listed and some of them figured in order to make the record more complete. Among the lots are several new species. These are described in detail. Species previously treated in the "Tetranychidae of Connecticut" [2] are purposely omitted except from the general list.

The general systematic arrangement is that of Vitzthum presented in the Handbuch der Zoologie and published in 1931.

The more common predators fall into two subfamilies of the Laelaptidae, formerly known as either Podocininae or Phytoseiinae. Both of these subfamilies were erected by Berlese in 1916. *Podocinum sagax* Berlese, on which the first is based, is so distinct from any of the genera later placed in the subfamily that it is doubtful whether the group has much standing in connection with the group considered here. To be sure, characters listed for Podocininae and Phytoseiinae are only vaguely distinct but, of the two, Phytoseiinae is much more suitable

1. Dr. E. W. Baker of the U. S. National Museum has given technical assistance of considerable value in the preparation of this paper. He has loaned specimens from the National Museum, and has spent considerable time in identification of species and examination of manuscript. It is a pleasure to record this help without which many errors would have passed unnoticed. He is not, however, responsible in any way for errors which may have crept in. It is also a pleasure to acknowledge assistance given me by Dr. H. H. J. Nesbitt of the Canadian National Museum, who provided valuable suggestions regarding classification of the Phytoseiinae. To both gentlemen I say thank you.

2. Conn. Agr. Exp. Sta. Bul. 431. 1940.

partly because it is based on a species definitely in the same genus or group of genera as those with which we are dealing. Examination of a large number of figures and descriptions and specimens show that the subfamily is a fairly natural one.

The mite fauna found on bark scales at the base of the trunk is apparently much richer than on any other part of the tree. We have found here a large number of Oribatei, many of which probably have no connection with populations of plant feeders or predators on the upper portions. Obviously, many species besides the Oribatei that occur on the ground or on vegetation surrounding the base may be found hibernating or hiding underneath the bark scales. Descriptions of these species are not desirable here and will not be attempted. However, as many as it has been possible to identify are listed.

As to the list of species, the ease with which new ones are still obtainable indicates that it is far from complete, even for Connecticut, but in the hope that what we have found may be of interest to others the paper is presented.

Several mites other than Laelaptidae (Ascaidae or Parasitidae) and groups other than the Phytoseiinae within the Laelaptidae have been taken from apple trees. Most of these, represented by one or two slides, were taken from bark scales near the ground, indicating that they are predators on ground feeding mites rather than those that inhabit the tree itself, in particular the foliage.

COMMENTS ON GENERA OF PHYTOSEIINAE

Amblyseius Berlese 1904. Type *Seius obtusus* Berlese 1889. Genus with conspicuously unequal setae of dorsum and legs.

Ameroseius Berlese 1903. Type *Acarus corbicula* Sowerby 1806, *Seius echinatus* Koch 1839, *S. muricatus* Koch 1839, *S. hirsutus* Berlese 1887, but not *S. muricatus* Berlese 1887. Regarded as a subgenus of Seius, also close to Lasioseius. Phytoseius and Iphidulus both have priority.

Iphidulus Ribaga 1902. Type *Iphidulus communis* Ribaga. All dorsal setae smooth.

Lasioseius Berlese 1916 with subgenera Lasioseius s. str. type *S. muricatus* Berlese 1887; Cheiroseius Berlese 1916, type *Seius unguiculatus* Berlese 1916; Zercoseius, type *Seius spathuliger* Leonardi 1899; and Leiseius Berlese 1916, type *Ameroseius minusculus* Berlese 1905. The genus should probably be limited to those with wide anal plates.

Phytoseius Ribaga 1902. Type *Phytoseius plumifer* R. Species with plumose hairs. Here regarded as synonym of Iphidulus.

Seiopsis Berlese 1923. Type *Amblyseius (Seiopsis) brevipilis* Berlese 1923.

Seiulus Berlese 1887. Type *Seius hirsutigenus* Berlese. This genus includes species with large modified dorsal setae, see Seius below. Oudeman's discussion is in Tijdschr. voor Ent. XLV. p. 17. 1902.

Seius Koch 1836. Type *Seius togatus* Koch — *togatus* evidently belongs elsewhere or is unrecognizable. Koch later stated that the type should be *S. viduus,* which opinion was rejected by Oudemans who replaced it with Seiulus. Koch's opinion, however, is upheld by Tragardh, Sellnick, and Vitzthum (1941).[1] Seiulus of Oudemans is regarded as *S. hirsutigenus.* This genotype, according to original figures and descriptions, has a pitted or rugose dorsum and large modified dorsal setae, therefore differing from our common genera occurring on apple.

Typhlodromus Scheuten 1857. Type *S. vepallidus* Koch. Original description and figures obscure. Oudemans, who accepted the genus, evidently placed at least two genera within its limits. Typhlodromus is here limited to species with small anal plates.

GENERA OBSCURE, UNDETERMINABLE OR PLAINLY OUT OF PLACE IN PHYTOSEIINAE

Antennoseius Berlese 1916. Type *Antennoseius delicatus* Berlese 1916. Dorsal shield divided - belongs elsewhere.

Asternolaelaps Berlese 1923. Type *Asternolaelaps fecundus* Berlese 1923. Probably belongs elsewhere.

Echinoseius Berlese 1902.

Epicriopsis Berlese 1916. Type *Zercon cometa* Berlese 1910. Ambulacra absent. Belongs elsewhere; see Podocinum.

Episeiella Willman 1938. Type ?. Belongs elsewhere, ambulacra absent, see Podocinum.

Hoploseius Berlese 1914. Subgenus of Epicriopsis.

Iphiseius Berlese 1916.

Kleemania Oudemans 1930. Type *Zercon pavidus* Koch 1829. Related to Typhlodromus. sp. in U. S. National Museum. Enlarged hairs, anal plate remote, 7-8 scapular setae, 1 pair metapodal plates, probably good genus.

Podocinum Berlese 1882. Type *Laelaps sagax* Berlese. This species obviously belongs elsewhere than in the Phytoseiinae because of the long first pair of legs and the absence of ambulacra on these.

Thinnoseius Halbert 1920. Type *Thinnoseius Berleseii* Halbert. Possibly the same as Typhlodromus. Genus with remote anal plate.

Zerconopsis Hull 1918. Type *Gamasus remigera* Kramer 1876.

BIBLIOGRAPHY OF ORIGINAL DESCRIPTIONS OF DIFFERENT GENERA CONSIDERED IN THE GROUP

Berlese, A. 1882. Acari, Myriopoda et Scorpiones etc. Fasc. 1, N. 1; LXX, N. 10. **Podocinum.**

Berlese, A. 1887. Acari, Myriapoda et Pseudoscorpiones Fasc. 54, N. 7, 8, 9; 41, N. 1, 2, 3, 4, 6. **Seius.**

Berlese, A. 1903. Redia, Vol. **I,** p. 258 (no figures). **Ameroseius.**

1. Lunds Universitets Arsskrift N. F. Avd. 2, Bd. v 2, Nv 4, p. 12.

Berlese, A. 1914. Redia, Vol. X, pp. 143-145. Tav. IV, 53, 54, 56. **Amblyseius.**

Berlese, A. 1916. Redia, Vol. **XII**, p. 33. **Lasioseius.**

Halbert, J. N. 1915. Terrestial and Marine Acarina. Proc. Royal Irish Academy. Vol. 31, No. 39, II. **Thinnoseius.**

Hull, J. E. 1922. On some land mites from Spitzbergen and Bear Islands. Ann. Mag. Nat. History. Ser. 9, Vol. 10, pp. 621-623.

