ERIOPHYID STUDIES C-3

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ARS USDA

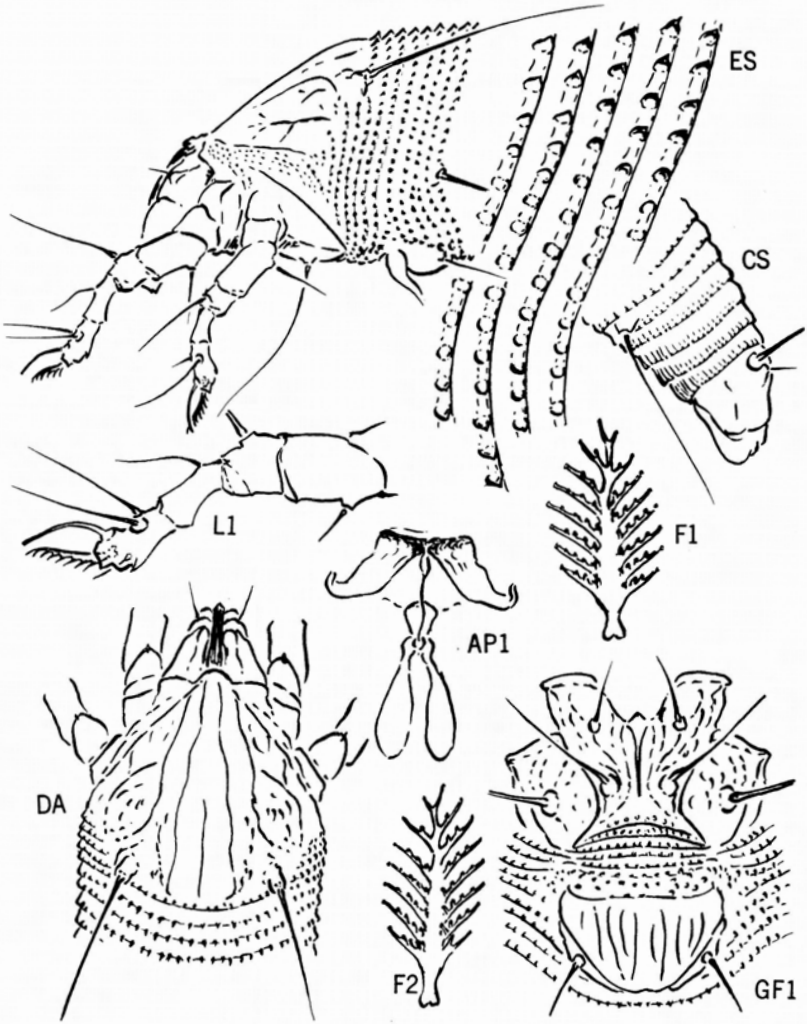

Plate 1 - Aceria tosichella, new species

Issued - October 15, 1969

Purchased by the Agricultural Research Service U. S. Department of Agriculture, for official use

Aceria tosichella, new species

Plate 1

This mite occurs on wheat and barley in Jugoslavia. The principal difference between this mite and tulipae is that tosichella has 8-rayed featherclaws on the forelegs and 7 to 8-rayed featherclaws on the second legs. Other possible differences are slight: lateral microtubercles on tosichella seem a little less pointed and the second ventral seta is possibly longer. But setal lengths are often unreliable due to breaking of the terminal parts, or bending. This species is another example of the complexities found in grass mites on the Eurasian continent. Interest in these mites is due to their abilities to transmit grass viruses. Nalepa's tenuis is one of these mites, but he always gave the featherclaw ray number as 5. A commoner ray number on mites in Europe is 6, with the 5-rayed species less frequently collected. No doubt any of this type of mite can carry virus. The length of the 7-rayed featherclaw on tulipae from garlic is 7µ. Tulipae also may not have as strong microtuberculation on the dorsum of the telosome.

Female 200µ-230µ long, 44µ-48µ thick; wormlike; color in life light yellowish-white. Rostrum 25µ long, projecting forward and down; antapical seta 8µ long. Shield 35µ long, 36µ wide; generally acuminate anteriorly, with small lobe over rostrum base. Median shield line present on rear 1/2 or 2/3; admedian lines complete from anterior lobe, gradually diverging to rear margin, somewhat sinuate; submedian line from front margin lateral to admedian, running back toward dorsal tubercle, curving laterally in front of tubercle, and with broken inner fork on inside of tubercle. Laterally shield with two longitudinal lines, the upper less distinct, obscurely branched, ending in granules below tubercle; lower line from rostrum base to granulations below tubercle; bands of granulations above coxae and dipping between coxae. Dorsal tubercles 22µ apart; dorsal setae about 60µ long, diverging to rear. Foreleg 36µ long; tibia 7.5µ long, with 13µ seta at 1/3; tarsus 9µ long; claw 10µ long, strongly bent down; featherclaw 8-rayed. Second leg 33µ long, tibia 7µ long, tarsus 7.5µ long, claw 10µ long; featherclaw 7-8-rayed. Coxae ornamented with short lines and lines of granules; moderately long sternal line between forecoxae; first setiferous coxal tubercles farther apart than second and opposite anterior coxal approximation; second tubercles a little ahead of line across third coxal tubercles. Abdominal thanosome with about 66 rings, completely microtuberculate; microtubercles tending to be slightly pointed, especially dorsally and ventrally, and just behind genitalia; microtubercles not particularly ahead of ring margins ventrally; ventral microtubercles ahead of telosome each with thin anterior line. Lateral seta 44µ long, on ring 9; first ventral seta 50µ-60µ long, on ring 24; second ventral 50µ-60µ long, on ring 42. Telosome with 5 rings, with fine microtubercles on margins, dorsally projecting over margins as short points, laterally and ventrally each with fine line ahead of margin, especially ventrally. Telosomal seta 28µ long. Accessory seta 4.5µ long. Female genitalia 17µ long, 22µ wide; deep bowl-shaped; coverflap with about 10 longitudinal ribs; seta 22µ long.

Type locality: Zemun-Beograd, Jugoslavia

Collected: May 27, 1969 by Malisa Tosic, for whom the species is named

Host: Triticum sativa Lam. (Graminae) wheat

Relation to host: the mites live at the leaf bases and in curled leaves

Type material: a type slide, with the above data, retained by the writer
one paratype slide sent to the collector
one paratype slide sent to the Entomology Research Division, Beltsville, Maryland
four paratypes retained by the writer, and also mites in liquid from which the above specimens were taken.

Deuterogyny in leaf erinea

In deuterogyny that is manifest by structural change in females, the deutogynes differ from protogynes by having suppressed microtubercles on the body rings, especially dorsally. There can also be size and empodial differences, with the deutogynes often smaller, and the empodia on deutogynes either with one less ray, or with the rays thickened basally. Also, protogynes resemble males whereas deutogynes have no male counterpart. This pattern of protogyne-deutogyne differences appears again and again in erinea on different hosts. The following examples of this are by no means exhaustive of this situation.

Purple erineum on Acer glabrum Torr., vine maple, was named Aceria calaceris K., and the form depicted lacks dorsal microtubercles. It has a distinctive crease across the body on each dorsal ring, giving the appearence of ring doubling. As indicated in the original description, another female form in this erineum, with complete microtuberculation and no creases, is otherwise similar

deuterogyny continued on p. 3

Addenda and Errata

p. 2- tosichella featherclaw 8.5 microns

- bottom paragraph, read:

The mite which causes purple erineum

p. 3 line 10- median for medina

p. 7- footenote: first two lines repeated

Aceria castanopsella, new species

Plate 2

This bud mite on chinquapin has pointed microtubercles on the abdominal rings, the median shield line is present as a light streak just ahead of the rear shield margin and ending in a slight pit-like structure, the legs lack prominent spinules on rear surfaces, and the line between the genital tubercles is concave to the rear. Two other Eriophyids with 3-rayed featherclaws that infest Fagaceous shrubs and trees are known that have pointed microtubercles. These are Aceria mackiei (K.) (Eriophyid Studies II, Bul. Cal. Dept. Agr. 27(3):302, 1938) and A. ecantyx K. (Eriophyid Studies C-2, p. 2, 1969.) Mackiei is Californian, forms erineum on Quercus agrifolia Nee leaves, and lacks the medina shield line. Ecantyx is from Portugal, is a bud mite on Quercus ilex L., has the median shield line at rear of shield, but is a somewhat larger species that has spinules on the rear sides of the legs.

Female 150µ-160µ long, 40µ thick; wormlike; color light yellowish-white. Rostrum 21µ long, projecting forward and down; antapical seta 5.5µ long. Shield 22µ-26µ long, 26µ-30µ wide; subtriangular anteriorly; median shield line indicated as broken line ahead of rear margin and ending in a pit-like mark at rear margin; admedian lines complete, gently sinuate, diverging a little to rear. The shield laterally with irregular granules and marks, an ocellate spot above rear coxae; partial rings below dorsal tubercles. Dorsal tubercles on rear margin, 18µ apart, directing setae divergently to rear; dorsal setae 14µ long. Foreleg 25µ long, with slight roughenings on side and rear but no projecting spinules; tibia 5µ long, with 5.5µ seta from 1/3-1/2; tarsus 5.5µ long; claw 6.5µ long, somewhat tapering; featherclaw 3-rayed. Hindleg 22µ long, tibia 4µ long, tarsus 5µ long, claw 6µ long. Coxae ornamented with rather coarse granulations, a strong sternal line between forecoxae; first setiferous coxal tubercles ahead of second and slightly ahead of anterior coxal approximation; second coxal tubercles well ahead of line across third tubercles. Abdominal thanosome with about 44 rings, some dorso-ventral reduction in ring number; rings completely microtuberculate, these microtubercles pointed or short-spinulate, more so ventrally. Lateral seta 25µ long, on ring 6; first ventral seta 21µ long, on ring 16; second ventral 8µ long, on ring 28. Abdominal telosome with 5 rings, the microtubercles becoming progressively weaker, especially dorsally; telosomal seta 7.5µ long. Accessory seta 7.5µ long. Female genitalia 19µ wide, 12µ long; with granulations ahead of coverflap, the coverflap with 8-11 irregular longitudinal ribs, partly granular; genital setiferous tubercles connected across by line concave to rear, the seta 6µ long.

