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Eriophyid Studies XXVI

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Bitterbrush is an important browse shrub of the semidesert regions east of the higher mountains in both Oregon and California. In 1957 G. F. Kraft, of the Oregon Agricultural College, surveyed this shrub for pests and has submitted 10 collections of mite-infested twigs and leaves from a wide area in Oregon east of the Cascade Range. These mite infestations are found by examining the plants for leaf and stem galls. These galls are usually less than a sixteenth of an inch in size but when numerous enough they produce twig and leaf deformities.

Kraft found three types of galls: 1. a twig gall; 2. a leaf gall; 3. a white wooly bud gall. From the material which the writer received for examination there is the conclusion that these galls occur independently of each other. The most widespread is the twig gall which is found throughout central and eastern Oregon. The leaf gall was in collections from central Oregon, south to Lassen County, California. One Pringle Falls collection in central Oregon had both kinds from the same shrub, and in this case the leaf galls were scarce. The leaf galls seem to become more numerous to the south, and the Lassen County collection, made by H. K. Wagon, of the California Department of Agriculture, is the only one showing severe leaf deformity.

The mites causing these leaf and stem galls are very similar and while the stem form seems to average a little larger, especially in the length of some setae, not enough evidence was found to justify making two species out of the complex.

The wooly bud gall, which deforms and prevents the growth of parts of the buds on side spurs, was found by Kraft only in Morrow County, northern Oregon. This bud gall mite is quite distinct from the other mite, as hereinafter explained.

I am naming the stem and leaf gall mite for its discoverer, G. F. Kraft, who has

made this extensive survey of the occurrence of these mites.

Aceria kraftella Keifer, New Species

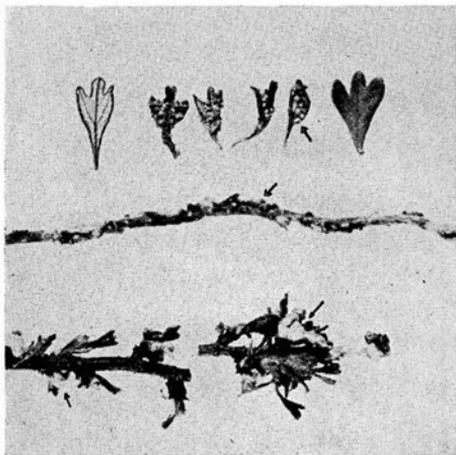
Fig. 1A

This species has a 5-rayed featherclaw, the microtubercles are rounded and closer and finer ventrally than on the sides and above, the only definite shield marking is a short central dash at the rear margin. The male is characterized by the almost complete lack of microtubercles.

Female up to 265 μ long, 60 μ thick, wormlike, dull yellowish. Rostrum 16 μ long, curved down. Shield 20 μ long, 33 μ wide, design unclear, the median line present as a short dash at the rear margin. Dorsal tubercles 18 μ apart; dorsal seta 16-18 μ long. Foreleg 25 μ long, tibia 5 μ long, with seta; tarsus 6.5 μ long; claw 7 μ long; featherclaw 5-rayed. Hindleg 24 μ long, tibia 4 μ long, tarsus 5 μ long, claw 10 μ long. Coxae smooth the anterior coxae broadly touching. Second pair of coxal setae well ahead of line through third pair. Abdomen with about 60 rings, completely microtuberculate, the microtubercles rounded and ahead of rear margin; ventral microtubercles smaller and closer together. Lateral abdominal seta 20 μ long, on ring 7; first ventral 35-50 μ long, on about ring 17; second ventral 15-18 μ long, on ring 29; third ventral 30-40 μ long, on ring 9 from rear. Accessory seta present, 6-7 μ long. Female genitalia 19 μ wide, 10 μ long; coverflap smooth; seta 8 μ long.

Males up to 180 μ long, the microtubercles absent except for those on a few anterior and posterior rings.

Type locality: Pringle Falls Experiment Station, Deschutes County, central Oregon. Collected: July 17, 1957 by G. F. Kraft. Host: *Purshia tridentata* DC., (Rosaceae), bitterbrush. Relation to host: The mites produce small bead galls along the young twigs while they are green. When numerous these galls cause some crookedness in the growth as well as a warty condition. A similar mite population causes small yellowish bead galls on the leaves that may deform the leaves. Type slide, so designated, of mites taken from stem galls collected at Pringle Falls. Three paratype slides also designated from this locality. There is an envelope of dry material on file.



Leaves and twigs of bitterbrush, *Purshia tridentata*, showing galls and deformation caused by Eriophyid mites. Top row with normal leaves at ends and mite galls on deformed leaves in center; these leaves from Lassen County. Twig across center showing effect of stem galls (leaves removed); specimen from Pringle Falls Experiment Station, Oregon. Lower twigs from Morrow County, Oregon, showing white bud galls. Arrows point to galls. Photo by G. M. Buxton.

Two paratype slides are also designated from each of the following localities where the mite was collected: 1. from stem galls 15 miles west southwest of Silver Lake, Lake County, Oregon, July 25, 1957, G. F. Kraft; 2. stem galls from nine miles north of Burns, Harney County, Oregon, August 7, 1957; 3. stem galls from Unity Reservoir, Baker County, August 7, 1957, G. F. K.; 4. stem galls at Kimberly, Grant County, Oregon, August 8, 1957, G. F. K.; 5. stem galls from 12 miles north of Spray, Wheeler County, Oregon, August 8, 1957, G. F. K.; 6. woody galls on side spurs seven miles east of Boardman, Morrow County, Oregon, August 8, 1957, G. F. K.; 7. leaf galls from the type locality; 8. leaf galls at Moffit Butte, Klamath County, Oregon, August 20, 1957, G. F. K.; 9. leaf galls at Johnstonville, Lassen County, California, June 18, 1958, collected by H. K. Wagon, California Department of Agriculture.

