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A Preliminary Survey of the Plant Mites of Puerto Rico[1]

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INTRODUCTION

This is a taxonomic study of the plant-feeding mites of Puerto Rico. These mites belong to the Class Arachnida, Order Acarina, Suborder Trombidiformes, and the families Tetranychidae, Tenuipalpidae, Tarsonemidae, and Eriophyidae.

The tetranychids are commonly called spider mites because of their web-spinning. When abundant they may cause plants to become completely defoliated and devitalized. Until the present project was undertaken, only eight species of spider mites were known from the Island of Puerto Rico, all of which were known also from the United States. The author has added five more species to the list, one of which was hitherto undescribed. Previous work on the spider mites of Puerto Rico was done by E. A. McGregor

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who described three new species on the basis of material sent to him by G. N. Wolcott (*227*)[3]. As yet, they are not pests of economic importance.

The tenuipalpids, commonly called false spider mites, were reported from Puerto Rico only once previous to this work. Originally, *Brevipalpus longisetosus* Baker (*8*) was collected on an unknown host at Yauco, but was not found during the author's stay on the Island. This group of mites are pests of ornamentals and citrus fruits all over the world. Three of the six species found in Puerto Rico are common to the United States: *Brevipalpus inornatus* (Banks), *B. australis* (Tucker), and *B. phoenicis* (Geijskes). Three new species were discovered in Puerto Rico.

In Puerto Rico three species of tarsonemid mites have been reported: *Steneotarsonemus bancrofti* (Michael), *S. ananas* (Tyron), and *Hemitarsonemus latus* (Banks). *S. bancrofti* and *H. latus* have been reported from the United States. The most important pest species of the Tarsonemidae on the Island is *Hemitarsonemus latus* which feeds on tomatoes, potatoes, and peppers. This species is a serious pest of cotton in Brazil and Central Africa (Beer, *31*). Twelve new species were found on the Island.

There has been little investigation on the Eriophyidae or gall mites of Puerto Rico. One species, *Cecidophyes gossypii* (Banks), was reported to have caused serious damage to cotton (Wolcott, *227*). The author, however, found no evidence of this species during the period he collected on the Island. Melville T. Cook (*54*), a botanist at the Agricultural Experiment Station in Río Piedras, P. R., described a number of eriophyids on the basis of gall formations on the leaves without ever viewing the mites themselves. Seven new species are described from the Island.

METHODS AND MATERIAL

MOUNTING TECHNIQUES

There are a large number of acarine mounting media in use today with each worker using that best suited to his particular needs. For example, Beer (*31*) used a medium of polyvinyl alcohol, lactic acid, and phenol in his tarsonemid work. Keifer (*127*) in his work on eriophyids preferred to use three media: One with a resorcinol base as a preparatory medium, one with a chloral hydrate base for expansion and clearing, and one with a base of chloral hydrate, gum arabic, and iodine for staining and permanent medium.

Hoyer's modified Berlese mounting medium was used for the mounting of all the mites described in this work. The formula of this medium is

[3] Italic numbers in parentheses refer to Literature Cited, pp. 135-44. Numbers immediately following these denote the pages of the references, unless number or volume is specified.

given below (Baker and Wharton, (*17*); Pritchard and Baker, (*184*); Baker and Pritchard, (*12, 15*); and, Beer, (*31*)).

Hoyer's Solution (a modified Berlese mounting medium)

Water	50 cc.
Gum Arabic (flakes)	30 gm.
Chloral hydrate	200 gm.
Glycerine	20 cc.

(Mix directly at room temperature in above sequence; mount directly living specimens, or those in water or alcohol)

The main advantage of this medium is that mites which have been improperly mounted can be easily remounted by soaking the mites from the slide in warm water and then using Hoyer's Solution. The disadvantages are that the medium is hygroscopic and cover slips become free and slide off under moist conditions such as are found in the Gulf States, and crystallization of the medium can occur. Ringing the cover slip with an agent such as Zutt's ringing compound or fingernail polish will correct the first disadvantage, but remounting is necessary for the second (Goldstein, *88*).

COLLECTION METHODS

The most commonly used method was to collect plant material in the field and examine it in the laboratory. The plant material was collected in paper moistureproof bags which served not only to keep material fresh for maximum periods of 3 days, but also prevented contamination from other plant specimens collected at the same time. Large mites were collected in the field by picking them off leaves with a camel's hair brush and placing them in vials containing 80-percent alcohol.

CLASSIFICATION

Many classifications for the trombidiforme mites have been proposed since the time of Linnaeus.

Latreille (*137*) proposed the first comprehensive but simple classification. Canestrini (*48*) developed the first modern classification based on characters in use today. Oudemans (*172*) in his review of the various classifications proposed a new arrangement for the Trombidiformes, basing his classification of categories above families almost exclusively upon the tracheal system. Vitzthum (*224*) presented the most comprehensive classification of the Acarina based on tracheae. Cunliffe (*59*) proposed a new classification of the Trombidiformes based upon a study of the tarsal characters and aided by characters as listed by Baker and Wharton (*17*) in their family diagnoses. Cunliffe, through the study of the tarsi, arranged

homogeneous groups which were strengthened by other characters such as the chelicerae, the tracheae, and the chaetotaxy. Cunliffe's classification is the one used in this paper, and, in part, is as follows:

Suborder Trombidiformes Reuter, 1909
Supercohors Heterostigmata Berlese, 1899
Cohors Tarsonemina Canestrini and Fanzago, 1877
Superfamily Tarsonemoidea Ewing, 1934
Family Tarsonemidae Kramer, 1877
Supercohors Prostigmata Kramer, 1877
Cohors Endeostigmata Grandjean, 1937
Subcohors Eleutherogona Oudemans, 1909
Superfamily Tetranychoidea Reck, 1952
Family Tetranychidae Donnadieu, 1875
Family Tenuipalpidae Berlese, 1913
Subcohors Tetrapodili Bremi, 1872
Superfamily Eriophyoidea Ewing, 1934
Family Eriophyidae Nalepa, 1894

KEY TO FAMILIES OF PLANT-FEEDING MITES OF PUERTO RICO

1. Body elongate, wormlike, annulate, with only two pairs of legs placed anteriorly; tarsal claws lacking, with pulvillus highly developed and used as claw.....ERIOPHYIDAE
Body generally normal, rounded, neither wormlike nor annulate, with more than two pairs of legs; tarsal claws present..... 2
2. Chelicerae tiny, needlelike, straight, and not set in pouch; stigma of female opening behind gnathosoma on propodosoma; male without stigma or tracheae; genital opening of female is longitudinal; leg IV of female ending in terminal and subterminal whiplike setae; pulvillus a membranous flaplike organ attached to claws....TARSONEMIDAE
Chelicerae very long, needlelike, strongly recurved proximally, and set in an eversible pouch, the stylophore; stigma opening at base of chelicerae in both males and females; genital opening of female is transverse; leg IV of female with claws and pulvillus; pulvillus free, padlike or clawlike, arising from tarsus..... 3
3. Palpus simple, without spur; tarsi I and II with distal sensory pegs
TENUIPALPIDAE
Palpus with penultimate segment bearing a strong, curved spur; tarsi I and II with duplex setae and not distal sensory pegs
TETRANYCHIDAE

After Cunliffe, (*59*).

GENERAL CHARACTERISTICS OF THE FAMILIES

ERIOPHYIDAE

Eriophyids are very small, averaging one-fifth of a millimeter in length. There are only two pairs of legs placed anteriorly. Just behind the posterior pair of legs is the transverse genital opening. There is no demonstrable tracheal system. The chelicerae consist of a pair of slender stylets which rest in a groove on the dorsal anterior side of the rostrum. The palpi are short and simple. There are no tarsal claws. The empodium is highly developed and many-rayed, and has been considered in the past to be a claw.

TARSONEMIDAE

Tarsonemids are small, ranging in length from one-tenth to one-third of a millimeter. The integument is relatively hard in the mature forms and characterized by a shiny surface. The chelicerae are tiny and styliform, and the palpi are stout and indistinctly segmented. The stigma of the female opens behind the gnathosoma on the propodosoma, while the male is without stigma or tracheae. The apodemes are well-developed ventrally. There is a single empodial claw on the first pair of legs and two true claws on legs II and III. The terminal segment of leg IV of the female has two setae and is without claws. The empodium is a membranous flaplike organ attached to the claws. The genital opening is longitudinal. The male has a large genital papilla situated at the apex of the hysterosoma. A clavate pseudostigmatic organ is on each side of the propodosoma between legs I and II of the female.

TETRANYCHIDAE

Tetranychids are medium-sized, ranging in length from one-fifth to one-half of a millimeter. The chelicerae are very long, needlelike, strongly recurved proximally, and are set in an eversible pouch called the stylophore. The stylophore is shorter and broader than in other tetranychoid families. The stigma opens at the base of the chelicerae in both males and females. The distinctive feature of the family is the presence of duplex setae on tarsi I and II. The fourth segment (tibia) of the palpus has a very strong spur, while the terminal segment (palpus) bears four sensory setae and three tactile setae. The transverse genital opening has radiate wrinkles around the vulva with a pair of setae immediately anterior and a pair of setae laterad. The male genitalia lack genital stylets and consist of a simple, sclerotized aedeagus, the slender apodeme of which receives the sperm duct.

TENUIPALPIDAE

Tenuipalpids are slightly shorter than the tetranychids and larger than the tarsonemids. The chelicerae are very long, needlelike, strongly recurved proximally, and are set in an eversible pouch called the stylophore. The palpus is simple, the penultimate segment without a spur. The terminal segment of the palpus bears a rodlike sensory process, one or two sensory setae and no tactile setae. The stigma opens at the base of the chelicerae in both males and females. There is a single sensory rod always present at the distal end of tarsi I and II; there may be two such sensillae present on one or both tarsi in the adults. The female has a genital plate which is well developed, transversely elliptical, and, in general, bears two pairs of setae. The male genitalia consist of a pair of simple, sclerotized genital stylets, a weakly sclerotized sperm sac, and a sperm duct which enters the funnel-shaped anterior end of the long, tapering aedeagus.

FAMILY TETRANYCHIDAE DONNADIEU 1875

The classification of the family Tetranychidae has undergone considerable evolution as far as concept since the group was first given a suprageneric name in 1875 (*61*). Only two genera, *Tetranychus* Dufour and *Bryobia* Koch, were recognized prior to that time, and to the former genus had been assigned a number of species of predaceous mites properly belonging to families of Prostigmata. The predaceous mites of families such as Raphignathidae, Caligonellidae, and Stigmaeidae were included in the genus *Tetranychus* because they possess similar morphological characters such as the thumb-claw complex on the palpus and stigma opening at the cheliceral bases. In 1889, Canestrini (*48*) included in the Tetranychidae predaceous mites properly belonging to other prostigmatic families. This practice was followed by a number of subsequent workers such as Banks (*27*) and Vitzthum (*222*, *225*). McGregor (*159*) removed the last raphignathid genus (*Neophyllobius* Berlese) that had been erroneously included.

The only comprehensive publications on the taxonomy of the family Tetranychidae in North America are by Banks (*19*), McGregor (*151*), McGregor (*159*), and Pritchard and Baker (*184*), the last two being monographic in scope.

European tetranychids have been considered only on a localized basis, but more recent papers by Hirst (*99*) for England, Vitzthum (*222*) for Europe, and Geijskes (*87*) for Holland, are worthy of mention. Womersley (*228*) reviewed the knowledge of this family in Australia. Reck (*191*, *192*, *193*) has been making important studies of the spider mites of Georgia, U. S. S. R., but very few of his papers are available to workers in North America. Pritchard and Baker (*184*) have made the first comprehensive treatment of the species of the world and have attempted to give the over-

all picture of the Tetranychidae. In their work they have tried to show phylogenetic relationships within the family, as well as the new interpretations of genera and the recognition of species groups to further delineate these relationships.

BIOLOGY

Biological research has been performed on very few species of this family in the past. Only in recent years have detailed studies been undertaken in this field. Some of the outstanding early workers were: R. V. Hanstein (*92*) who worked on life histories, Schrader (*206*) who worked on haploidy in the spider mites, and Zacher (*233*) who studied biology in general. In India, Rahman and Sapra (*189, 190*) investigated the life histories of *Oligonychus indicus* (Hirst) and *Tetranychus cucurbitae* Rahman & Punjab. L. R. Cagle, an outstanding American worker, has described the life histories of the schoene spider mite, *Tetranychus schoenei* McG. (*42*), the European red mite, *Metatetranychus ulmi* (Koch) (*43*), and the two-spotted mite, *Tetranychus telarius* (L.) (*44*). Newcomer and Yothers (*169*) studied the biology of European red mite in the Pacific Northwest. In recent years the use of new techniques such as radioactive tracers has led to a more detailed physiological research. Neiswander and Rodríguez, and Neiswander (*168*) worked on inducing variations in two-spotted mite populations on tomatoes with a controlled amount of nitrogen in fertilizer added. Rodríguez (*194*) used nitrogen and phosphorus as his control factors in research on the mineral nutrition of two-spotted mites and established the relationships between minerals and population increase or decrease. Then, in 1952 (*195*), working with a similar technique he attempted to demonstrate the relationships between mineral supply and absorption and vitamin elaboration in tomato plants, and the relationship between vitamin content and mite development. He found inconclusive relationships of riboflavin, thiamine, and niacin to mite development. Beament (*30*) studied egg formation and egg structure in *Metatetranychus ulmi* (Koch). Keh (*106*) experimented on mating within the two-spotted mite complex in the determination of physiological species.

In recent years the German workers have produced several excellent papers on the biology of spider mites. Dosse (*62*) worked out the morphology, biology, and control of *Tetranychus cinnabarinus* (Boisduval). Linke (*141*) investigated the biology and epidemiology of *Tetranychus telarius* (Linnaeus), demonstrating the direct relationship between vital functions of the mite to temperature and especially temperature effects on the rate of embryonic and postembryonic development.

More certainty in defining a taxonomic species has been obtained by interbreeding related species. Davis (*60*) was able to secure free inter-

breeding between *Tetranychus multisetis* and the carmine form of *T. cinnabarinus* (Boisduval) for several generations with no decline in fertility. Iglinsky and Rainwater (*105*) failed to produce females by crossing *T. desertorum* Banks with *T. cinnabarinus* (Boisduval). Boudreaux (*40*) was able to split the two-spotted mite complex into three distinct species: *T. cinnabarinus* (Boisduval), *T. telarius* (L.), and *T. lobosus* Boudreaux, on the basis of breeding experiments.

GENERAL EXTERNAL MORPHOLOGY

The mites of the family Tetranychidae (fig. 1, A and B) bear three types of setae. These are: tactile, which are slender, finely pointed, with thick

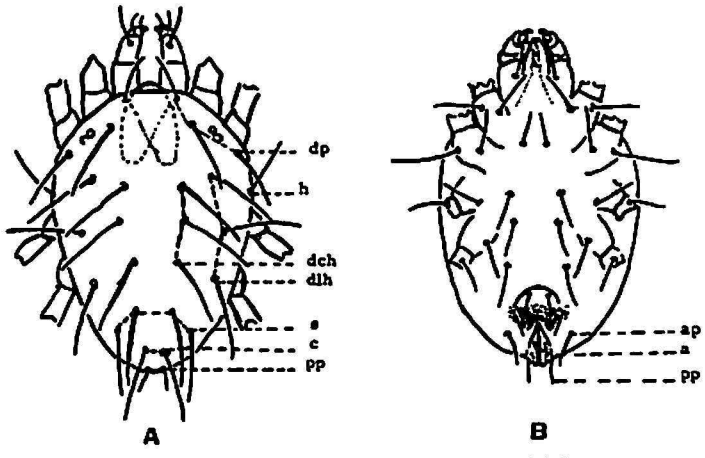


FIG. 1.—Dorsal and ventral view of female tetranychid: A, Dorsum of body showing nomenclature of the setae; B, venter of body showing nomenclature of the setae. (After Pritchard and Baker, 1953). Explanation of abbreviations: dp, Dorsal propodosomals; h, humeral; dch, dorsocentral hysterosomals; dlh, dorsolateral hysterosomals; s, sacrals; c, clunals; pp, posterior para-anals (postanals); ap, anterior para-anals; a, anals.

walls and bearing pubescence; chemosensory, which have thin walls and transverse striations and are nude; and tenent hairs, which have a knob or hook at their distal end. Tenent hairs are always found on the claw, and usually a number of them are amalgamated together distally, each appearing to originate from a number of roots.

The stylophore is shorter and broader than in other tetranychoid families. (See fig. 2,A.) The chelicerae are very long, needlelike and strongly recurved proximally. The palpus bears a very strong spur or thumb-claw on segment four, while the short, broad terminal segment bears four sensory setae and three tactile setae. The peritremes consist of a pair of arms that arise medially near the anterior end of the body and then verge over the surface of the protrusible stylophore.

The adult bears two pairs of intimately associated setae on the dorsum of the tarsus of leg I. These are the duplex setae and are characteristic of

the family Tetranychidae. Only one pair is present on the dorsum of tarsus II. The distal and comparatively long member of each duplex is sensory and the proximal member is tactile. The legs also possess other sensory and tactile setae. A pair of true claws laterad to a central empodium make up the tarsal appendages. However, the true claws may be modified and the empodium may be clawlike. (See fig. 2, B and C.)

The dorsal texture of the integument of the body of a tetranychid varies considerably. In the tetranychids, higher on the evolutionary scale than many other trombidiforme mites, are found integumentary striations,

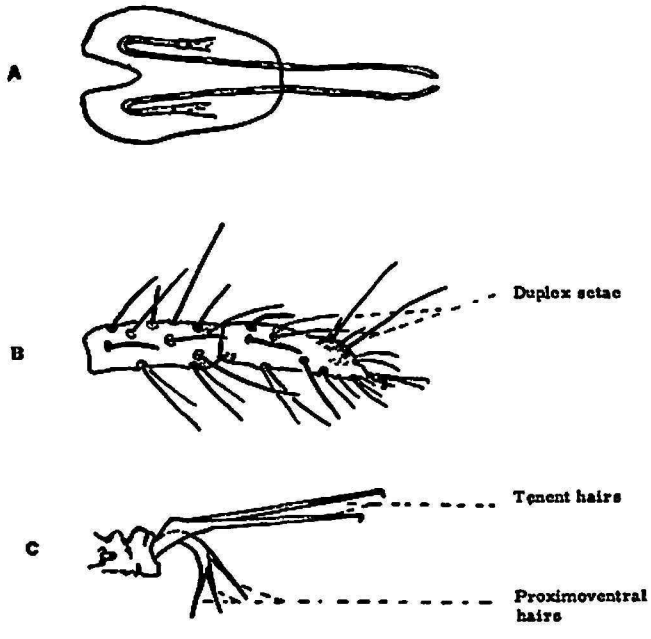


FIG. 2.—Diagnostic characters of the Tetranychidae: A, Stylophore and chelicerae of a tetranychid mite, *Tetranychus telarius* (Linn.); B, tibia and tarus I of male of *Eotetranychus planki* (McG.); C, tenent hairs and proximoventral hairs of female tarsal appendage I of *Eotetranychus planki* (McG.).

irregular and widely spaced in some species, but similar to that of a finger-print pattern in most. These striations are very characteristic for each species group, and in some cases for each species. The chaetotaxy of the body of a spider mite is of tribal and generic significance. There are 3 or 4 pairs of dorsal propodosomals, and the hysterosoma possesses from 9 to 12 pairs of setae.

The genital area of the female is distinctive. There are radiate wrinkles around the vulva with a pair of setae immediately anterior and a pair of setae laterad. The medioventral opisthosomals are present but are not associated with the genitalia. There are two or three pairs of anal setae and a pair of para-anals, and a pair of postanals. For species determination the male genitalia are very distinctive, consisting of a simple sclerotized aedeagus which receives the sperm duct. There are no genital stylets pres-

ent with the exception of a single species, *Schizotetranychus cynodonis* McGregor.

KEY TO SUBFAMILIES OF TETRANYCHIDAE

1. Empodium with tenent hairs; female with three pairs of anal setae and male with five pairs of genitoanal setae.....*Bryobiinae*
   Empodium (rarely absent) without tenent hairs, female with two pairs of anal setae and male with four pairs of genitoanal setae..*Tetranychinae*[4]

KEY TO TRIBES OF TETRANYCHINAE BERLESE

1. Tarsus I dorsally with at most a single pair of usually loosely associated duplex setae, the proximal member usually as long as or longer than the distal member, or else duplex setae absent; empodium very small or absent.....*Eurytetranychini*[4]
   Tarsus I dorsally with two pairs of duplex setae, the proximal member of each pair shorter than the distal member.....*Tetranychini*[4]

TRIBE EURYTETRANYCHINI RECK

Eurytetranychinae Reck, (*191*) 123; Reck, (*192*) 25; Reck, (*193*) 423; Pritchard and Baker, (*184*) 100.

Members of the Tribe Eurytetranychini are quite distinctive in that tarsi I and II both lack duplex setae which otherwise are so characteristic of the family Tetranychidae.

KEY TO THE GENERA OF *Eurytetranychini*

1. Empodial claw present, small and hooked.....*Eurytetranychus*
   Empodium rudimentary and rounded, appears absent..*Eutetranychus*[4]

Genus Eutetranychus BANKS

Neotetranychus (*Eutetranychus*) Banks, (*28*) 197. Type of subgenus: *Tetranychus banksi* McGregor, by subsequent designation of McGregor, 1950.
Eutetranychus McGregor, (*157*) 267; Pritchard and Baker, (*184*) 111.
Anychus McGregor, (*151*) 622; (*155*) 125; Sayed, (*203*) 143. Type of genus: *Tetranychus banksi* McGregor; by original designation.

The genus is distinctive in possessing a rudimentary empodium which consists only of a rounded knob. Tarsus I bears on the dorsum a pair of associated setae that are probably homologous with one pair of the duplex setae. The females usually have oval, somewhat flattened bodies with 10 pairs of dorsal hysterosomal setae and two pairs of para-anals. The dorsal integument of the body is striate. The palpus generally has the terminal segment or tarsus (thumb) rather long, its terminal sensilla is elongate;

[4] Groups, *i.e.*, subfamily, tribe, genus, or species found in Puerto Rico.

the "thumb" bears a dorsal sensilla and four or five additional setae. In this genus males are not taxonomically important as they are in specific determination in other genera. One species, *Eutetranychus banksi* (McG.), is found in Puerto Rico. This species is differentiated from other members of the genus in that the dorsocentral hysterosomal setae are obviously shorter than the dorsolateral hysterosomals and the dorsal setae of the body are not set on tubercles.