Type locality: Mt Shasta City

Collected: August 16, 1967 by the writer

Host: Castanopsis sempervirens (Kall.) (Fagaceae) chinquapin

Relation to host: the mites are bud mites

Type material: a type slide, so designated, with the above data, retained by the writer; also four paratype slides retained
two paratype slides sent to the Entomology Research Division, USDA, Beltsville, Maryland

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deuterogyny continued from p. 2

to the described form. Males resemble this second form. The conclusion here is that this is a case of deuterogyny.

Eriophyids in the undersurface erineum on eastern red maple, Acer rubrum L., have been named Aceria major (Hodgkiss) and A. ornatus (H.), with the former having page priority. The two types of females described for calaceris are in this erineum, but the deutogyne has less pronounced ring creases. Hodgkiss' literature does not furnish enough information to tell which of the names applies to the protogyne.

Erineum pockets on boxelder leaves, Acer negundo L. have Aceria negundi (Hodgk.) as the causitive agent. A deutogyne form, with remarkable structure, which Hodgkiss evidently missed, has the tergites broadened like rust mites in the Phyllocoptinae, but has the same shield as the protogyne. On this deutogyne the microtubercles on the tergites are confined to the lower sides, and the sternites are completely microtuberculate.

Erineum on Acer pseudoplatanus L. leaves contains a form similar to calaceris, but the ring creases are weaker. Nalepa names this pseudoplatanus mite Aceria macrochelus eriobius (Nal.), stating that it makes the erineum and that eriobius has strong microtuberculation on the rings. He associates Aceria macrochelus psilomerus (Nal.) with it and characterizes psilomerus as having a smooth abdomen. This would then make psilomerus the deutogyne and eriobius the protogyne, and places psilomerus in synonymy.

continued at bottom of p. 5

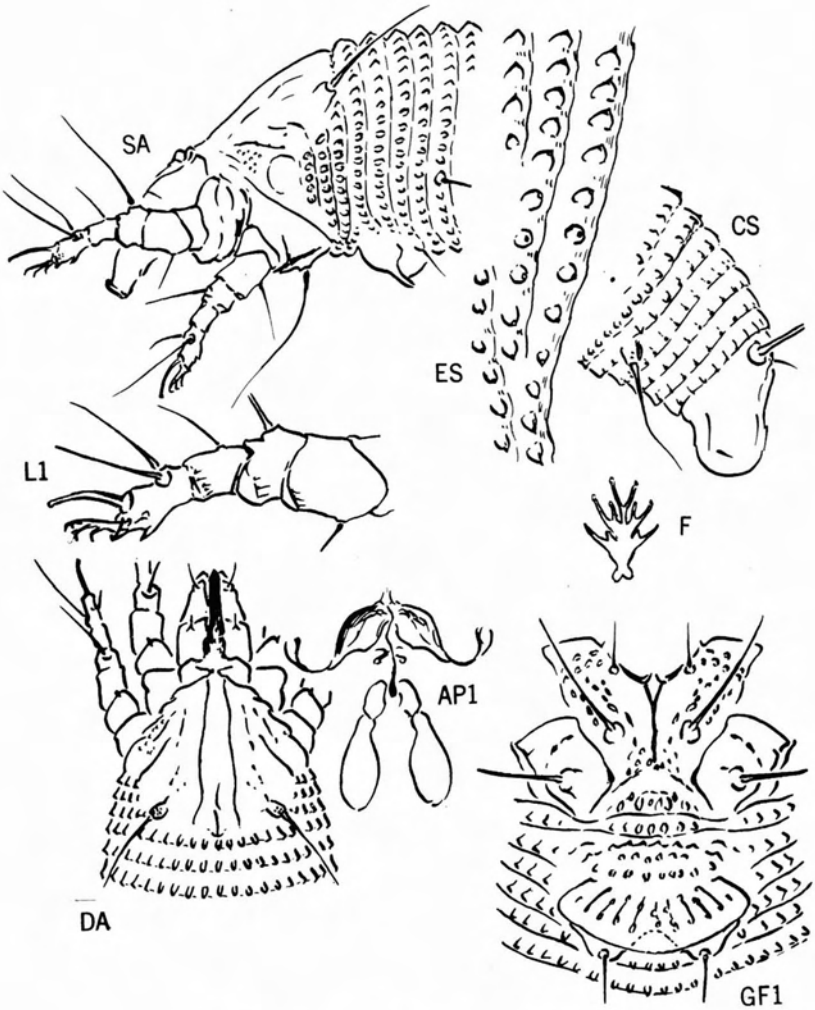

Plate 2 - Aceria castanopsella, new species

Aculops amandae, new species

Plate 3

This species is one of a group in the genus with a 4-rayed featherclaw, a moderately long acuminate anterior shield lobe, a foretibial seta arising from the basal 1/4 or 1/3, and the abdominal rings nearly equal dorsoventrally. The species which seems the closest as regards shield pattern and ring microtubercules is alachuae K. A species on Rhus in Florida. This is a long geographical reach for a comparison. Alachuae has a more definite shield design, heavier ornamentation on the coxae, and the female genital coverflap has stronger ribs.

Female 148µ-160µ long, about 50µ thick; fusiform and somewhat robust; color light yellowish-white. Rostrum 23µ long, projecting down; antapical seta 5µ long. Shield 39µ long, 42µ wide; subtriangular in anterior outline, the anterior lobe over rostrum rather elongate-acuminate, ending in a point. Shield design not strong: median line faint anteriorly, stronger on rear 2/3, ending in dart-shaped mark at rear margin. Admedian lines complete from sides of anterior lobe point, gently undulate, subparallel to 1/3 and meeting a slight cross line there, gently diverging from there and recurving at 3/4, almost meeting arms of dart-shaped mark before rear margin. Submedian shield line from toward lateral base of anterior lobe, curving back and to outer part of dorsal tubercle, receiving curved line on inner side up from rear shield margin; submedian line receiving slight outer line just ahead of dorsal tubercle. Shield laterally with band of granules above coxae and two or three partial rings below dorsal tubercle. Dorsal tubercles 24µ apart, directing setae divergently to rear; dorsal setae 20µ long. Foreleg 27µ long; tibia 7µ long, with 3.5µ seta from 1/4; tarsus 6.5µ long, claw 6µ long, with slight apical knob; featherclaw 4-rayed. Hindleg 25µ long, tibia 5µ long, tarsus 6µ long, claw 6µ long. Coxae with ornamentation of curved lines of granules, anterior coxae with moderate sternal line between; first setiferous coxal tubercles farther apart than second and slightly ahead of anterior coxal approximation. Second coxal tubercles ahead of line across third tubercles. Abdominal thanosome with rings nearly equal dorsoventrally, the back rings about 45 in number, the ventral rings 53-55 in number. Microtubercles approximately elliptical, not strong, touching ring margins, slightly larger above, fading dorsally over position of second ventral seta and the fading progressing gradually down to end of thanosome. Lateral seta 12µ long, on ring 9; first ventral seta 44µ long, on ring 21; second ventral seta 13µ long, on ring 36. Telosome with 5 rings, the microtuberculation nearly absent above, weak below; telosomal seta 23µ long. Accessory seta 3µ long. Female genitalia 19µ wide, 15µ long; coverflap with three gently curved granular transverse lines basally, and 8-10 short longitudinal ribs; seta 17µ long.

Type locality: Amanda Park, Washington

Collected: August 14, 1967, by the writer

Host: Rhamnus purshiana DC. (Rhamnaceae) cascara sagrada

Relation to host: the mites occur in the hairs around the buds, and to a lesser extent along the shoots or on the leaves.

Type material: a type slide, so designated, with the above data, retained by the writer; two paratype slides retained.
two paratype slides sent to the Entomology Research Division USDA, Beltsville, Maryland

Reference for Aculops alachuae K. - Eriophyid Studies B-21, Nov. 23, 1966

deuterogyny continued from p. 3

Yellow erineum on North American beech, Fagus grandiflora L., is caused by Acalitus fagerineus (K.). Again there is this same protogyne-deutogyne type of structural association of two forms.

Fagus sylvatica L., European beech, has upper surface vein erineum and again this same type of structural combination occurs. Nalepa's Aceria nervisequus typicus is completely microtuberculate, whereas his nervisequus fagineus has smooth rings above and fine microtuberculation below. This makes fagineus the deutogyne and nervisequus the protogyne, with fagineus then a synonym.

The European beech leaf edgeroller, Acalitus stenapis typicus (Nal.) has protogyne characters, and stenapis blastophthirus (Nal.) has deutogyne features.

On European little-leaf linden, Tilia chordata Mill. the mites in Erineum tiliaceum Pers. are deuterogynous, with Eriophyes tiliae nervalis Nal. having protogyne features, and tiliae liosoma Nal. with the deutogyne structure.

The points to this discussion are: first, the assertion that these erineum mites are deuterogynous. Second, many of Nalepa's polynomials are actually for deutogynes and can be eliminated as synonyms. Third, that mites in one type