Koch, C. L. 1836 (1835). Deutchlands Crustaceen, Myriapoden und Arachniden. Regensberg. Fasc. 2, 3.

Kramer, P. 1876. Beitrag fur Naturgeschichte der Milben. Archiv. fur Naturgeschichte. V. 42 *(Gamasus remigera)*

Ribaga, C. 1902. Gamasidi planticoli, Revista di Patologia Vegetale V. 10, pp. 175-178. **Iphidulus, Phytoseius.**

Scheuten, A. 1857. Einiges über Milben. Archiv. fur Naturgeschichte 23; p. 104, **Typhlodromus.**

SYSTEMATIC ARRANGEMENT OF MITES COLLECTED FROM APPLE TREES

Parasitiformes	
Mesostigmata	
Ascaidae (= Parasitidae)	*Gamasellus americanus* n. sp.
Laelaptidae	
Phytoseiinae	*Iphidulus pomi* Parrott n. comb.
	Iphidulus fallacis n. sp.
	Iphidulus conspicuus n. sp.
	Seiulus bakeri n. sp.
	Amblyseius grandis Berlese
	Amblyseius (Amblysiopsis) americanus n. sp.
Blattisociinae	*Blattisocius triodons* Keegan
Trombidiformes	
Tarsonemini	
Tarsonemidae	*Tarsonemus confusus* Ewing
Prostigmata	
Tydeidae	*Tydeus globiferus* Baker [1]
	Lorryia reticulata Oudemans
Stigmaeidae	*Mediolata mali* Ewing
Anystidae	*Anystis agilis* Banks
Tetranychidae	*Bryobia pretiosa* Koch
	Tetranychus bimaculatus Harvey
	Paratetranychus pilosus Can. and Fanz.
Raphignathidae	*Raphignathus cardinalis* Ewing
Cheyletidae	*Cheyletia pyriformis* Banks
Cunaxidae	*Eupalus biscutum* Nesbitt [1]
Bdellidae	*Biscirus* sp.
	Cyta latirostris Herm. [1]
	Bdella depressa Ewing [1]
Sarcoptiformes	
Diacotricha	
Acaridea (= Tyroglyphidae)	*Tyrophagus (Tyroglyphus) lintneri* Osborn
Czenspinskiidae	*Czenspinskia lordi* Nesbitt

1. Determinations by Dr. E. W. Baker, U. S. National Museum.

Oribatei	
Oribatidae	Tricheremaeus sp.
Oribatulidae	Liebstadia sp.[1]
	Zygorabitula sp.
Ceratozetidae	*Humerobates arborea* Banks
Damaeidae	*Damaeus globifer* Ewing
Belbidae	Several species
Tetrapodili	
Eriophyidae	*Eriophyes pyri* Pagenstecher

1. Determinations by Dr. E. W. Baker, U. S. National Museum.

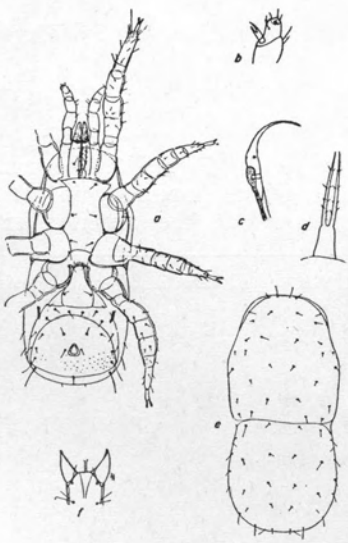

Figure 1. *Gamasellus americanus* n. sp. a. Ventral aspect. b. Tip of palpus. c. Peritremal plate. d. Tritosternum. e. Dorsal plate. f. Epistome.

PARASITIFORMES

Family Ascaidae (Parasitidae)

The most important representative of this group that we have found in Connecticut is Gamasellus. Several other genera have been found in small numbers and are represented in our collections by single specimens. All occur on the bark and have not been found on leaves.

Gamasellus americanus n. sp. (Figure 1). Female: Body divided behind middle by line separating it into two plates. Dorsal setae 5 on both anterior and posterior plate and about 7 laterals on each side of each plate. Integument smooth. Chelicerae with 4 to 5 teeth on fixed arm of shears. Maxillary cornicula (lateral arms of the epistome) triangular (Figure 1-f) and heavy set, not slender as in Iphidulus.

Legs not as long as the body, none of the segments conspicuously enlarged, setae of uniform length. Sternal plate long, three pairs of setae on it. Anal plate with opening nearly in the center posterior portion punctate, 4 setae each side besides para anals, 6 setae on venter just outside the anal plate on each side. No metapodal plates seen, one parapodal each side. Parapodals much longer than wide. Peritreme plate pointed at posterior end as in Figure 1-c.

Dimensions: Length .350 - .390 mm. by .150 - 180 mm. wide. Leg I 2.6 - 240 mm.

Male not seen.

Habitat: Mount Carmel, April 1, June 10, 1937. Hamden (Westwoods), August 19, 31, 1947. Wallingford, August 11, 1947. All collections from apple bark.

Types in Connecticut Agricultural Experiment Station collection.

Family Laelaptidae, subfamily Phytoseiinae [1]

Fixed arm of chelicerae with or without teeth; epistome between lateral arms or spines usually truncate, sometimes pointed. Lateral arms (maxillary cornicles) narrow, not broad and triangular as in Figure 1-f. Dorsal setal pattern as in Figure 2, the number of setae present much fewer than in other groups, especially in the lateral regions. Peritremes long, almost meeting at the anterior ends and with typical

1. Combination of Vitzthum's Podocininae and Phytoseiinae.

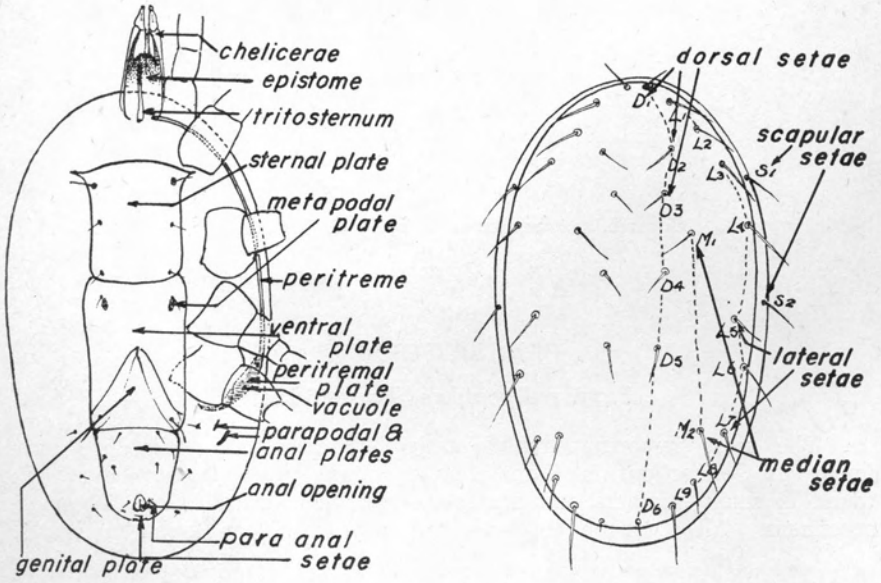

Figure 2. Ventral and dorsal views showing characters used in identification of Phytoseiinae.

plates at the posterior ends (Figure 2). Legs of moderate length, none conspicuously longer than the body, segments mostly uniform in width, tarsi long, attenuated ambulacra present on all. Males differing from the females in the shape of the anal plate which is usually broader than the female plate; in having only one plate in the ventral area, presumably combined sternal and ventral shields; and in the possession of cheliceral appendages (Figure 4-a). Males immediately identifiable by the characteristic organ (genital opening) near the anterior portion of the combined ventral shield (Figure 4-b).