***Aceria tridentatae* Keifer, New Species**

This mite causes wooly bud galls on bitterbrush. The mite has five-rayed feather-claws, as *kraftella*, but unlike it the genital coverflap is furrowed, and the males have normal microtuberculation. The shield also

lacks the strong short mark at the rear margin but the design seems slightly clearer.

Female 160-170 μ long, 35-40 μ thick, wormlike, yellowish. Rostrum 17 μ long, curving down. Shield 16 μ long, 27 μ wide; design faint: median line present on rear third; admedians close anteriorly, diverging to rear on each side of median; lateral granulations extending forward from first rings past rear coxae. Dorsal tubercles 20 μ apart; dorsal setae 15 μ long. Foreleg 24 μ long, tibia 4.5 μ long, with seta; tarsus 7 μ long; claw 5 μ long; feather-claw 5-rayed. Hindleg 21 μ long, tibia 3 μ long, tarsus 5 μ long, claw 7 μ long. Coxae somewhat granular; second pair of coxal setae well ahead of line through third pair. Abdomen completely microtuberculate, the tubercles rounded and ahead of rear ring margin; microtubercles finer and closer ventrally; abdomen with 60-65 rings. Lateral abdominal seta 28 μ long, on ring 8; first ventral 26 μ long, on ring 18; second ventral 15 μ long, on ring 32; third ventral 23 μ long, on ring 7 from rear. Accessory seta present, 4.5 μ long. Female genitalia 16 μ wide, 9 μ long, coverflap with 10-12 furrows seta 6 μ long.

Males 150-170 μ long, completely microtuberculate.

Type locality: seven miles east of Boardman, Morrow County, north central Oregon. Collected: August 8, 1957, by G. F. Kraft. Host: *Purshia tridentata* DC. (Rosaceae), bitterbrush. Relation to host: the mites form wooly or whitish outgrowths around the buds, especially buds on lateral spurs. This is apparently followed by a stunting of the growth. Type slide, so designated, and also six paratype slides. There is also an envelope on file with the dry material from which these slides were made.

***Aceria breakeyi* Keifer, New Species**

This mite has been found at two widely separated places on the West Coast, on two different species of gooseberry. It is remarkable in belonging to a group heretofore believed to be confined to trees of the oak and walnut families. (A similar mite occurs on *Nyssa* in the eastern United States.) This mite by having spur-like genital tubercles is allied to the walnut erineum mite, *erineus*, and to a mite forming catkin galls on southern California black walnut, *neobeavori*. These three are compared as follows: *erineus*—dull yellow color, microtubercles rounded, set ahead of rear ring margin; *neobeavori*—dull yellow color, microtubercles pointed; *breakeyi*—red, microtubercles rounded and on rear ring margin.

Female 200-240 μ long, 40-50 μ thick, wormlike, red. Rostrum 22 μ long, curved down. Shield 28 μ long, 36 μ wide, without design except rear ends of submedian lines present near dorsal tubercles. Dorsal tubercles on rear shield margin, 19 μ apart; dorsal setae 24 μ long. Foreleg 30 μ long,

tibia 3.5μ long, with small seta; tarsus 9μ long; claw, 8μ long, slender; featherclaw 3-rayed. Hindleg 28μ long, tibia 3.5μ long, tarsus 8μ long, claw 8μ long. Coxae relatively smooth, anterior coxae broadly touching; second pair of coxal tubercles well ahead of transverse line through third pair of tubercles. Abdomen with 65-70 rings, entirely microtuberculate except dorsal rear; microtubercles rounded, touching rear ring margin. Lateral seta 14μ long on ring 5; first ventral 16μ long, on ring 20; second ventral seta 14μ long, on ring 36; third ventral 22μ long, on ring 6 from rear. Accessory seta present. Female genitalia 20μ wide, 11μ long, anterior section present in front of coverflap; coverflap smooth; seta 4μ long, on spur-like tubercles.

Type locality: Forest City, Nevada County, California. Collected: September 3, 1956, by H. K. Wagnon, State Bureau of Plant Pathology. Host: *Ribes roezlii* Regal (Saxifragaceae), gooseberry. Relation to host: the mites cause a ragged white erineum on the leaves with considerable deformation. Type slide and four paratypes designated from the type locality, plus the dry material.

Dr. E. P. Breakey, for whom the species is named, has sent me this mite from gooseberry leaves, collected on Orcas Island, Washington, September, 1957. Dr. Breakey, who is entomologist for the State College of Washington, writes the host is probably *Ribes divaricatum* Douglas, the coastal black gooseberry. He reports that nearly every leaf on the infested plant was damaged.

Cecidophyes Nalepa, 1889

References:

- Nalepa—Sb. Akad. Wiss. math-nat.
Wien, 1889, 98:31
Keifer—Bul. Cal. Dept. Agr. 1938, 27:302
genotype set as *galii* (Karp.) Nal.

This is a short stocky mite that rolls the leaves of various species of *Galium* in Europe. This plant belongs to the madder family (Rubiaceae) and is known as bedstraw. Through the kindness of H. Roivainen of Helsinki, Finland, of whom I requested specimens, and also of Donald Macfarlane of the British Museum, who sent me infested plant parts among a collection of various Eriophyids, I have been able to study *galii*. An illustration of the species is drawn up but lack of space prevents inclusion in this article.