continued at bottom of p. 7

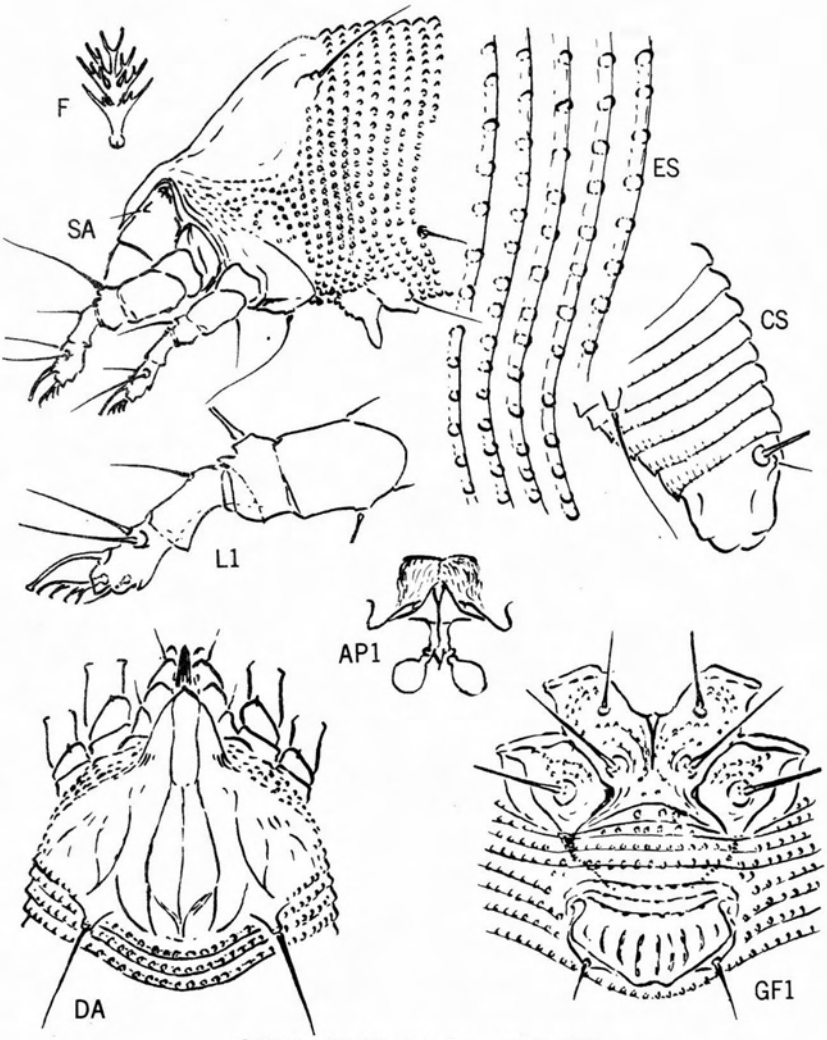

Plate 3 - Aculops amandae, new species

Aculus purshivagrans, new species

Plate 4

This is a species with four spinules projecting forward from under the anterior margin of the shield lobe. In this respect it is similar to other Rhamnus infesting Eriophyids. Aculus rhamnivagrans (K.) has these four points although they are more difficult to see. Rhamnivagrans also has solider lines on the shield and it lives on Rhamnus californica tomentella (Benth.) in California.

Female 175µ-195µ long, 50µ-58µ wide, 45µ thick; fusiform; light yellowish-white. Rostrum 25µ long, projecting diagonally down; antapical seta 5.5µ long. Shield 41µ long, 47µ wide; anterior shield lobe over rostrum moderately acute, with 4 spinules projecting forward from under front margin; shield design a network of lines varying in degrees of granulation: median line indicated on rear half, meeting cross lines at 1/2 and 3/4; admedian lines complete, gradually diverging to rear, forking just behind anterior lobe to give off lateral line, branching at 1/2, both inwardly and outwardly, meeting diagonal line from in front of dorsal tubercle just ahead of rear shield margin. Submedian line from side of anterior lobe base, curving back to first fork of admedian, arching inward and back toward dorsal tubercle and curving laterally past front of tubercle. Upper lateral shield line more or less granular, extending back to rear margin below dorsal tubercle, receiving indistinct diagonal branches from lower line. Lower lateral line rough and granular, from side of anterior lobe base to rear margin, and below a moderately broad band of granules. Partial rings below dorsal tubercle. Dorsal tubercles directing dorsal setae divergently to rear, 42µ apart; dorsal setae 25µ long. Foreleg 29µ long; tibia 8µ long, with 6µ seta from 1/4; tarsus 5.5µ long; claw 7.5µ long, knobbed; featherclaw 4-rayed. Hindleg 25µ long, tibia 6µ long, tarsus 5.5µ long, claw 8µ long. Coxae ornamented with curved lines of short dashes, forecoxae with moderate sternal line between; first setiferous coxal tubercles a little farther apart than second and even with anterior coxal approximation; second tubercles a little ahead of line across third tubercles. Abdominal thanosome with about 31 tergites which are moderately broad, the microtubercles bead-like on rear margins but elongate anteriorly. Sternites about 57 in number, the microtubercles bead-like, somewhat acuminate, set on ring margins or a little ahead. Lateral seta 17µ long, on sternite 10 behind shield; first ventral seta 52µ long, on sternite 23; second ventral 21µ long, on sternite 40. Abdominal telosome with 5 rings, the microtubercles as small points on ring margins, with hair-line extending forward, heavier and longer below. Telosomal seta 25µ long. Accessory seta 3.5µ long. Female genitalia 20µ wide, 18µ long; female coverflap with cross lines of granules basally and about 10 longitudinal ribs apically; seta 14µ long.

Male 165µ long.

Type locality: Amanda Park, Washington

Collected: August 14, 1967 by the writer

Host: Rhamnus purshiana DC. (Rhamnaceae) cascara sagrada, a small tree

Relation to host: the mites are undersurface leaf vagrants

Type material: a type slide so designated, with the above data, etained by the writer; three paratypes also retained
three paratype slides sent to the Entomology Research Division, USDA, Beltsville, Maryland

Reference to Aculus rhamnivagrans (K.) - Bul. Cal. Dept. Agr. 28(6): 419 1939

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deuterogyny continued from p. 5
of gall which appear structurally similar to those in another type of gall, but that lack deutogynes, are not subspecies or varieties, but areactually a

of gall which appear structurally similar to those in another type of gall, but that lack deutogynes, are not subspecies or varieties, but are actually a different species. An example possibly is Eriophyes tiliae typicus (Nal.), in nail galls on linden, preparations of which show no deutogynes. This would make it a different species from the nervalis-liosoma complex.

Nalepa lists three or more 'varieties' as living in some erinea. This may indicate that some species have more than the two forms characteristicof typical deuterogyny. Perhaps Aculops rhoicecis K. is an illustration of this multiplicity of forms as this species has what seems to be a gradation of forms between the typical protogyne and typical deutogyne.

References: Aceria calaceris (K.) Bul. Cal. Dept. Agr. 41:33, 1952
Aceria major (Hodgk.) Tech. Bul. N.Y. Agr. Exp. Sta. #163, 1930
Acalitus fagerineus (K.) An. Ent. Soc. Am. 52(6):650, 1959
Aculops rhoicecis K. Eriophyid Studies B-7:2, 1962

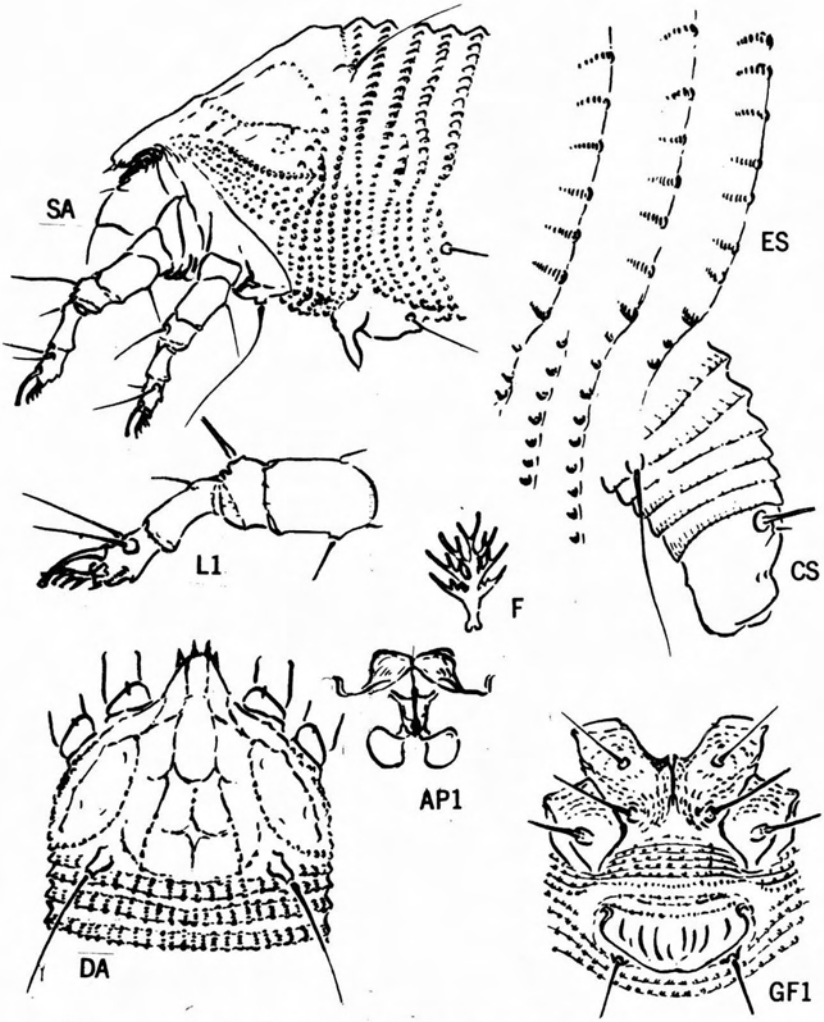

Plate 4 - Aculus purshivagrans, new species

The three new species below are members of a series that infest Cupressaceous trees, and the mites have the following characters in common: anterior shield lobe rather acute in dorsal view,and thin in lateral view; dorsal tubercles with axes more or less longitudinal with body and situated a moderate distance ahead of shield margin; forecoxae more or less separated, or with indistinct separation, lacking definite sternal line except virgae n. sp.; female genital coverflap with transverse curved lines, or the apical ones broken on rufoclivus n. sp. The distributional patterns of these species on cypress and juniper seem more influenced by climate (atmospheric humidity), than by host. Whether or not the back structures, which tend to be diverse, are of true generic significance is a question remaining to be answered. A summary of these species is -

1. Tergites lacking microtubercles and having a middorsal groove flanked by subdorsal grooves - Cupacarus cuprifestor K., on Cupressus macrocarpa Hartw., and on C. goveniana Gord. in high humidity fronting the ocean
1. No middorsal groove and subdorsal grooves present or absent - - - - - 2.
2. Subdorsal grooves present, faint on libocedri and macnabianae - - - - 3.
2. Subdorsal grooves absent, tergites evenly arched - - - - - - - - - - - 5.
3. Tergites broader, lacking definite microtubercles,subdorsal grooves widespaced but definite - Epitrimerus cupressifoliae K., found in coastal areas a few ridges back from ocean on Cupressus sargentii Jepson,and on C. abramsiana Wolf, and on Juniperus californica Carr. from the central California inner coastal range, south.
3. Tergites narrower, with or without microtubercles - - - - - - - - - - -4.
4. Tergites lacking microtubercles except a few laterally; subdorsal grooves slight - Epitrimerus libocedri (K.), found in the drier Sierra Nevada foothills, on Libocedrus decurrens Torr.
4. Tergites with microtubercles which are more or less pointed; subdorsal grooves almost non-existant - Epitrimerus macnabianae n. sp., infesting Cupressus macnabiana A. Mur. in the drier Sierra Nevada foothills
5. Tergites completely microtuberculate, the back rings evenly arched;microtubercles bluntly pointed; forecoxae with no definite separation - Phyllocoptes rufoclivus n. sp., on Juniperus californica Carr. in dry hills surrounding the Sacramento Valley
5. Microtubercles rounded off; sternal line between forecoxae - Phyllocoptes virgae n. sp., on Juniperus virginiana L., Maryland