In addition the Phytoseiinae have, in common with higher groups to which they belong, a two-timed papal comb or seta and always a tritosternum.

Small, oval brown to hyalin, leathery appearing mites frequently inhabiting plant foliage, usually accompanying Tetranychid mites (red spiders, red mites or spider mites). They constitute the principal mite enemies of Tetranychidae in Connecticut.

The following synopsis includes the genera *believed* to belong within the subfamily. Of these probably only Seiulus, Amblyseius, Lasioseius and Iphidulus will qualify. Species placed in Typhlodromus undoubtedly belong here if the genus is considered in a broad sense. Limited to those species with remote anal plates, as is done in this paper, their placement within Phytoseiinae seems doubtful. Blattisocius is so distinct that it must belong elsewhere.

No attempt is made to place the remaining Mesostigmata that we have found on apple in subfamilies.

KEY TO GENERA OF PHYTOSEIINAE

1. Dorsum rugose, dorsal setae often enlarged and serrate ..... **Seiulus**

   Dorsum smooth, with smooth or plumose setae, not enlarged and/or serrate (Figure 7) 2

2. At least four of the lateral setae and some of the leg setae much longer than others (Figure 9). Peritreme plates (Figure 9) usually blunt or truncate at the mesal ends 3

   Lateral and leg setae more nearly equal in length with other body and leg setae; peritreme plates acute at mesal ends 5

3. Anal plate usually with breadth and length equal; remote from the ventral plate ..... **Seiopsis**

   Anal plate larger, much wider than the ventral plate; or its width and length unequal 4

4. Anal plate of female much wider than ventro-genital shields; peritreme plates truncate (Figures 8, 9) ..... **Amblyseius**

   Anal plate not conspicuously wider than the ventral; peritreme plates usually blunt or approaching acute (Figure 8) ..... **Amblyseiopsis n. subg.**

5. Female anal plate very broad; median portion of epistome extended forward in a feathered point between cornicles ..... **Lasioseius**

Female anal plate narrow, not wider than the ventro-genital. Epistome truncate with small teeth between the lateral arms or cornicles 6

6. Anal plate remote from the genital; dorsum thickly setose ..... **Typhlodromus**

Anal plate nearly or quite in contact with the genital; dorsum sparsely setose (Figures 3-6) ..... **Iphidulus** [1]

1. Combination of Iphidulus and Phytoseius of Ribaga. The main point of division, according to Ribaga, lies in the plumose dorsal setae which seems of doubtful importance as a generic character. The two are therefore combined under the name Iphidulus.

Genus Iphidulus Ribaga 1902

Dorsum smooth, not roughened, rugose or pitted. Setae of legs and dorsum nearly equal in length, those of dorsum frequently longer. Dorsum with only 1 pair conspicuously longer than others, this pair sparsely plumose. Dorsal setal pattern (Figures 3, 5) consisting usually of 6 dorsal, 2 median and 8 pairs lateral setae. One to 2 pairs scapular setae. Peritremal plates acute at mesal ends (Figure 3-a). One or 2 metapodal plates and 2 parapodals, one of which may be small and indistinct. Sternal plate with 2 to 3 pairs of setae. Anal plate of the female with 3 or 4 pairs of setae besides the para anals, sometimes a pore on each side in addition. Front margin in contact with the genital plate or very near to it. Chelicerae with few teeth usually confined to the tips; or several distributed along the fixed arm.

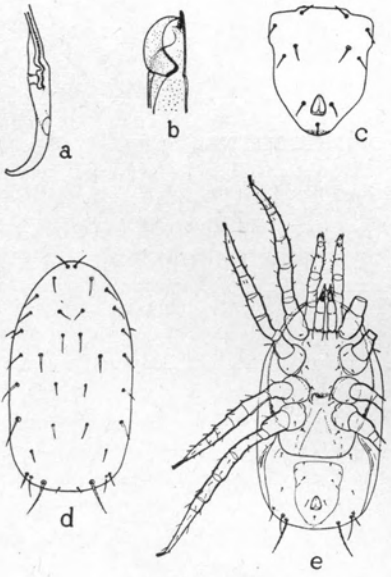

Figure 3. *Iphidulus pomi* Parrott, female. a. Peritremal plate. b. Chelicera. c. Anal plate. d. Dorsal plate. e. Ventral view.

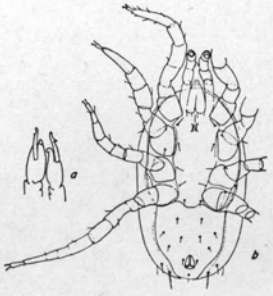

Figure 4. *Iphidulus pomi* Parrott, male. a. Chelicerae. b. Ventral view.

KEY TO CONNECTICUT SPECIES OF IPHIDULUS

1. Two setae on each side of sternal plate; third pair on small plates just behind the caudal margin ..... *conspicuus*

   Three setae on each side of sternal plate 2

2. One pair metapodal plates; two distinct parapodals on each side; anal plate reticulate with 9 setae and 2 pores; dorsum with median setae no. 2 and lateral no. 7 parallel or side by side ..... *fallacis*

   No metapodal plates; two distinct parapodals; anal plate with 11 setae and no pores; not reticulate. Dorsal setae M2 and L7 not parallel or in line ..... *pomi*

Iphidulus pomi (Parrott) N.Y. (Geneva) Agr. Exp. Sta. Bul. 283, p. 302, Pl. IV, Fig. 3, 1906. (Seius, Seiulus).

Female (Figure 3): Dorsum smooth, 6 dorsal, 9 lateral, 2 median and 1 scapular setae. M2 between L7 and L8 in position. Chelicerae with 2 teeth at tips of mandibles. Epistome with typical cornicles and teeth along the distal margin. Longest seta L9. Anal plate longer than wide, with 4 setae on each side besides the para anals. Sternal plate with 3 setae each side. No metapodal plates visible and only 1 parapodal near lateral margin of abdomen, sometimes a faint indication of a second but nothing definite. Peritremal plate slender, hooked, not blunt or truncate, with large vacuoles.

Dimensions: Length .29 mm. to .31 mm., width .16 to .19 mm.; Leg IV .22 to .25 mm., seta L8 .03 mm.

Male (Figure 4): Mandibles of chelicerae with strongly hooked appendage. Anal plate with 4 pairs setae each besides the para anals.