Eutetranychus banksi (MCGREGOR)

Tetranychus banksi McGregor, (*148*) 358. Types: Females, Orlando, Florida, on castor bean and velvet bean; in the U. S. National Museum.

Neotetranychus (*Eutetranychus*) *banksi*, Banks, (*28*) 177.

Anychus banksi, McGregor, (*151*) 644.

Eutetranychus banksi, McGregor, (*159*) 268; Muma, Holtzberg, and Pratt, (*165*) 141; Pritchard and Baker, (*184*) 115. (Figs. 3 and 4.)

Tetranychus rusti McGregor, (*150*) 582. Types: Males and females, Mira Flores Station, Dept. Piura, Hacienda "San Jacinto," Perú; in the U. S. National Museum.

Anychus rusti, McGregor, (*151*) 645.

Eutetranychus rusti, McGregor, (*159*) 669.

Anychus latus, Hirst, (*99*) 991. Misidentification.

Anychus latus, Sayed, (*202*) 125. Misidentification.

Anychus africanus Tucker, (*220*) 5. Types: Males and females, Durban, Natal, on oranges and lemons, and *Plumeria* (Frangipani); of unknown disposition.

Anychus clarki McGregor, (*152*) 161. Types: Males and females, Weslaco, Tex., on citrus; in the U. S. National Museum.

Eutetranychus clarki, McGregor, (*159*) 270.

Anychus orientalis (Zacher) Klein, (*128*) 3; Sayed, (*202*) 143. (This species appears to be based on a manuscript name of Zacher).

Anychus verganii Blanchard, (*35*) 24. Types: Females, Bella Vista, Corrientes, Argentina, on citrus; of unknown disposition.

Anychus ricini Rahman and Sapra, (*189*) 194. Types: Males and females, Lyallpur, India, on castor bean, almond, *Cassia fistula*, *Ziziphus jujuba*, and citrus; of unknown disposition.

Eutetranychus mexicanus McGregor, (*159*) 27. Types: Female and two nymphs, Guadalajara, Mexico, on Sapota; in the U. S. National Museum.

Female.—The body of the female is widest across the propodosoma. The color is rusty-red with the exception of a median abdominal area and a clear area overlying the stylophore. There are 26 serrate dorsal body setae, most clavate to spatulate. The eyes are over coxae II. The penultimate segment of the palpus bears a short claw dorsally; the last segment is

subconical, bearing terminally a single sensilla which is over four times as long as thick, the dorsal sensilla arises near the base of the segment; the "thumb" bears five additional setae. The dorsal body setae are not set on tubercles. The dorsocentral hysterosomals are obviously shorter than the dorsolateral hysterosomals.

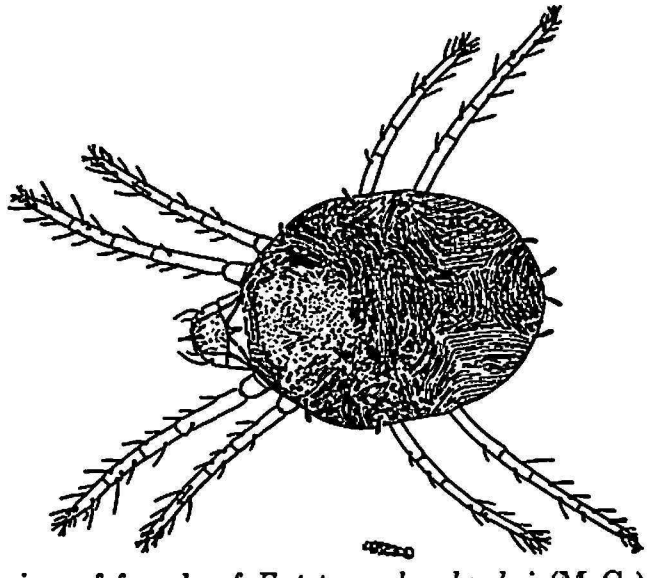


FIG. 3.—Dorsal view of female of *Eutetranychus banksi* (McG.). (After Pritchard and Baker, 1955).

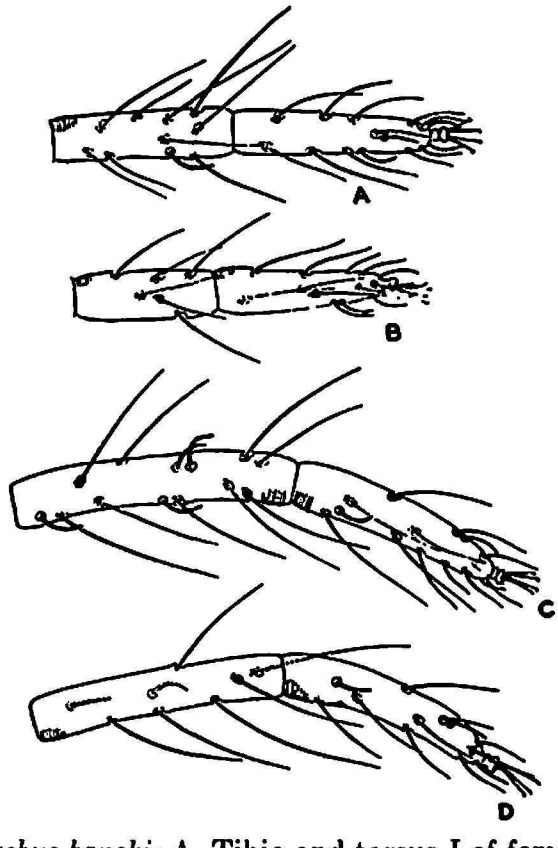


FIG. 4.—*Eutetranychus banski:* A, Tibia and tarsus I of female; B, tibia and tarsus II of female; C, tibia and tarsus I of male; D, tibia and tarsus II of male. (After Pritchard and Baker, 1955).

Male.—The male is similar to the female. The aedeagus is simple and turns abruptly dorsad near the distal end.

Collected in Puerto Rico on *Erythrina* sp., Fajardo, May 4, 1955, by M. Pérez, S. Medina, and H. L. Cromroy; on *Trichilia pallida*, Cayey-Salinas Road, altitude of 1,300 feet, June 14, 1955, by L. F. Martorell and H. L. Cromroy.

TRIBE TETRANYCHINI RECK

Tetranychinae Reck, (*191*) 123; Reck, (*192*) 25; Reck, (*193*) 423; Pritchard and Baker, (*184*) 124.

This tribe is distinguished by having the empodium well developed in contrast to the Eurytetranychini which have the empodium as a tiny hook or protuberance. (See fig. 2, C). The empodium is usually represented by several pairs of ventrally directed, proximoventral hairs; a dorsomedian clawlike appendage may or may not be developed.

Members of this tribe are capable of producing silken strands. Grandjean (*89*) believes that the silk glands are located in the palpi.

KEY TO THE GENERA OF *Tetranychini* FOUND IN PUERTO RICO

1. Opisthosoma with two pairs of para-anal setae..... *Eotetranychus*
   Opisthosoma with a single pair of para-anals..... 2
2. Empodium clawlike and somewhat shorter than, or about as long as, proximoventral hairs; peritreme usually straight distally and ending in a simple bulb; tarsus I usually with duplex setae adjacent and placed near distal end..... *Oligonychus*
   Empodium with clawlike dorsal member much shorter than proximoventral hairs or else rudimentary; peritreme recurved distally or rarely anastomosing; tarsus I with duplex setae widely spaced on dorsum of segment..... *Tetranychus*

Genus Eotetranychus OUDEMANS

Eotetranychus Oudemans, (*177*) 224; Zacher, (*235*) 587; Geijskes, (*87*) 30; Pritchard and Baker, (*184*) 138. Type of genus: *Trombidium tiliarium* Hermann, referred to as *Acarus telarius* Linnaeus; by original designation.

Apotetranychus Oudemans, (*177*) 225; Geijskes, (*87*) 32. Type of genus: *Apotetranychus muscicola* Oudemans; monobasic and by original designation.

Platytetranychus Oudemans, (*177*) 224; Oudemans, (*178*) 293; Geijskes, (*87*) 45. Type of genus: *Tetranychus gibbosus* Canestrini; by original designation and monobasic.

This genus is characterized by having the caudal pair of para-anals present, and the empodium (except for leg I and sometimes leg II of the

male) consisting of three pairs of hairs. *Eotetranychus* resembles the genus *Tetranychus* in that the empodium is similar. However, it is distinct, in addition to having two pairs of para-anals, in that the duplex setae on tarsus I are adjacent. The peritreme often ends in a simple bulb.

The dorsal striations are generally transverse between the third pair of dorsocentral hysterosomals and the sacrals.

Adults of this genus are usually tiny, straw-colored or somewhat greenish, with several spots of dark pigment along each side of the body. The mites are generally found feeding on the under surface of leaves. Two species, *E. caribbeanae* (McG.) and *E. planki* (McG.), are found in Puerto Rico.

KEY TO THE SPECIES OF *Eotetranychus* FEMALES FOUND IN PUERTO RICO

1. Dorsocentral hysterosomals not over one-half as long as intervals between them; propodosomal integument with irregularly arranged dots or granulations mediodorsally, and usually around tubercles on the hysterosoma..... *caribbeanae*
   Dorsocentral hysterosomals about as long as intervals between them; propodosoma with an anastomosing striae mediodorsally, as well as on the lateral part of the hysterosoma..... *planki*

(For a complete key to the females of the genus *Eotetranychus* see Pritchard and Baker, (*184*) 142).

Eotetranychus caribbeanae (MCGREGOR)

Tetranychus caribbeanae McGregor, (*159*) 283. Types: Females, Loiza, P. R., on cassava; in the U. S. National Museum.

Eotetranychus caribbeanae (McGregor) Pritchard and Baker, (*184*) 147.

The female is readily recognized by the anastomosis of many of the dorsal striae, which are composed of short dashes rather than dots.

Female.—The body is oval-shaped with 24 short, clavate dorsal body setae. The dorsocentral hysterosomals are less than one-half as long as intervals between their bases, and they widen to near the tip. There are seven tactile setae plus a sensory seta on tibia I. There are seven setae on tibia II. The empodium has a moderately long base before division into six hairs.

Male.—Males of this species are not known.

Collected on "Yuca," *Manihot utilissima*, Aguadilla, P. R., August 27, 1954, by G. N. Wolcott, M. Pérez, and H. L. Cromroy.

Eotetranychus planki (MCGREGOR)

Tetranychus planki McGregor, (*159*) 300. Types: Males and females, Mayagüez, P. R., on *Erythrina berteroana*; in the U. S. National Museum.

Eotetranychus planki (McGregor) Pritchard and Baker, (*184*) 148.

The female of *Eotetranychus planki* (figs. 5 to 7) is differentiated from other species in this genus by having the mediodorsal portion of the propodosoma, as well as broad areas around the dorsal hysterosomals, with an irregularly dotted integument. Males of this species are distinguished by possessing dorsal body setae borne on strong tubercles, in that the peritremes are straight distally and end in simple bulbs, and in that the knob of the aedeagus has both angulations very short.

Female.—The body is elliptically shaped and bears 24 rodlike to clavate body setae. The dorsocentral hysterosomals are as long as the intervals

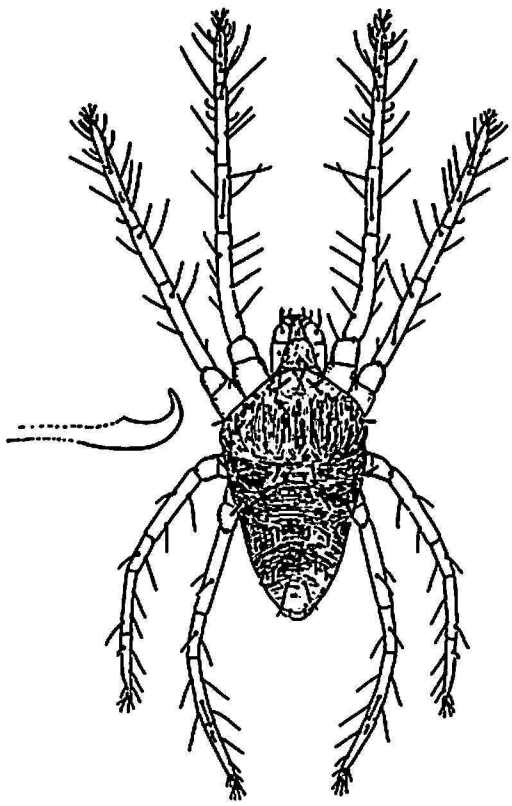


FIG. 5.—Dorsal view of male of *Eotetranychus planki* (McG.). (After Pritchard and Baker, 1955).

between them. The propodosomal integument is irregularly dotted with striae anastomosing mediodorsally; these are also found on the lateral parts of the hysterosoma. There are nine tactile and one sensory seta on tibia I; tibia II has seven tactile setae. There is a moderately long base on the empodium before it divides into six hairs.

Male.—The body is smaller and more narrow than the body of the female. The dorsal body setae are borne on strong tubercles. The peritremes are straight distally and end in simple bulbs. There are nine tactile setae plus four sensory setae on tibia I; tibia II has seven tactile setae. Empodium I consists of a slender, moderately elongate base, with three short teeth on each side distally. The aedeagus is bent ventrad, with a terminal knob with both angulations very short.

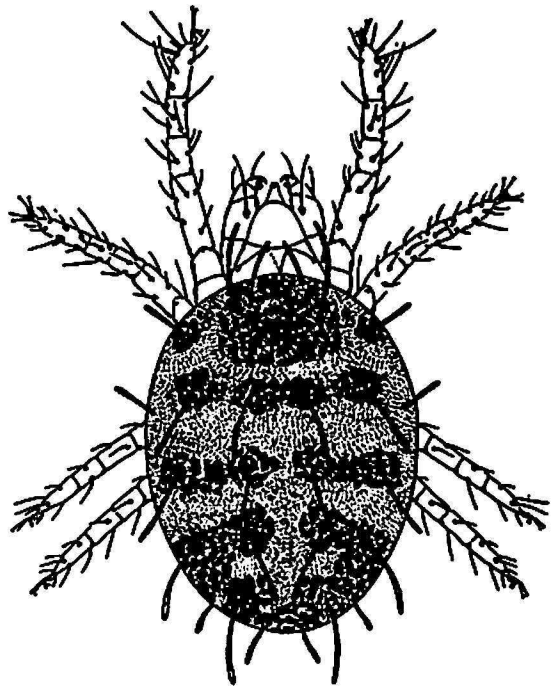


FIG. 6.—Dorsal view of female of *Eotetranychus planki* (McG.). (After Pritchard and Baker, 1955).

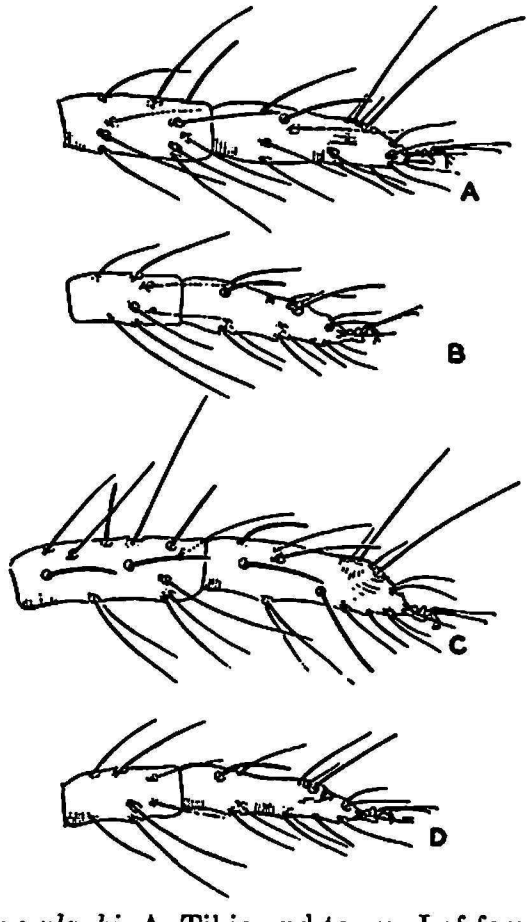


FIG. 7.—*Eotetranychus planki:* A, Tibia and tarsus I of female; B, tibia and tarsus II of female; C, tibia and tarsus I of male; D, tibia and tarsus II of male. (After Pritchard and Baker, 1955).

Collected on *Centrosema virginiana*, Maricao Insular Forest, P. R., April 19, 1955, by L. F. Martorell and H. L. Cromroy.

Genus Oligonychus BERLESE

Oligonychus Berlese, (*32*) 24; Canestrini, (*48*) 532, 534; Banks, (*28*) 197; Hirst, (*99*) 58; Ewing, (*74*) 659; Pritchard and Baker, (*184*) 270. Type of genus: *Heteronychus brevipodus* Targioni Tozetti; monobasic.

Paratetranychus Zacher, (*231*) 39; Tragardh, (*217*) 162; McGregor, (*151*) 665; Geijskes, (*87*) 33; Garman, (*86*) 75; McGregor, (*159*) 329; Baker and Pritchard, (*12*) 209. Type of genus: *Tetranychus ununquis* Jacobi; by subsequent designation.

Tacebia Yokoyama, (*230*) 536. Type of genus: *Tacebia parva* Yokoyama; monobasic.

The empodium is clawlike and somewhat shorter than, or about as long as, the proximoventral hairs. The peritreme generally ends in a simple bulb and is straight distally. Tarsus I usually has the duplex setae adjacent and placed near the distal end.

Pritchard and Baker (*184*) recognized five major species groups or complexes in this genus, each of which is probably of subgeneric rank. These species groups or complexes are as follows: Ununguis Group, Peruvianus Group, Pritchardi Group, Pratensis Group, and the McGregori Group. Females can be determined only to species group at present time; whereas, with male specimens a species determination can be made. Species are distinguished on the basis of the number of tactile setae on tibia I, the dorsal striae of body of female, the number of ventral hairs proximoventral to the empodial claw, and the structure and direction of the aedeagus.

Trees, shrubs, or perennial grasses serve as hosts for this genus of mites. Feeding is generally done on the dorsal surface of broad leaves giving the upper surface a speckled appearance. Four species of *Oligonychus* were found in Puerto Rico.

KEY TO PUERTO RICAN SPECIES OF *Oligonychus*

Females.—

1. Tibia I with seven tactile setae; tarsus I with a single tactile seta on venter beyond first duplex setae; empodium with four pairs of proximoventral hairs..... *punicae* (Hirst)
   Tibia I with eight or nine tactile setae, tarsus I usually with the tactile setae on venter beyond first duplex setae; empodium with only three pairs of proximoventral hairs..... 2
2. Body with dorsal setae broadened proximally and strongly tapering distally; integumentary striae transverse between third pair of dorsocentral hysterosomals..... *smith*, n. sp.

Body with dorsal setae broadened proximally and strongly tapering distally; integumentary striae longitudinal between third pair of dorsocentral hysterosomals.....*peruvianus* (McGregor)[5]
Body with dorsal setae not acutely tapering from an obviously widened base; integumentary striae transverse between third pair of dorsocentral hysterosomals..... 3
3. Found only on sugarcane.....*sacchari* (McGregor)
Found on other grasses.....*pratensis* (Banks)

Males.—

1. Aedeagus bent dorsad although the distal end may be directed ventrad; tarsus I with two tactile setae on venter just distad of duplex setae.. 2
Aedeagus bent ventrad; tarsus I with not more than a single tactile seta on venter just distad of duplex setae..... 3
2. Aedeagus with distal end strongly sigmoid, the S-shaped portion without obvious enlargement.....*sacchari* (McGregor)
Aedeagus with distal end enlarged, not sigmoid....*pratensis* (Banks)
3. Body with dorsal setae slender, not acutely tapering from widened proximal portion; tibia I with seven tactile setae; empodium usually with four to six pairs of proximoventral hairs.....*punicae* (Hirst)
Body with dorsal setae obviously widened proximally and acutely tapering distally; tibia I with nine tactile setae; empodium with three pairs of proximoventral hairs..... 4
4. Aedeagus parabolic in shape, very sharply curving, tapering to a fine point.....*smithi*, n. sp.
Aedeagus slightly curved very little tapering to tip
peruvianus (McGregor)[5]

Oligonychus pratensis (BANKS)

Tetranychus pratensis Banks, (*25*) 97; Ewing, (*72*) 459. Types: Females, Pullman, Wash., on timothy; in the U. S. National Museum.

Paratetranychus pratensis, Banks, (*27*) 37; McGregor, (*151*) 668; McGregor, (*159*) 350.

Tetranychus simplex Banks, (*26*) 57. Types: Described from specimens from El Centro, Calif., on date palm, in the Museum of Comparative Zoology, Cambridge, Mass.

Paratetranychus simplex, Banks, (*27*) 37; U. S. Dept. Agr. Rep.; McGregor, (*153*) 248; McGregor, (*159*) 352.

Paratetranychus heteronychus Ewing, (*75*) 105. Types: Males and females, Coachella Valley, Calif., on dates; in the U. S. National Museum.

[5] These species are not found in Puerto Rico; however, because of the close relationship between the new species *smithi* and *peruvianus* (McGregor), the species *peruvianus* was included in the key.

Oligonychus pratensis (Banks), Pritchard & Baker, (*184*) 349. (Figs. 8 to 11.)

Female.—The body is roughly oval. The dorsal integumentary striae are transverse between the sacrals, and the dorsolateral striae are mostly transverse. The peritreme ends in a simple bulb. There are nine tactile setae on tibia I. There are four tactile setae on tarsus I proximal to the duplex setae, and the venter of tarsus I bears two tactile setae on the ventral surface distal to the duplexes. The empodium has only three pairs of proximoventral hairs. The female cannot be distinguished from females

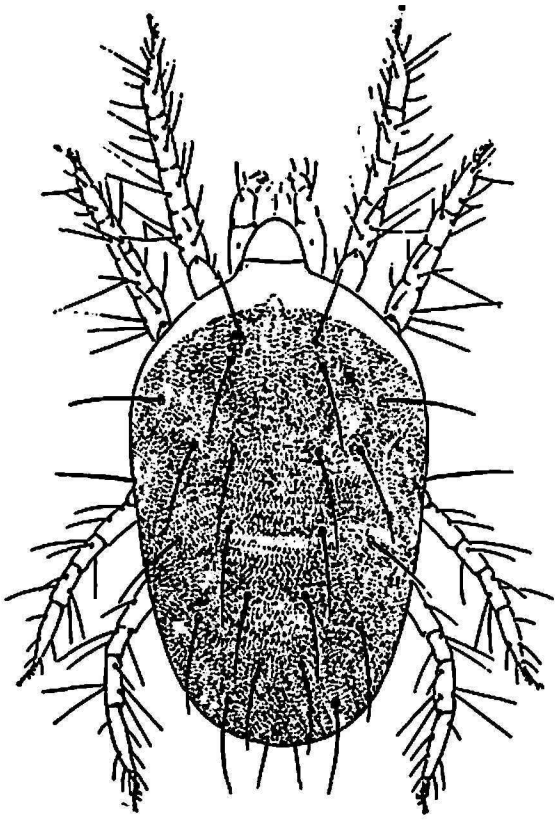


FIG. 8.—Dorsal view of *Oligonychus pratensis* (Banks). (After Pritchard and Baker, 1955).

of *O. stickneyi* (McGregor), *O. gramineus* (McGregor), *O. exsiccator* (Zehntner), *O. indicus* (Hirst), *O. modestus* (Banks), *O. sacchari* (McGregor), *O. oryzae* (Hirst), *O. iseilemae* (Hirst), and *O. stenoperitrematus* (Ugarov and Nikolskii).