Phyllocoptes rufoclivus, new species

Plate 5

Female 195µ-210µ long, 60µ wide, 60µ thick; fusiform; light yellowish mites. Rostrum 35µ long, projecting down; antapical seta 8µ long. Shield 55µ wide, 50µ long; general shape subtriangular, the anterior lobe over rostrum acuminate, thin in lateral view. Shield design obscure, with suggestions of admedian lines and submedian lines. Shield laterally with granular edge and longitudinal lines of granules above coxae. Dorsal tubercles with axes convergent to rear, 21µ apart; dorsal setae 8µ long, projecting up and inward. Foreleg 33µ long; tibia 9µ long with 7µ seta from 2/3; tarsus 7µ long; claw 8µ long, slightly tapering, with slight knob; featherclaw 6-rayed. Hindleg 28µ long, tibia 7µ long, tarsus 7µ long, claw 7.5µ long. Coxae ornamented with lines of granules the anterior coxae not separated centrally;first setiferous coxal tubercles farther apart than second and well ahead of anterior coxal joining;second tubercles ahead of line through third tubercles. Abdominal thanosome with about 38 tergites, somewhat wider than sternites, the microtubercles a little elongate, of moderate size, tending to be bluntly pointed on ring margins. Abdominal sternites about 70 in number, microtubercles abruptly smaller than on tergites, the sternites not increasing in number until slightly below lateral ends of tergites; microtubercles on sternites usually slightly ahead of ring margins.Lateral seta about 26µ long, on sternite 14; first ventral seta about 60µ long, on sternite 31; second ventral 33µ long, on sternite 50.Telosome with 6 rings, completely microtuberculate, the microtubercles decreasing in size dorsally and tending to extend pointed over ring margins on last two or three rings; microtubercles ventrally becoming elongate; seta 21µ long. Accessory seta 3µ long. Female genitalia 26µ wide, 17µ long; coverflap with 2 or 3 transverse lines of granules basally, apically with irregular lines tending to converge to rear; seta 26µ long.

Male about 160µ-170µ long.

Second nymph with smaller, sparser microtubercles, there being less dorsoventral differentiation.

Type locality: Eleven miles east of Red Bluff, Cal.

Collected: September 14, 1967 by the writer

rufoclivus continued at bottom of p. 11

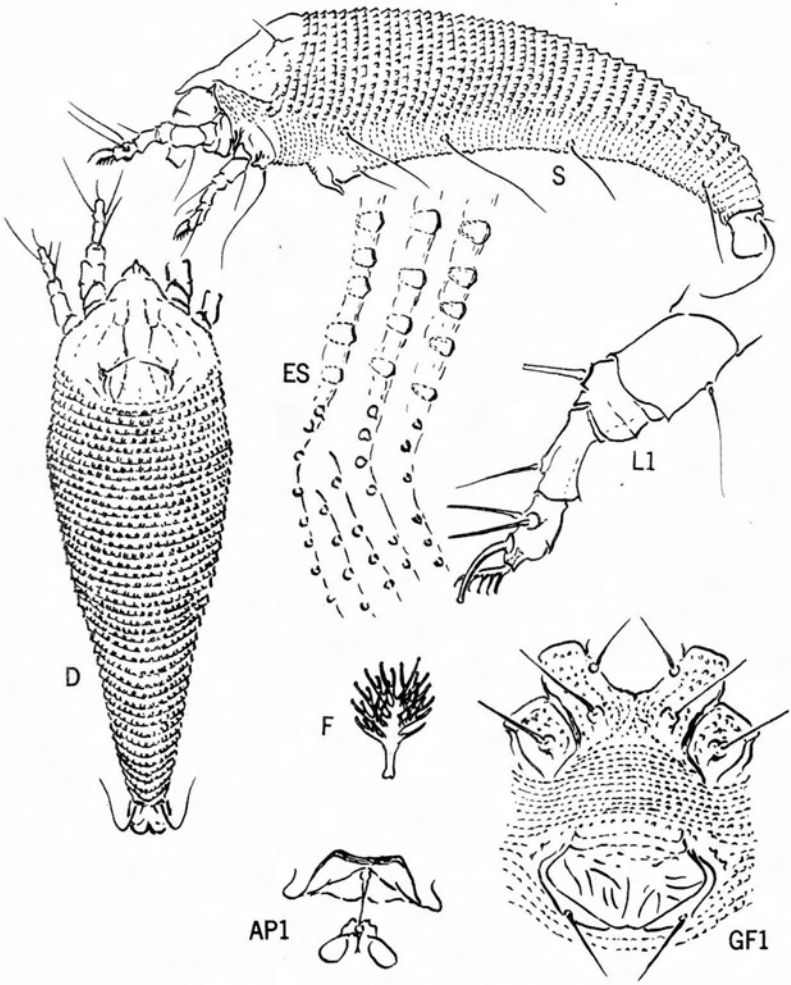

Plate 5 - Phyllocoptes rufoclivus, new species

Phyllocoptes virgae, new species

Plate 6

Female 150µ-160µ long, 55µ wide, 40µ thick; fusiform; color light yellow. Rostrum 28µ long, downcurved; antapical seta 9µ long. Shield subtriangular; 47µ long, 40µ wide; anterior lobe over rostrum moderately acute, very thin in side view. Shield with more or less obscure granulation suggesting admedian lines, sinuate, ending inside dorsal tubercles. Below dorsal tubercles on side some obscure granulations and lateral line above coxae consisting of granules and short dashes, curving up to a partial ring at end; below this a band of granules. Dorsal tubercles 20µ apart, a little ahead of rear margin; dorsal setae 6µ long, projecting up and centrad. Foreleg 27µ long; tibia 5µ long, with 5µ seta at 1/2; tarsus 6µ long; claw 7.5µ long, with slight terminal knob; featherclaw 6-rayed. Hindleg 23µ long, tibia 5µ long, tarsus 5µ long, claw 7µ long. Coxae with little ornamentation; forecoxae separated by strong sternal line centrally; first setiferous coxal tubercles farther apart than second and a little farther forward than anterior coxal approximation; second tubercles ahead of line across third tubercles. Abdominal thanosome with about 37 tergites, completely microtuberculate, these microtubercles of moderate size and rounded off on ring margins. Sternites about 50 in number, with smaller microtubercles that change abruptly in size where tergites and sternites meet laterally, these microtubercles tending to be ahead of ring margins except caudally and to be rounded off. Lateral seta 30µ long, on about ring 8; first ventral seta 47µ long, on sternite 20; second ventral seta 43µ long, on sternite 35. Abdominal telosome with 6 rings; microtubercles present as fine beads on ring edges, elongate below; telosomal seta 19µ long. Accessory seta 4µ long. Female genitalia 24µ wide, 15µ long; coverflap with 5 to 7 transverse curved lines, the anterior 3 or 4 of granules or short dashes, the more apical lines solid; seta 17µ long.

Type locality: Laurel, Maryland

Collected: October 27, 1969 by the writer

Host: Juniperus virginiana L. (Cupressaceae) eastern red cedar

Relation to host: the mites live in crevices around scale-like needles on twig tips

Type material: a type slide, with the above data, so designated, retained by the writer; also a paratype slide
two paratype slides sent to the Entomology Research Division, Beltsville, Maryland (USDA)
a vila with twigs and mites in sugar-water-alcohol syrup from which the slides were made.

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rufoclivus continued from p. 9

Host: Juniperus californicus Carr. (Cupressaceae) California juniper

Relation to host: the mites live in the grooves and crevices formed by the scale-like leaves; they are especially numerous on fast growing tips

Type material: a type slide, so labeled, with the above data, retained by the writer; also two paratype slides retained
two paratype slides sent to the Entomology Research Division, USDA, Beltsville, Maryland

California juniper occurs in a sparse number along the lower hills to the west of the Sacramento Valley, and crosses over to the east in the Red Bluff area. This mite is found on the west side of the Sacramento Valley, as well as in the type locality. From Mt. Diablo in central California, south, this juniper is infested by Epitrimerus cupressifoliae K.