Dimensions: Length .23 mm., width .13 mm., Leg IV .22 mm., L8 seta .03 mm.

Redescribed from material collected in and around New Haven.

Original types destroyed or lost according to information from Dr. Glasgow of the New York Agricultural Experiment Station.

Iphidulus fallacis n. sp. (Figure 5). Female: 6 dorsal, 2 median and 9 lateral setae. L7 opposite M3. L9 sparsely plumose. Integument smooth, not rough or pitted. Chelicerae without teeth. Epistome of usual shape with long sharp cornicles or lateral arms and small teeth on distal margin between. Legs with one long seta on proximal segment of Tarsus IV. Sternal plate with 3 pairs of setae; anal plate reticulate, usually with 3 pairs of setae on the anterior portion (besides the para anals) and 1 pair of pores in addition; sometimes 4 pairs seen. One pair metapodals and 2 pairs of parapodals each side. Peritremal plates blunt and hooked at mesal ends (Figure 5-c), though not always quite as blunt as illustrated.

Dimensions: Length .34, width .22 mm., Leg IV .32, L9 seta .03 mm. Anal plate .06 by .09 mm.

Male: Hooks on male cheliceral appendages short, inconspicuous. Anal plate broad, with 3 pairs setae besides para anals and 1 pair pores.

Dimensions: Length .25, width .16 mm.

Habitat: Apple leaves. Branford, August 11, 1947; Deep River, August 31; Hamden, August 9, 12, 19, 1947; Wallingford, August 10, 1947.

Types in the Connecticut Agricultural Experiment Station collection.

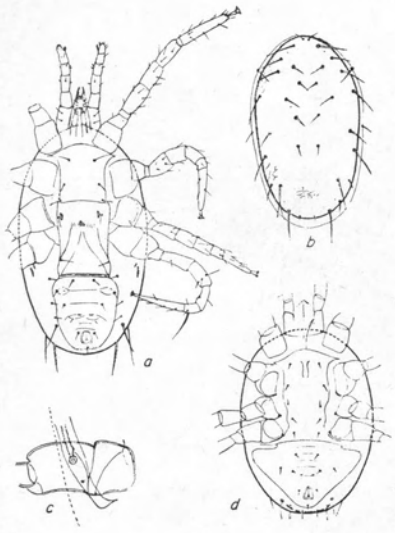

Figure 5. *Iphidulus fallacis* n. sp. a. Ventral aspect of female. b. Dorsal view. c. Peritremal plate. d. Ventral aspect of male.

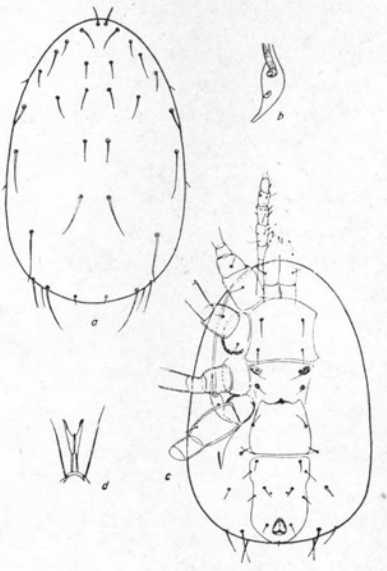

Figure 6. *Iphidulus conspicuus* n. sp. a. Dorsal view. b. Peritremal plate. c. Ventral aspect. d. Tarsus I.

Iphidulus conspicuus n. sp. (Figure 6). Female: 6 dorsal, 8 lateral and 2 median setae on dorsum, longest M2 and L8. Integument of dorsum smooth, faintly reticulate in some. Chelicerae with mandibular teeth if present very indistinct not more than 2 or 3 at most, all at tips. Epistome with lateral arms or cornicula slender, very sharp; distal margin between cornicles with indistinct teeth. Legs with setae uniform in length. Anal plate much longer than wide, lateral margins indentate, 5 paired setae including the 2 short para anals on each side of the anal opening. Two metapodal plates with short seta on each, 1 parapodal plate each side, the plate long, slender, appearing more like a slit in the integument. Peritremal plates long, acute at mesal ends.

Dimensions: Length .38, width .22 mm., Leg IV .44 mm., seta L8 .06 mm.

Male not seen.

Habitat: Apple bark. Hamden, January 24, March 16, October 25, 1937; New Haven, February 10, April 27, 1937 (pear bark).

Types in Connecticut Agricultural Experiment Station collection.

Genus Seiulus Berlese 1887

Dorsal setae and leg seta nearly equal in length. Dorsum rugose or pitted (Figure 7). Caudo-marginal setae somewhat enlarged but not serrate. Dorsal setal pattern typical though varying from Iphidulus. Peritremal plates bluntly rounded at mesal ends, the peritremes almost meeting at the anterior ends. Two distinct parapodal plates. Anal plate with a number of setae (4 pairs besides para anals in the only

species available), front margin almost in contact with genital shield. Mandibles of chelicerae distinctly toothed near tips.

Seiulus bakeri n. sp. (Figure 7). Female: Dorsum pitted and roughened, with 5 dorsal, 10 lateral, 2 median and only 1 scapular seta. Pattern as for other Phytoseiinae. Shears or mandibles of chelicerae with 3 teeth on fixed arm. Epistome of usual form, the cornicles or arms long and slender. Legs not longer than the body length, setae uniform. Sternal plate with 2 pairs of setae, ventral plate 1 pair, and genital plate 1. No metapodal plates visible, but 2 parapodals each side shaped as in Figure 7-e. Anal plate shorter and more rounded at sides than Iphidulus with 4 pairs setae besides the para anals, and the anal opening apparently within a small plate included in the larger anal plate. Peritreme plate bluntly rounded at mesal ends, otherwise of usual form.

Dimensions: Length .378 to .39 mm., width .210 to .270 mm., Leg I .270 to .300 mm., Leg IV .270 to .300 mm.

Male not seen.

Habitat: All collections from apple bark. Hamden (Westwoods), February 4, 16, May 3, 1937. Hamden (Mount Carmel), March 19, 1938.

Types in Connecticut Agricultural Experiment Station collection.

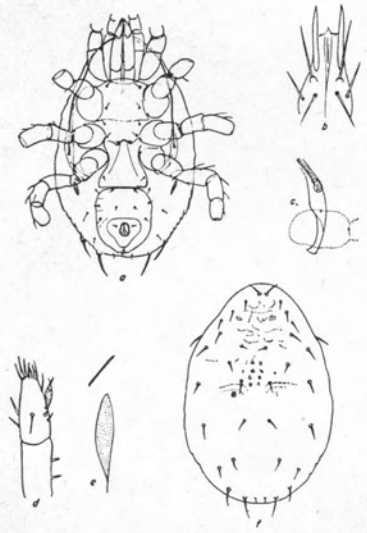

Figure 7. *Seiulus bakeri* n. sp. a. Ventral aspect. b. Epistome. c. Peritremal plate. d. Palpus. e. Parapodal plates. f. Dorsal aspect.