Male.—The male of this species is recognized as belonging to the pratensis complex by tarsus I having two tactile setae on the venter just distal of the duplex setae, and the proximoventral empodial appendages of tarsus I forming a pair of empodial spurs. The aedeagus is bent dorsad with the distal knob about twice as wide as the stem of the knob. The axis of this knob forms a distinct angle with the axis of the shaft, and the anterior projection of the knob is bluntly angulate while the posterior angulation is acute. There is some doubt as to whether the tropical form

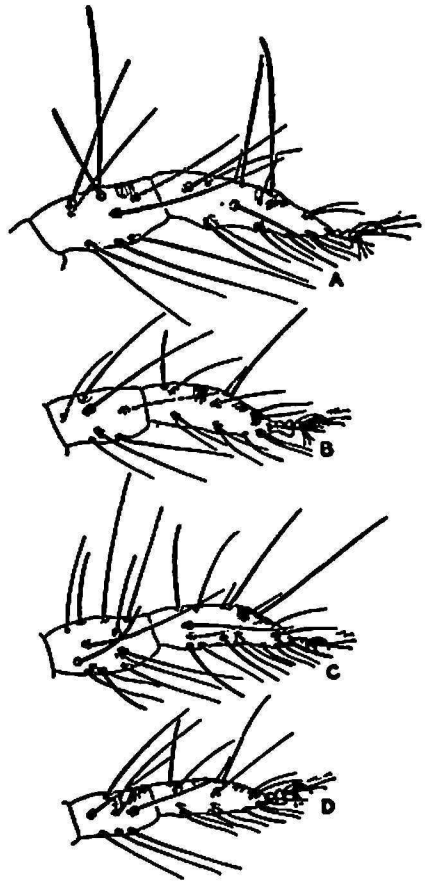


FIG. 9.—*Oligonychus pratensis* (Banks): A, Tibia and tarsus I of female; B, tibia and tarsus II of female; C, tibia and tarsus I of male; D, tibia and tarsus II of male. (After Pritchard and Baker, 1955).

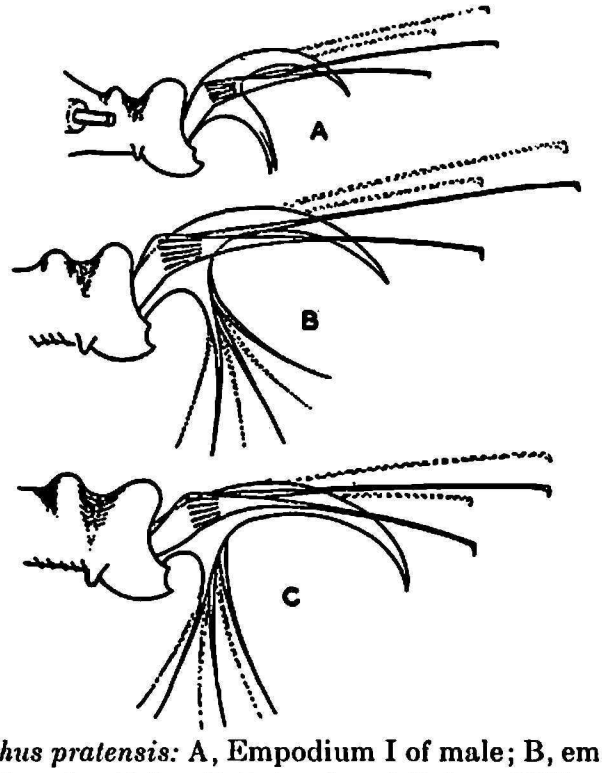


FIG. 10.—*Oligonychus pratensis:* A, Empodium I of male; B, empodium III of male; C, empodium III of female. (After Pritchard and Baker, 1955).

is the same as the Northwestern typical form, since the heads of the aedeagi from the tropical regions are smaller and not quite similar to those from the temperate areas. Only cross-breeding can determine the status of this widespread species.

Collected on *Paspalum fimbriatum*, Agricultural Experiment Station grounds, Río Piedras, P. R., June 6, 1955, by G. Rivera and H. L. Cromroy

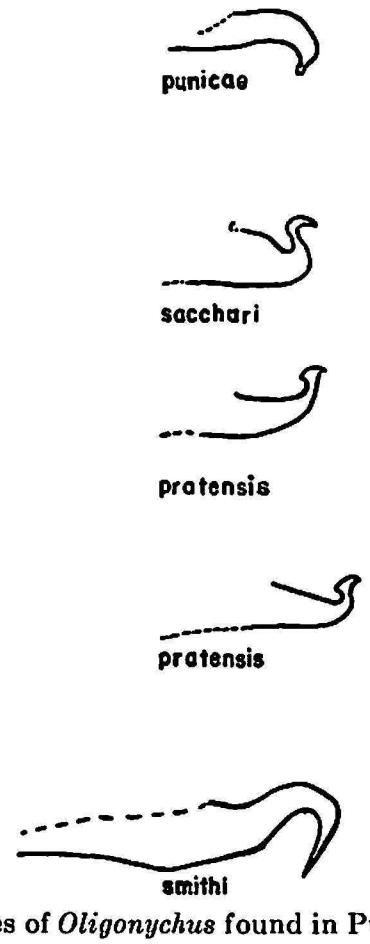


FIG. 11.—Aedeagi of species of *Oligonychus* found in Puerto Rico. (After Pritchard and Baker, 1955).

Oligonychus punicae (HIRST)

Paratetranychus punicae Hirst, (*100*) 830. Types: Males and females, Coimbatore, South India, on pomegranate and grape; probably in the British Museum of Natural History.

Paratetranychus coiti McGregor, (*154*) 85; McGregor, (*159*) 337. Types: Males and females, Chula Vista, Calif., on avocado; in the U. S. National Museum.

Oligonychus punicae (Hirst) Pritchard and Baker, (*184*) 335.

This species is recognized as belonging to the Ununguis complex by having only seven tactile setae on tibia I.

Female.—The integumentary striae are transverse throughout the dor-

socentral area of the hysterosoma. There are seven tactile setae on tibia I and four tactile setae on tarsus I proximal to the duplex setae. The female of this species cannot be distinguished from females of *O. vothersi* (McGregor), *O. mangiferus* (Rahman and Punjab), and *O. peronis* Pritchard and Baker.

Male.—The dorsal body setae are slender, with the first pair of dorsocentral hysterosomals longer than the interval to the second pair, and the outer sacrals more or less similar in length to the inner sacrals. Tarsus I of the male has a single tactile seta on the venter just distad of the duplex setae. The proximal member of each pair of duplex setae is greatly shorter than the distal member. There are seven tactile setae on tibia I. The aedeagus is bent ventrad, with the bent portion much shorter than the shaft and forming an obtuse angle with the shaft. The distal end of the aedeagus is abruptly narrowed.

Collected in Puerto Rico on *Persea* species, Isabela Substation, March 29, 1955, by L. F. Martorell and H. L. Cromroy; on *Mangifera indica*, Isabela Substation, March 29, 1955, by L. F. Martorell and H. L. Cromroy.

Oligonychus sacchari (MCGREGOR)

Paratetranychus sacchari McGregor, (*155*) 91; McGregor, (*159*) 351. Types: Males and females, Mayagüez, P. R., on sugarcane; in the U. S. National Museum.

Oligonychus sacchari (McGregor) Pritchard and Baker, (*184*) 355. (Fig. 12.)

The female of this species is indistinguishable from other species in the pratensis complex, while the male is distinct in that the distal end of the aedeagus is strongly sigmoid.

Female.—The color is yellowish-green. The body is roughly oval. The integumentary striae on the dorsum are transverse between the dorsocentral hysterosomals, longitudinal between the sacrals, and the dorsolateral striae are mostly transverse. The peritreme ends in a simple bulb. The palpal thumb is thicker than long. There are nine tactile setae on tibia I, and four tactile setae on tarsus I proximal to the duplex setae. The empodium has three pairs of proximoventral hairs.

Male.—There are two tactile setae on the venter of tarsus I just distad of the duplex setae. Tarus I has the proximoventral empodial appendages forming a pair of empodial spurs. The aedeagus is bent dorsad, the distal end is strongly sigmoid, the **S**-shaped portion is without obvious enlargement, and the tip is turned down.

Collected in Puerto Rico on *Saccharum officinarum*, Isabela Substation, August 13, 1954, by L. F. Martorell and C. F. Smith; Agricultural Experiment Station grounds, Río Piedras, May 3, 1955, by H. L. Cromroy.

Oligonychus smithi, NEW SPECIES

Oligonychus smithi (figs. 13–14) is closely allied both to *O. peruvianus* (McGregor) and members of the pritchardi complex. *O. smithi* has transverse integumentary striae similar to the pritchardi complex and dorsal body setae acutely tapering similar to *O. peruvianus*. It is the combination of these two characters and the distinct male aedeagus which indicate that this is a new species.

These are white opalescent mites which blend into the background of the white underside of the leaf. They are web-spinners.

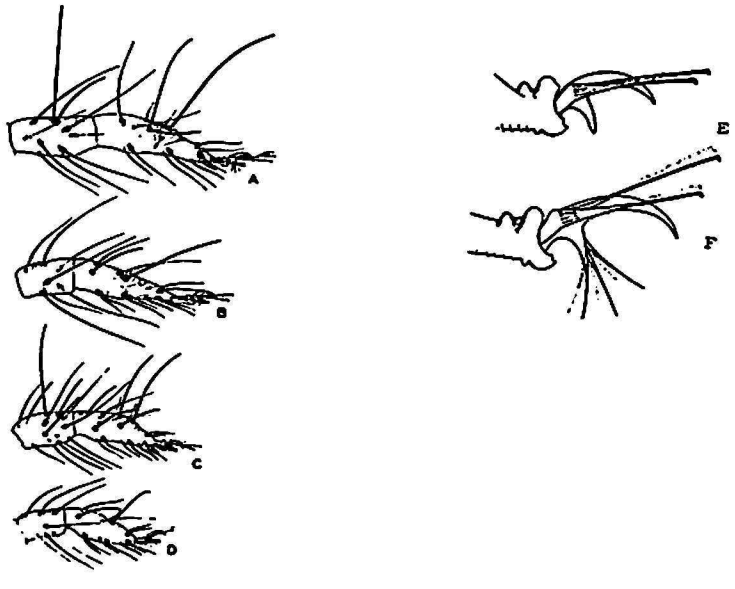


FIG. 12.—*Oligonychus sacchari* (McG.): A, Tibia and tarsus I of female; B, tibia and tarsus II of female; C, tibia and tarsus I of male; D, tibia and tarsus II of male; E, empodium I of male; F, empodium I of female. (After Pritchard and Baker, 1955).

Female.—The body is roughly oval. The dorsal body setae are broadened proximally and strongly tapering distally. The hysterosoma has the dorsal body setae similar to the dorsal propodosomals, and the para-anals are similar to the clunals. The dorsal integumentary striae are transverse between the third pair of dorsocentral hysterosomals. There are nine tactile setae and one sensory seta on tibia I; tarsus I has four tactile and two sensory setae proximal to the duplexes, and two tactile setae ventrally at the level of the duplexes; the empodium has three pairs of proximoventral hairs. There are six tactile setae on tibia II. The length of the body is 0.218–0.258 mm., including the rostrum 0.298–0.375 mm.; greatest width of the body is 0.160–0.210 mm.

Male.—The terminal sensillum of the palpus is much shorter than the fusiform sensillum and is about as long as wide. The dorsal setae of the

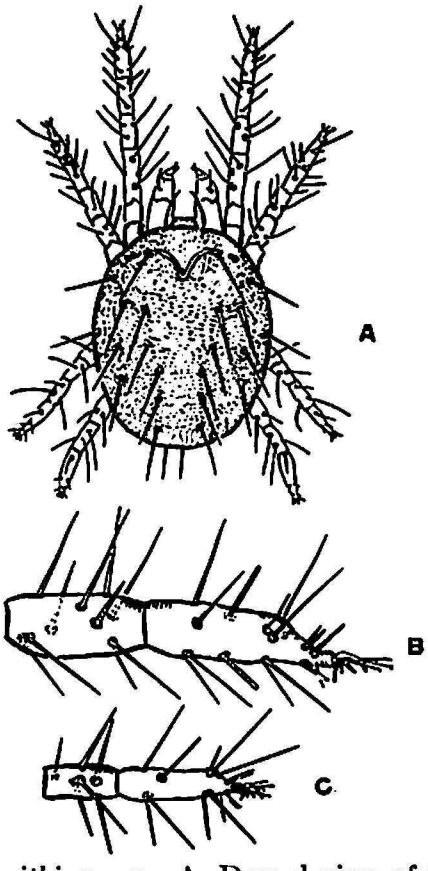


FIG. 13.—*Oligonychus smithi*, n. sp.: A, Dorsal view of female; B, tibia and tarsus I of female; C, tibia and tarsus II of female.

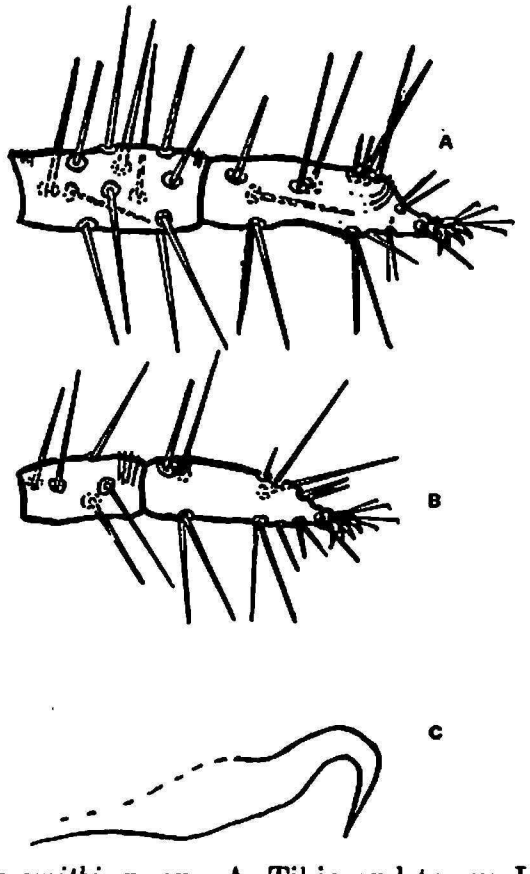


FIG. 14.—*Oligonychus smithi*, n. sp.: A, Tibia and tarsus I of male; B, tibia and tarsus II of male; C, aedeagus of male.

propodosoma are broadened proximally and strongly tapering distally and are longer than the longitudinal intervals between them. The peritreme is straight distally. There are nine tactile and three sensory setae on tibia I; tarsus I has three tactile and three sensory setae proximal to the duplexes, and there are two tactile setae ventrally at the level of the duplexes; the empodial claw is long and slender, longer than any of the three pairs of proximoventral hairs. There are five tactile setae on tibia II. The aedeagus has the distal one-half bent sharply ventrad at approximately a right angle, the distal portion with the caudal face curved and tapering to near the tip. The length of the body is 0.205–0.240 mm., including the rostrum 0.278–0.370 mm.; the body width is 0.130–0.148 mm.

Holotype.—Male, collected on *Tetrazygia elaeagonoides*, Guayama, P. R., May 31, 1955, by M. Pérez and H. L. Cromroy; in the collection at the Department of Entomology at North Carolina State College of Agriculture and Engineering, Raleigh, N. C., hereafter referred to as "North Carolina State College."

Paratypes.—10 males, 25 females, collected on *Tetrazygia elaeagnoides*, Guayama, P. R., May 31, 1955, by M. Pérez and H. L. Cromroy; in the U. S. National Museum.

This species is named in honor of Clyde F. Smith, Chairman, Department of Entomology, North Carolina State College, Raleigh, N. C., for his fine guidance and assistance in the preparation of this thesis.

Genus Tetranychus DUFOUR

Tetranychus Dufour, (*64*) 276; Koch, (*129*) 10; Duges, (*65*) 14; Koch, (*130*) 58; Donnadieu, (*61*) 147; Murray, (*166*) 97; Canestrini and Fanzago, (*50*) 148; Canestrini, (*48*) 494; Banks, (*19*) 79; Banks, (*23*) 498; Tragardh, (*217*) 163; Tragardh, (*218*) 19; McGregor, (*151*) 649; Hirst, (*99*) 49; Vitzthum, (*222*) 49; Oudemans, (*175*) 158; Oudemans, (*176*) 190; Oudemans, (*177*) 221; Oudemans, (*179*) 1012; Geijskes, (*87*) 35; Garman, (*85*) 89; Womersley, (*228*) 256; McGregor, (*159*) 277; Baker and Pritchard, (*12*) 212; Pritchard and Baker, (*184*) 373.

Distigmatus Donnadieu, (*61*) 146. Type of genus: (*Distigmatus pilosus* Donnadieu) *Tetranychus telarius* (Linnaeus); monobasic.

Tetranychus (*Epitetranychus*) Zacher, (*232*) 22. Type of subgenus: (*Tetranychus altheae* Hanstein) = *T. telarius* (Linnaeus); by original designation.

Epitetranhychus, Zacher, (*232*) 24; Oudemans, (*176*) 193.

Septanychus McGregor, (*151*) 663; McGregor, (*159*) 316. Type of genus: *Tetranychus tumidus* Banks, by subsequent designation of Baker and Pritchard (*13*).

Amphitetranychus Oudemans, (*177*) 225; Geijskes, (*87*) 32. Type of genus: *Tetranychus viennensis* Zacher; by original designation and monobasic.

Mites of this genus may be recognized by the following characters: There is one pair of para-anal setae. The empodium is composed of three pairs of proximoventral hairs on the female, or on tarsi III and IV of the male, above which is a rudimentary spur much shorter than the ventrally directed hairs. The duplex setae on the dorsum of tarsus I are widely separated. The end of the peritreme always bears a long, four- or five-chambered hook, rarely anastomosing. The aedeagus bends sharply dorsad, and the development of the distal end is characteristic of the species.

Mites of the genus *Tetranychus* feed on the underside of leaves of most angiospermous plants, usually forming colonies and sometimes producing a great deal of webbing. Adult females in the Tropics are carmine in color; in temperate regions they are greenish in color. They overwinter, or enter a nonfeeding phase, as orange females.

Six different species were found in Puerto Rico.

KEY TO SPECIES OF *Tetranychus* FOUND IN PUERTO RICO

1. Tarsus I with proximal pair of duplex setae in line with most other proximal setae (Desertorum Group) 2
2. Aedeagus with knob about one-fourth as long as dorsal margin of shaft ..... *desertorum* Banks

   Aedeagus with knob scarcely longer than stem and caudal angulation absent ..... *ludeni* Zacher
3. Empodium with an obvious empodial spur ..... *tumidus* Banks

   Empodium (except for legs I and II of male) with the empodial spur very tiny or absent (Telarius Group) 4
4. Knob of aedeagus berrylike, the rounded anterior projection more strongly developed than the posterior convexity ..... *cucurbitae* Rahman and Punjab

   Knob of aedeagus not globular, the caudal projection angulate 5
5. Axis of knob of aedeagus forming a strong angle with axis of shaft, the posterior angulation obviously longer than the tiny anterior angulation ..... *marianae* McG.

   Axis of knob of aedeagus parallel or forming a small angle with axis of shaft, the posterior angulation no longer than the anterior angulation ..... *telarius* complex

(Complete key to the species of this genus may be found in Pritchard and Baker, (*184*) 376).

KEY TO THE *Tetranychus telarius* COMPLEX (FROM BOUDREAUX, 1956)

Females.—See figures 15 and 16.

1. Females with dorsal integumentary folds bearing semioblong lobes; basic

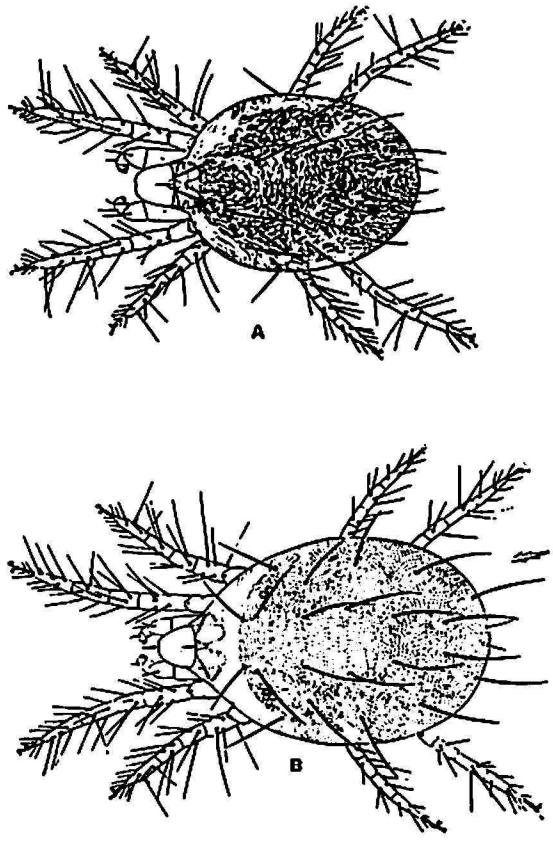


FIG. 15.—*Tetranychus telarius* (Linn.): A, Dorsal aspect of nonfeeding female; B, dorsal aspect of actively feeding female. (After Pritchard and Baker, 1955).