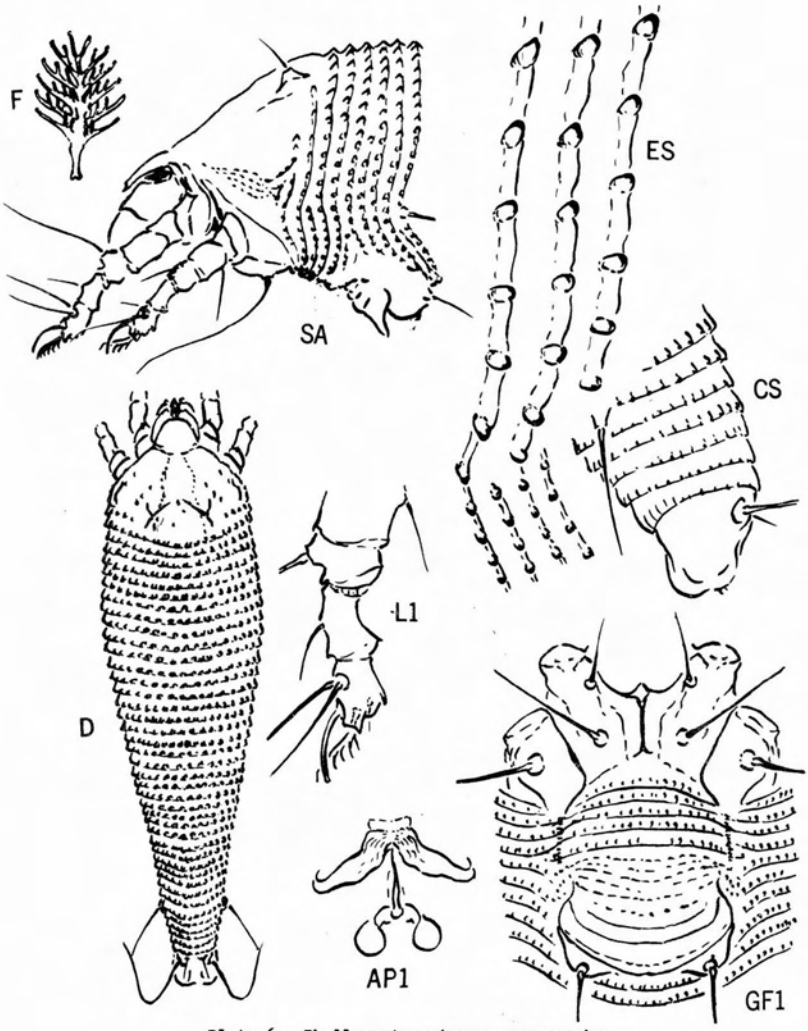

Plate 6 - Phyllocoptes virgae, new species

Epitrimerus macnabianae, new species

Plate 7

Female 175µ-220µ long, 55µ wide, 45µ thick; fusiform; color light tan. Rostrum 28µ long, projecting down; antapical seta 8µ-9µ long.Shield 45µ long, 55µ wide;anterior lobe somewhat acuminate over rostrum,thin in lateral view. Shield design not prominent: median line absent;admedians present as pair of sinuate lines in center of shield; faint suggestion of submedian line ahead of dorsal tubercle; line across shield between dorsal tubercles. Shield laterally with granulate border above coxae and band of granules below it. Dorsal tubercles with longitudinal axes, 20µ a art; dorsal setae 10µ long, directed up and inwardly. Forelegs stocky, 31µ long; tibia 7µ long, with 8µ seta at 1/2; tarsus 7µ long; claw 9µ long, tapering, strongly downcurved. Hindleg 26µ long, tibia 5µ long, tarsus 5µ long, claw 8µ long. Coxae ornamented with short dashes and curved lines of granules; short sternal line between anterior coxae; first setiferous coxal tubercles farther apart than second and well ahead of anterior coxal approximation;second tubercles ahead of line across third tubercles. Abdominal thanosome with tergites and sternites similar; tergites about 45 in number, the microtubercles on ring margins and tending to project over slightly, at times pointed; these microtubercles heaviest behind shield.Sternites about 55-60 in number; microtubercles beadlike and set ahead of rear margins except toward rear where they become increasingly elongate.Lateral seta 25µ long, on sternite 8; first ventral seta 43µ long, on sternite 22; second ventral seta 35µ long, on sternite 38. Telosome with 5 rings, the microtubercles on margins, more or less pointed, elongate ventrally; seta 21µ long.Accessory seta 5µ long. Female genitalia 24µ wide, 15µ long; coverflap with curved transverse lines, the anterior ones of granules, the rear 2 or 3 more solid, tending to turn to rear centrally; seta 33µ long.

Male 165µ-180µ long.

Type locality: River Pines, Amador County, Cal.

Collected: October 23, 1967 by the writer

Host: Cupressus macnabiana A. Murr. (Cupressaceae) McNab cypress

Realtion to host: the mites are twig vagrants

Type material: a type slide, so designated,,with the above data, retained by the writer; two paratype slides retained
Two paratype slides sent to the Entomology Research Division USDA, Beltsville, Maryland

In the 1952 UC Survey Bulletin, p.54, this species was reported as Epitrimerus cupressifoliae K. This is in error as cupressifoliae has much wider tergites and occurs in the Coast Range. The present locality cited above is in the foothills on the east side of the Sacramento,Valley.

Notes on three species of walnut mites with three-rayed featherclaws

The three species are: Aceria tristriatus (Nal.) with tibiae longer than the tarsi, with projecting setiferous genital tubercles;Aceria erineus (Nal.), (sometimes quoted as tristriatus erineus) with tibiae and tarsi about the same length and with projecting genital tubercles; Aceria brachytarsus (K.) with tibiae and tarsi about the same length, but with normal, unprojecting setiferous genital tubercles.

The first species, tristriatus, makes pustules in leaves of Persian walnut, Juglans regia L. There are two types of mites found in the leaf pustules: one with spinulate microtubercles, the other with flattened or obscure microtubercles. The forms with spinulate microtubercles are both males and females, whereas the latter are females only and are smaller than the other females. The conclusion is that this is a case of deuterogyny, with the females having spinulate microtubercles being the protogynes,and the ones with the flattened structures the deutogynes.

On this same walnut, erineus forms dense hairy patches on the undersides of the leaves. Erineus has only one type of mite present, represented by both sexes, and the microtubercles are elongate but not produced or in any way pointed. If erineus is deuterogynous it is not indicated by structural change. Thus erineus differs from tristriatus not only by having shorter tibiae, but also by lacking structural deuterogyny, and also by the type of leaf deformation it causes.

I am indebted to H. K. Wagnon of the Cal. Dept. of Agriculture who collected tristriatus at Yenicekoy, Turkey, August 9, 1968, and erineus at Dagyenikoy, Turkey, May 16, 1968.

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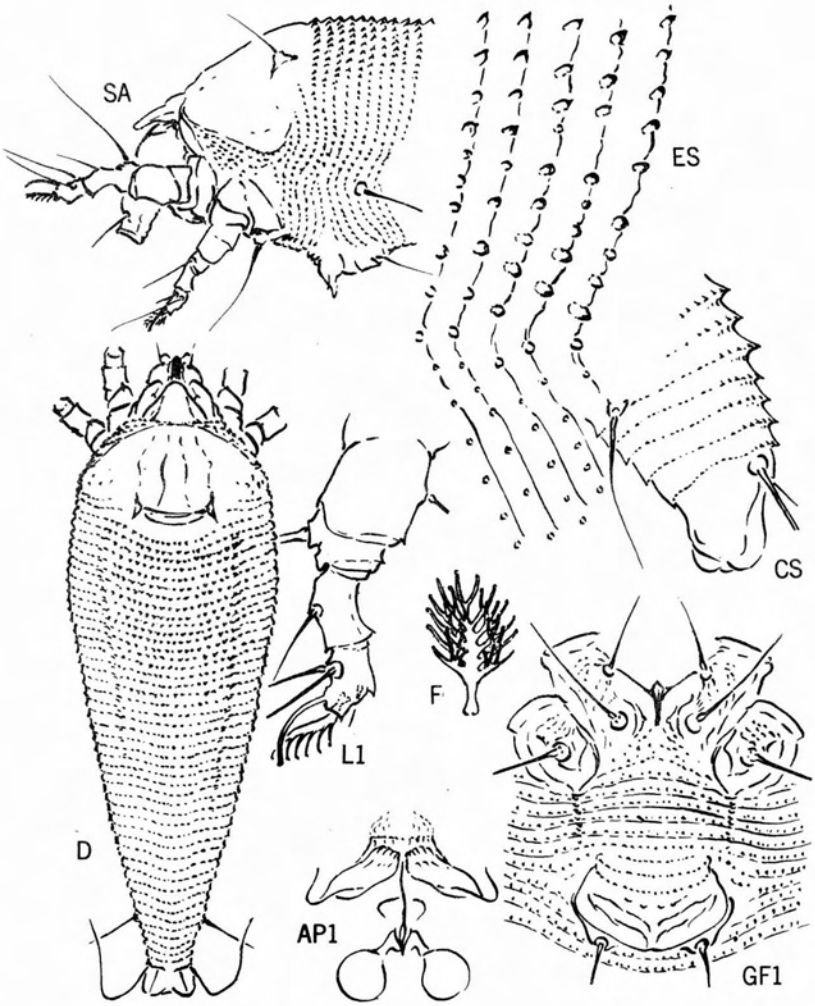

Plate 7 - Epitrimerus macnabianae, new species

C-3

Epitrimerus pentathrix, new species

Plate 8

At Newfound Gap on the Tennessee-North Carolina state line the writer found this species lying at the bases of the needles of Fraser fir in company with a second species. The present species has a 5-rayed featherclaw, an elongate knob on the claw, lateral projecting lobes on the shield, and longitudinal ribs on the female genital coverflap. The other species, named below as hexathrix, has a 6-rayed featherclaw, the claw knob is small and round, the shield has no laterally projecting lobe, and the coverflap has basal granules, and a transverse line or two subparallel to the rear margin.

Female 185µ-200µ long, 73µ wide (shield), 45µ thick; fusiform; light yellowish-white in color. Rostrum large, 38µ long, curved down; antapical seta 9µ long. Shield 65µ long, 73µ wide, subtriangular; anterior lobe rather broad, slightly emarginate centrally, with several small points projecting ahead from front margin. Shield design obscure, especially centrally: subparallel lines running back short distance from anterior margin of front lobe; a sublateral line, or series of lines, from anterior lobe base running diagonally back and disappearing laterally to dorsal tubercles; rear lateral lobes of shield projecting out and bluntly pointed. Dorsal tubercles 25µ apart, elongate, the axes converging diagonally to rear; setae 5µ long, directed up. Forelegs 37µ long; tibia 10µ long, with 5.5µ seta from just beyond 1/2; tarsus 6µ long; claw 8µ long, with elongate terminal knob; featherclaw 5-rayed. Hindleg 33µ long, tibia 7µ long, tarsus 7µ long, claw 8µ long. Coxae ornamented with lines of fine granules; anterior coxae with no definite sternal line between; first setiferous coxal tubercles farther apart than second and slightly farther ahead than anterior coxal approximation; second tubercles a little ahead of line across third tubercles. Abdominal thanosome with about 23 tergites, these tergites with obscure elongate microtubercles. About 67 sternites, the microtubercles fine and on ring margins. Lateral seta 16µ long, on sternite 10; first ventral seta 60µ long, on sternite 26; second ventral seta 30µ long, on sternite 46. Abdominal telosome with 6 rings, the rings mostly smooth with obscure microtuberculation below; seta 19µ long. Accessory seta 3µ long. Female genitalia 26µ wide, 19µ long; coverflap with a pattern of granules basally and 11-13 longitudinal ribs; seta 10µ long.