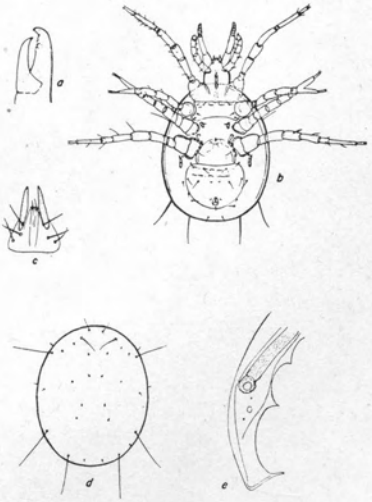

Figure 8. *Amblyseius grandis* Berlese. a. Chelicerae. b. Ventral aspect. c. Epistome. d. Dorsal aspect. e. Peritremal plate.

Genus Amblyseius Berlese 1904

Setae of dorsum and legs conspicuously unequal in length; fourth pair of legs with at least 3 elongate setae. Integument of dorsum smooth, with at least 4 pairs of very long setae, much longer than the majority. Dorsal setal pattern as follows: 6 dorsal, 1 median, 8 lateral each side. Peritremal plate blunt or truncate at mesal ends. Sternal plate with 3 pairs of setae. Chelicerae often with a number of teeth, not confined to the tips. Anal plate broader than genital, with 3 pairs of setae besides the para anals, front margin in contact with the genital plate.

Amblyseius grandis Berlese. Redia, Vol. X fasc. 1, pp. 144-145, Tav. IV, 53. 1914.

Female (Figure 8): Integument of dorsum smooth, lateral setae 1, 4, 6 and 8 much longer than the others. Chelicerae with 4 teeth on fixed arm. Epistome with typical long, slender cornicles and small teeth and hairs on distal margin. Legs with longer setae on tibia, genual, and first tarsal segment of Leg IV. Sternal plate with 3 setae each side, middle one nearer the posterior setae than the anterior. Anal plate much wider than the genital, reticulate and with 3 pairs setae besides the para anals, and 1 pair of pores. Anterior para anals in line with the front margin of the anal opening. One large metapodal and 1 cigar-shaped parapodal plate each side. Peritremal plates squarely truncate at mesal ends.

Dimensions: Length .44 to .47 mm., width .34 mm., Leg IV .44 mm.

Male not seen.

Habitat: Taken entirely from apple bark. Mount Carmel, February 23, May 15, 1937; Branford, August 11, 1947.

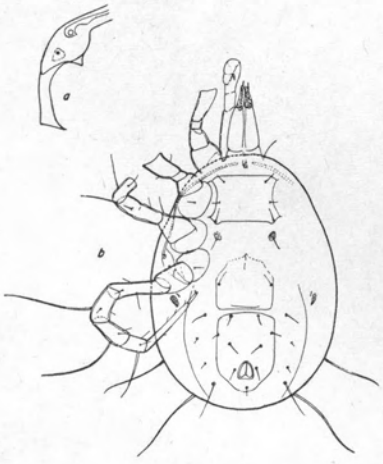

Figure 9. *Amblyseius americanus* n. sp. a. Peritremal plate. b. Ventral aspect of female.

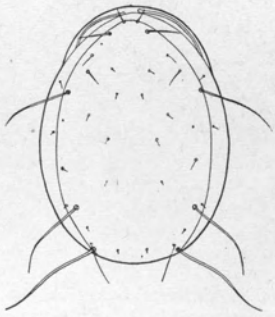

Figure 10. *Amblyseius americanus* n. sp. Dorsal view of female.

Subgenus Amblysiopsis n. subg.

Differs from Amblyseius mainly in width of the anal plate which is no wider than the genital.

Amblyseius (Amblyseiopsis) americanus n. sp. Female (Figures 9, 10): Dorsal integument smooth or faintly reticulate. Dorsal setae 6, medians 2, laterals 9; L4, L7 and L9 much longer than others, also M2 which is about half as long as L9. Chelicerae with 10 to 12 teeth. Epistome of usual form, the cornicles long, slender and sharp. Tibia, genual, and first tarsal segment of Leg IV with very long setae, longest on tibia and diminishing to tarsus. Sternal plate with 3 pairs of setae; anal plate almost rectangular, not wider than the genital, with 3 long pairs of setae in front of anal opening, no pores visible. Peritremal plate almost truncate at mesal end (Figure 9-a).

Dimensions: Length .36, width .19 mm., Leg IV .34 mm., seta L9 .19 mm.

Male: Chelicerae with long conspicuous T-shaped appendage. Anal plate with 3 pairs setae besides the para anals, much broader than the genital plate.

Dimensions: Length .34 mm., width .22 mm., Leg IV .34 mm., L9 seta .13 mm.

Habitat: Apple bark and leaves. Lebanon, March 23, 30, 1938; Branford, April 12, 1938; New Haven, April 7, 1938; Mount Carmel, September 20, October 25, 1937; Hamden, August 5, 1937; Wallingford, March 9 and February 17, 1938; Branford, July 1, 1947.

Types in Connecticut Agricultural Experiment Station collection.

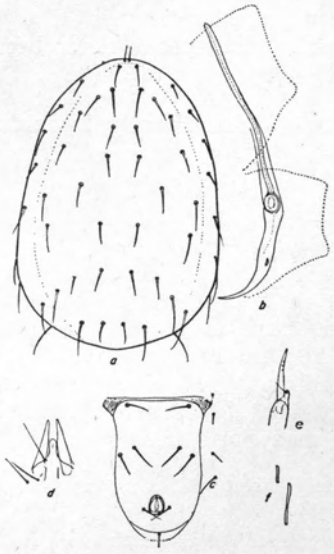

Figure 11. *Blattisocius triodons* Keegan. a. Dorsal aspect of female. b. Peritreme and peritremal plate. c. Anal plate of female. d. Epistome. e. Chelicera. f. Parapodal plates.

Subfamily Blattisocinae n. subf.

A number of important characters throw Blattisocius out of the Phytoseiinae, but in several points the genus corresponds with members of that family. The anal plate, for example, is typical, and the parapodals and epistome are quite similar. On the other hand, the dorsal setal pattern is radically different — there are more lateral and scapular setae — the arms of the chelicerae are very unequal and the peritreme does not extend forward beyond the third pair of coxae (Figure 11-b). *Blattisocius triodons* Keegan is very similar to the one female specimen taken from apple bark but there are some slight differences. For various reasons, however, it seems unwise to make a new species until more material is available. It is, therefore, designated here as *B. triodons* Keegan (Jour. Parasitology 30, No. 3; pp. 181-183, 1944). Members of the Blattisocinae are evidently enemies of small insects. Keegan describes *triodons* from cockroaches and we have a number of specimens from grain moth cultures.

TROMBIDIFORMES

Tarsonemini; Family Tarsonemidae

Only one species, *Tarsonemus confusus*[1] Ewing, has been found on apple in the Northeast. It is frequently encountered in examination of leaves and may be easily mistaken for predator mites which it resembles in general appearance. Ewing has described *confusus* and a number of closely related species in his "Revision of the mites of the subfamily Tarsoneminae, etc". The species never becomes sufficiently abundant in our experience to do serious damage.