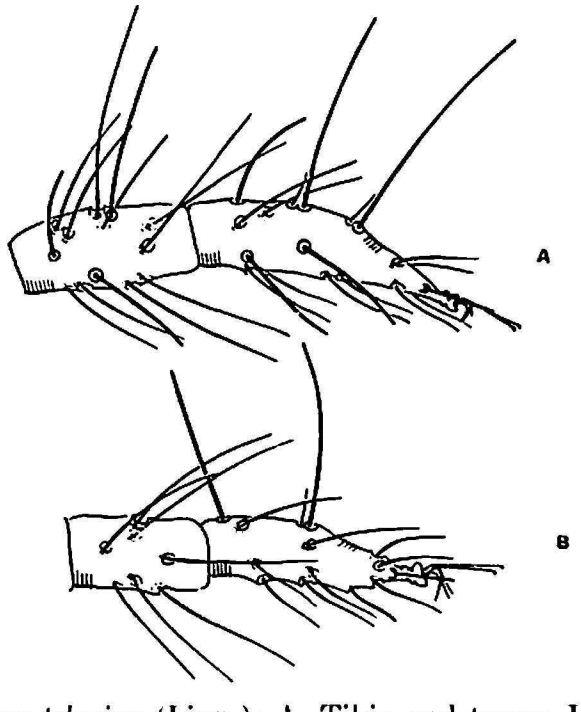


FIG. 16.—*Tetranychus telarius* (Linn.): A, Tibia and tarsus I of female; B, tibia and tarsus II of female. (After Pritchard and Baker, 1955).

color of live summer females green; eggs always white. . . . *telarius* (Linn.)
Females with dorsal integumentary folds bearing semicircular or triangular lobes; basic color of live summer females carmine; eggs often reddish 2

2. Ventral integumentary folds lacking lobes in the area bounded by the ventralmost hysterosomal setae; live summer females with four distinct dark spots; eggs always with some trace of red color
cinnabarinus (Boisduval)[6]
Ventral integumentary folds in the area bounded by the three pairs of pregenital hysterosomal setae bearing lobes on the outer fold; live summer females with dark spots diffuse, not clearly marked; eggs from mated females white, from unmated females reddish. . *lobosus* Boudreuax

Males.—

1. Anterior projection of knob of aedeagus rounded, posterior projection acutely pointed, upper surface of knob with slight indentation, axis of knob parallel with shaft . . . . . *lobosus* Boudreaux
Anterior projection of knob of aedeagus acute or acutely rounded, upper surface of knob broadly rounded or broadly angulate, axis of knob forming a small angle with shaft or parallel 2

2. Anterior projection of knob of aedeagus very slightly rounded, axis of knob forming a small angle with the shaft, dorsum of knob broadly angulate . . . . . *cinnabarinus* (Boisduval)[6]
Anterior projection of knob usually acute, upper surface usually rounded, angle of axis of knob with shaft very small or axis parallel
telarius (Linn.)

The southern distribution of *T. lobosus* in the United States indicates the possibility of finding it throughout the Caribbean Islands.

Tetranychus cinnabarinus (BOISDUVAL)

Acarus cinnabarinus Boisduval, (*37*) 88.
Tetranychus multisetis McGregor, (*159*) 294.
Tetranychus urticae dianthica Dosse, (*62*) 250.
Tetranychus cinnabarinus (fig. 17) (Boisduval), Boudreaux, (*40*) 46. Types: Males and females, numerous hosts, Louisiana; in the U. S. National Museum.

This species belongs to the Telarius Complex (fig. 17).

Female.—The basic color is carmine red with the carmine color restricted to the body behind the eyes. The anterior portion of the body is yellowish. There are four dark body spots laterally; the anterior pair is larger; the posterior pair is near the anal area. The dorsal integumentary folds have semicircular or triangularly rounded lobes on the edge of the outer folds.

[6] The only member of this complex found in Puerto Rico.

Ventrally the skin folds lack these lobes, as in *telarius*. There are longitudinal striae on the integument between the third pair of dorsocentral hysterosomals and also the inner sacrals and a diamond-shaped figure is formed in the area between these setae. There are four tactile setae on tarsus I proximad to the proximal duplex setae; tibia I has nine tactile and one sensory setae. The mediodorsal spur of the empodium is tiny. The female is indistinguishable from other females in the Telarius Complex.

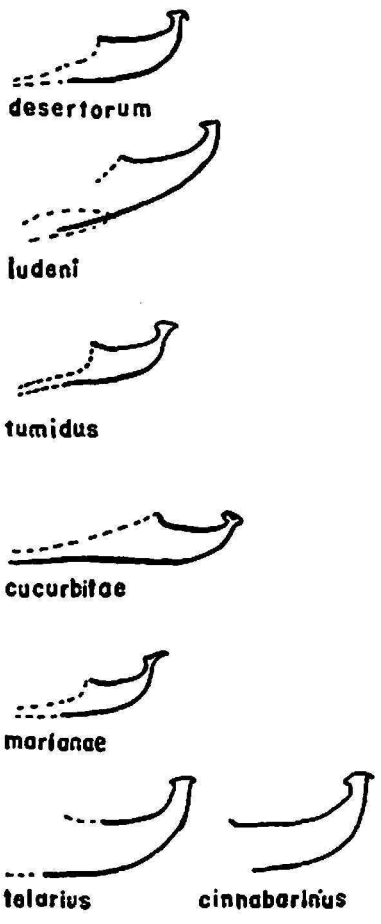


FIG. 17.—Aedeagi of species of *Tetranychus* found in Puerto Rico. (After Pritchard and Baker, 1955).

Male.—There are four tactile and two sensory setae on tarsus I proximad to the proximal duplex setae, and tibia I has nine tactile and four sensory setae. The aedeagus has a dorsally directed bend of about 90 degrees and the posterior projection is small and acute as in *T. telarius* (L.). The axis of the knob, however, always forms a slight angle with the shaft; the anterior angulation is slightly rounded; the upper surface of the knob is obtusely angulate.

Collected in Puerto Rico on *Manihot utilissima*, Aguadilla, August 13, 1954, by G. N. Wolcott, M. Pérez, and H. L. Cromroy; on *Adenoropium gossypifolium*, Cabo Rojo, April 19, 1955, by M. Pérez and H. L. Cromroy.

Tetranychus cucurbitae RAHMAN AND PUNJAB

Tetranychus cucurbitae Rahman and Punjab (fig. 18) (*87*) 179; Rahman and Sapra, (*190*) 124; Pritchard and Baker, (*184*) 419. Types: Males and females, Lyallpur, India, on pumpkins (*Cucurbita maxima, C. pepo,* and *C. moschata*), *Citrullus vulgaris* var. *fistulosus, Luffa aegyptica,* cabbage (*Brassica oleracea*), tomato (*Lycoperciscum esculentum*), and hollyhock (*Althaea rosea*), as well as many others, totalling about 60 different species.

Tetranychus equatorius McGregor, (*159*) 285. Types: Males and females,

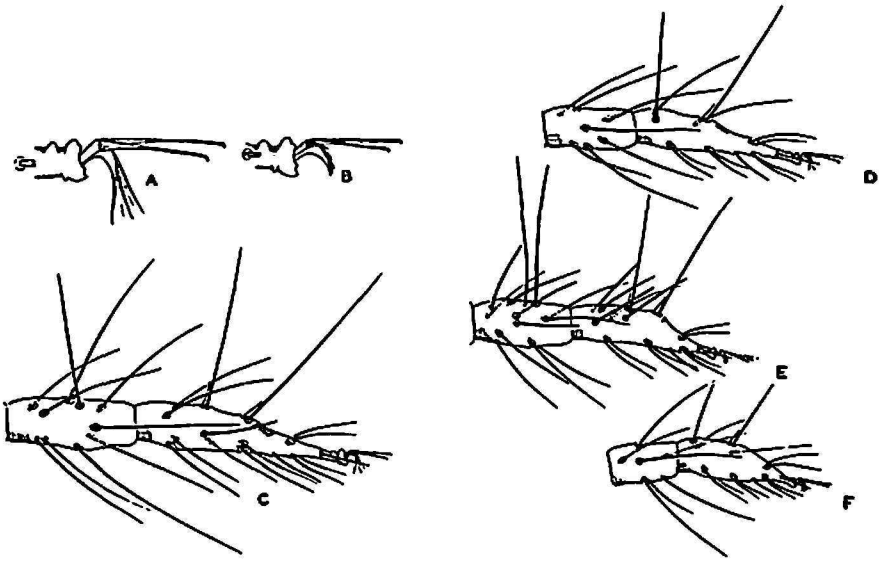


FIG. 18.—*Tetranychus curcurbitae* Rahman and Punjab: A, Empodium I of female; B, empodium I of male; C, tibia and tarsus I of female; D, tibia and tarsus II of female; E, tibia and tarsus I of male; F, tibia and tarsus II of male. (After Pritchard and Baker, 1955).

Waipahu School, Oahu, T. H., on string beans; in the U. S. National Museum.

This species belongs to the Telarius complex. The mediodorsal spur of the empodium is tiny or absent. The proximal pair of duplex setae on tarsus I is distal to the four tactile setae at the base of the segment.

Female.—The adult feeding female is carmine in tropical or subtropical areas. The hysterosoma has longitudinal striae between the third pair of dorsocentral hysterosomals and also the inner sacrals. A diamond-shaped figure is formed in the area between these setae. The female of *T. cucurbitae* cannot be differentiated from other females in the complex.

Male.—There is a very tiny empodial spur on tarsi III and IV. The male genitalia distinguish the species. The knob of the aedeagus is berry-like with the anterior curvature more strongly developed than the posterior convexity.

Collected in Puerto Rico on *Cleome gynandra*, Colonia Santa Rita, Guánica, August 13, 1954, by C. F. Smith and L. F. Martorell; on *Dolichos lablab*, Río Piedras, March 22, 1955, by H. L. Cromroy; on *Lycopersicon esculentum*, Río Piedras, March 28, 1955, by H. L. Cromroy; on *Cajan cajan*, Agricultural Experiment Station, Río Piedras, March 28, 1955, by G. Rivera and S. Medina; on *Datura stramonium*, Agricultural Experiment Station, Río Piedras, April 15, 1955, by G. Rivera and S. Medina; on *Pueraria hirsuta*, Agricultural Experiment Station, Río Piedras, April 15, 1955, by G. Rivera and S. Medina; on *Phyllanthus niruri*, Santurce, May 11, 1955, by L. F. Martorell; on *Bauhinia purpurea*, Cayey, May 23, 1955, by M. Pérez; on *Cordia alliodora*, Cayey-Salinas Road, June 14, 1955, by H. L. Cromroy.

Tetranychus desertorum BANKS

Tetranychus desertorum Banks, (figs. 19–20) (*19*) 76; Baker and Pritchard, (*12*) 229; Pritchard and Baker, (*184*) 403. Types: Males and females, Mesilla Park, N. Mex., on *Larrea tridentata* and *Phacelia crenulata;* in the U. S. National Museum.

Tetranychus opuntiae Banks, (*24*) 36. Types: Females, San Antonio, Tex., on *Opuntia* sp.; in the U. S. National Museum.

Tetranychus thermophilus Ewing, (*75*) 142. Types: Males and females, Furnace Creek, Death Valley, Calif., on (Covillea) = *Larrea* sp., in the U. S. National Museum.

Septanychus argentinus McGregor, (*157*) 176; McGregor, (*159*) 317. Types: Males and females, Argentina (at New York, Quarantine), on pear; in the U. S. National Museum.

Septanychus deserticola McGregor, (*159*) 321. Types: Males and females, Palm Springs, Calif., on creosote bush; in the U. S. National Museum.

Septanychus texazona McGregor, (*159*) 328. Types: Males and females, College Station, Tex., on turnip; in the U. S. National Museum.

Female.—The body color is carmine. The dorsal striae of the female hysterosoma form a broad triangle between the third pair of dorsocentrals and the inner sacrals, the striae being longitudinal between these setae. The proximal pair of duplex setae of tarsus I are in line with the four tactile setae on tarsus I. The peritreme ends in a simple hook. The females are morphologically indistinguishable from other species of the desertorum complex.

Male.—The dorsal margin of the knob of the aedeagus is sigmoid, the anterior angulation being small and acute and the posterior angulation acute and curved ventrad to a variable extent. The knob of the aedeagus is one-fourth as long as the dorsal margin of the shaft. There are certain characters of the aedeagus which typify the Desertorum Complex, but this

species is distinguished from the rest of the complex by the relative length of the knob to the dorsal margin of the shaft.

Collected in Puerto Rico on *Cordia alliodora*, Peñón del Collao, Cayey, August 13, 1954, by C. F. Smith; on *Ipomoea* sp., Ciales-Jayuya Road, Kilometer 30.5, May 11, 1955, by H. L. Cromroy.

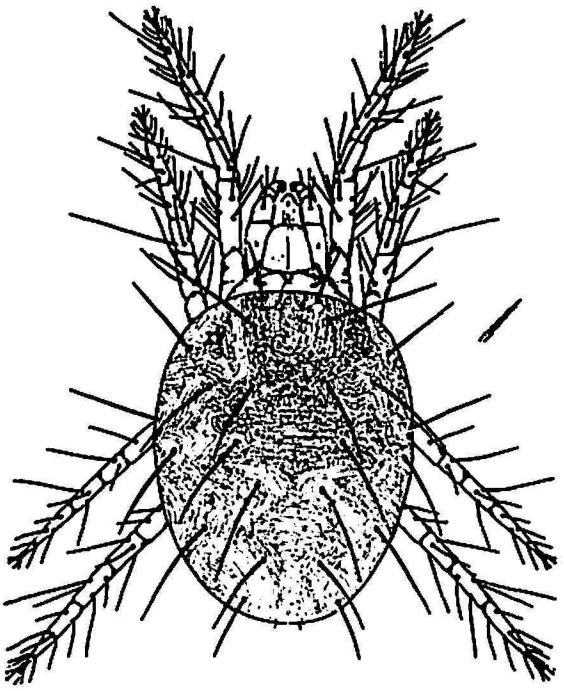


FIG. 19.—Dorsal view of *Tetranychus desertorum* Banks. (After Pritchard and Baker, 1955).

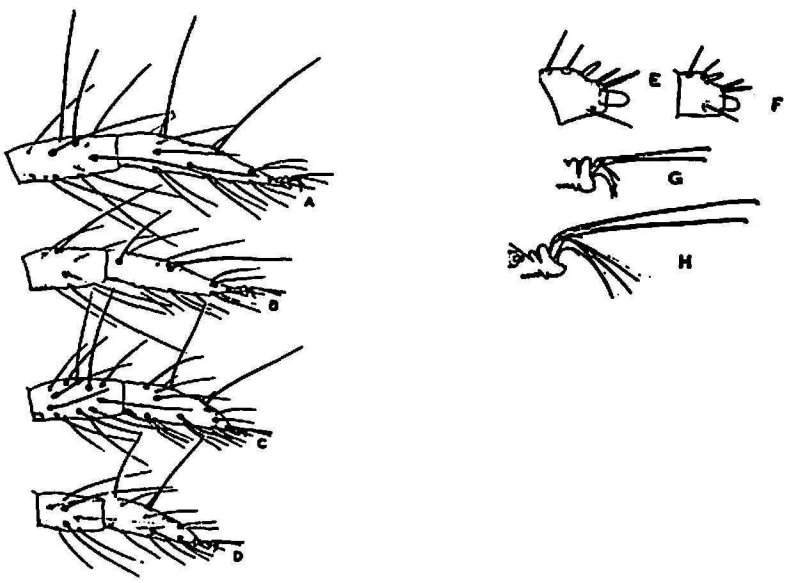


FIG. 20.—*Tetranychus desertorum* Banks: A, Tibia and tarsus I of female; B, tibia and tarsus II of female; C, tibia and tarsus I of male; D, tibia and tarsus II of male; E, terminal palpal segment of male; F, terminal palpal segment of female; G, empodium I of male; H, empodium I of female.

Tetranychus ludeni ZACHER

Tetranychus ludeni Zacher, (*231*) 40; Zacher, (*233*) 187; McGregor, (*151*) 653; Hardouin, (*94*) 123; Pritchard and Baker, (*184*) 405. Described from specimens from St. Cloud, near Paris, France, on *Salvia splendens*, *Solanum melongena*, and *Cucurbita* sp. (Figs. 21–22).

Tetranychus (*Epitetranychus*) *ludeni*, Zacher, (*233*) 187; Hardouin, (*94*) 123; Andre, (*4*) 348.

Tetranychus salviae Oudemans, (*176*) 230. Types: 3 females, possibly from

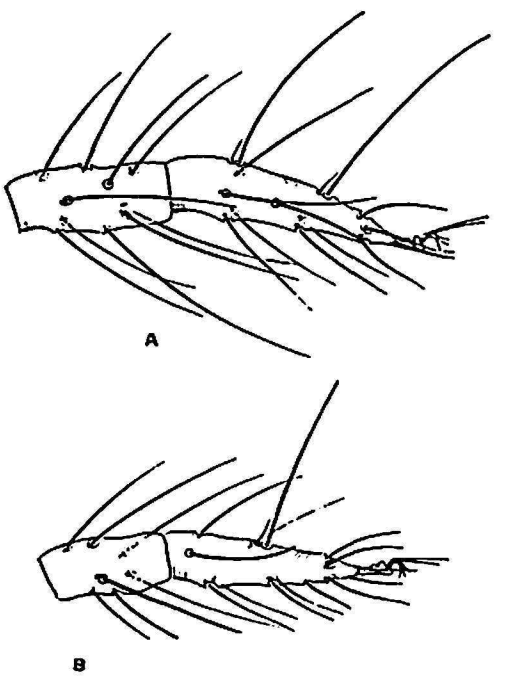


FIG. 21.—*Tetranychus ludeni* Zacher: A, Tibia and tarsus I of female; B, tibia and tarsus II of female. (After Pritchard and Baker, 1955).

Paris, France, on *Salvia splendens*; possibly in the Rijksmuseum van Natuurlijke Historie, Leiden, Holland.

Septanychus deviatarsus McGregor, (*159*) 322. Types: Males and females, Anaheim, Calif., on castor bean; in the U. S. National Museum.

Female.—This species is typical of the Desertorum Group. The body color is carmine. The dorsal striae of the hysterosoma form a broad triangle between the third pair of dorsocentrals and the inner sacrals, the striae being longitudinal between these setae. The peritreme ends in a simple hook. There is a pair of proximal duplex setae in line with the four tactile setae on tarsus I. The female is indistinguishable from other species in the desertorum complex.

Male.—The aedeagus is typical of the desertorum complex. The dorsal margin of the aedeagus is sigmoid and the anterior angulation is small and

acute. It differs from other members of this complex in that the knob is scarcely larger than the stem and the caudal angulation is absent.

Collected in Puerto Rico on *Trichachne insularis*, Maunabo, August 11, 1954, by L. F. Martorell and H. L. Cromroy; on *Ipomoea* sp., Peñón del Collao, Cayey, altitude of 2,000 feet, August 13, 1954, by L. F. Martorell; on *Lantana camara*, Guayama, May 31, 1955, by M. Pérez and H. L. Cromroy.

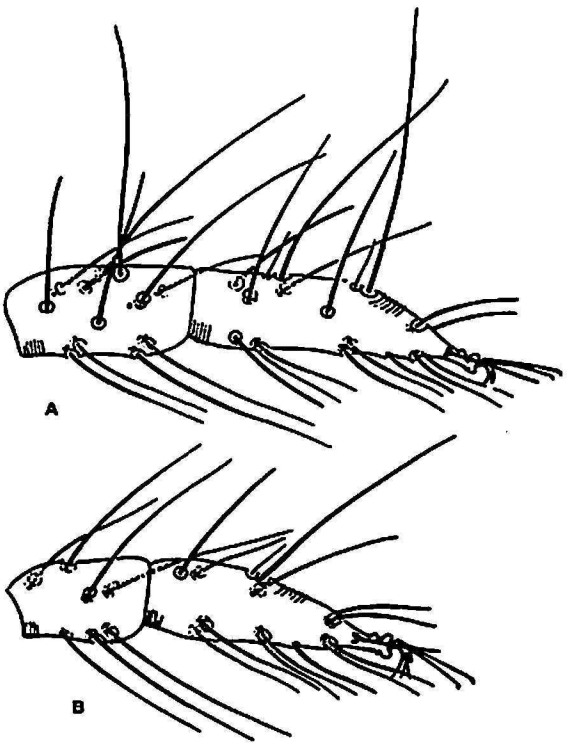


FIG. 22.—*Tetranychus ludeni* Zacher: A, Tibia and tarsus I of male; tibia and tarsus II of male. (After Pritchard and Baker, 1955).

Tetranychus marianae MCGREGOR

Tetranychus marianae McGregor, (*159*) 291; Baker and Pritchard, (*12*) 229; Pritchard and Baker, (*184*) 429. Types: Males and females, Mt. Lasso, Tinian Island, Mariana Group, on *Passiflora foetida*; in the U. S. National Museum. (Fig. 23).

T. marianae also belongs to the Telarius Complex.

Female.—The body color is carmine. There is a diamond-shaped figure on the hyseterosoma in the area between the third pair of dorsocentral hyseterosomals and the inner sacrals. The mediodorsal spur of the empodium is tiny or absent. The proximal pair of duplex setae on tarsus I is distal to the four tactile setae at the base of the segment. The female of this species is indistinguishable from other females in the telarius complex.

Male.—The empodium has a very tiny spur on tarsi III and IV. The

axis of the terminal knob of the aedeagus forms a definite angle with the axis of the shaft, with a small anterior angulation and with a longer, dorsocaudally directed angulation. The stem is obviously shorter than the knob.

Collected in Puerto Rico on *Abelmoschus esculentus*, Aguadilla, August 27, 1954, by M. Pérez; on *Urena lobata*, Susúa Forest in Yauco, May 26, 1955, by H. L. Cromroy; on *Petivera alliacea*, Lajas Agricultural Experiment Substation, May 26, 1955, by L. F. Martorell and H. L. Cromroy.