The conclusion, after study of this mite, is that the genus should be transferred from the subfamily Eriophyinae, where I had originally treated it, to the Phyllocoptinae. This is based mainly on the projection of the cephalothoracic shield over the rostrum which largely hides the rostrum in dorsal view, a character inconsistent with typical

members of the Eriophyinae, but present on nearly all Phyllocoptine mites. The character of the body rings on *Cecidophyes* is inconclusive. Typical Phyllocoptine mites have a sharp differentiation between the tergites and sternites. On *galii* and relatives there is very little difference dorso-ventrally although the rings ventrally are usually a little more numerous, a non-Eriophyine character.

Cecidophyes galii lacks dorsal setae and coupled with this is the spreading of the coxae and appressed genitalia. The female genital coverflap is characterized by longitudinal furrows in two uneven ranks, and the genital apodeme is shortened in ventral view.

This transfer causes *Cecidophyes* to take over two California species which are very similar to the genotype, namely *arbuti* (K.) 1939, and *caliquerci* (K.) 1944. These are transferred from *Coptophylla* K. 1944. The genotype of *Coptophylla* which is *lamimani* K. is sufficiently distinct by its broad tergites to remain separate and hold the genus name.

The two species listed above and other undescribed ones, that now go into *Cecidophyes*, are rust mite types more consistent with the Phyllocoptinae than with the habit of the genotype.

This transfer of *Cecidophyes* to the Phyllocoptinae leaves a group of species in the Eriophyinae, that lack dorsal setae, without a genus name. The following name is therefore set up to fill this place.

Cecidophyopsis Keifer, new genus

Body wormlike. Rostrum small, down-curved, first visible segment longer than second. Shield broadly rounded anteriorly, not projecting over rostrum and concealing it in dorsal view; dorsal tubercles and setae missing. Legs typical of Eriophyine mites, with all usual setae. Abdomen circular in cross section; abdominal rings similar dorso-ventrally, not divided into tergites and sternites; rings completely microtuberculate. Female genitalia close to coxae, the coxae separated somewhat; coxal tubercles, especially the second pair, partially surrounded by subcircular elevations; female genital coverflap with numerous uneven longitudinal furrows, partly in two ranks; apodeme shortened in ventral view.

Genotype: *vermiformis* Nalepa 1889 *Cecidophyopsis vermiformis* (Nal.)

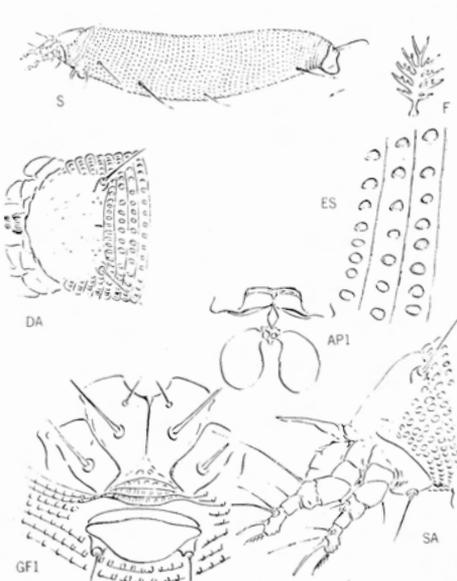


Fig. 1A - *Aceria kraftella*, new species



Fig. 1B - *Vasates wagnoni*, new species

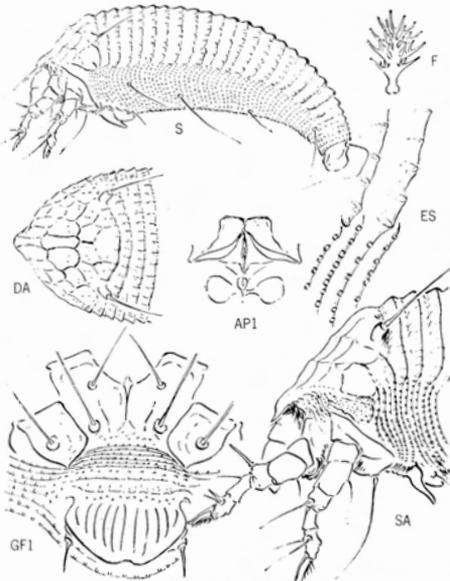


Fig. 1C - *Vasates gleditsiae*, new species

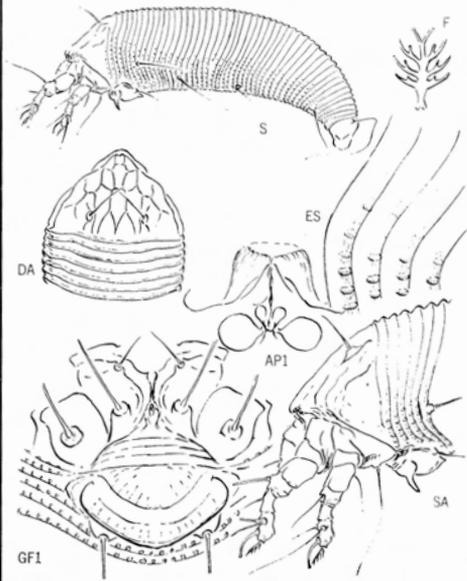


Fig. 1D - *Phyllocoptes graniti*, new species

References:

- Nalepa—Sb. Akad. Wiss. math-nat.
Wien 1889, 98:18
Keifer—Bul. Cal. Dept. Agr. 1944, 33:24

This mite is an inquilin in big-bud galls on filbert. It is widespread. My specimens came from Oregon.

Additional species in North America which will go into *Cecidophyopsis* are: *malpighianus* (C. & M.) on laurel; *psilaspis* Nal. in *Taxus* buds; *verilicis* (K.) on holly; *bendersoni* (K.) on *Yucca*.