Prostigmata; Family Tydeidae

A group of very small active mites found usually on the bark and thought by some to be predators of Eriophyidae. A large number of species have been described by Oudemans and others and at least one of them from apple *(Tydeus mali)*. The description offered for *mali* nymph indicates that it has a reticulated cuticle which would now place it in Lorryia. We have in Connecticut at least two species, one of them a Lorryia. They are not over .270 mm. in length and the general appearance is shown in Figures 12 and 13. The tarsal claws are very minute and slender and there is always a well developed pulvillus. There are two sense hairs on the thorax which in some genera described are enlarged similar to many oribatids.

Tydeus globiferus Baker (Figure 12). Proc. Ent. Soc. Washington 46 (6), pp. 160-161, Figs. 2-4. 1944.

Dorsum striate, not reticulate, setal pattern as in Figure 13-d. Palpi with a thick terminal finger flanked by 2 slender hairs and a wide pulvillus. Dorsal setae slender and pointed, not blunt at apices.

Dimensions: Length .180 - .210 by .108 mm. in width.

Habitat: Apple bark.

1. U. S. Dept. Agr. Tech. Bul. 653, pp. 26-28. 1939. Fig. 23C.

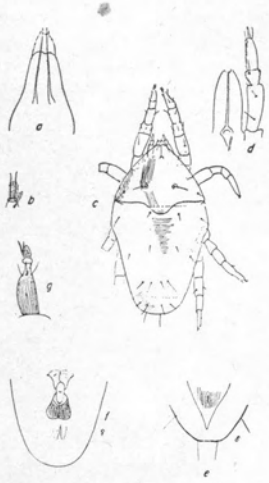

Figure 12. *Tydeus globiferus* Baker. a. Mandibular plate and chelicerae. b. Tarsus I. c. Dorsal view. d. Palpus. e. Male genitalia. f. Female genital and anal openings. g. Tarsus IV.

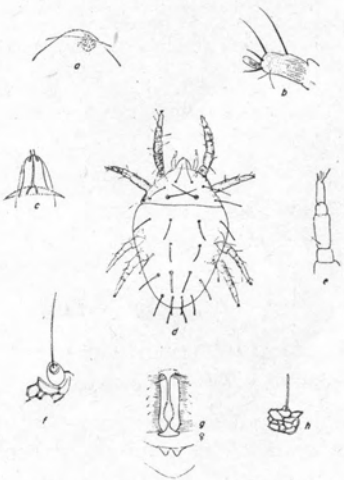

Figure 13. *Lorryia reticulata* Oudemans. a. Reticulation of anterior dorsum. b. Tarsus I. c. Mandibular plate and chelicerae. d. Dorsal aspect. e. Palpus. f. Dorsal seta of thorax and surrounding reticulation. g. Genital opening. h. Dorsal abdominal seta.

Lorryia reticulata Oudemans (Figure 13). Ent. Ber. Neder., V. 7. 381, 481. 1929, 1931. Thor, Sig. Das Tierreich 60 Lief., pp. 55-58. 1933.

Dorsum reticulate with distinct rosettes around the blunt abdominal setae. Palpi without thickened terminal finger but instead, four slender setae visible. Ambulacra of usual form present on all tarsi. Abdominal setae blunt at tips.

Dimensions: length .270 - .330 mm., width .162 - .210 mm.

Habitat: Apple bark.

Family Stigmaeidae

Characters that distinguish the family include (1) distinct collar tracheae separated at anterior ends, (2) no mandibular plate, (3) palpal thumb considerably longer than the hook, and (4) Tarsus I without clavate sense organ.

Genus Mediolata[1] (Eustigmaeus)

Represented here by only one species.

Mediolata mali Ewing (Figure 14). Formerly *Syncaligus (Caligonus) mali.* Jour. Econ. Ent. 10, 5, p. 499, Fig. 25, 5. 1917.

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1. Nesbitt, H. H. J. Canadian Entom. LXXVIII, pp. 15-22. 1946.

Dorsum longitudinally striate with 26 dorsal setae divided into 3 definite areas by impressed lines. Chelicerae in the form of stylets, the same as Tetranychidae. Mandibular plate absent. Collar tracheae long, extending between Leg I and II, no terminal enlargement or chamber. Legs short, not greater than the body width, tarsi two-clawed with plumose hair-like empodium (Figure 14-e). Palpal thumb longer than the terminal claw or hook and provided with a triple forked sensory hair (Figure 14-f).

Dimensions: Length .300 to .330 mm., width .186 to .192 mm., Leg I .138 mm.

Habitat: Apple bark, twigs and leaves. Hamden, February 22, March 16, 21, 1938; May 7, June 19, 1937.

Family Anystidae

A group of long-legged, very active mites with coxae contiguous, and the body provided with many stout bristles.

Only one representative, *Anystis agilis* Banks, has been seen in Connecticut. This well-known species is very active, red in color, and occurs frequently on foliage. It is regarded as beneficial.

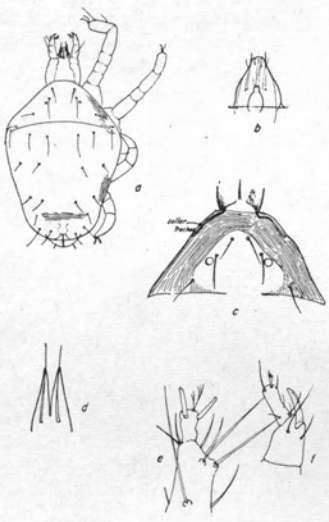

Figure 14. *Mediolata mali* Ewing. a. Dorsal view. b. Epistome. c. Details of thorax. d. Chelicerae. e. Tarsus I. f. Palpus.

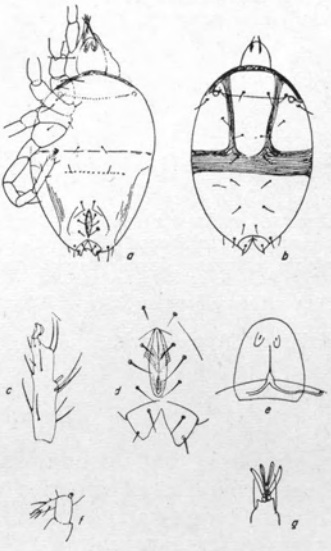

Figure 15. *Raphignathus cardinalis* Ewing. a. Ventral aspect of female. b. Dorsal aspect. c. Tarsus I. d. Genital and anal openings. e. Mandibular plate and collar tracheae. f. Palpus. g. Tarsal claws of Leg III.

Family Tetranychidae

Characters that distinguish the family comprise (1) presence of collar tracheae united in front, (2) tarsi usually with hooked tenent hairs, (3) the absence of a clavate sense organ on Tarsus I, (4) the presence of a well-defined mandibular plate, and (5) needle-like chelicerae.

Three species, *Bryobia praetiosa* Koch, clover mite; *Tetranychus bimaculatus* Harvey, the two-spotted mite, and *Paratetranychus pilosus* C. & F., the European red mite, are of common occurrence. Only the latter, *P. pilosus,* is consistently a pest. *T. bimaculatus* is becoming more and more important since the growers started using DDT. *Bryobia pretiosa* has never been important. These mites are all described and figured in Connecticut Agricultural Experiment Station Bulletin 431, "Tetranychidae of Connecticut" (1940).

Family Raphignathidae

Tarsus I with a clavate sense organ (Figure 15-c). Collar tracheae well-defined, united in front. Tenent hairs of the tarsi simple, not hooked as in Tetranychidae.