Type locality: Newfound Gap, Tennessee-North Carolina state line, in the Great Smoky Mountains

Collected: October 30, 1968 by the writer

Host: Abies fraseri (Pursh.) (Pinaceae) Fraser fir

Relation to host: the mites are needle vagrants and at the time of collection were lying at the needle bases on the tip growth

Type material: a type slide, so designated, with the above data, retained by the writer; a paratype slide also retained
a second paratype slide sent to the Entomology Research Division, USDA, Beltsville, Maryland
a vial with twigs and mites in sugar-water-alcohol solution

As there are several mites on each slide this 5-rayed species is mixed with the 6-rayed species. The two are readily separated by characters given above, especially the shape of the claw knob. In comparison to fir mites in the west that also belong to Epitrimerus, the species abietis K., on white fir is similar with a somewhat enlarged claw knob and a 5-rayed featherclaw, but the central shield design is more apparent, and the female genital coverflap has many more ribs in two ranks. Another California species, santaluciae K. on Santa Lucia fir, has a 4-rayed featherclaw and the coverflap has no definite longitudinal ribs.

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continued from p. 13

Aceria brachytarsus (K.) makes pouch galls in California on the leaves of Juglans californica Wats. and J. hindsii Jeps. These pouch galls yield two types of mites - one with spinulate microtubercles, (described by me in 1940 as amiculus), and one with flattened microtubercles. This latter form I named brachytarsus in 1939. By analogy it is now clear that amiculus stands for the protogyne, and brachytarsus stands for the deutogyne. The name of the species is therefore Aceria brachytarsus (K.), and amiculus is a synonym.

References: brachytarsus - Cal. Dept. Agr. Bul 28:328, 1939
amiculus - ibid 29:23, 1940

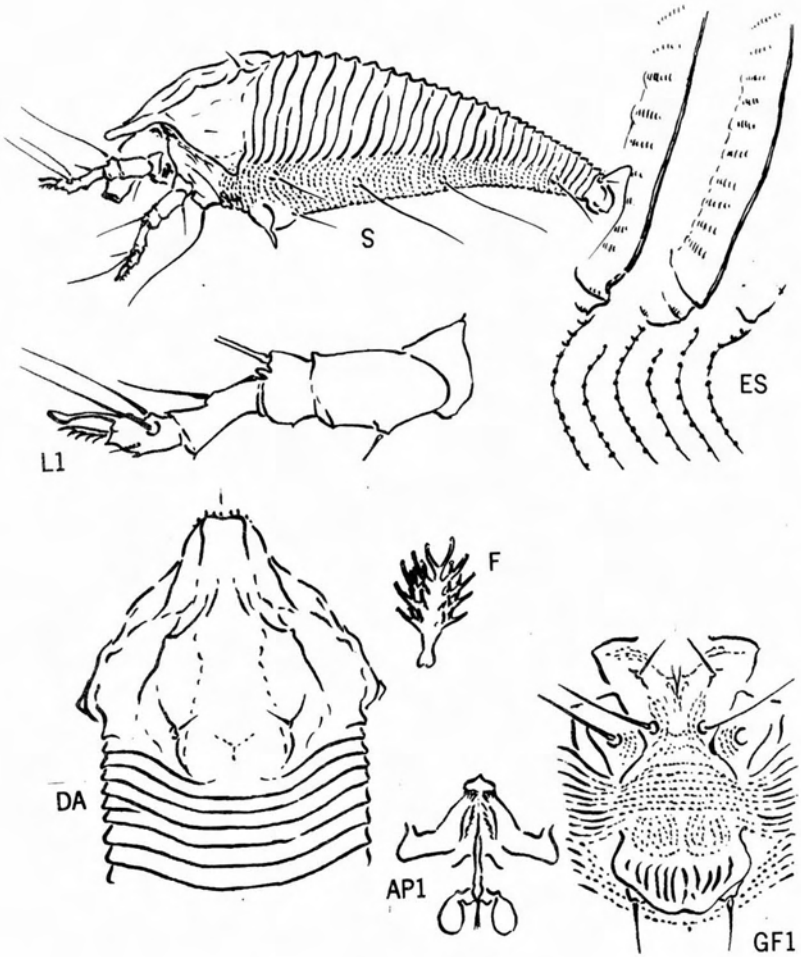

Plate 8 - Epitrimerus pentathrix, new species

C-3

Epitrimerus hexathrix, new species

Plate 9

This is the second species of this genus found on Fraser fir at Newfound Gap in the great Smokies. It differs from pentathrix as already noted, and also as compared to western fir species.

Female 175µ-195µ long, 60µ wide, 40µ thick;fusiform; color light yellowish-white. Rostrum large, 40µ long; antapical seta 8µ long. Shield half elliptical, the anterior lobe broad, bluntly acuminate. Shield design obscure: median line absent; admedian lines indicated from sides of anterior lobe edge, curving out and disappearing, beginning again at about 1/4 and curving out, recurving from rear end of line at 1/4 and arching back to dorsal tubercles; lateral lines from end of the 1/4 line, undulate, running back past dorsal tubercle on outer side. Lateral shield lobe not prominent, defined by a longitudinal line with granules below rear end. Dorsal tubercles elongate, 20µ apart and running diagonally inward to rear; dorsal setae 8µ long, projecting up. Foreleg 33µ long; tibia 8µ long, with 7µ seta from 2/3; tarsus 7µ long; claw 8.5µ long, with small rounded knob; featherclaw 6-rayed. Hindleg 29µ long,tibia 6µ long, tarsus 6µ long, claw 7.5µ long. Coxae unornamented; anterior coxae with short sternal line between;first setiferous coxal tubercles not much farther apart than second and well ahead of anterior coxal approximation; second coxal tubercles a little ahead of line across third tubercles. Abdominal thanosome with about 20 tergites,lateral lobes strong, faint elongate microtubercles present,especially on lateral lobes. Thanosomal sternites about 54 in number,microtubercles not present immediately below tergal lobes, when present the microtubercles being fine points on ring margins and with anterior extensions.lateral seta 19µ long, on sternite 6; first ventral seta 55µ long, on sternite 20; second ventral 43µ long, on sternite 36. Telosome with 5 rings,the microtubercles fine, generally distributed, elongate below; seta 21µ long. Accessory seta 4µ long. Female genitalia 25µ wide, 21µ long; coverflap with basal elongate granulations and one or two transverse lines subparallel to rear margin; seta 45µ long.

Type locality: Newfound Gap, Great Smoky Mountains, Tennessee-North carolina state line.

Collected: October 30, 1968 by the writer

Host: Abies fraseri (Pursh.) (Pinaceae) Fraser fir

Relation to host: the mites are needle vagrants and when found were lying at needle bases on current year's growth

Type material: a type slide, so designated, with the above data, retained by the writer
a paratype slide, sent to the Entomology Research Division, Beltsville, Maryland

As with pentathrix the two slides designated above as type material have both species on them. There are also mites and twigs in alcohol-water-sugar syrup, in a one by four inch capsule vial. The type slides were taken from this vial.

Habit versus structure in the Eriophyoidea

The most plausible explanation of the origin of the wormlike body and reduced number of legs and setae shown by these mites is that it arose in response to a microenvironment. Farkas, 1966 (Zesz.Probl.Post.Nauk Roln.65: 195-198) suggests that the form began in a gall. Of the three Eriophyoid families the Phytoptidae have the most residual setae and therefore may be the most primitive,but they are not a strong gall forming group. Like the Eriophyidae proper, the Phytoptidae have bud mites, gall formers, and leaf vagrants, but most Phytoptids living under cover are in leaf sheaths or around flowers and seeds. However, the gall origin theory still seems best.

Free living Eriophyoids,which are numerous in the Eriophyidae, and constitute all of the Rhyncaphytoptidae, are, by their shape and structure derived from those living in microenvironments. The exposed life then caused certain structural changes, some of which are: broad-based anterior shield lobe, loss of dorsal shield setae in some cases,and often broader and less numerous dorsal half rings on the abdomen.When we find these modifications for free living on gall mites, the conclusion is that the gall formers were previously leaf vagrants and had resumed gall making. There are many examples in structurally diverse groups but one of the better ones is the series of species that includes the willow leaf gall mite, Aculops tetanothrix (Nal.)

Dorsal and ventral setae on Eriophyoids that live sequestered help them to sense the optimum clearence for well being. We can call this clearence 'mite space'. Nearly all bud mites and gall makers have these setae. But on free living species the dorsal setae tend to shorten and disappear, so when we find

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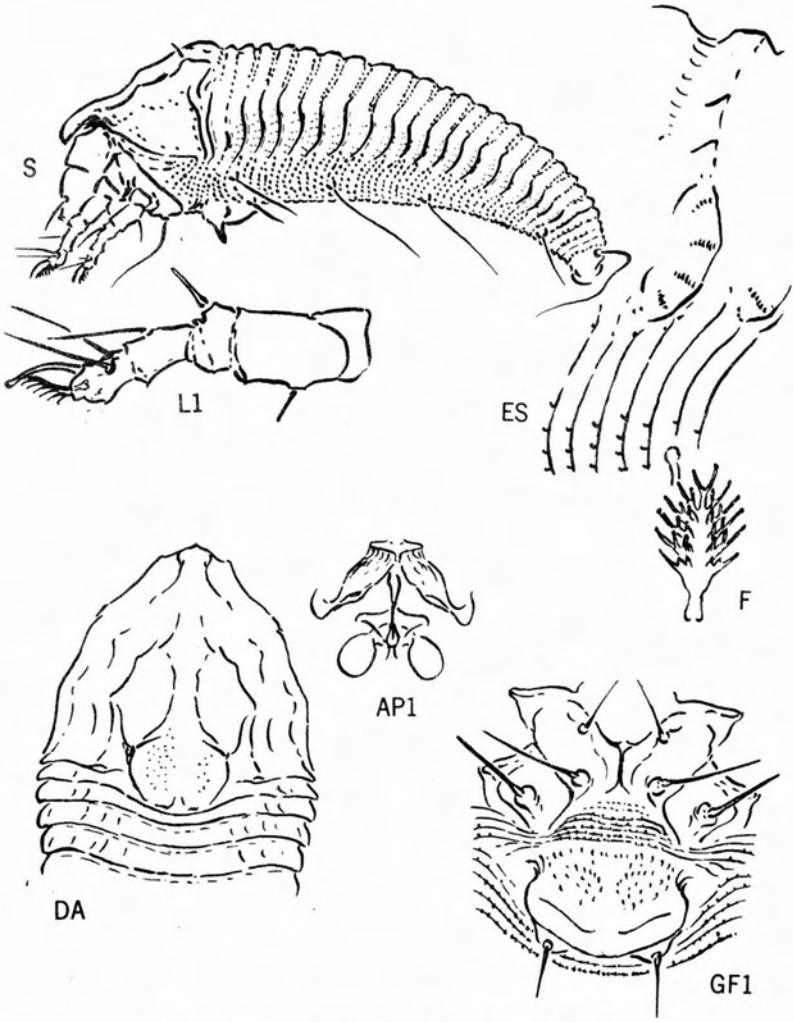

Plate 9 - Epitrimerus hexathrix, new species

Plataculus capsicellus, new species

Plate 10

This pepper mite in a general way has the characters of the genus to which it is assigned. These are: forward projecting points under the edge of the anterior shield lobe; dorsal setae directed to rear; broad shallow dorsal abdominal trough. It differs from the genotype of Plataculus, which is pyramidicus, by having more than two anterior points, and with the dorsal setae converging to rear instead of diverging.