European species which have not been seen that likely go into this genus are: *atricbus* Nal., *betulae* Nal., *glaber* Nal., *nudus* Nal., *psilonotus* Nal., *rubsaameni* Nal.

Vasates wagnoni Keifer, new species

Fig. 1B

This mite belongs to the group of species having a pair of small spines projecting from the lower margin of the anterior shield lobe. It is comparable with *cornutus* (Banks), the peach silver mite. From *cornutus* the new species is distinguished by having the microtubercles projecting from the rear ring margins as short points. The new species also has 8 to 9 longitudinal furrows on the female coverflap, whereas *cornutus* has about 12.

Female 190-200 μ long, 60 μ wide, 45 μ thick, spindleform, yellowish. Rostrum 20 μ long, projecting down. Shield 45 μ long, 55 μ wide, with a narrowly rounded anterior lobe bearing a pair of small spines on anterior lower edge; design obscure, admedian apparently complete; slight lateral granulations. Dorsal tubercles 36 μ apart; dorsal setae 20 μ long. Foreleg 33 μ long, tibia 10 μ long, seta present; tarsus 7 μ long, claw 7 μ long; featherclaw 4-rayed. Hindleg 30 μ long, tibia 7 μ long, tarsus 7 μ long, claw 8 μ long. Coxae somewhat lined, especially forecoxae, and with granules along lines; second pair of setae slightly ahead of transverse line through third pair. Abdomen with 30-32 tergites; 60-65 sternites; microtubercles extending past rear ring edges as short points, more elongate on the tergites. Lateral abdominal seta 21 μ long, on sternite 6; first ventral 40 μ long, on sternite 19; second ventral 18 μ long, on sternite 38; third ventral 25 μ long, on sternite 5 from rear. Accessory seta present. Female genitalia 23 μ wide, 15 μ long, coverflap with 8-9 longitudinal furrows; seta 17 μ long.

Type locality: Capell Creek, Wooden Valley, Napa County, California. Collected: June 5, 1958, by H. K. Wagon, State Bureau of Plant Pathology. Host: *Prunus subcordata* Benth. (Rosaceae), Sierra plum. Relation to host: the mites appear on the undersides of the leaves in the spring when they are readily found, but they become scarce by early summer. No leaf damage has been noted although this is a rust mite.

Type slide and seven paratype slides bear the above data. The mite is named for the collector who has brought me many Eriophyids.

Vasates gleditsiae Keifer, new species

Fig. 1C

The five-rayed featherclaw, network shield design, and elongate dorsal microtubercles that project unevenly from the ring edge, characterize this species. There is more definite differentiation between the tergites and sternites than on previously described species with the above combination of characters.

Female up to 190 μ long, 60 μ thick, elongate-spindleform, yellowish. Rostrum 16 μ long, curved down. Shield 38 μ long, 48 μ wide, the anterior lobe a narrow rounded point; design a network with numerous curved and cross lines which form cells; median line present as a short mark at central rear; admedian lines distinct on anterior $\frac{2}{3}$; lateral granulations present below margin. Dorsal tubercles 37 μ apart; dorsal setae 16 μ long. Foreleg 25 μ long, tibia 4.5 μ long, with seta; tarsus 4.5 μ long; claw 4 μ long, knobbed; featherclaw 5-rayed. Hindleg 21 μ long, tibia 4 μ long, tarsus 4.5 μ long, claw 4.5 μ long. Coxae smooth; second pair of setae a little ahead of line through tubercles of third setae. Abdomen with about 28 tergites and 60-65 sternites; tergites with elongate microtubercles that project unevenly slightly beyond rear ring edge; microtubercles on sternites small and rounded. Lateral seta on abdomen 17 μ long, on sternite 9; first ventral 54 μ long, on sternite 24; second ventral seta 14 μ long, on sternite 41; third ventral 18 μ long, on sternite 4 from rear. Accessory seta present. Female genitalia 23 μ wide, 20 μ long, coverflap with about 12 furrows; seta 28 μ long.

Type locality: Alexandria, Virginia. Collected: July 3, 1959, by H. V. Webster of the National Park Service, and submitted to the writer by E. W. Baker. Host: *Gleditsia triacanthos* L. (Leguminaceae), Honey locust. Relation to host: the mites are rust mites and in this case were associated with new growth on dying trees. The mite population on the submitted leaves was exceedingly heavy. Type slide and eight paratype slides designated. In addition there is the dry material from which the slides were made.

Phyllocoptes graniti Keifer, new species

Fig. 1D

The four-rayed featherclaw and other characters relates this mite in a general way to *abaenus* K., (*abaenus* is on plum), but unlike *abaenus* the new species has smooth tergites and no diagonal lines on the female coverflap. The microtubercles on the new species are present on the sternites, but fade laterally.

Female 180-200 μ long, 50 μ thick, elongate and somewhat wormlike, light yellowish white. Rostrum 20 μ long, projecting down. Shield 33 μ long, 40 μ wide, anteriorly with a short blunt lobe over rostrum. Shield design a network; median line absent; admedians complete, in curved sections and cross-linked, forking to rear inside dorsal tubercles; first submedian line complete, joined to adjacent lines by cross lines, ending on rear margin just inside dorsal tubercles. No lateral granules on shield. Foreleg 35 μ long, tibia 7 μ long, with seta; tarsus 8 μ long; claw 10 μ long, curved, slight knob; featherclaw 4-rayed. Hindleg 32 μ long, tibia 4 μ long, tarsus 8 μ long, claw 10.5 μ long. Coxae smooth except for curved lines toward center on anterior coxae; anterior coxae touching. Tubercles bearing second pair of coxal setae a little ahead of transverse line through third pair of coxal tubercles. Abdomen with 55-60 rings, little distinction between tergites and sternites, the former slightly more numerous; sternites microtuberculate, the tergites smooth. Lateral abdominal seta 24 μ long, on sternite 7; first ventral 37 μ long, on sternite 16; second ventral 9 μ long, on sternite 28; third ventral seta 20 μ long, on sternite 5 from rear. Accessory seta absent. Female genitalia 24 μ wide, 14 μ long, coverflap unfurrowed; seta 16 μ long.