One genus and species, *Raphignathus cardinalis* Ewing, has been found on apple foliage. The species is so closely related to the Tetranychidae that it would almost seem to belong there. Presumably the habits of feeding are the same as the Tetranychids but there are no records of *R. cardinalis* becoming a pest of any importance in the Northeast. The species is shown in Figure 15.

Genus Raphignathus

The main character that distinguishes the genus and separates it from Tetranychidae is the clavate organ on Tarsus I and the nature of the palp-tarsus as shown in Figure 15.

Raphignathus cardinalis Ewing. Trans. Amer. Ent. Soc., 35, p. 403. Pl. XIII. Figs. 3, 4. 1905.

Female (Figure 15): Dorsal integument smooth, not reticulate. Stylets and mandibular plate similar to Tetranychidae, front margin of the plate entire. Palpal thumb (fourth segment) much longer than the hook which is very short. Epistome with prominent lateral setae near tip, indefinitely toothed or setose along the front margin. Legs short, all four coxae contiguous. Tarsi two-clawed, empodium with tenent hairs as in Tetranychidae but more numerous. Front tarsi with clavate sense organ as in Figure 15-c. Collar tracheae (Figure 15-e), hooked at tip and slightly enlarged. Border of the genital opening striate somewhat similar to Tetranychidae females.

Dimensions: Length .480, width .270 mm., Leg I .480 mm.

Habitat: Apple leaves. Cheshire, June 25, 1937.

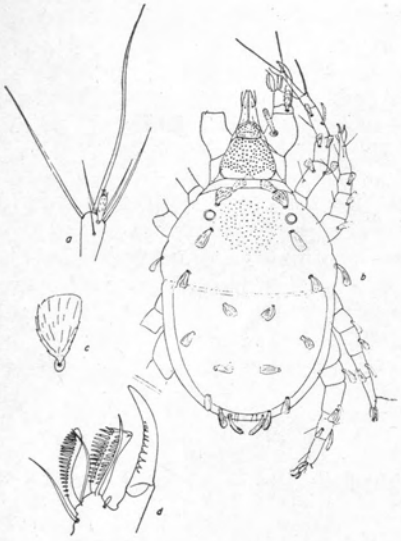

Figure 16. *Cheyletia pyriformis* Banks. a. Tip of Tarsus I. b. Dorsal view. c. Dorsal scale enlarged. d. Tip of palpus.

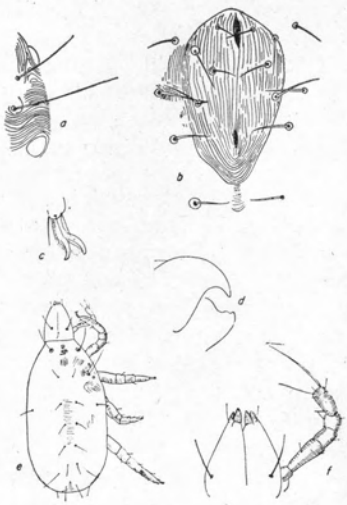

Figure 17. *Cyta latirostris* Herm. nymph. a. Lateral portion of thoracic dorsum. b. Genital opening. c. Tarsal claw. d. Mandibles. e. Dorsal view. f. Mandibles and palpus.

Family Cheyletidae

A group of mites conspicuous by reason of their comb-like mouth parts, often with flat striate scales on the dorsum. Only one species has been found on apples and that one on bark.

Cheyletia (Cheyletis) pyriformis Banks is shown in Figure 16 in some detail. It is described in Proceedings Ent. Soc. Washington. Vol. 7, p. 135, 1905.

Habitat: Apple leaves. Cheshire, June 25, 1937.

Family Bdellidae

Our collections from apple are represented by a number of genera and at least three species. The group in general includes those mites of the Prostigmata having fixed mouthparts, shear-like mandibles on chelicerae and long maxillary palpi with long sensory hairs or setae. There are usually a number of simple eyes on the propodosoma or thorax. The general appearance is illustrated in Figures 17-19.

Mites of this family are considered as important predators on other Acarina, and most of our collections are from apple bark, not from leaves. This indicates that their functions may be more general than specific. However, the number of species involved suggests that they may be of

more than academic interest. The family Cunaxidae is very similar to the Bdellidae and the following key is offered for their separation.

Chelicerae ending in well-defined shear-like mandibles. Palpi with terminal sense setae. ..... **Bdellidae**

Chelicerae not ending in well-defined shear-like mandibles but instead provided with a simple hook. Palpi for grasping, last segment claw-like. ..... **Cunaxidae**

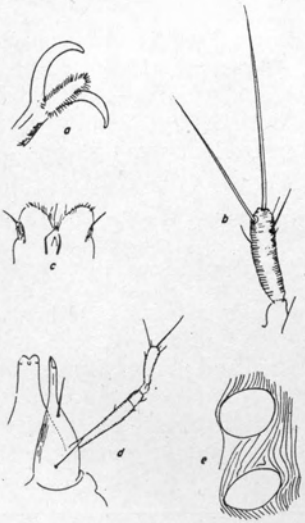

Figure 18. Biscirus sp. a. Tarsal claws and pulvillus. b. Tip of palpus. c. Epistome. d. Chelicerae and palpus. e. Eyes.

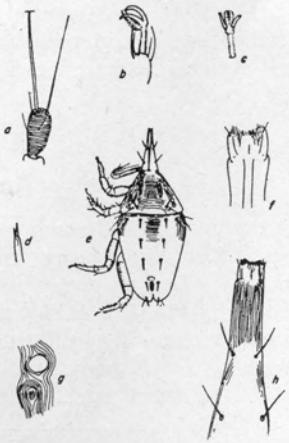

Figure 19. *Bdella depressa* Ewing. a. Palpus. b. & c. Tarsal claws. d. Tip of chelicera. f. Tip of rostrum. g. Eyes. h. Rostrum.

KEY TO GENERA OF BDELLIDAE[1]

1. Fifth palpal segment shortened and broadened towards distal end and with 2 or 3 long bristles at end. Chelicerae each with 2 dorsal setae. Thoracic dorsum with 4 pairs of setae and usually 2 small longitudinal bands 2

   Palpi relatively long, fifth segment neither shortened nor broadened, approaching cylindrical. Number of hairs on chelicerae variable (1, 2 or many). On thorax only 2 or 3 pairs of setae - no shields; with no chitinous bands or very seldom 3

2. An unpaired median eye and 2 pairs on sides. Rostrum and chelicerae very short and thick. The 2 dorsal longitudinal shields united in front by a strong transverse chitin band ..... **Cyta**

   No median eye - only 2 lateral pairs. Rostrum and chelicerae small or very small. Dorsal shields separate or only united by a weak connection .... **Bdella**

1. Key adapted from Thor.

3. Each chelicera with only 1 seta, no shield on dorsum ..... **Scirus**

   Each chelicera with 2 seta. Usually only 2, seldom 3 thoracic dorsal pairs of setae. Typical shield as in Figure 18. ..... **Biscirus**

In the family Bdellidae we have found at least three genera of mites, all presumably predators. Cyta, Biscirus and Bdella are shown in Figures 17, 18 and 19.