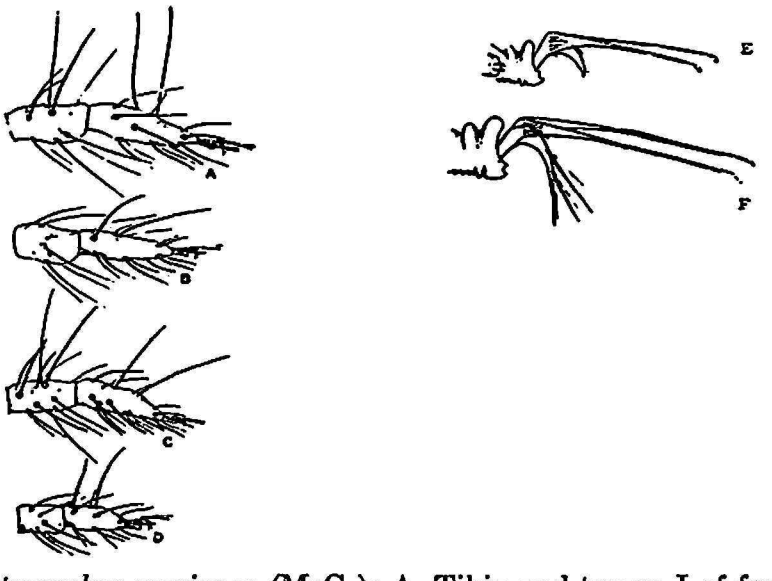


FIG. 23.—*Tetranychus marianae* (McG.): A, Tibia and tarsus I of female; B, tibia and tarsus II of female; C, tibia and tarsus I of male; D, tibia and tarsus II of male; E, empodium I of male; F, empodium I of female. (After Pritchard and Baker, 1955).

Tetranychus tumidus BANKS

Tetranychus tumidus Banks, (*19*) 73; Baker and Pritchard, (*12*) 232; Pritchard and Baker, (*184*) 408. Types: Females, Eustis, Fla., on water hyacinth; in the U. S. National Museum.

Septanychus tumidus, McGregor, (*151*) 664; McGregor, (*159*) 326.

Tetranychus gloveri Banks, (*19*) 76. Types: Females, Baton Rouge, La., on cotton; in the U. S. National Museum.

Tetranychus quinquenychus McGregor, (*148*) 358. Types: Females, Orlando, Fla., on castor bean; in the U. S. National Museum.

Septanychus quinquenychus, McGregor, (*151*) 664.

Tetranychus antillarum Banks, (*27*) 194. Types: Females, Río Piedras, P. R., on *Leonotis nepetaefolia* and *Asclepias curassavica;* in the U. S. National Museum (fig. 17).

This species belongs to the Tumidus Complex which consists of the following species: *T. tumidellus* Pritchard and Baker, *T. mexicanus* (McGregor), *T. magnoliae* Boudreaux, *T. cocosi* (McGregor), *T. cocosinus* Boudreaux and *T. tumidus*.

Female.—The adult female is carmine. There is a diamond-shaped pattern on the hyseterosoma in the area between the third pair of dorsocentrals and the inner sacrals, the striae being longitudinal in the interval between each of these pairs of setae. There is an obvious mediodorsal spur on the empodium. The proximal pair of the duplex setae on tarsus I are located distad of the proximal tactile setae. The female is indistinguishable from other species in this complex.

Male.—There is an obvious empodial spur present on tarsus III and IV. The male aedeagus differentiates this mite from other closely related species. The aedeagus has the anterior development of the knob short and acutely angulate.

Collected in Puerto Rico on *Macroptilium lathyroides*, Barrio Sumidero, Aguas Buenas, August 13, 1954, by Crystle Smith; Agricultural Experiment Station, Río Piedras, April 15, 1955, by G. Rivera and S. Medina; on *Sida carpinifolia*, Cabo Rojo Lighthouse, August 18, 1954, by L. F. Martorell and H. L. Cromroy; on *Abelmoschus esculentus*, Aguadilla, August 27, 1954, by M. Pérez; on *Gossypium barbardense*, Lajas Substation, September 1, 1954, by H. L. Cromroy; Agricultural Experiment Station Greenhouse, Río Piedras, April 15, 1955, by G. Rivera and S. Medina; on *Caladium colocasia*, Agricultural Experiment Station, Río Piedras, September 7, 1954, by G. Rivera; Girl Scout Camp at El Verde, May 20, 1955, by M. Pérez and H. L. Cromroy; on *Xanthosoma violacea*, Agricultural Experiment Station, Río Piedras, March 28, 1955, by G. Rivera and S. Medina; on *Ipomoea batatas*, Isabela Substation, April 1, 1955, by M. Pérez; Agricultural Experiment Station Greenhouse, Río Piedras, April 13, 1955, by J. Bird; on *Leonotis nepetaefolia*, Isabela Substation, April 1, 1955, by M. Pérez; on *Synedrella nodiflora*, Loíza Aldea Road, April 13, 1955, by H. L. Cromroy; on *Amaranthus bispinosus*, Santurce, April 18, 1955, by L. F. Martorell; on *Rauwolfia lamarckii*, Lighthouse at Las Cabezas de San Juan, May 4, 1955, by M. Pérez and H. L. Cromroy; on *Salvia splendens*, Ciales-Jayuya Road, Kilometer 30.5, May 11, 1955, by L. F. Martorell; on *Elephantopus mollipes*, Vega Alta-Corozal Road, Kilometer 3.6, May 18, 1955, by M. Pérez and H. L. Cromroy; on *Asclepias curassavica*, Vega Alta-Corozal Road, Kilometer 3.6, May 18, 1955, by M. Pérez and H. L. Cromroy; on *Centrosema pubescens*, Vega Alta-Corozal Road, Kilometer 3.6, May 18, 1955, by M. Pérez and H. L. Cromroy; on *Ipomoea learii*, Girl Scout Camp at El Verde, May 20, 1955 by M. Pérez and H. L. Cromroy.

FAMILY TENUIPALPIDAE BERLESE 1913

The present concept of the family evolved gradually, and several names have been proposed. These mites were included with the Tetranychidae by

many workers until relatively recently. Berlese proposed the family name Tenuipalpidae in an obscure, privately published paper in 1913 (*34*). The family name is based upon the generic name *Tenuipalpus* Donnadieu (*61*).

Ewing (*75*) used the aberrant genus *Phytoptipalpus* Trägårdh for establishing the Phytoptipalpidae. He apparently believed these to be distinct from the then known genera *Tenuipalpus* and *Brevipalpus*. Pritchard and Baker (*182*), believing that *Phytoptipalpus* is closely allied to *Pseudoleptus* Bruyant and could not be relegated to separate subfamilies, used Phytoptipalpidae for the family name. This name was used throughout their various papers on the genera of the family.

Oudemans (*174*) proposed the name Pseudoleptidae to include the genera *Pseudoleptus* Bruyant and *Raoiella* Hirst. Later (*180*) he considered *Pseudoleptus* to be a synonym of *Trichadenus* Bondani, and changed the family name to Trichadenidae. Vitzthum (*225*), however, continued to use the name Pseudoleptidae, not accepting the synonymy of *Pseudoleptus* with *Trichadenus*, and this usage was followed by McGregor (*158*) and Baker (*8*).

The subfamily Pseudotetranychinae was proposed as a subfamily name in the family Tetranychidae by Sayed in 1938 for the genera *Raoiella* Hirst and *Phyllotetranychus* Sayed. Sayed's concept was later (*202*) enlarged to include the genera *Tenuipalpus*, *Pseudoleptus*, and *Dolichotetranychus*. However, his suprageneric category has no nomenclatural standing since it was not based upon any proposed generic name.

Sayed (*204*) proposed the subfamily names Phytoptipalpinae and Tenuipalpinae as divisions of the family Tenuipalpidae. He proposed Tenuipalpidae since *Tenuipalpus* was the oldest included genus, and because he considered *Pseudoleptus* Bruyant to be atypical of the group and, therefore, inappropriate as the type genus. He gave no consideration to *Phytoptipalpus* Trägårdh as the type, presumably for similar reasons.

Finally, Cunliffe (*59*) first properly used the family name Tenuipalpidae Berlese, 1913 (*34*) in his paper on the classification of the Trombidiforme mites.

Previous to 1900, when Banks described *Dolichotetranychus floridanus* from Florida pineapple, tenuipalpids were unreported from the United States. Until McGregor (*158*) and Baker (*8*) published the first of a long series of papers dealing with these mites, only eight species had been described from this country. Now, because of their economic importance, even though limited in most cases, the number of described species has greatly increased, and our knowledge of the biology and morphology is slowly developing.

GENERAL EXTERNAL MORPHOLOGY

The palpi of the Tenuipalpidae (fig. 24) are distinctive in that they lack a palpal claw. One to five palpal segments are present in the known North

American species. In nearly all species the second palpal segment bears a dorsal seta (usually a sensory peg in the male); when antepenultimate, the third palpal segment is bare; when penultimate, the fourth segment bears two setae. The terminal palpal segment bears a rodlike sensilla and one or two setae. The mouth parts are also characterized by having the cheliceral stylets curved proximally within an elongated oval stylophore that may be withdrawn deeply into the propodosoma. The tracheae consist of two anteriorly directed pairs of tubes. The legs of the North American tenuipalpids have a rather constant setal pattern with a single sensory rod always present at the distal end of tarsi I and tarsi II, respectively, and with two such sensilla sometimes present on one or both of the tarsi in the adults. Each claw bears several pairs of long outer tenent hairs that are usually

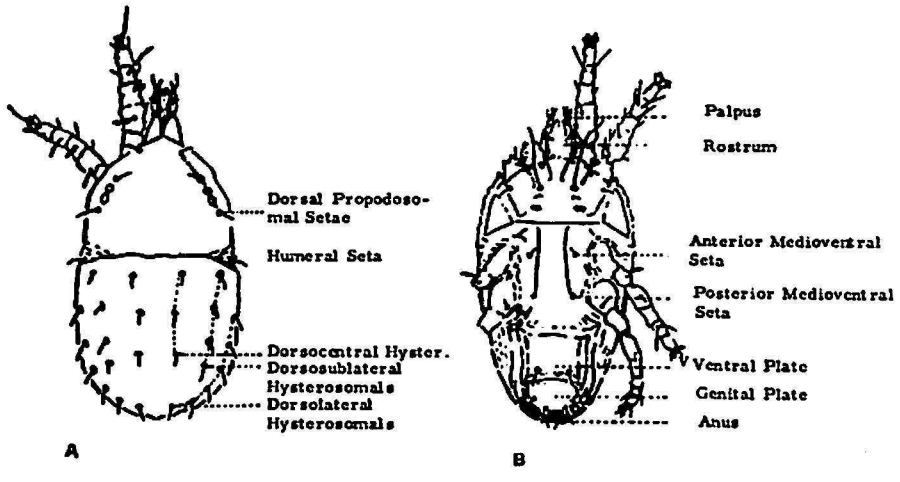


FIG. 24.—Dorsal and ventral view of a typical female tenuipalpid: A, Dorsal view of body showing nomenclature of the setae; B, ventral view of body showing nomenclature of the setae. (After Pritchard and Baker, 1951).

united distally and a row of shorter, inner tenent hairs; the distal hook of the claw may be strong, reduced, or lacking. The empodium consists of an elongate pad bearing two rods of tenent hairs below. A simple or well-developed rostral shield partially covering the gnathosoma may be present. The body, or idiosoma, of a tenuipalpid is divided to form a propodosoma and hysterosoma. At the present time the dorsal chaetotaxy and the skin pattern are most valuable for the classification of this group of mites. The propodosoma always bears three pairs of dorsal propodosomal setae. The hysterosoma bears a series of setae: The dorsocentral hyseterosomals, the dorsosublateral hysterosomals, and the dorsolateral hysterosomals. The first pair of dorsolateral hysterosomals is referred to as humeral setae. The terminology utilized by Baker and Pritchard (*182*) is continued in this paper. (Fig. 21.) A pair of long, medioventral setae are always found on the bases of the anterior coxae of the venter of the propodosoma. The metapodosoma of the adult and deutonymph bears two pairs of medio-

ventral setae, although in *Tenuipalpus* three or four pairs may be present with the anterior setae displaced to the propodosoma. The venter of the opisthosoma of the adult female bears a pair of medioventral setae usually set in a ventral plate, two pairs (very rarely one pair) of setae on the genital plate, and two or three pairs of anal setae that may be set on anal plates. The venter of the opisthosoma of the male bears a pair of medioventral setae. There are three or four pairs of genitoanal setae. The outer genitalia of the male consist of a pair of terminal styletlike rods that are called the genital stylets; the aedeagus is very long and tapering, and the sperm duct enters its funnel-shaped anterior end.

KEY TO THE GENERA OF TENUIPALPIDAE FOUND IN PUERTO RICO

1. Body evenly ovate or elliptical with no constriction between propodosoma and opisthosoma; palpus four-segmented.....*Brevipalpus*
   Body not evenly ovate or elliptical; propodosoma broad with constricted opisthosoma; palpus one-to five-segmented.....*Tenuipalpus*

Genus Brevipalpus DONNADIEU

Brevipalpus Donnadieu, (*61*) 116; Vitzthum, (*224*) 145; Vitzthum, (*225*) 811; Baker, (*7*) 33; McGregor, (*158*) 9; Baker, (*8*) 350; Pritchard and Baker, (*182*) 13. Type of genus: *Brevipalpus obovatus* Donnadieu, by subsequent designation of Vitzthum, (*225*).

The genus *Brevipalpus* may be recognized by having four palpal segment. The body of the female is generally ovate and the dorsum of the adult is nearly always reticulate or coarsely striate. The female bears a definite ventral plate with one pair of setae, a genital plate with two pairs of setae, and two anal plates, each with a pair of setae.

The brevipalpid male differs from the female in having the median lobes of the rostral shield shorter and broader and the rostrum somewhat shorter. The male idiosoma may have a similar integumental pattern to that of the female or it may vary to a considerable extent. The body is divided into three distinct portions by transverse sutures.

The main distinction between the immature stages and the adults is the lack of genitalia, the lack of certain ventral setae, and the lack of distinctive integumental patterns and rostral shield.

In the descriptions of the new species, the length measurement is from the anterior margin of the gnathosoma to the posterior margin of the opisthosoma. The width measurement is the greatest body width.

KEY TO PUERTO RICAN SPECIES OF *Brevipalpus* (FEMALES)

1. Hysterosoma with six dorsolaterals.....2
   Hysterosoma with five dorsolaterals.....3

2. Tarsus II with one sensory rod (posteriodistally)..*bakeri*, new species
   Tarsus II with two sensory rods (anterodistally and posterodistally) .....*australis* (Tucker)
3. Tarsus II with one sensory rod (posterodistally).....*inornatus* (Banks)
   Tarsus II with two sensory rods (anterodistally and posterodistally) .....*phoenicis* (Geijskes)

Brevipalpus bakeri NEW SPECIES

Brevipalpus bakeri (figs. 25–26) belongs to those species having six dorsolateral hysterosomals, two setae, and a sensory peg on the terminal segment of the palpus, and one sensory rod on tarsus II. It resembles *B. oncidii* Baker in that the posterior medioventral setae of the metapodosoma of both are very short and similar to the anterior medioventral pair. However, *bakeri* is distinct from *oncidii* in having two sharply defined mediolateral lobes on the rostral shield and in lacking a lateral seta on genus IV.

Female.—The body is ovate. The third segment of the palpus is enlarged at the distal end, and the terminal segment has two setae and a sensory peg. The dorsal setae on femur I and II of the legs are lanceolate, lightly serrate and shorter than the width of the segment; the dorsal setate on patella I and II are narrow and short, the dorsal setae on tibia I and II are setiform; tarsi I and II each has a single sensory rod posterodistally; the tarsal claw hook is strong; the empodium has two ventral rows of tenent hairs. The rostral shield has nonstriate and deeply emarginate median lobes with the mediolateral and lateral angulations sharply pronounced. The propodosoma is evenly reticulate laterally and mediolaterally, and medially has a lobose appearance; the propodosomal setae are minute and lanceolate-serrate. The hysterosoma is evenly reticulate laterally and mediolaterally, and has medial transverse striae; hysterosomal pores are absent; the dorsocentral setae are minute and setiform; the humeral setae are lanceolate-serrate and minute; the dorsolateral setae are six in number and more broadly lanceolate and serrate than the propodosomals. The anterior and posterior pairs of the metapodosomal medioventral setae are very short. The opisthosoma has slender, tapering and nude ventral setae. The length is 0.315–0.325 mm.; the width is 0.178–0.191 mm.

Male.—Males are not known.

Holotype. —Female, collected on *Guarea ramiflora*, Cayey-Salinas Road, P. R., altitude of 1,300 feet, June 14, 1955, by L. F. Martorell and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Two females, collected on *Guarea ramiflora*, Cayey-Salinas Road, P. R., altitude of 1,300 feet, June 14, 1955, by L. F. Martorell and H. L. Cromroy; in collection at the U. S. National Museum.

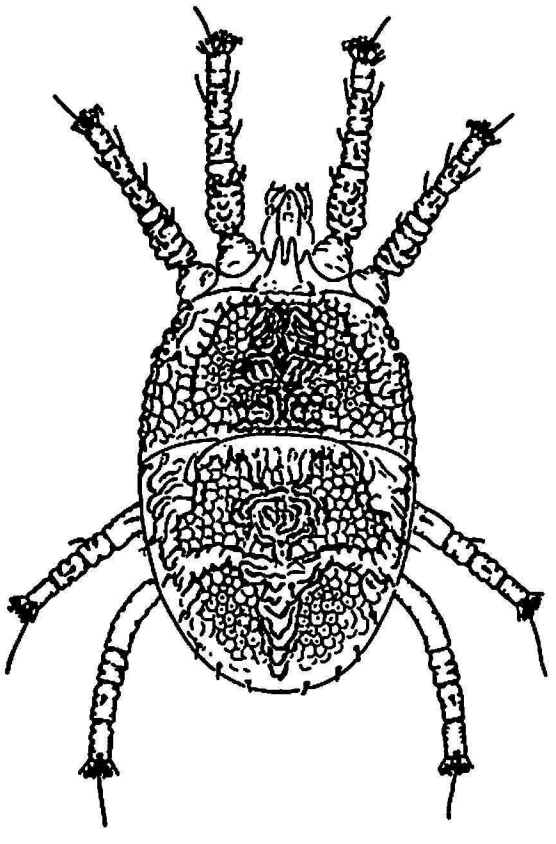
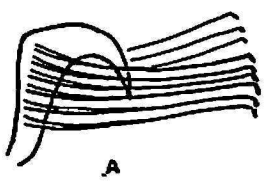


FIG. 25.—*Brevipalpus bakeri*, n. sp. (Drawn by Dr. E. W. Baker).



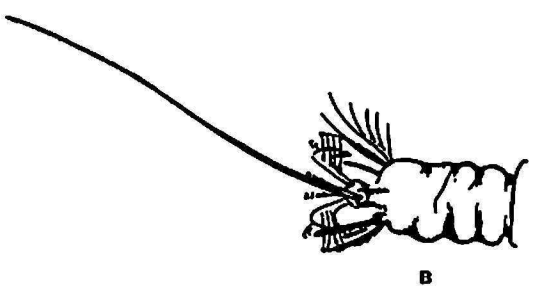


FIG. 26.—*Brevipalpus bakeri*, n. sp.: A, Enlarged view of claw; B, enlarged view of tarus I. (Drawn by Dr. E. W. Baker).

This species is named in honor of E. W. Baker for his helpful guidance and assistance in the preparation of this thesis.

Brevipalpus australis (TUCKER)

Tenuipalpus australis Tucker, (*220*) 3; Wormersley, (*229*) 42; Lawrence, (*140*) 39; Baker, (*8*) 379. Cotypes: Females, Cape Province, Natal,

Transvaal and Southern Rhodesia, Africa, on citrus fruits; of unknown disposition.

Brevipalpus australis (Tucker) Pritchard and Baker, (*182*) 29. (Fig. 27).

Tenuipalpus vitis Wormersley, (*228*) 241. Type: Nymph, Western Australia, on lemon; in the South Australian Museum.

Tenuipalpus obovatus, Sayed, (*202*) 97; Sayed, (*203*) 100. Misidentification.

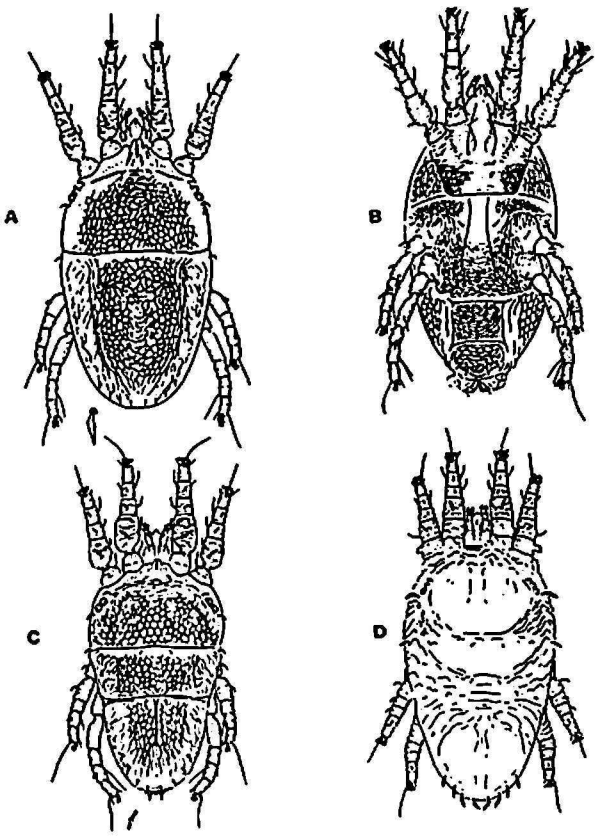


FIG. 27.—*Brevipalpus australis* Tucker: A, Dorsal aspect of female; B, ventra aspect of female; C, dorsal aspect of male; D, dorsal aspect of nymph. (After Pritchard and Baker, 1951).

Brevipalpus confusus Baker, (*8*) 380. Type: Female, Maryland, on orchid; in the U. S. National Museum.

Brevipalpus browningi Baker, (*8*) 382. Type: Female, Palestine, on citrus; in the U. S. National Museum.

Female.—The body is ovate. There are six dorsolateral setae on the hysterosoma; and dorsomedial reticulations on the propodosoma. The terminal segment of the palpus has two setae and a sensory peg. There are two sensory pegs on tarsus II.

Male.—The male is similar to the female and has elongate reticulations mediolateral on the opisthosoma.

Nymph.—The nymph has four pairs of long, lanceolate-serrate, dorso-

lateral setae on the caudal margin of the hysterosoma. The third dorsal propodosomal and humeral setae are similar.