Type locality: Carovigno on southern Adriatic coast of Italy. Collected: August, 1958, by Dr. Antonio Graniti, Plant Pathologist, Istituto di Patologia Vegetale, Bari. Host: *Amygdalus communis* L. (Rosaceae), almond. Relation to host: the mites produce erineum patches on the undersides of the leaves. A type slide and three paratype slides are designated. There is also the dry leaf from which the slides were made. The mite is named for Dr. Graniti who submitted the leaf to me.

***Tetra nielseni* Keifer, new species** **Fig. 2A**

The possession of two-rayed featherclaws, and elm as a host, allies this species to *concava* K. From *concava* the new species is differentiated by having a blunter anterior shield lobe, and more numerous tergites. Both kinds have unusually elongate dorsal setae. The new species is American but *concava* is probably European in origin.

Female 160-170 μ long, 50 μ wide, 40 μ thick; spindleform, with a broad dorsal concavity; yellowish. Rostrum 25 μ long, projecting down. Shield 45 μ long, 50 μ wide, anterior lobe rough, broad and blunt. Median line missing from shield; admedians complete, curving, diverging in broad arcs posteriorly between dorsal tubercles; submedians short, ending well ahead of dorsal tubercles; first two or three rings curving ahead of dorsal tubercles from behind the lateral shield lobes; some lateral granulations. Dorsal tubercles large, 24 μ apart. Dorsal setae 100 μ or more long, stout. Foreleg 31 μ long, tibia 7 μ long, with seta; tarsus 6.5 μ long; claw 6.5 μ long, knobbed, featherclaw 2-rayed. Hindleg 28 μ long, tibia 6 μ long, tarsus 6.5 μ long, claw 6.5 μ long. Coxae somewhat marked with curved lines bearing granules; second pair of coxal tubercles

a little ahead of line through third pair of tubercles. Abdomen with about 55 tergites and 60-65 sternites; the sternites with small, round microtubercles on rear ring margin, microtubercles fainter on tergites. Tergites not much broader than sternites; abdomen with a broad dorsal longitudinal trough, in the central front of which is a broad rounded elevation continuing backward 8 or 10 tergites from the rear shield margin. Lateral abdominal seta 11 μ long, on sternite 6; first ventral 30 μ long, on sternite 20; second ventral 8.5 μ long, on sternite 36; third ventral seta 15 μ long, on sternite 5 from rear. Accessory seta present, small. Female genitalia 24 μ wide, 15 μ long, coverflap with 6 furrows, the outer ones diagonal; seta 10 μ long.

Type locality: Mechanicville, New York. Collected: August 10, 1958, by Gordon R. Nielsen, Research Assistant, Cornell University. Host: *Ulmus americanus* L. (Ulmaceae), American elm. Relation to host: the mites are rust mites and cause leaf browning and drop. This damage is confused with dutch elm disease. The mites inhabit the undersides of the leaves. Type slide and four paratype slides are indicated. In addition there is the dry material from which the mites were taken. The species is named for the collector who has sent me a number of mites.

***Tetra americana* Keifer, new species**

This mite occurs along with *nielseni* and contributes to the damage on the trees, but it differs by having a seven-rayed featherclaw and very short dorsal setae. As in *nielseni* there is a broad dorsal trough with an anterior elevated midsection, but the anterior shield lobe of the new species is much more acute in dorsal view and the shield pattern is different.

Female 160-170 μ long, 40 μ wide, 37 μ thick; elongate spindleform, light yellowish. Rostrum 23 μ long, projecting down. Shield 43 μ long, 38 μ wide, anterior lobe produced into a moderately acute but terminally rounded point, blunter in lateral view. Shield with median line missing; admedian lines complete, bent somewhat centrad on rear of frontal lobe, expanding and slightly recurved to center, diverging behind this and recurved to rear of shield, forked between dorsal tubercles; submedian line outside of and following admedian on posterior $\frac{2}{3}$; shield rounded laterally, hardly lobed; some granules above coxae. Dorsal tubercles 22 μ apart. Dorsal setae 14 μ long. Foreleg 30 μ long, tibia 6.5 μ long, with seta; tarsus 6.5 μ long; claw 8 μ long, slender; featherclaw 7-rayed. Hindleg 27 μ long, tibia 5 μ long, tarsus 6.5 μ long, claw 8.5 μ long. Coxae with some lines of granulations; second pair of coxal tubercles slightly ahead of transverse line through third pair of tubercles. Abdomen with about 60 tergites and sternites, the sternal microtubercles fine and somewhat elongate; microtubercles fading dorsally. Dorsum with broad longitudinal trough and a central elevated broad ridge extending back 10-12 tergites from shield. Lateral seta 22 μ long, on about sternite 10; first ventral 30 μ long, on sternite 24; second ventral