Family Cunaxidae

A single specimen of *Eupalus biscutum*[1] Nesbitt was collected from an unsprayed apple tree at Deep River, August 31, 1947 and at Hamden August 14, 1947. Associated with it were a number of Iphidulus, possibly indicating a common habit. As described by Nesbitt, this species has well-defined hooks on the mandibles instead of weak shears.

SARCOPTIFORMES

Family Acaridea (Tyroglyphidae)

Tyroglyphids in general feed upon plant tissues, either alive or decayed. The two species most commonly found on apple foliage are *Tyrophagus (Tyroglyphus) lintneri*[2] Osborn and *Czenspinskia lordi* Nesbitt belonging to the following family. Of the two, the latter appears to be more numerous and important. Tyroglyphids are mostly weakly chitinized mites without tracheae, and with one or more clavate sense organs on the front tarsi.

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1. Canadian Entomologist Vol. LXVIII, pp. 18-20. 1946. Pl. III, Figs. 10, 11.
2. Science, 1893, p. 360. Lintner, 10th Report (N. Y.) p. 254. 1896.

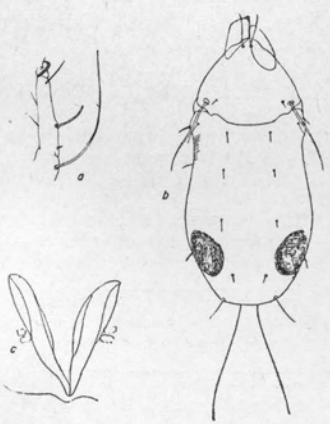

Figure 20. *Czenspinskia lordi* Nesbitt. a. Tarsus I. b. Dorsal view. c. Genital structure of female.

Family Czenspinskiidae Oudemans 1927 [1]

A relatively common species on apple leaves in Connecticut is *Czenspinskia lordi* [2] (Figure 20), conspicuous and easily recognized by its dark colored (reddish or brown) spots on the abdomen or hysterosoma. These spots are supposed to be excretory in function. Nesbitt reports having seen apple scab spores in the digestive tract of the species and it may possibly feed on the leaves themselves.

ORIBATEI

The Oribatei are small horn-like (sometimes called horn, beetle, or moss mites) individuals with two clavate sense organs on the thorax. These organs assume a variety of shapes, but are always present. Tarsi are one- to three-clawed. There are many species, identification of which appears to be extremely difficult owing to frequent changes of names, incomplete synopses and inadequate descriptions and figures. The references below [3] will help those interested in the group to place species in their respective families and genera.

Various representatives of the Oribatei or beetle mites are frequently found on the trunk of apple trees. Both winged (Pterogasterinae including Galumnae) and others (Aphictima) occur often, but so far no Phyctima (including Phthiracaridae) have been taken. Several species have been identified, some of them evidently of common occurrence on trees of various kinds. Their food probably consists of dead wood, fungi or lichens, as stated by many authors, and their presence here may be of a secondary nature. They are not thought to be of primary importance, but they *may* serve as a connecting link in the ecology of the apple, between predators and plant feeders, possibly by furnishing food for predators during scarcity of other forms.

Species found to date include *Humerobates humeralis arborea* Banks, *Damaeus globifer* Ewing, Zygorabitula sp., Tricheremaeus sp., Liebstadia sp. and others. Two of them are shown in Figures 21 and 22.

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1. Oudemans, A. C. Ent. Ber. 7 (157), pp. 242-248. 1927.

2. Nesbitt, H. H. J. Canadian Entomologist LXXVIII, pp. 20-22, Pl. II, Figs. 12, 13. 1946.

3. Ewing, H. E. Synopsis of the genera of beetle mites, with special reference to the North American fauna. Annals Ent. Soc. Amer. Vol. X. pp. 117-132. 1917.

Jacot, A. P. Genera of Pterogasterine Oribatidae (Acarina). Trans. Am. Microscopical Soc. Vol. XLVIII. No. 4. 1929.

Sellnick, Max. Horn milben, Oribatei. Die Tierwelt Mittel Europas. Bd. III. 1929.

Willman, C. Moos milben oder Oribatiden (Oribatei) Tierwelt Deutschl. 22, pp. 79-200. 1931.

Figure 21. *Humerobates humeralis arborea* Banks. a. Thoracic shield and pseudostigmatic organ. b. Tarsal claw. c. Pseudostigma. d. Dorsal plates. e. Genital and anal plates. f. Internal genitalia. g. Tarsus I and armature.

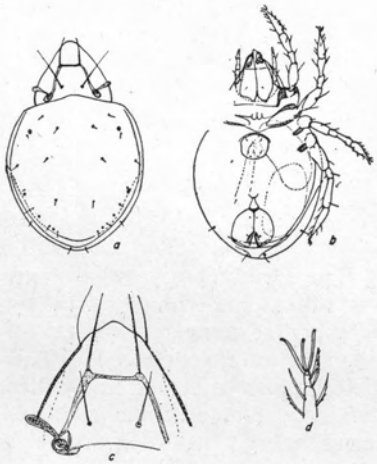

Figure 22. Zygorabitula sp. a. Dorsal view. b. Ventral view. c. Thoracic shield and pseudostigma. d. Tarsal claws.

TETRAPODILI

Family Eriophyidae

Eriophyes pyri Pag., the pear leaf blister mite, has been reported many times from apple and has been seen frequently in Connecticut. This minute four-legged mite may deserve more attention than is commonly given to it, but so far it has never become an important pest of apples in this State.

From the foregoing notes it is apparent that there are on apple trees in Connecticut many plant feeders, a corresponding or greater number of predators, and some of doubtful position. Following is a list of species that we have found, divided into the three categories.

PLANT FEEDERS

1. *Paratetranychus pilosus* C. & F.
2. *Tetranychus bimaculatus* Harvey
3. *Bryobia praetiosa* Koch
4. *Tyrophagus (Tyroglyphus) lintneri* Osborn
5. *Czenspinskia lordi* Nesbitt
6. *Tarsonemus confusus* Ewing
7. *Eriophyes pyri* Pagenstecher

PREDATORS

1. *Iphidulus (Seiulus, Seius) pomi* Parrott
2. *Iphidulus fallacis* n. sp.
3. *Iphidulus conspicuus* n. sp.
4. *Seiulus bakeri* n. sp.
5. *Amblyseius grandis* Berlese
6. *Amblyseius (Amblyseiopsis* n. subg.) *americanus* n. sp.
7. *Gamasellus americanus* n. sp.
8. *Blattisocius triodons* Keegan
9. *Cheyletia pyriformis* Banks
10. *Eupalus biscutum* Nesbitt
11. *Biscirus* sp.
12. *Cyta latirostris* Herm.
13. *Bdella? depressa* Ewing

SCAVENGERS OR DOUBTFUL

1. *Lorryia reticulata* Oudem. Possibly predator on Eriophyidae.
2. *Tydeus globifer* Baker. Possibly predator on Eriophyidae.
3. *Mediolata mali* Ewing. Possibly a predator.
4. *Raphignathus cardinalis* Ewing
5. *Zygoribatula* sp.
6. *Humerobates arborea* Banks
7. *Liebstadia* sp.
8. *Damaeus globifer* Ewing