Female 195µ-210µ long, 65µ-70µ wide, about 40µ thick; flattened-fusiform; color in life light yellowish. Rostrum 26µ long, projecting down; antapical seta 9µ long. Shield 47µ long, 57µ wide, subtriangular; anterior lobe bluntly rounded apically, with several small points projecting forward from under front edge. Shield design a network: center lines tending to thickness; median line present on rear 1/2; admedian lines complete, curving back from sides of anterior lobe, meeting diagonal line on inside at just beyond 1/2, which connects with median line, forking at about 2/3, inner fork running back and curving to median line ahead of rear margin, the outer fork directed toward tubercle and curving inside dorsal tubercle and meeting transverse line at rear margin; submedian line faintly present ahead of dorsal tubercle, branching to admedian at 3/4 and again inward just ahead of dorsal tubercle; this submedian line receiving obscure lines on outer side above lateral line. Lateral edge of shield somewhat outcurved above coxae, connected to lateral line above by 4 or 5 diagonal branches; some granules or short dashes between lateral shield line and coxae. Dorsal tubercles 22µ apart, their axes set diagonally and directing dorsal setae divergently to rear and inward; dorsal setae 15µ long. Foreleg 39µ long; tibia 11µ long, with 5µ seta at 1/3; tarsus 8µ long; claw 7µ long, slightly knobbed; featherclaw 5-rayed. Hindleg 37µ long, tibia 9µ long, tarsus 6.5µ long, claw 7.5µ long. Coxae with slight ornamentations of broken lines; sternal line hardly reaching to between second setiferous coxal tubercles; first coxal tubercles farther apart than second and opposite anterior coxal approximation; second tubercles ahead of line across third tubercles. Abdominal thanosome with about 22 tergites; a broad shallow trough 40µ wide, extending from shield and fading to rear, flanked by low lateral ridge on each side, more or less indistinct granulations between tergites. Tergites with irregular formations suggesting microtubercles on lower lateral ends. About 68 sternites with beadlike microtubercles on or just ahead of margins, the sternites often indistinct below ends of tergites; microtubercles becoming finer and with anterior thread-like extensions just ahead of telosome. Lateral seta 20µ long, on sternite 8; first ventral seta 55µ long, on sternite 25; second ventral 13µ long, on sternite 43. Telosome with 5 rings, microtubercles present dorsally on last 3 rings, these microtubercles projecting over margins as fine points; laterally and ventrally the rings with microtubercles that have anterior thread-like extensions, longer ventrally; seta 41µ long. Accessory seta 3µ long. Female genitalia 23µ wide, 15µ long; coverflap with about 10 weak longitudinal ribs; seta 48µ long.

Type locality: near Coro, Falcon State, Venezuela

Collected: May 22, 1969, by Ernesto Doreste, Fundacion Shell

Host: Capsicum frutescens L. (Solanaceae) pepper

Relation to host: the mites prefer the upper sides of the leaves, but they feed on other green surfaces, including stems, and they attack flowers. Leaf deformation results as well as plant changes similar to virus disease or herbicide action. Uncontrolled infestations result in plant death.

Type material: a type slide, with the above data, retained by the writer
a paratype slide sent to the Entomology Research Division, USDA, Beltsville Md.
also dry plant parts from which the mites were taken

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continued from p. 17
a gall mite lacking dorsal setae we can assume it came in from a free life. An example of this is the big bud mite on currant, Cecidophyopsis ribis (Westw.). It belongs to the Eriophyidae Cecidophyinae, many of which are leaf vagrants and lack dorsal setae.

From these considerations, and many more could be cited, it is apparent that different structural groups of the Eriophyoidea have independently moved out of a sequestered existance, developed structures for free living, and then returned to galls and buds. How many have moved out a second time?

Gall formation is a chemical function of the Eriophyoid saliva, certain ingredients of which enter the genetic components of plant cells and change their growth pattern. When Eriophyoids change from galls to free living they lose this function, only to regain it again upon resumption of gall formation. Plant resistance to gall formation exists but is another consideration.

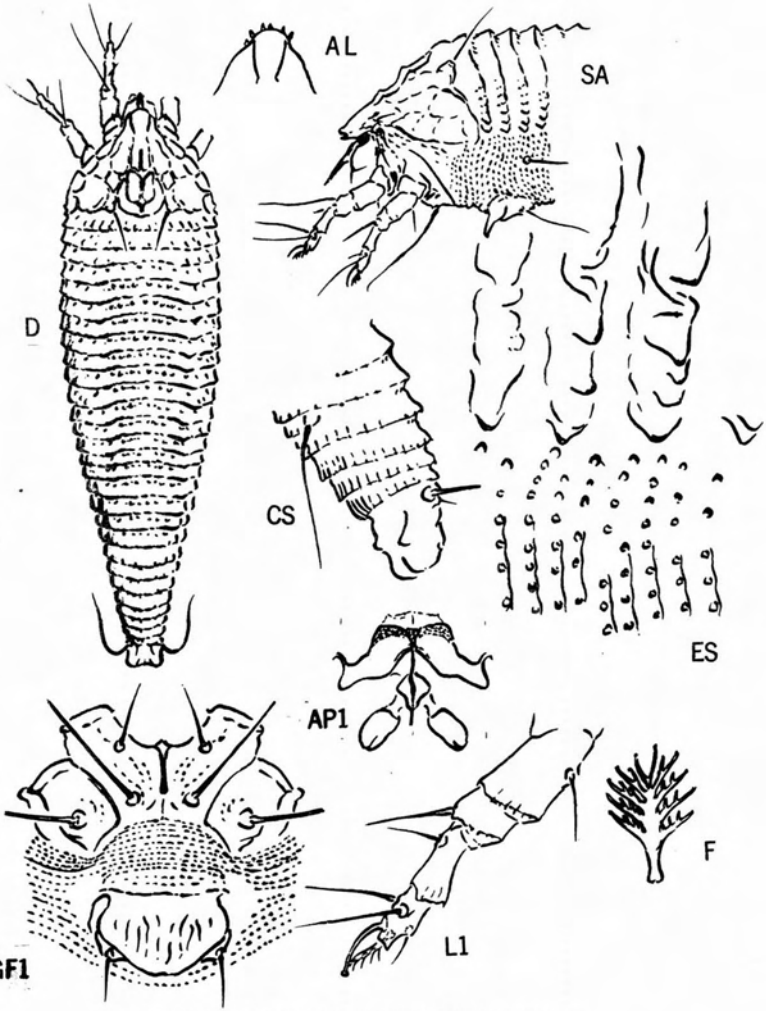

Plate 10 - Plataculus capsicellus, new species

Acarelliptus oregonus, new species

Plate 11

Oregonus is another of the curious tiny Eriophyids that lie on the underside of oak leaves like scale crawlers. This one, found on Garry oak in southern Oregon, differs from Acarelliptus occidentalis K. mainly by having only the middorsal longitudinal groove on the abdomen. Occidentalis lives on Kellog black oak in California, has three longitudinal grooves on dorsum, and there are other differences in detail such as longer dorsal setae, shorter rostrum, etc. The feature of the group containing Acarelliptus and Caliphytoptus is the hinged anterior shield lobe. It was thought at one time that Caroloptes might share this hinged anterior lobe but careful investigation indicates the lobe is a solid projection of the shield. All three genera belong to the Phyllocoptinae

Female 148µ-172µ long, 50µ wide, 38µ-43µ thick; flattened-fusiform, with telosome downcurved to rear; color orange. Rostrum 22µ long, projecting diagonally down; antapical seta 6.5µ long. Shield 44µ long, 45µ wide, subtriangular in anterior outline with sides outcurved, anterior lobe hinged from underside of front. Shield design rather faint: median line absent; admedian lines complete but partly faint, curving back from sides of front blunt angle, meeting cross line at about 1/5, projecting diagonally outward and back to anterior end of lateral line, recurving toward 1/2 point and becoming widened and more definite, a cross line at 1/2, the thickened line projecting diagonally out to transverse line across front of dorsal tubercle, sinuate from this and faint, ending at rear margin well centrad of dorsal tubercle. Lateral shield line faint, joining three or four cells above lateral margin. Dorsal tubercles with longitudinal axes parallel to body length, 20µ apart; dorsal setae 12µ long, projecting up and centrad. Foreleg 29µ long; tibia 5µ long, with 7.5µ seta from 1/3; tarsus 7µ long; claw 7.5µ long, tapering curved; featherclaw 5-rayed. Hindleg 27µ long, tibia 4µ long, tarsus 6.5µ long, claw 9µ long. Coxae with few curved lines, a vague sternal line between anterior coxae; first setiferous coxal tubercles farther apart than second and opposite anterior coxal approximation; second setiferous tubercles well ahead of line across third tubercles. Abdominal thanosome with about 14 tergites, broad, smooth, with one central longitudinal irregular shallow groove fading to rear. Sternites about 46 in number, completely microtuberculate, the microtubercles elliptical and touching ring margins, becoming pointed over ring margins toward rear. Lateral seta 9µ long, on sternite 5; first ventral seta from sternite 17, 27µ long; second ventral seta 12µ-14µ long, from sternite 29. Abdominal telosome with 4 or 5 rings, sometimes doubled below, smooth above, microtubercles below irregular and pointed over ring edges; seta 17µ long. Accessory seta 3.5µ long. Female genitalia 18µ wide, 12µ long; coverflap with pair of moderately strong curved lines across base and with about 8 irregular longitudinal ribs; seta 20µ long.