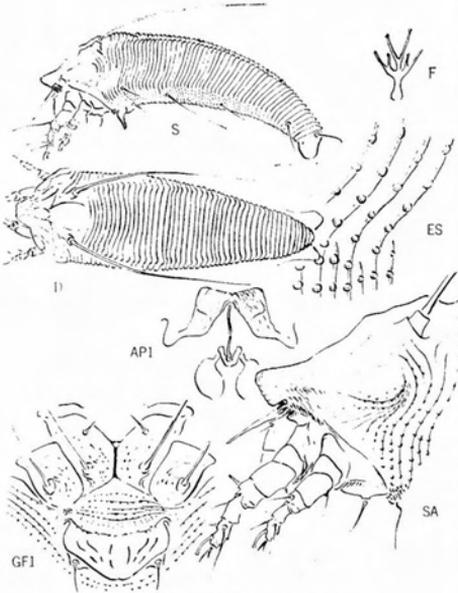


Fig. 2A. *Tetra nielsenii*, new species

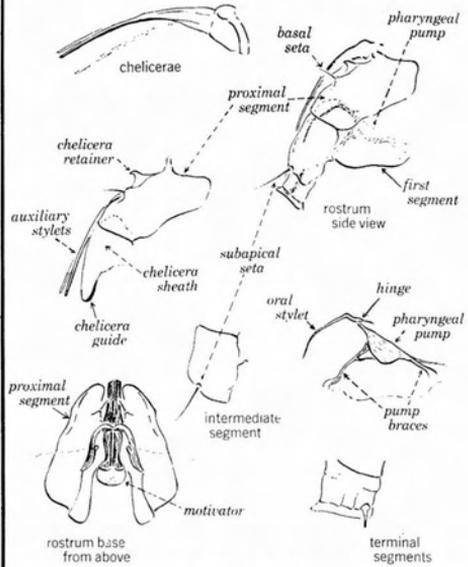


Fig. 2B. *Aceria ligustris* K., mouthparts

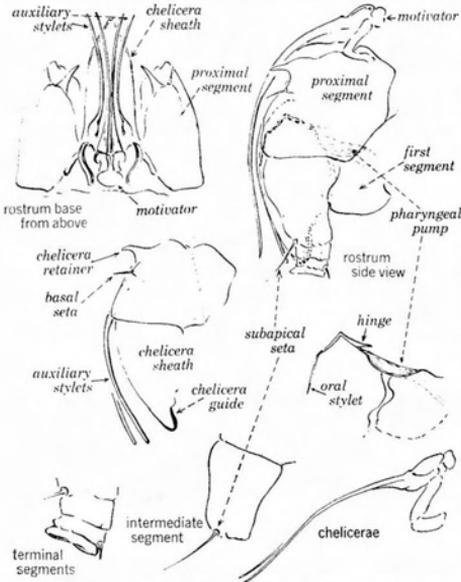


Fig. 2C. *Calacarus carinatus* (Greene), mouthparts

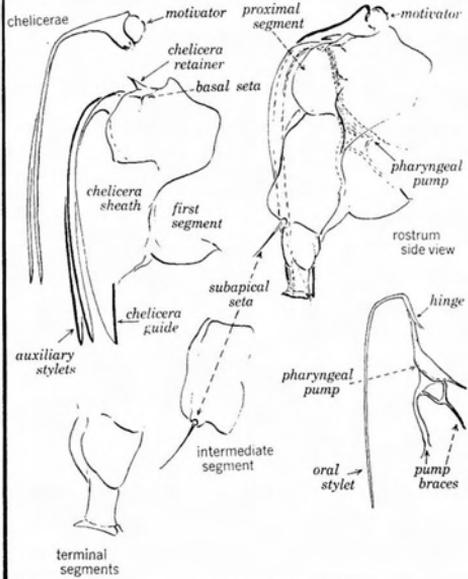


Fig. 2D. *Diptacus gigantorhynchus* (Nal.), mouthparts

9 μ long, on sternite 37; third ventral 19 μ long, on sternite 5 from rear. Accessory seta present. Female genitalia 18 μ wide, 12 μ long, coverflap with about 13 longitudinal furrows; seta 12 μ long.

Type locality: Mechanicville, New York. Collected: August 10, 1958, by G. R. Nielsen. Host: *Ulmus americana* L. (Ulmaceae), American elm. Relation to host: the mites are undersurface rust mites causing browning of the leaves. Type slide and three paratype slides so designated. In addition there is dry material of this mite on the leaves.

* * * *

The mouthparts of Eriophyids are of importance in the classification of these mites so this installment will close with a discussion of this subject. The mouthparts of Eriophyids are in the form of a frontal beak-like structure, pointing downwards, and here collectively called the *rostrum*. While these mouthparts have their distinctive features they nevertheless stem from the fundamental organization of the Acarine gnathosome. For a general discussion of the feeding organs of mites and other Arachnids, see R. E. Snodgrass, Smithsonian Misc. Coll. 1948: 110/, No. 10, Aug.

The mouthparts of Tetranychid mites (red spiders) have been somewhat better treated than those of the Eriophyids, because they are easier to study, so some preliminary remarks on these larger mites will be helpful. The chelicerae of mites are typically a pair of separate pincher-like feeding organs, operating independently above the fused bases of the mouth palpi. In red spiders these chelicerae have become fused basally into a large protrusible lobe known as the stylophore, from the lower side of which hang the stylets. The stylets are supposed to represent the movable digits of the chelicerae.

The Tetranychid stylophore is alternately protruded and retracted during the feeding operation, the stylets running back and forth in a groove on the upper side of the rostrum. The Tetranychid rostrum is the protruded anterior part of the fused palpal bases, or palpal coxae.