Collected in Puerto Rico on *Amaranthus spinosus*, Yabucoa, August 11, 1954, by C. F. Smith and H. L. Cromroy; on *Parthenium hysterophorus*, Cabo Rojo, August 18, 1954, by H. L. Cromroy; on *Bidens pilosa*, El Yunque, April 4, 1955, by G. Rivera, M. Pérez, and H. L. Cromroy; on ornamental, Río Piedras, April 15, 1955, by H. L. Cromroy; on *Phyllanthus niruri*, Santurce, May 11, 1955, by L. F. Martorell; on unknown shrub,

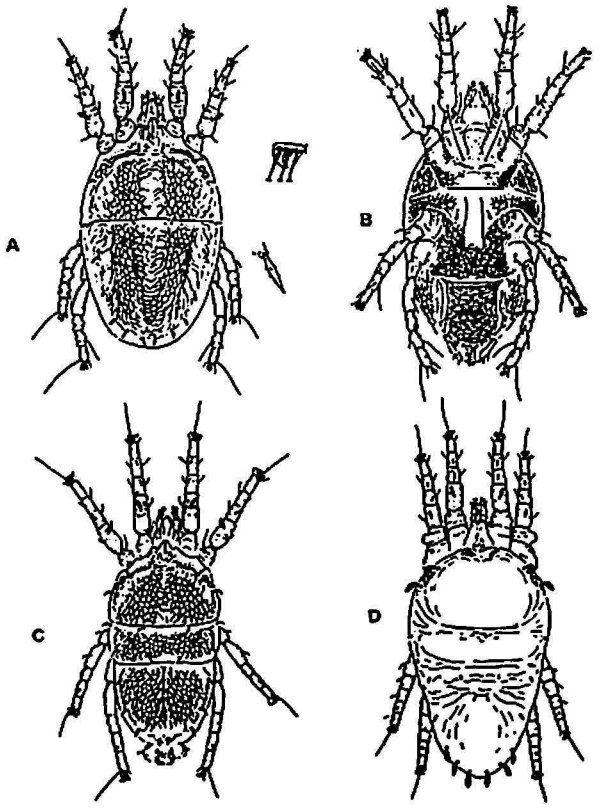


FIG. 28.—*Brevipalpus inornatus* (Banks): A, Dorsal aspect of female; B, ventral aspect of female; C, dorsal aspect of male; D, dorsal aspect of nymph. (After Pritchard and Baker, 1951).

Corozal Substation, May 18, 1955, by M. Pérez and H. L. Cromroy; on *Osmia odorata*, Cayey, June 14, 1955, by L. F. Martorell and H. L. Cromroy.

Brevipalpus inornatus (BANKS)

Tenuipalpus inornatus Banks, (*25*) 97. Cotypes: 6 females, Batesburg, S. C., on goldenrod; in the U. S. National Museum (fig. 28).

Brevipalpus inornatus (Banks) Baker, (*7*) 33; McGregor, (*158*) 13; Baker, (*8*) 358; Pritchard and Baker, (*182*) 36.

Tenuipalpus bioculatus McGregor, (*148*) 354; McGregor, (*149*) 556. Lectotype: By subsequent designation of Pritchard and Baker, 1952, female,

Batesburg, S. C., on *Liqustrum amurense*; in the U. S. National Museum.

Tenuipalpus pseudocuneatus Blanchard, (*35*) 11. Cotypes: Females, provinces of Entre Ríos, Corrientes, and Santa Fe, Argentina, on citrus; in E. E. Blanchard's personal collection.

Female.—The body is ovate. There are five dorsolateral hysterosomal setae, and rather even reticulations mediolaterally, and irregular transverse striae medially on the dorsum of the propodosoma. The dorsal setae of the body are much shorter than their longitudinal intervals. The marginal setae are short, lanceolate, and serrate. Weak hysterosomal pores are present.

Male.—The male is similar to the female and is rarely encountered.

Nymph.—The nymph resembles that of *B. phoenicis*. The third dorsal propodosomal seta and the last three dorsolateral hysterosomal setae are all similar in length, rather broadly lanceolate and serrate. The first propodosomal seta and the first two dorsolateral hysterosomal setae are shorter by one-fourth to two-thirds the length of the longer setae. The humeral seta is usually distinctly shorter than the third propodosomal seta, but it can vary from one-fourth to as long as the third propodosomal seta. The nymphal stage is subject to variation in the proportionate length of the setae.

Collected on *Salvia splendens*, Ciales-Jayuya Road, P. R., Kilometer 30.5, May 11, 1955, by L. F. Martorell.

Brevipalpus phoenicis (GEIJSKES)

Tenuipalpus phoenicis Geijskes, (*87*) 230. Cotypes: 3 females, 6 nymphs, Holland, on *Phoenix* sp.; in the Laboratorium voor Entomologie, Landbouwhoogeschool te Wageningen, Holland. (Fig. 29).

Brevipalpus phoenicis (Geijskes) Sayed, (*203*) 99; Baker, (*8*) 360; Pritchard and Baker, (*182*) 38.

Brevipalpus pseudocuneatus, Baker, (*8*) 375. Misidentification.

Brevipalpus yothersi Baker, (*8*) 373. Type: Female, Orlando, Fla., on privet; in the U. S. National Museum.

Brevipalpus mcbridei Baker, (*8*) 374. Type: Female, Orlando, Fla., on English walnut; in the U. S. National Museum.

Brevipalpus papayensis Baker, (*8*) 373. Type: Female, Oahu, T. H., on papaya; in the U. S. National Museum.

Female.—The body is ovate. There are five dorsolateral setae on the hysterosoma. The dorsum of the propodosoma has very uneven aerolae on the anterior portion of the mediolateral area. The propodosomal pores are present. The mediolateral area of the hysterosoma is striate longitudinally. The terminal segment of the palpus bears two setae and a sensory peg.

Male.—The dorsal integumentary pattern of the propodosoma is similar

to that of the female. The dorsum of the metapodosoma is irregularly striate medially and reticulate mediolaterally. The opisthosoma bears long reticulations dorsally and is evenly areolate ventrally.

Nymph.—The nymph resembles that of *inornatus.*

Collected in Puerto Rico on *Bidens cynapiifolia,* Peñón del Collao, Cayey, August 13, 1954, by L. F. Martorell; on *Erythrina* sp., Fajardo, May 4, 1955, by M. Pérez, S. Medina, and H. L. Cromroy; on *Cordia alliodora,* El

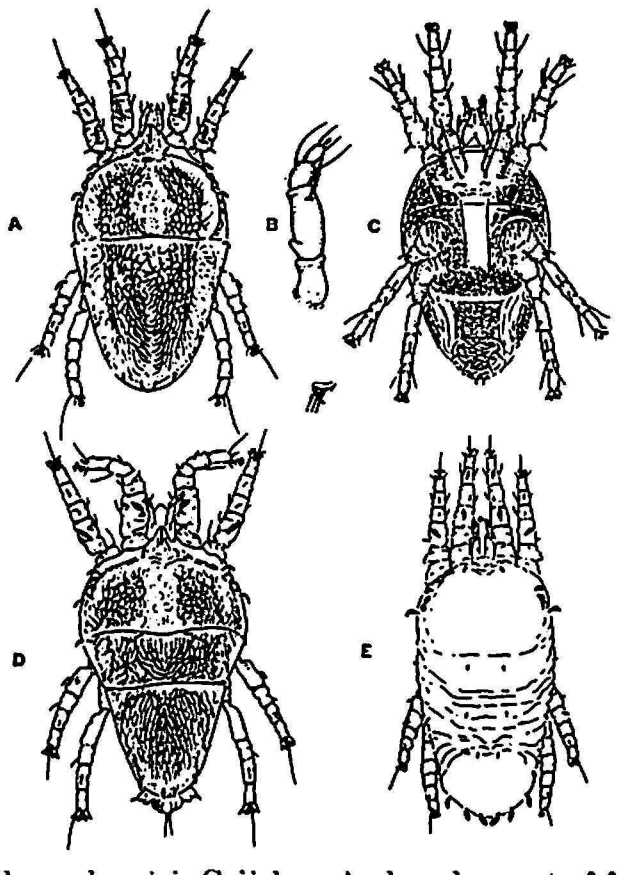


FIG. 29.—*Brevipalpus phoenicis* Geijskes: A, dorsal aspect of female; B, details of female palpus; C, ventral aspect of female; D, dorsal aspect of male; E, dorsal aspect of nymph. (After Pritchard and Baker, 1951).

Collao, Cayey-Salinas Road, June 14, 1955, by L. F. Martorell and H. L. Cromroy.

Genus Tenuipalpus DONNADIEU

Tenuipalpus Donnadieu, (*61*) 111; Vitzthum, (*222*) 49; Zacher, (*234*) 18a; Geijskes, (*87*) 20; Lawrence, (*139*) 114; Sayed, (*202*) 82, 93; Lawrence, (*140*) 47; Baker, (*7*) 33; Sayed, (*203*) 99; McGregor, (*158*) 4; Sayed, (*204*) 1016; Pritchard and Baker, (*182*) 41; Baker and Pritchard, (*13*) 317. Type of genus: *Tenuipalpus palmatus* Donnadieu, by subsequent designation of Vitzthum (*222*).

Tenuipalpus contained a heterogeneous group of mites until Baker (7) restricted it to only those species having three palpal segments together with a broad podosoma and narrow opisthosoma. De Leon's discovery of a species in Florida with a single palpal segment and no ventral rostral setae has caused the generic concept to be changed to those species with the broad podosoma and narrow opisthosoma. In general, this genus may be distinguished in that there are usually a pair of feathered setae on the venter of the rostrum; in that the anterior end of the stylophore lacks or nearly lacks transverse ribs; in that the fifth dorsolateral seta is flagelliform (lacking in one species); and in that one or both pairs of medioventral podosomals may be doubled and the anterior setae displaced to the propodosoma.

The deutonymphs of this genus are unusual in that they possess a rostral shield.

The length measurement is from anterior margin of the gnathosoma to the posterior margin of opisthosoma; the width is the greatest width of the body.

KEY TO THE PUERTO RICAN SPECIES OF *Tenuipalpus* (FEMALES)

1. Third dorsal propodosomal and third, fourth, and fifth dorsolateral hysterosomals broad and strongly serrate.....*frondosus*, n. sp.
   Third dorsal propodosomal and third, fourth, and fifth dorsolateral hysterosomals slender and setiform.....*simplychus*, n. sp.

Tenuipalpus frondosus, NEW SPECIES

Tenuipalpus frondosus (fig. 30) belongs to those species having a single pair of anterior medioventral podosomals and a single pair of posterior medioventral podosomals. It differs from other members of this group in having two sensory setae on the distal segment of the palpus of the female. It resembles *T. anoplus* Baker and Pritchard in that the third dorsal propodosomal and third, fourth, and fifth hysterosomal setae are broadly serrate, but differs in having a lateral serrate seta on tibia IV which *anoplus* lacks, as well as having the two sensory setae on the distal segment of the palpus of the female.

Female.—There are a few mediolongitudinally directed striae and many transverse striae on the propodosoma; the first and second dorsal propodosomal setae are minute; the third dorsal propodosomal setae are elongate and lanceolate-serrate. The hysterosoma has a few large, dorsal striae; dorsal pores are present; the dorsocentral setae are minute; the humeral setae are minute and lanceolate-serrate; there are six dorsolateral setae—the fifth is flagelliform, the others narrowly lanceolate, strongly serrate, and shorter than the intervals between their bases. There are a short pair

of anterior medioventral and a long pair of posterior medioventral setae on the podosoma. The opisthosoma has slender, tapering, nude ventral setae. The palpus is five-segmented; the distal segment has an elongate sensory rod and a tiny peg. The rostral shield has a pair of deeply divided median lobes and a secondary mediolateral lobe on each side. Femora I and II have serrate setae. Femora and genua IV lack dorsal and lateral setae. Tarsi I and II each has a short, slender lanceolate distal seta above

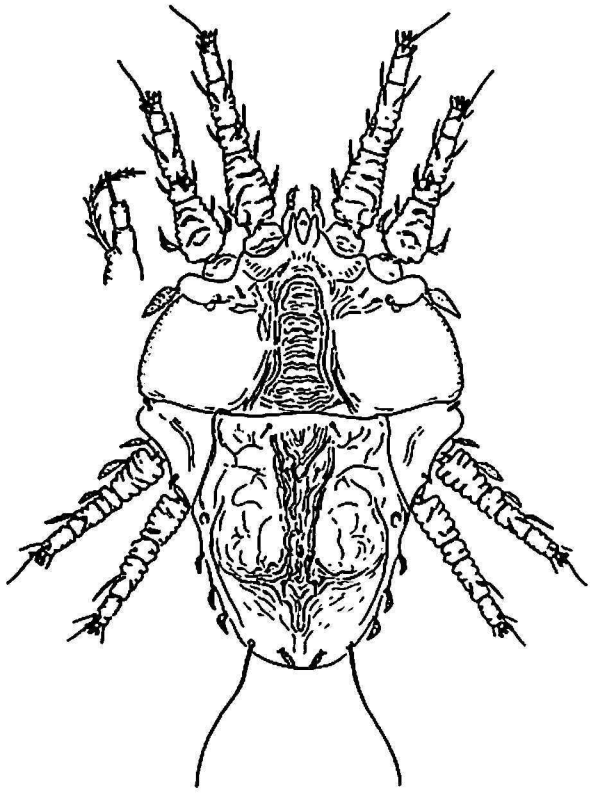


FIG. 30.—*Tenuipalpus frondosus*, n. sp.: Dorsal view of female. (Drawn by Dr. E. W. Baker).

a rodlike sensilla; tarsal appendages consist of two padlike claws and an empodium each bearing two ventral rows of tenent hairs.

Male.—No male specimens are known.

Holotype.—Female, collected on fern tree, El Yunque, P. R., April 5, 1955, by H. L. Cromroy; in collection at Department of Entomology at North Carolina State College. No other specimens taken.

Tenuipalpus simplychus NEW SPECIES

Tenuipalpus simplychus (fig. 31) belongs to that group of species having a single pair of anterior medioventral podosomal and a single pair of posterior medioventral podosomal setae. It resembles *T. knorri* Baker and Pritchard in having very slender dorsolateral hysterosomal setae, and a single sensory seta on the distal segment of the palpus of the female. *T.*

simplychus differs from *T. knorri* in that neither a dorsal nor lateral seta is present on tibia IV or genu III; the dorsum is strongly reticulated; and the third dorsal propodosomal seta is not more than twice as long as either of the first two pairs.

Female.—The dorsum of the propodosoma has many median longitudinal striae; the first and second pairs of dorsal propodosomal setae are short and setiform; the third pair are but slightly longer and are also setiform.

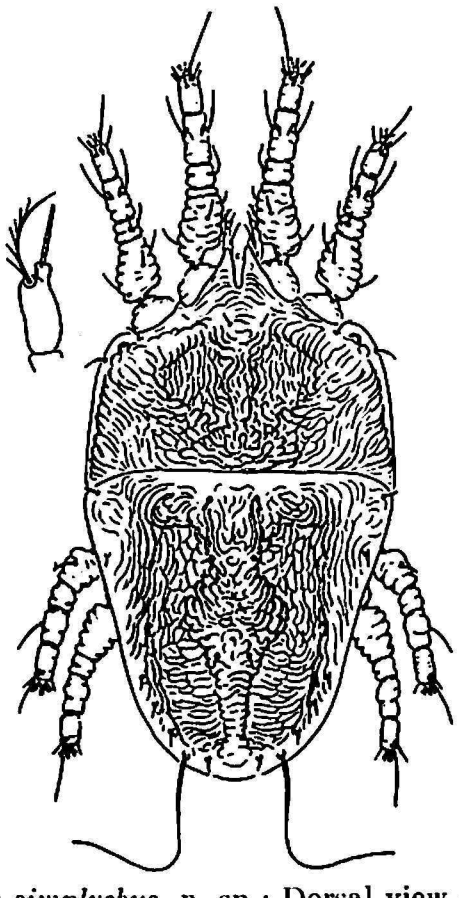


FIG. 31.—*Tenuipalpus simplychus*, n. sp.: Dorsal view of female. (Drawn by Dr. E. W. Baker).

The hysterosoma has many transverse and longitudinal striae medially and lateromedially, giving this area a reticulated appearance; dorsal pores are present; dorsocentral setae are minute; humeral setae are minute; the fourth dorsolateral setae are long, flagelliform, the other dorsolateral setae are setiform and shorter than the interval between their bases. The podosoma has a short pair of anterior medioventral and a long pair of posterior medioventral setae. The ventral opisthosomal setae are slender, tapering, and nude. There are a pair of deeply divided median lobes and a pair of mediolateral lobes on the rostral shield. The palpus is five-segmented and has a single sensory seta on the distal segment. Femora I and II have slender, simple setae of medium length. Femora IV, genua III and IV,

and tibia IV lack dorsal or lateral setae. Tarsi I and II each have a rodlike sensilla; tarsal appendages consist of two padlike claws and an empodium each bearing two ventral rows of tenent hairs. The length is 0.238–0.255 mm.; the width is 0.130–0.145 mm.

Male.—No male specimens are known.

Holotype.—Female, collected on *Cordia sulcata*, Maricao Insular Forest, P. R., April 19, 1955, by H. L. Cromroy; in collection at the Department of Entomology at North Carolina State College.

Paratypes.—Four females, collected on *Cordia sulcata*, Maricao Insular Forest, P. R., April 19, 1955, by H. L. Cromroy; in collection at the U. S. National Museum.

FAMILY TARSONEMIDAE KRAMER, 1877

Kramer (*132*) based the family Tarsonemidae upon the genus *Tarsonemus* Canestrini and Fanzago (*50*), which then included only two species. Although several species are of economic importance, little was known about the group until recently. *Tarsonemus pallidus* Banks (*20*) was the first tarsonemid to be described in the Western Hemisphere. Ewing's (*79*) revision of the species from the Western Hemisphere was the first comprehensive treatment of this family. Ewing considered the group to be of subfamily rank only. Beer's (*31*) revision of the Tarsonemidae of the Western Hemisphere listed 31 species and five genera. Three of these were new. Beer re-elevated the tarsonemids to the family rank given them by Vitzthum (*222*).

GENERAL EXTERNAL MORPHOLOGY

Tarsonemids (figs. 32–33) are very small, ranging in length from one-tenth to one-third of a millimeter. They are characterized by the pronounced development of apodemes on the ventral portion of the body. Their integument is relatively hard in the mature forms and has a shiny surface. The body is divided into three well-defined portions: The gnathosoma, the propodosoma, and the hysterosoma. The propodosoma, the area extending from the gnathosoma to behind the first two pairs of legs, is a single, more or less continuous body region which in some species has a dorsum prolonged anteriorly, forming a rostral shield. This shield is at times separated from the dorsal surface of the propodosoma by a suture. The propodosoma is divided from the hysterosoma by the main body suture which runs between the anterior and posterior pairs of legs. The mouthparts consist of stout, paired palpi of indistinct segmentation inserted on the apical portion of the gnathosoma and slender, styliform, paired chelicerae, the bases of which are inserted just medial to the bases of the palpi. Beer (*31*) considered the paired, tubelike structures which

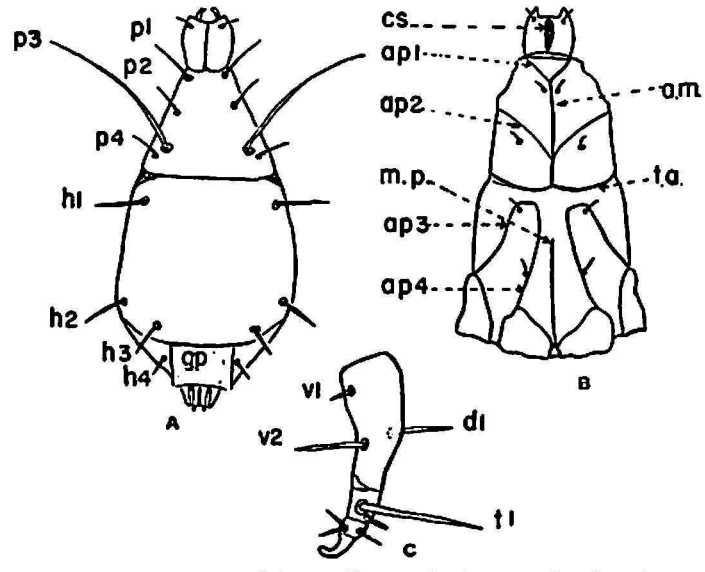


FIG. 32.—Typical male tarsonemid: A, Dorsal view of body showing nomenclature of setae; B, ventral view of body showing nomenclature of apodemes; C, enlarged view of leg IV showing nomenclature of setae. Explanation of abbreviations: p1, p2, p3, p4, Dorsal propodosomal setae; h1, h2, h3, h4, dorsal hysterosomal setae; gp, genital papilla; cs, cheliceral sheath; ap1, ap2, ap3, ap4, ventral apodemes 1, 2, 3, and 4; an, anterior median apodeme; ta, transverse apodeme; mp, posteria median apodeme; v1, first ventral femoral seta; v2, second ventral femoral seta; d1, dorsal femoral seta; t1, tactile seta of tibia.

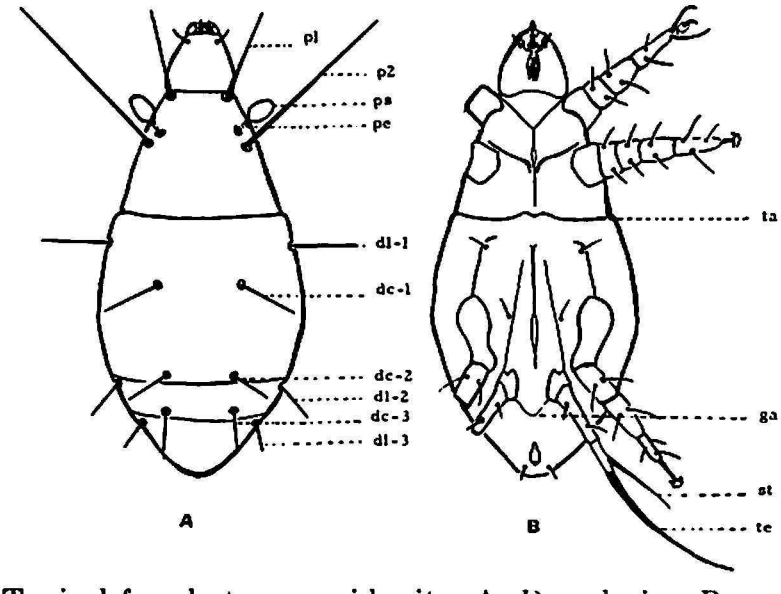


FIG. 33.—Typical female tarsonemid mite: A, Dorsal view B, ventral view. Explanation of abbreviations: p1, First dorsal propodosomal seta; p2 second dorsal propodosomal seta; ps, pseudostigmatic organ; pe, pedicel of pseudostigmatic organ; dl, dorsolateral hysterosomal seta with corresponding numbers to indicate order; dc, dorsocentral hysterosomal seta with corresponding numbers to indicate order; ta, transverse apodeme; ga, genital apodeme; st, subterminal seta of leg IV; te, terminal seta of leg IV.

are situated medially and internally in the gnathosoma as the cheliceral sheaths.