Type locality: Cabin Creek Camp Ground, near Oakland, Oregon

Collected: August 17, 1967 by the writer

Host: Quercus garryana Dougl. (Fagaceae) Garry oak

Relation to host: the mites lie on the undersides of the leaf among the leaf hairs, especially along the midrib near the leaf base.

Type material: a type slide, so designated, with the above data, retained by the writer; two paratype slides retained.
a paratype slide sent to the Entomology Research Division, USDA, Beltsville, Maryland

References:

Acarelliptus occidentalis K. - Bul. Cal. Dept. Agr. 35(1):98, 1946
Caroloptes fagivagrans K. - Bul. Cal. Dept. Agr. 29(2):166, 1940
This reference also has the description of the genus Caroloptes.

Acalitus phloeocoptes (Nal.)

The plum bud gall mite, phloeocoptes, has the characters of the genus Acalitus. These are: absence of forfemoral and foretibial setae; first setiferous coxal tubercle often moved forward toward anterior end of coxae; second setiferous coxal tubercle moved ahead to near line between first and third tubercles; granulations on forecoxae run across midline when these coxae have no definite separation; female genital coverflap usually with granulations, less often ribs. Examples of phloeocoptes from bud galls have been available both from Trotter's Cecidotheca Italica, fasc. XVII, #423; and from Dr. D. Sutic, Zemun-Beograd, Jugoslavia, collected May 27, 1969.

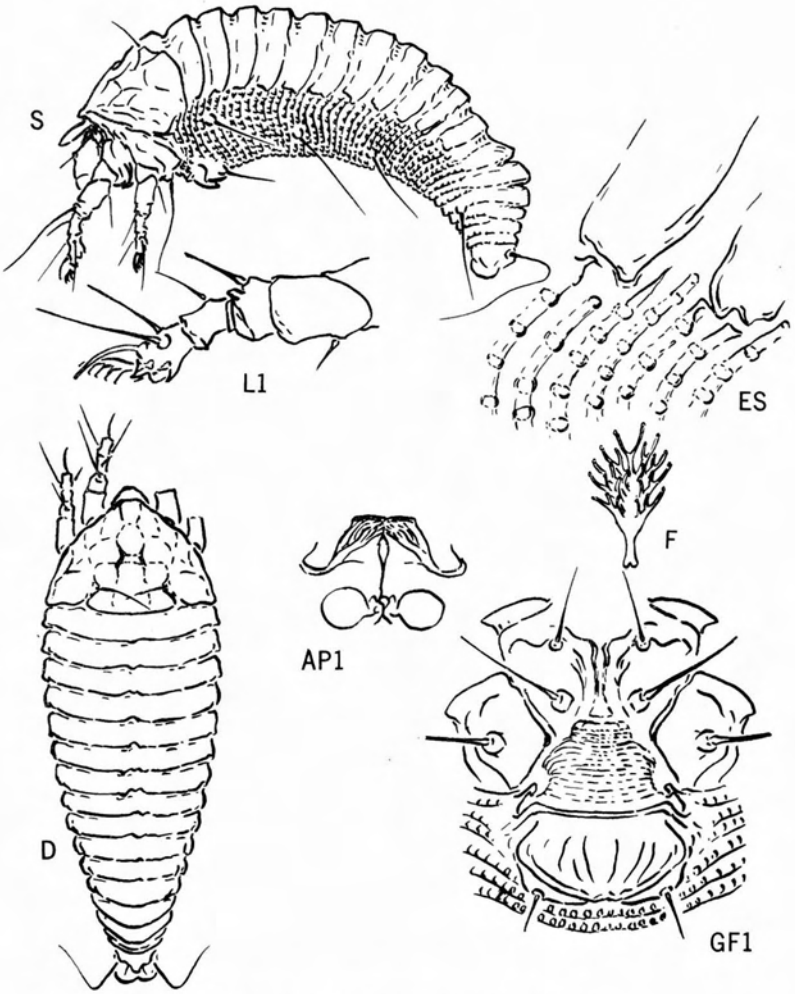

Plate 11 - Acarelliptus oregonus, new species

Calacarus helus, new species

Plate 12

This is a dark purple species with prominent white wax stripes that lives on both leaf surfaces of low-growing Kalmia in marshy mountain meadows. It is the first native California species of this distinct genus that is close to Asiatic and African members of the genus, unlike other native species here. An imported species on camellia, carinatus (Green) (adornatus K.) is quite similar to this Kalmia mite. The Kalmia mite differs from carinatus mainly in a few shield pattern details: the admedian lines each have a short out-curving line at just behind 1/2; these lines lack the small appended edge marks which characterize in part the features of carinatus.

Female 200µ-220µ long, 80µ thick; robust-fusiform; color in life deep purple with white longitudinal wax stripes. Rostrum 44µ long, projecting down; antapical seta 10µ long. Shield 60µ long, 78µ wide; median line indicated on short blunt anterior lobe over rostrum, absent to 1/2 where it reappears as short dash, reappearing again just ahead of rear margin. Admedian lines curving back and out from anterior lobe base, recurving toward center and meeting cross line at 1/2, curving out and emitting short curved transverse line just beyond 1/2, forking well ahead of rear margin, the inner forks from each side arching inward and meeting at rear margin, outer fork curving back to rear margin and slightly outcurved at first ring. Laterally the shield with about four irregular cells along margin above coxae. Dorsal tubercles indicated ahead of rear margin, 35µ apart but lacking setae. Foreleg 45µ long; tibia 12µ long, with 8µ seta from 1/2; tarsus 9µ long; claw 8µ long, knobbed; featherclaw 5-rayed. Hindleg 42µ long, tibia 9µ long, tarsus 9µ long, claw 9µ long. Coxae ornamented with irregular dashes, anterior coxae rather narrowly attached to small central ridge; first setiferous coxal tubercles farther apart than second tubercles and slightly ahead of anterior coxal approximation; second tubercles a little ahead of line across third tubercles. Abdominal thanosome with narrow rings about equal dorsoventrally, approximately 69 in number, forming five longitudinal ridges: a middorsal ridge, a subdorsal ridge on each side, a lateral ridge extending back from lateral rear angles of shield. Ridges roughened by presence of wax-secreting glands. Thanosomal microtubercles fine, beadlike on ventral rings, tending to become pointed over rear ring margins to rear. Lateral seta 36µ long, on ring 9; first ventral seta 43µ long, on ring 27; second ventral 40µ long, on ring 50. Telosome with 8 rings, the microtubercles fine, on margins, elongate below; seta 33µ long. Accessory seta 21µ long. Female genitalia 27µ long, 35µ wide; coverflap basally with central section bearing numerous short dashes, about 12 short longitudinal ridges ahead of rear margin; seta 21µ long.

Male 160µ long.

Type locality: Kings Creek Meadow, Lassen National Park, California

Collected: September 13, 1967 by the writer

Host: Kalmia polifolia var. microphylla (Hook.) (Ericaceae) a low growing shrub of the American laurel group

Relation to host: the mites are leaf vagrants on both leaf surfaces.

Type material: a type slide, so designated, with the above data, retained by the writer; six paratype slide retained
Two paratypes sent to the Entomology Research Division, USDA, Beltsville, Maryland

Designations on Plates

AP1 - Internal female genital structures
CS - Lateral caudal section of mite
D - Dorsal diagram of mite
DA - Dorsal diagram of anterior section
ES - Lateral skin structures
F - Empodium or featherclaw F1- on first leg; F2- on second leg
GF1 - External female genitalia and coxae from below
L1 - Left anterior leg
L2 - Left second leg
S - Diagram of side of mite
SA - Anterior view of side of mite

Telosome - caudal section of mite including third ventral or telosomal seta
Thanosome - abdomen from rear shield margin to telosome

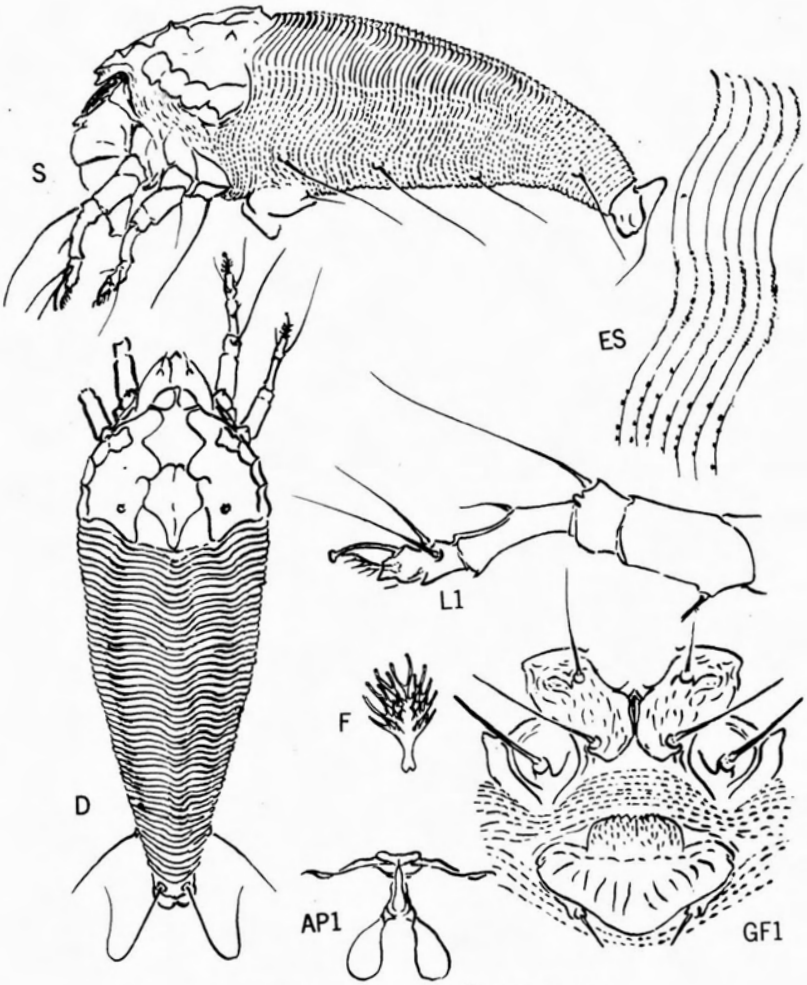

Plate 12 - Calacarus helus, new species