These fused palpal coxae of the Tetranychids have the mouth at the anterior end of the rostrum, with the pharyngeal pump located just behind the mouth. The position of this pump is important as it locates the basal segment of the palpi both in the Tetranychids and in the Eriophyids.

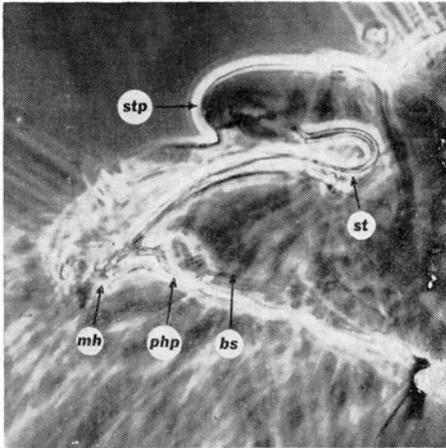
The Tetranychid palpi project anteriorly from each side of the rostrum, and consist of five segments with a claw on the fourth, or palpal tibia.

The rostrum of the Eriophyid mite (see Figures 2B, 2C, 2D, and photographs) includes the chelicerae and the palpi. It differs markedly in most respects from the mouthpart organization of the Tetranychids. The Eriophyid chelicerae are needle-like stylets, straight or curved, which originate at the upper base of the rostrum and lie in an open anterior groove on this rostrum. There is no indication of a stylophore, and these stylets cannot be projected and retracted. Their bases remain fixed and the only movement they have is a slight alternate back and forth motion produced by the action of a small knob which pivots at the chelicera bases. This knob, which moves rapidly from side to side, is here called the *motivator*. By its action it produces the boring action of the chelicerae.

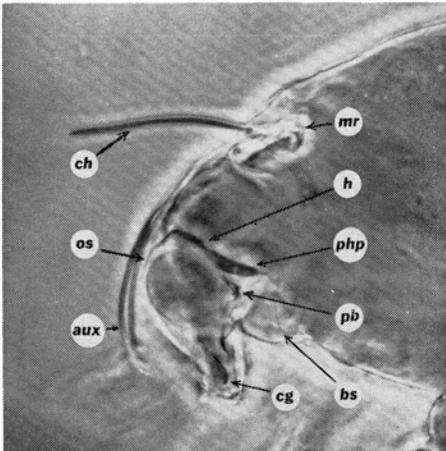
The Eriophyid chelicerae are of two fundamental forms. The usual type is that present in the smaller rostra where the cheliceral stylets are either straight, or evenly curved to the rostrum apex. Some large rostra also have this evenly curved type of chelicerae and are therefore correlated with mites possessing smaller rostra.

In the Rhyncaphytopinae (Roivainen—Ann. Ent. Fenn. 1953:19, [No. 2], 83-87) the chelicerae usually project directly ahead from the rostrum base for a short distance and then abruptly curve down to the rostrum tip. This is the most conspicuous diagnostic feature of the mites in this subfamily, but there are additional structures that are even more useful in defining the Rhyncaphytopinae, as will be shown.

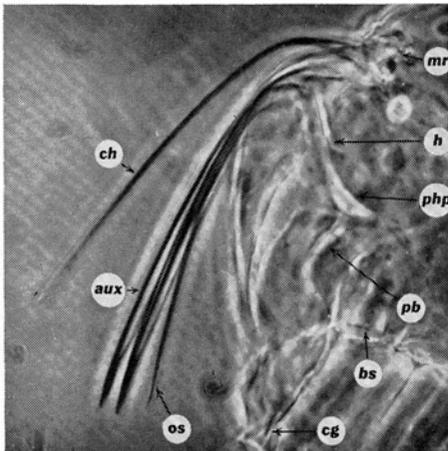
The pharyngeal pump of the Eriophyid mite is just above and ahead of the anterior coxae (see both drawings and photographs). This then indicates that the section, or lobe, lying ahead of the forecoxae is the fused first segment of the palpi. Two arms, which hold the pump front and rear are here called the *pump braces*. From the upper anterior end of the pump a curved stylet extends anteriorly upward and then recurves downward. At the base of this stylet, in front of the pump, there is a flexible joint here called the *oral hinge*. This hinge allows the *oral stylet*, which has the mouth opening at its apex, to move up and down independently.



Left side view of mouthparts of a male spider-mite, *Oligonychus stickneyi* (McG.), illustrating stylets, mouth and pharyngeal pump. Designations: bs—basal or first palpal segment, fused into rostrum; mh—mouth at apex of rostrum; php—pharyngeal pump; st—stylet; stp—stylophore. Photo by G. M. Buxton.



Left side view of the mouthparts of the camellia rust mite, *Calacarus carinatus* (Greene), with detail of the oral stylet. Designations: aux—auxiliary stylets; bs—basal or first palpal segment; cg—cheliceral guide; ch—chelicerae; h—hinge; mr—motivator; os—oral stylet; pb—pump brace; php—pharyngeal pump. G. M. Buxton photo.



Left side view of the mouthparts of the big beaked plum mite, *Diptacus gigantorhynchus* (Nal.). Designations: aux—auxiliary stylets; bs—basal or first palpal segment; cg—cheliceral guide; ch—a chelicera; h—hinge; mr—motivator; os—oral stylet; pb—pump brace; php—pharyngeal pump. G. M. Buxton photo.

In most Eriophyids the anterior bent down part of the oral stylet is hardly as long as the base of this stylet plus the pump length. In the Rhyncaphyoptinae the bent down part is considerably longer than its base plus the pump.