The females are characterized by possession of specialized bladderlike or clublike organs (pseudostigmatic organs) located dorsolaterally between coxae I and II. Beer (*31*) considered these structures to be highly modified sensilla trichodea and more properly referred to as specialized sense organs, since they appear to have no relation to the tracheal system. The females have six pairs of dorsal hysterosomal setae, three pairs of dorsolateral hysterosomal setae and three pairs of dorsocentral hysterosomal setae. Pronounced sexual dimorphism is characteristic. Not only are the males much smaller in size than females of the same species but also the general body contour is markedly different. The males are more bluntly shaped at the posterior end of the body. The males are equipped caudally with a unique structure which has been termed by Ewing and other authors as the genital papilla.

Tarsonemid classification has been based largely upon the distinctive characters of the fourth pair of legs of the males. The fourth pair of legs of the females end in paired whiplike setae, usually without specific characters.

BIOLOGY

Comprehensive biological studies have been conducted on only two species of tarsonemid mites. *Steneotarsonemus pallidus* (Banks) was studied by Garman (*85*), Moznette (*164*), Massee (*162*) and Smith and Goldsmith (*219*). *Hemitarsonemus latus* (Banks) was successfully reared and the results were reported by Cameron (*45*). Beer conducted some rather limited investigations into the bionomics of a few species. Generally, tarsonemid mites have four distinct stages of their life history. Eggs, which are laid singly, are white, ovoid, opaque and large in comparison to the size of the adult. The eggs hatch into the six-legged larvae which are white and opaque. The two anterior pairs of legs are situated as in the adult and the posterior pair are in the position of legs III of the adults. The mites pass from this active stage to a quiescent "pupal" stage in which transformation to the adult takes place. At the completion of the transformation to the adult the pupal skin splits dorsally and the mature individual emerges. In the tarsonemid mites parthenogenesis is common, but there appears to be some difference of opinion concerning the type of progeny resulting from this type of reproduction. Gadd (*83*) in rearing *Hemitarsonemus latus* found that the unfertilized eggs of this species produced only males, and Beer found similar results in his work on *Tarsonemus randsi* Ewing and *T. setifer* Ewing. However, Garman (*85*) found that the offspring of *Steneo-*

tarsonemus pallidus (Banks) resulting from parthenogenesis are invariably female.

KEY TO THE GENERA OF THE FAMILY TARSONEMIDAE (AFTER BEER)

1. Palpi of both sexes prolonged anteriorly forming an elongate beak ..... *Rhynchotarsonemus*
   Palpi of both sexes projecting slightly beyond apex of capitulum but never forming an elongate beak 2
2. Males without claws, empodia or knoblike arolia on tips of legs IV ..... *Xenotarsonemus*[7]
   Males with legs IV terminating in a claw or a knoblike pretarsal element 3
3. Males with body laterally compressed 4
   Males with body dorsoventrally depressed 5
4. Leg IV with three segments, coxa, femur and tibiotarsus; plant feeders ..... *Hemitarsonemus*[7]
   Leg IV of the male with four segments, coxa, femur, tibia, and tarsus; fungus feeders ..... *Fungitarsonemus*, n. gen.[7]
5. Males with large, flangelike expansion on inner margin of femur IV or if absent then fourth dorsal propodosomal seta in linear arrangement with setae of three preceding pairs of capitulum broader than long ..... *Steneotarsonemus*[7]
   Males with inner flange on femur IV absent or greatly reduced in size; fourth dorsal propodosomal seta always laterad from third seta or capitulum longer than broad ..... *Tarsonemus*[7]

The female key covers all genera, and the male keys will be found under each generic heading.

KEY TO TARSONEMID FEMALES FOUND IN PUERTO RICO

1. Transverse apodeme distinct with a single median notch 2
   Transverse apodeme distinct with two mesal notches 3
   Transverse apodeme lacking a notch or indistinct 5
2. Pedicel of pseudostigmatic organ longer than the longest diameter organ; genital apodeme V-shaped ..... *Tarsonemus gramineus*, n. sp.
   Pedicel of pseudostigmatic organ equal to the longest diameter of the organ; genital apodeme U-shaped ..... *Tarsonemus modicus*, n. sp.
3. First pair of dorsocentral hysterosomal setae three-fourths as long as first pair of dorsolateral setae ..... *Tarsonemus purpurus*, n. sp.
   First pair of dorsocentral hysterosomal setae equal to the length of first pair of dorsolateral hysterosomal setae 4
4. Second pair of dorsocentral hysterosomals equal in length to first pair

[7] Genera found in Puerto Rico.

of dorsocentrals; pedicel of pseudostigmatic organ equal to diameter of organ..... *Tarsonemus tertiapilus*, n. sp.
Second pair of dorsocentral hysterosomals two-thirds as long as first pair; pedicel of pseudostigmatic organ longer than the diameter of the organ..... *Tarsonemus labrus*, n. sp.

5. First pair of dorsocentral hysterosomal setae equal in length to second pair of dorsocentrals or shorter than the second pair..... 6
First pair of dorsocentral hysterosomals at least one and one-half times longer than the second pair of dorsocentrals..... 9
6. Second pair of dorsocentral hysterosomals one and one-half times longer than the first pair of dorsocentrals..*Steneotarsonemus martorelli*, n. sp.
First pair of dorsocentral hysterosomal setae equal to length of the second pair..... 7
7. Third pair of dorsolateral hysterosomal setae longest
Steneotarsonemus perezi, n. sp.
First pair of dorsolateral hysterosomal setae longest..... 8
8. Pseudostigmatic organ elliptically shaped, twice as long as broad
Xenotarsonemus cadeae, n. sp.
Pseudostigmatic organ ovate, as broad as it is long
Tarsonemus rotundus, n. sp.
9. First pair of dorsal propodosomal setae one and one-half times longer than the second pair.....*Hemitarsonemus latus* (Banks)
Second pair of dorsal propodosomal setae twice the length of the first pair.....*Tarsonemus prominens*, n. sp.

Genus Tarsonemus CANESTRINI AND FANZAGO

Tarsonemus Canestrini and Fanzago, (*50*) 142; Kramer, (*132*) 215; Canestrini and Berlese, (*49*) vol. 9; Canestrini, (*50*) 313; Berlese, (*32*) No. 1–2; Sicher and Leonardi, (*208*) 183; Banks, (*20*) 294; Banks, (*21*) 273; Ewing, (*71*) 37; Banks, (*25*) 96; Quayle, (*187*) 503; Quaintance, (*186*) 103; Rutherford, (*201*) 490; Banks, (*26*) 55; Banks, (*27*) 104; Oudemans, (*171*) 76; Ewing, (*73*) 497; Harada, (*93*) 251; Oudemans, (*172*) 67; Oudemans, (*173*) XXXV; Vitzthum, (*221*) 281; Oudemans, (*174*) 421; Vitzthum, (*222*) 40; Vitzthum, (*223*) 97; Ewing, (*77*) 36; Ewing, (*78*) 31; Putoni, (*185*) 359; Massee, (*160*) 198; Oudemans, (*179*) V; Ewing, (*79*) 10; Cooreman, (*56*) 1; McGregor, (*156*) 270; Hughes, (*103*) 80; Beer, (*31*) 1114. Type of genus: *Chironemus minusculus* Canestrini and Fanzago by original designation.

Chironemus Canestrini and Fanzago (not Cuvier 1829, Pisces), (*50*) 110; Ewing, (*79*) 10. Monotypic genotype: *Chironemus minusculus* C. and F.

Dendroptus Kramer, (*131*) 28; Ewing, (*79*) 11. Genotype: *Dendroptus kirchneri* Kramer by original designation.

Cheylurus Trouessart, (*219*) 90; Canestrini, (*46*) 311; Berlese, (*32*) No. 1; Ewing, (*79*) 11. Genotype: *Cheylurus socialis* Trouessart by original designation.

This genus is characterized by a subcordate gnathosoma. The fourth dorsal propodosomal seta is laterad to the third dorsal propodosomal seta; the fourth pair of dorsal propodosomal setae is never in a linear arrangement with the three anterior pairs. The inner margins of femora IV of the males are generally simple and are not produced into either a flangelike enlargement or a spurlike process. Leg IV of the male always has a terminal claw. The first pair of ventral propodosomal setae of the females is always posterior to apodemes I. This genus is composed of fungus or alga feeders showing little host preference.

The measurements given for each species were taken as follows:

1. Male body length—from the anterior margin of the gnathosoma to the posterior margin of the genital papilla.

2. Female body length—the anterior margin of the gnathosoma to the posterior margin of the hysterosoma.

3. Male and female body width—the greatest width of the body.

The following key is an exception to the general presentation in that it is for the Western Hemisphere rather than the Island of Puerto Rico alone.

KEY TO THE MALES OF THE GENUS *Tarsonemus* FOR THE WESTERN HEMISPHERE

1. Femur IV angulate at its base 2
   Femur IV nonangulate at its base 10
2(1). Dorsal seta of femur IV equal to or greater in length than second ventral seta 3
   Second ventral seta of femur IV conspicuously longer than the dorsal femoral seta 7
3(2). First pair of dorsal propodosomals conspicuously longer than the fourth pair 4
   First pair of dorsal propodosomals equal to the length of the fourth pair 5
4(3). First pair of dorsal hysterosomals longer than the second pair; inner margin of femur IV with sharp projection at proximal end *prominens*, n. sp.[7]
   First pair of dorsal hysterosomal setae equal in length to the second pair; inner margin of femur IV smooth ..... *confusus* Ewing
5(3). Second pair of dorsal propodosomals approximately equal in length to the first pair ..... *occidentalis* Ewing
   First pair of dorsal propodosomals one and one-half times or more longer than the second pair 6

6(5). First pair of dorsal hysterosomals longer than the second pair *scaurus* Ewing

First pair of dorsal hysterosomals equal in length to second pair *modicus*, n. sp.[7]

7(2). Second pair of hysterosomal setae are longest pair *cryptocephalus* (Ewing)

Third pair of hysterosomal setae are longest pair. . *tertiapilus*, n. sp.[7]

First pair of dorsal hysterosomal setae are longest pair, or first, second and third pair of hysterosomal setae equal in length.... 8

8(7). First pair of dorsal propodosomal setae longer than the fourth pair.....*gramineus*, n. sp.[7]

First pair of dorsal propodosomal setae equal in length to the fourth pair..... 9

9(8). First pair of dorsal hysterosomal setae longer than second pair *labrus*, n. sp.[7]

Second pair of dorsal hysterosomals approximately equal in length to the first pair.....*rotundus*, n. sp.[7]

10(1). Femur IV with flange..... 11

Femur IV lacking flange..... 13

11(10). Tactile seta of tibia IV longer than leg IV.....*rebros*, n. sp.[7]

Tactile seta of tibia IV shorter than leg IV..... 12

12(11). First pair of dorsal propodosomal setae longer than the fourth pair; first pair of dorsal hysterosomals longest pair; second ventral seta of femur IV longer than the dorsal femoral seta. .*dispar* Beer

First pair of dorsal propodosomals equal in length to the fourth pair; second pair of dorsal hysterosomals equal in length to the third pair and both are longer than the first or fourth pair; dorsal seta of femur IV equal in length to the second femoral seta *sulcatus* Beer

First pair of dorsal propodosomals shorter than the fourth pair; second pair of dorsal propodosomals equal in length to third pair and both are longer than the first or fourth pair; second ventral seta of femur IV longer than the dorsal femoral seta *laminifer* Ewing

13(10). Third pair of dorsal hysterosomal setae are longest pair *smithi* Ewing

First pair of dorsal hysterosomal setae longest pair..... 14

Second pair of dorsal hysterosomal setae is longest pair..... 18

14(13). First pair of dorsal propodosomal seta longer than fourth pair.. 15

First pair of dorsal propodosomal setae equal in length to fourth pair..... 16

First pair of dorsal propodosomal setae shorter than fourth pair
17

15(4). Tactile seta of tibia IV longer than leg IV.....*texanus* Ewing
Tactile seta of tibia IV shorter than femur IV....*randsi* Ewing

16(14). Tactile seta of tibia IV longer than leg IV; second ventral seta of femur IV longer than dorsal femoral seta....*pritchardi* Beer
Tactile seta of tibia IV shorter than leg IV; dorsal seta of femur IV longer than second ventral femoral seta.....*unguis* Ewing

17(14). Tactile seta of tibia IV longer than leg IV; second ventral seta of femur IV longer than the dorsal femoral seta....*simplex* Ewing
Tactile seta of tibia IV shorter than leg IV; dorsal seta of femur IV longer than second ventral femoral seta.....*wailei* Banks

18(13). Third pair of dorsal propodosomals over twice as long as fourth pair; tactile seta of tibia IV longer than leg IV....*setifer* Ewing
Fourth pair of dorsal propodosomals longer than the third pair; tactile seta of tibia IV shorter than leg IV.....*purpurus*, n. sp.[7]

Tarsonemus gramineus, NEW SPECIES

The male of *Tarsonemus gramineus* (fig. 34) is similar to the male of *T. scaurus* Ewing on the basis of general body shape and the angulation of femur IV at its base. The long second ventral seta of femur IV of *T. gramineus* readily distinguishes the two, for males of *T. scaurus* have the second ventral seta of femur IV approximately equal to the dorsal femoral seta. In addition, there is a long, lanceolate seta on tarsus I of the male *T. scaurus*; whereas, there is a broad spatulate seta on tarsus I of the *gramineus* male. There is a single median notch in the transverse apodeme of the female of *T. gramineus*; whereas, *T. scaurus* has none.

Female.—The body is elongate, oval and widest at the level of coxae III. The transverse apodeme is distinct and has a single median notch; the genital apodeme between coxae IV has a widened V-shape. The pseudostigmatic organs are oval with the apices flattened; the pedicel is longer than the longest diameter of the organ. The first pair of dorsal propodosomal setae is one-third as long as the second propodosomals. The first pair of dorsolateral hysterosomal setae is subequal in length to the first pair of dorsal propodosomal setae and one and one-half times longer than any of the rest of the dorsal hysterosomal setae. The second pair of dorsolateral setae is half as long as the first pair of dorsolaterals; the third pair of dorsolaterals is equal in length to the first pair of dorsocentral setae. The terminal seta of tarsus IV is twice the length of the subterminal seta. The length is 0.198–0.222 mm.; the width is 0.105–0.125 mm.

Male.—The body is oval and widest at the level of coxae III. Apodemes III and IV are conspicuous and well defined. Apodeme III is joined to

apodeme IV anteriorly and apodeme IV is joined to the posterior median apodeme. The first pair of dorsal propodosomal setae is one and one-half times longer than the second pair. The third pair of dorsal propodosomals is over twice as long as the first pair; the fourth pair of dorsal propodosomal setae is almost three-fourths as long as the first pair of dorsal propodosomals. The first pair of dorsal hysterosomal setae is equal to the length of the first pair of dorsal propodosomals; the first pair of dorsal hysterosomals is one and one-half times longer than the second pair. The third pair of dorsal hysterosomals is slightly longer than the second pair. The fourth pair is one-half as long as the first pair of hysterosomals. There is a

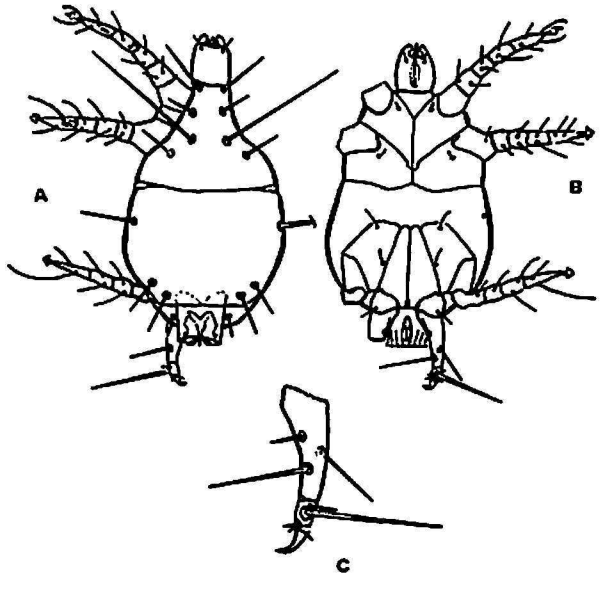


FIG. 34.—*Tarsonemus gramineus*, n. sp.: A, Dorsal aspect of male; B, ventral aspect of male; C, enlarged view of leg IV of male.

large, clavate, annulated seta on tarsus I. Femur IV is angulate at base and has three setae, the second ventral seta is one and one-half times longer than the dorsal seta, the first ventral seta is one-third as long as second ventral seta. The tactile seta of tibia IV is longer than femur IV. The claw is long and acuminate. The length is 0.132–0.137 mm.; the width is 0.072–0.078 mm.

Holotype.—Male, collected on *Paspalum paniculatum* Agricultural Experiment Station, Río Piedras, P. R., June 8, 1955, by G. Rivera and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—One male and nine females, collected on *Paspalum paniculatum*, Agricultural Experiment Station, Río Piedras, P. R., June 8, 1955, by G. Rivera and H. L. Cromroy; in collection in the U. S. National Museum.

Tarsonemus labrus, NEW SPECIES

The male of *Tarsonemus labrus* (fig. 35) bears a resemblance to the male of *T. occidentalis* Ewing in general body shape and the angulation of the base of femur IV. It can be differentiated from the latter on the basis of comparative lengths of the femoral setae of femur IV. The second ventral seta of *labrus* is the longest femoral seta while the dorsal seta is longest in *occidentalis*. In addition, the first and second dorsal propodosomals are almost equal in length in *occidentalis*; whereas, in *labrus* the first propodo-

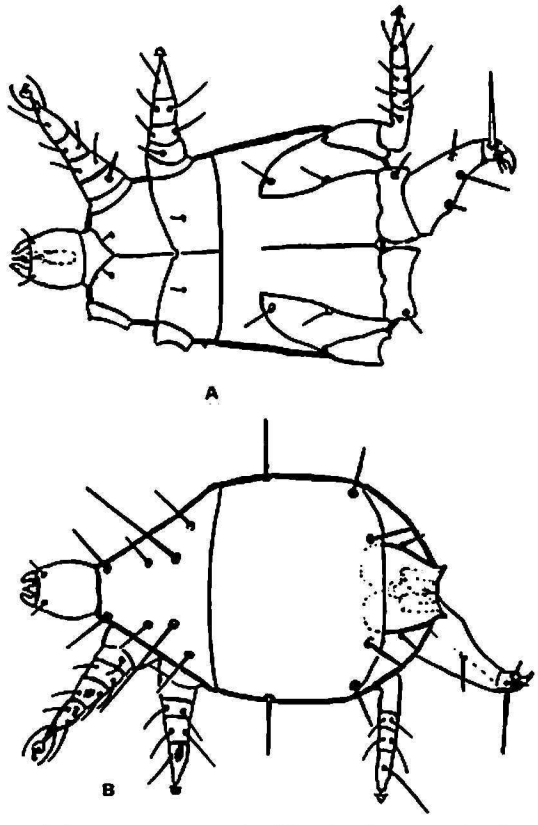


FIG. 35.—*Tarsonemus labrus*, n. sp.: A, Ventral aspect of male; B, dorsal aspect of male.

somal is one and one-half times longer than the second. There are two mesal notches in the transverse apodeme of the female of *labrus* and no notches in the *occidentalis* female.

Female.—The body is ovate and widest at the level of coxae III. The transverse apodeme is distinct with two mesal notches; the genital apodeme is a widened V-shaped structure. The pseudostigmatic organs are oval with pedicels longer than the diameter of the organs. The first pair of dorsal propodosomal setae is one-third as long as the second pair of dorsal propodosomals. The first pair of dorsolateral hysterosomals and the first pair of dorsocentral hysterosomals are equal in length and at least one and one-half times longer than any of the other hysterosomal setae. The second pair of dorsolateral setae is less than one-half as long as the first pair of

dorsolaterals; the third pair is two-thirds the length of the first pair of dorsolaterals. The second pair of dorsocentral setae is two-thirds the length of the first pair of dorsolateral setae; the third pair of dorsocentrals is equal in length to the second pair. The terminal seta of tarsus IV is twice as long as the subterminal seta. The length is 0.130–0.158 mm. The width is 0.078–0.102 mm.

Male.—The body is oval and widest at the level of coxae III. Apodemes III and IV are well-defined; apodeme III is joined to apodeme IV anteriorly. The first pair of dorsal propodosomal setae is one and one-half times longer than the second pair; the third pair of dorsal propodosomals is twice as long as the first pair; the fourth pair of dorsal propodosomal setae is approximately equal in length to the first pair. The first pair of dorsal hysterosomals is equal to the length of the first pair of dorsal propodosomals, and is one and one-fourth times longer than the second pair of dorsal hysterosomal setae. The third pair of dorsal hysterosomals is equal to the length of the second pair of hysterosomals; the fourth pair is one-half as long as the first pair of dorsal hysterosomal setae. There is a small, annulated, spatulate seta on tarsus I. Femur IV is angulate at the base; there are three setae, the second ventral seta being one and one-half times longer than the dorsal seta, and the first ventral seta one-half as long as the second ventral seta. The tactile seta of the tibia is shorter than the femur; the claw is very stout and tapers sharply at tip. The length is 0.130 mm.; the width is 0.075 mm.

Holotype.—Male, collected on *Artocarpus communis*, Agricultural Experiment Station, Río Piedras, P. R., June 8, 1955, by H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Eleven females, collected on *Artocarpus communis*, Agricultural Experiment Station, Río Piedras, P. R., June 8, 1955, by H. L Cromroy; in collection at the U. S. National Museum.

Tarsonemus modicus, NEW SPECIES

Tarsonemus modicus (fig. 36) resembles *T. scaurus* Ewing, but is separated from the latter by the comparative lengths of the first and second pairs of dorsal hysterosomal setae in the males. The first pair is equal in length to the second pair in *T. modicus*, while in *T. scaurus* the first pair is one and one-half times longer than the second pair. There is a median notch in the transverse apodeme of the female of *T. modicus*, while the notch is absent in the *scaurus* female.