Projecting anteriorly and down from the inner base of the rostrum are a pair of membranes that are open along the upper anterior edge, but closed or fused to the rear. These extend to the apex of the rostrum and the palpi lie along the outside of these membranes. The cheliceral stylets lie just inside the anterior edges of these membranes, and this structure is here called the *cheliceral sheath*. At the lower apex of this sheath, just behind the points of the chelicerae, the sheath is stiffened. This stiffened end is the *cheliceral guide*. This guide is rounded apically in the rostra of most Eriophyids, but pointed in the Rhyncaphyoptinae.

Within the base of the cheliceral sheath there project a pair of stylets which resemble the true chelicerae and evidently lie alongside or just behind them during the feeding operation. In many Eriophyids these stylets are observed clinging to the chelicerae and they are here called the *auxiliary stylets*. In some positions the Rhyncaphyoptinae exhibit five stylets projecting from the rostrum. These are the two chelicerae, the two auxiliary stylets, and the oral stylet. If the chelicerae are split, which often happens, additional threads will be present.

The auxiliary stylets should be investigated for a possible connection to the salivary ducts.

The segmented portion of the oral palpi lie on each side of the above described inner structures. These palpi are flat on the inner side and the apical segments have considerable freedom of movement. Under certain circumstances these palpi move independently, and may even aid in crawling movements. These palpi have a series of segments, and while this recital will not attempt to definitely designate what each of these segments is, there is a possibility that all six segments of the Acarine pedipalp are actually present.

The first visible segment of the palpus projects from the body just below the chelicera base. This segment extends back into the body under the cephalothoracic shield, but our discussion mainly concerns the external or visible part of this segment. Since the chelicera sheath appears to origi-

nate at the base of this first external segment, and since the sheath may be part of the first palpal segment, or palpal coxae, this first external segment is very likely the second palpal segment. However, it is here called the *proximal segment*.

On the upper anterior edge of this proximal segment there are two significant structures: a spine (from each side) curving centrally over the chelicerae, and here called the *chelicera retainer*, and just below and outside it the *basal seta*. The chelicera retainer and basal seta are situated above the upper curve of the oral stylet, and just anterior to the origin of the auxiliary stylet. On Eriophyids with smaller rostra, and relatives, this retainer and seta are about midway from the body edge to the distal end of the proximal segment. In the Rhyncaphyoptinae the oral stylet curves up nearer the chelicera base than in the mites with smaller rostra, and the auxiliary stylets also originate nearer the chelicera base. This draws the retainer and basal seta closer to the body edge in the Rhyncaphyoptinae, and shortens the proximal segment.

The *intermediate segment* of the palpus originates at the distal end of the proximal segment and is characterized by the presence of a large seta at its anterior distal edge. This is the *subapical seta* of the palpus. The intermediate segment is shorter than the external part of the proximal segment on smaller rostra. On the Rhyncaphyoptine rostrum the visible, or external, part of the proximal segment is shorter than the intermediate segment.

From the lower distal end of the intermediate segment hang the terminal segments. A sensory seta, or papilla, projects from the rear side of this section just above the lips. If the terminal lips of this section are a segment, then the terminal segments are three in number and all six palpal segments are accounted for. On smaller rostra these terminal segments are relatively short and stout. The Rhyncaphyoptine terminal segments are attenuate.

When an Eriophyid projects its stylets into plant tissue it does not push these ahead or down from the normal body position. Instead, the terminal palpal segments telescope, in the case of the smaller rostra, or fold back, as in the Rhyncaphyoptinae. The cheliceral guide also apparently moves with these terminal palpal segments.

The following table summarizes and compares the preceding information:

RHYNCAPHYOPTINAE

Rostrum large in comparison to body and apically attenuate.

Chelicerae usually projecting ahead for short distance, then abruptly bent down to rostrum apex.

Oral stylet with distal recurved portion longer than stylet base plus pump; curve of oral stylet not far below chelicera base.

Proximal segment with external part shorter than intermediate segment; basal seta and retainer drawn close to body edge.

Cheliceral guide pointed apically.

Terminal segments of palpi attenuate and folding back during feeding operation.

This discussion of the mouthparts is illustrated by three figures. Figure 2B is of *Aceria ligustri* (K.), one of the species with a small rostrum. The body of this mite is about 40μ thick, the rostrum is 25μ long, the external part of the proximal segment is 12μ long, intermediate segment 8μ long, terminal segments 5μ long.

Figure 3B is of *Calacarus carinatus* (Greene), (*adornatus* K.). This is a mite with a large rostrum but is otherwise similar to *Aceria*. The body is 60μ thick, rostrum 50μ long, external part of proximal segment 28μ long, intermediate segment 14μ long, terminal segments 8μ long.

The Rhyncaphyoptinae are illustrated in Figure 4B, by *Diptacus gigantorhynchus*

OTHER ERIOPHYIDS

Rostrum usually small in comparison to body, but may also be large.

Chelicerae straight or evenly curved to rostrum apex.

Oral stylet with distal recurved portion usually shorter than length of stylet base plus pump; stylet recurving well below chelicera base.

Proximal segment with external part longer than intermediate segment; retainer and basal seta at about midpoint on proximal segment.

Cheliceral guide rounded apically.

Terminal palpal segments short, stout, telescoping during feeding operation.

(Nal.). In this case the body is 70μ thick, rostrum 60μ long, external part of proximal segment 18μ long, intermediate segment 27μ long, terminal segments 15μ long.

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Designations on the drawings which appear as letters and figures are: AP1—internal structures in the female genitalia; D—dorsal view of mite; DA—dorsal view of shield; ES—lateral epidermal structures; F—feather-claw from below; GFI—coxae and female genitalia from below; S—lateral view of mite; SA—side view of anterior section of mite.

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