Female.—The body is oval and widest at a level just below the transverse apodeme. The transverse apodeme is distinct with a single median notch; the genital apodeme is a broad, U-shape. The pseudostigmatic organ is ovate with a flattened apex and an acuminate base; the pedicel is equal

to the diameter of the organ. The first pair of dorsal propodosomal setae is one-third as long as the second dorsal propodosomal setae. The first pair of dorsolateral hysterosomals is the longest of the hysterosomal setae. The second pair of dorsolaterals is one-half as long as the first pair of dorsolaterals; the third pair of dorsolateral setae is two-thirds the length of first pair of dorsolateral setae. The first pair of dorsocentral setae is subequal in length to the first pair of dorsolaterals. The second pair of dorsocentrals is two-thirds as long as the first pair; the third pair is equal in length to the first pair. The subterminal seta of tarsus IV is one-half as long as the terminal seta. The length is 0.160–0.185 mm.; the width is 0.098–0.122 mm.

Male.—The body is oval and widest at a level just above coxae III.

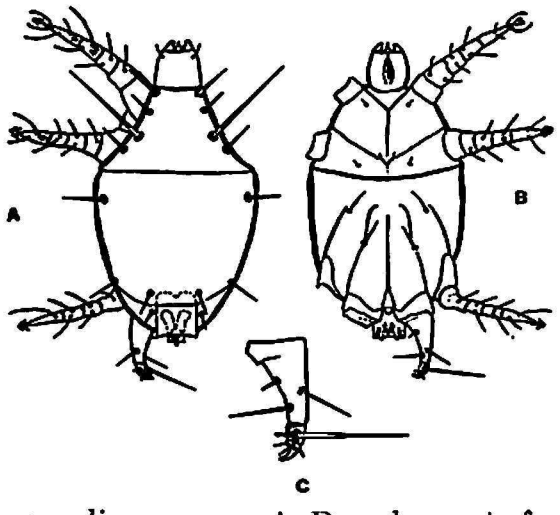


FIG. 36.—*Tarsonemus modicus*, n. sp.: A, Dorsal aspect of male; B, ventral aspect of male; C, enlarged view of leg IV of male.

Apodemes III and IV are conspicuous and well-defined. The first pair of dorsal propodosomal setae is one and one-half times longer than the second pair; the third pair is over two and one-half times longer than the first pair; the fourth pair of dorsal propodosomals is subequal in length to the first pair. The first pair of dorsal hysterosomals is slightly shorter than the first pair of dorsal propodosomals and equal in length to the second pair of dorsal hysterosomal setae. The third pair of hysterosomals is three-fourths as long as the first pair; the fourth pair of hysterosomal setae is one-half as long as the first pair. There is a small, annulated, spatulate seta on tarsus I. Femus IV is angulate at its base; there are three setae; the dorsal seta is subequal in length to the second ventral seta, the first ventral seta is one-fourth as long as the second ventral seta. The tactile seta of the tibia is longer than the femur, but shorter than the leg. The claw is small and acuminate. The length is 0.122 mm.; the width is 0.072 mm.

Holotype.—Male, collected on *Bixa orellana*, Cayey, P. R., June 14,

1955, by L. F. Martorell and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Eight females, collected on *Bixa orellana*, Cayey, P. R., June 14, 1955, by L. F. Martorell and H. L. Cromroy; in collection at the U. S. National Museum.

Tarsonemus prominens, NEW SPECIES

The male of *Tarsonemus prominens* (fig. 37) is similar to that of *T. confusus* Ewing in most respects, but possesses a projection on the inner margin of femur IV. In addition, the first pair of dorsal hysterosomal seta

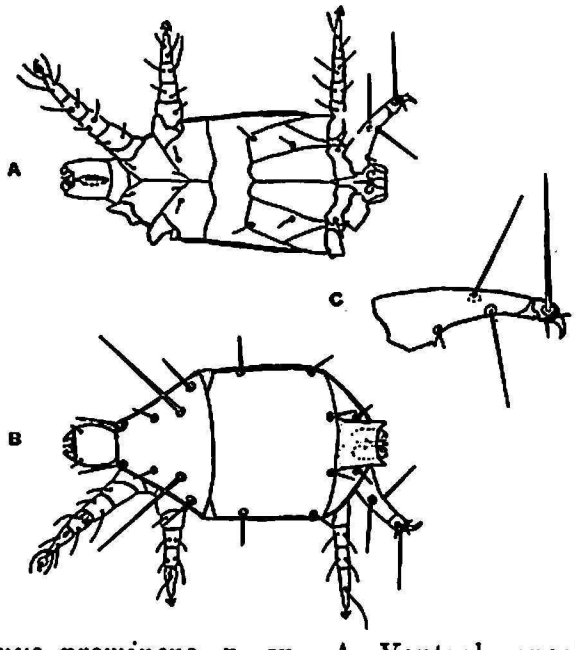


FIG. 37.—*Tarsonemus prominens*, n. sp.: A, Ventral aspect of male; B, dorsal aspect of male; C, enlarged view of leg IV of male.

in *prominens* is longer than the second pair; whereas, in *confusus* the first pair is equal in length to the second pair. There are two distinctive notches in the transverse apodeme of the female of *T. confusus*, while only one is present in *prominens*.

Female.—The body is ovate and widest at the level below the transverse apodeme. The transverse apodeme is distinct and slightly emarginate in the center; the genital apodeme is widely rounded. The pseudostigmatic organ is globose, and the pedicel is shorter than the diameter of the organ. The first pair of dorsal propodosomal setae is one-half as long as the second pair. The first pair of dorsolateral hysterosomal setae is longer than any of the other pairs. The second and third pairs of dorsolaterals are equal in length and are one-half as long as the first pair of dorsolaterals. The first pair of dorsocentral hysterosomals is three-fourths as long as the first pair of dorsolaterals. The second and third pairs of dorsocentrals are equal

in length and are one-half as long as the first pair of dorsolaterals. The terminal seta of tarsus IV is twice as long as the subterminal seta. The length is 0.160 mm.; the width is 0.100 mm.

Male.—The body is roughly oval and widest at the level of coxae III. Apodemes III and IV are well-defined; apodeme III is joined to apodeme IV anteriorly; apodeme IV is joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is twice as long as the second pair; the third pair is over twice as long as the first pair; the fourth pair is subequal in length to the first pair of setae. The first pair of dorsal hysterosomal setae is one and one-half times longer than the second pair. The third pair is equal in length to the second pair; the fourth pair of hysterosomals is one-half as long as the first pair. There is a broad, lanceolate, annulated seta on tarsus I. Femur IV is angulate at its base, with a spur on the inner margin located one-third of the length of the femur from base. There are three femoral setae; the first ventral seta is one-seventh as long as the dorsal seta; the dorsal seta is one and one-fourth times longer than the second ventral seta. The tactile seta of the tibia is subequal to the length of the femur. The claw is large and acuminate. The length is 0.120 mm.; the width is 0.062 mm.

Holotype.—Male, collected on golden dwarf palm of Sumatra, Río Piedras, P. R., April 14, 1955, by H. L. Cromroy; in collection at Department of Entomology, North Carolina State College.

Allotype.—Female, collected on golden dwarf palm of Sumatra, Río Piedras, P. R., April 14, 1955, by H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Tarsonemus purpurus, NEW SPECIES

Tarsonemus purpurus (fig. 38), although closely resembling *T. setifer* Ewing, is easily differentiated from *setifer* by several morphological characters. The males are distinguished by the short tactile setae of tibia IV in *T. purpurus* contrasted with the long tactile setae of *setifer* and the comparative lengths of the third pair of dorsal propodosomals to the fourth pair. In addition to the characters indicated in the key, the male of *T. purpurus* further differs from *T. setifer* in the type of seta on tarsus I, *purpurus* having a long, lanceolate annulated seta and *setifer* a clavate, annulated seta. The females of the two species can be most easily distinguished by the shape of the transverse apodemes. There are two mesal notches in the apodeme of *T. purpurus* and none in that of *T. setifer*.

Female.—The body is oval and widest at the level of coxae III. The transverse apodeme is distinct in having two mesal notches; the genital apodeme is U-shaped. The pseudostigmatic organ is ovate with a flattened apex and a pedicel shorter than the diameter of the organ. The second

pair of dorsal propodosomals is two and one-half times longer than the first pair. The first pair of dorsolateral hysterosomals is the longest pair of dorsal hysterosomal setae. The second pair of dorsolaterals is one-half as long as the first pair. The third pair of dorsolaterals is longer than the second pair and two-thirds as long as the first pair. The first pair of doroscentrals is three-fourths as long as the first pair of dorsolaterals. The second pair and third pair of dorsocentral hysterosomals are equal in length and are one-half as long as the first pair of dorsolaterals. The terminal seta of tarsus IV is one and one-half times longer than the subterminal seta. The length is 0.135–0.162 mm.; the width is 0.080–0.090 mm.

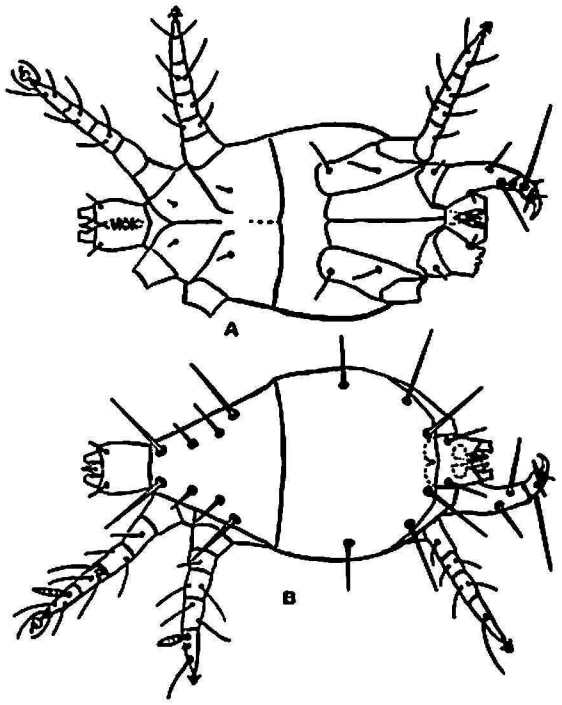


FIG. 38.—*Tarsonemus purpurus*, n. sp.: A, Ventral aspect of male; B, dorsal aspect of male.

Male.—The body is roughly oval and widest at the level above coxae III. Apodemes III and IV are conspicuous and well-defined; apodeme III is joined anteriorly to apodeme IV, and apodeme IV is joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is three times as long as the second pair; the third pair of propodosomals is one-half as long as the first pair. The fourth pair is one and one-half times longer than the third pair and is subequal in length to the first pair of dorsal propodosomal setae. The first pair of dorsal propodosomals is one and one-half times longer than the first pair of dorsal hysterosomal setae. The second pair of dorsal hysterosomals is one and one-half times longer than the first pair of dorsal hysterosomals; the third pair is equal in length to the second pair; and the fourth pair of hysteroso-

mals is subequal in length to the first pair. There is a long, lanceolate annulated seta on tarsus I. Femur IV is nonangulate at its base. There are three femoral setae; the first ventral seta is one-third as long as the dorsal seta and the second ventral seta is one and one-half times longer than the dorsal seta. The tactile seta of the tibia is as long as the femur. The claw is long and acuminate. The length is 0.120–0.150 mm.; the width is 0.052–0.078 mm.

Holotype.—Male, collected on *Rapanea ferruginea*, Comerío-Barrio Palomas, P. R., altitude of 2,000 feet; August 11, 1954, by H. L. Cromroy; in collection at Department of Entomology, North Carolina State College.

Paratypes.—Collected in Puerto Rico on *Rapanea ferruginea*, one male and three females, Comerío-Barrio Palomas, altitude of 2,000 feet, August 11, 1954; two females in Maricao Insular Forest, altitude of 2,300 feet,

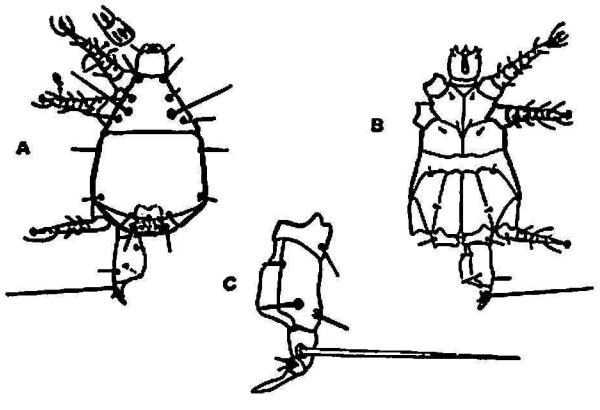


FIG. 39.—*Tarsonemus rebros*, n. sp.: A, Dorsal aspect of male; B, ventral aspect of male; C, enlarged view of leg IV of male.

August 17, 1954; two males and three females in Río Abajo Forest, Utuado, March 24, 1955, by H. L. Cromroy; all slides are in collection at the U. S. National Museum.

Tarsonemus rebros, NEW SPECIES

In general appearance the male of *Tarsonemus rebros* (fig. 39) resembles the male of *T. waitei* Banks, but is easily separated from *waitei* in having a flange on femur IV.

Male.—The body is slender and elliptical. Apodemes III and IV are distinct; apodeme III is joined anteriorly to apodeme IV, and apodeme IV is joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is twice as long as the second pair. The third pair of propodosomals is twice as long as the first pair. The fourth pair of propodosomals is equal in length to the first pair. The first pair of dorsal hysterosomals is equal in length to the first pair of dorsal propodosomal setae. The second pair of dorsal hysterosomals is equal in length to the

third pair, and both pairs are three-fourths as long as the first pair. The fourth pair of dorsal hysterosomals is equal in length to the first pair. There is a small, clavate, annulated seta on tarsus I. Femur IV is non-angulate at the base; there is a flange extending the length of the inner margin of the femur; there are three femoral setae; the dorsal seta being twice as long as the first ventral seta; the second ventral seta is equal in length to the dorsal seta. The tactile seta of tibia IV is longer than the leg. The claw is long and slender. The length is 0.098–0.102 mm.; the width is 0.048–0.052 mm.

Holotype.—Male, collected on *Alchornea latifolia*, Maricao insular Forest,

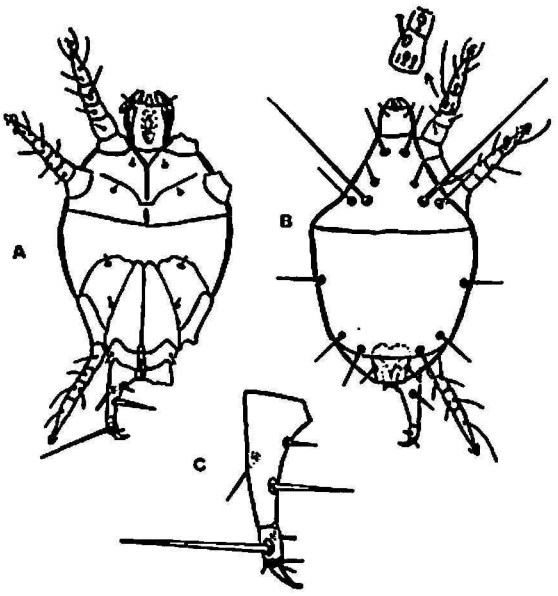


FIG. 40.—*Tarsonemus rotundus*, n. sp.: A, Ventral aspect of male; B, dorsal aspect of male; C, enlarged view of leg IV of male.

P. R., April 20, 1955, by M. Pérez, G. N. Wolcott, and H. L. Cromroy; in collection at U. S. National Museum.

Tarsonemus rotundus, NEW SPECIES

The male of *Tarsonemus rotundus* (fig. 40) is similar to *T. scaurus* Ewing in general body shape and the angulation of femur IV. However, the long second ventral seta of femur IV and the equal length of the first, second and third pairs of dorsal hysterosomal setae distinguish the male of *T. rotundus* from the closely related species. The female of the species can be separated most easily from the female of *T. scaurus* on the character of the transverse apodeme. The apodeme of *T. scaurus* is indistinct mesially; whereas, the apodeme of *T. rotundus* is distinct for its entire length.

Female.—The body is roughly oval and widest at coxae III. The transverse apodeme is distinct and evenly rounded; the genital apodeme is

U-shaped. The pseudostigmatic organ is oval-shaped with a flattened apex and a pedicel shorter than the diameter of the organ. The first pair of dorsal propodosomal setae is one-third as long as the second pair of prodosomals. The first pair of dorsolateral hysterosomal setae is one and one-third times longer than the second and third pairs of dorsolaterals; the second pair of dorsolaterals is equal in length to the third pair. The first, second and third pairs of dorsocentral hysterosomals are approximately equal in length and are one-half as long as the first pair of dorsolateral hysterosomals. The terminal seta of tarsus IV is twice as long as the subterminal seta. The length is 0.152–0.165 mm.; the width is 0.082–0.095 mm.

Male.—The body is roughly oval and widest at the transverse suture. Apodemes III and IV are conspicuous and well-defined; apodeme III is joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is twice as long as the second pair. The third pair of dorsal propodosomals is three times longer than the first pair. The fourth pair of dorsal propodosomals is approximately equal in length to the first pair. The first pair of dorsal hysterosomals is three-fourths as long as the first pair of dorsal propodosomal setae. The second pair of dorsal hysterosomals is equal in length to the first pair and the third pair of hysterosomal setae. The fourth pair of dorsal hysterosomal setae is one-half as long as the first pair of hysterosomals. There is a small annulated, clavate seta on tarsus I. Femur IV is angulate at the base, with three femoral setae; the first ventral seta is one-fifth as long as the second ventral seta; the dorsal seta is two-thirds as long as the second ventral seta. The tactile seta of tibia IV is as long as the femur. The claw is elongate and slender. The length is 0.110 mm.; the width is 0.067 mm.

Holotype.—Male, collected on *Pterocarpus* sp., El Verde, P. R., May 20, 1955, by M. Pérez and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Four females, collected on *Pterocarpus* sp., El Verde, P. R., May 20, 1955, by M. Pérez and H. L. Cromroy; in collection at the U. S. National Museum.

Tarsonemus tertiapilus, NEW SPECIES

The male of *Tarsonemus tertiapilus* (fig. 41) resembles the male of *T. cryptocephalus* (Ewing), but the two are distinguished on differences in comparative lengths of dorsal hysterosomal setae. There are two mesal notches in the transverse apodeme of the female of *T. tertiapilus*; these are lacking in the female of *T. cryptocephalus*.

Female.—The body is oval and widest at the level of coxae III. The transverse apodeme is distinct with two mesal notches; the genital apodeme is indistinct, being wide and U-shaped. The pseudostigmatic organ is ovate

with a pedicel as long as the diameter of the organ. There are two pairs of dorsal propodosomal setae; the first pair is one-half as long as the second pair. The first pair of dorsolateral hysterosomal setae is one and one-half times longer than the second pair of dorsolaterals. The second pair of dorsolaterals is equal in length to the third pair of dorsolaterals. The first pair of dorsocentral hysterosomal setae is equal in length to the first pair of dorsolateral hysterosomals. The second pair of dorsocentrals is equal in length to the first pair of dorsocentrals. The third pair of dorsocentral hysterosomals is four-fifths as long as the first pair of dorsocentrals. The terminal seta of tarsus IV is over twice as long as the subterminal seta. The length is 0.095–0.108 mm.; the width is 0.072–0.090 mm.

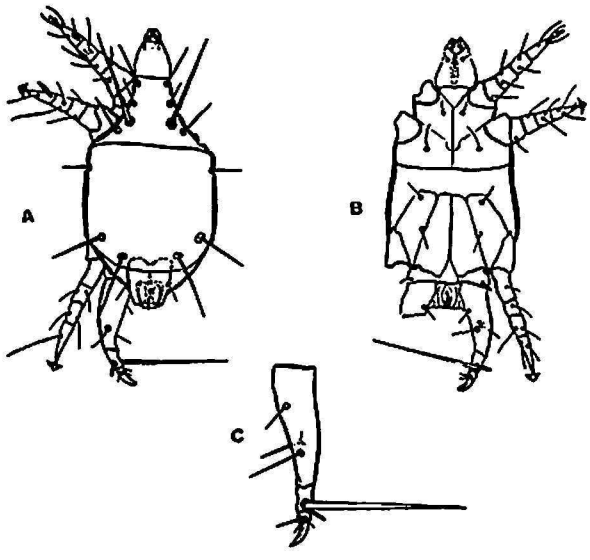


FIG. 41.—*Tarsonemus tertiapilus*, n. sp.: A, Dorsal aspect of male; B, ventral aspect of male; C, enlarged view of leg IV of male.

Male.—The body is roughly oval and widest at the level of coxae III. Apodemes III and IV are conspicuous and well-defined; apodeme III is joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is twice as long as the second pair. The third pair of propodosomals is one and one-half times longer than the first pair; the fourth pair is subequal in length to the first pair. The first pair of dorsal hysterosomal setae is two-thirds as long as the first pair of dorsal propodosomals. The second pair of dorsal hysterosomals is one and one-half times longer than the first pair. The third pair of hysterosomals is twice as long as the first pair. The fourth pair of dorsal hysterosomals is one-half as long as the first pair of hysterosomals. There is an annulated, spatulate seta on tarsus I. Femur IV is angulate at the base; there are three femoral setae, the first ventral seta is one-half as long as the second ventral seta; the dorsal seta is two-thirds as long as the second ventral seta. The tactile

seta of tibia IV is slightly shorter than the leg. The claw is long and broad and tapers acutely at the tip. The length is 0.130 mm.; the width is 0.078 mm.

Holotype.—Male, collected on *Elaeis guineensis*, Agricultural Experiment Station, Río Piedras, P. R., June 7, 1955, by W. Pennock and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Four females, collected on *Elaeis guineensis*, Agricultural Experiment Station, Río Piedras, P. R., June 7, 1955, by W. Pennock and H. L. Cromroy; in collection at the U. S. National Museum.

Genus Steneotarsonemus BEER

Steneotarsonemus Beer, (*31*) 1229. Type of genus: *Steneotarsonemus hyaleos* Beer, by original designation.

The characters of this genus are as follows: The males, with one exception, have the dorsal propodosomal setae in linear arrangement, the usual number being four pairs. Femora IV usually have the inner margins highly modified to form a flangelike process, and never with a spurlike projection. The transverse apodeme of the females is indistinct near the main body suture. The body is often elongate, with the anterior pairs of legs widely separated from the posterior pairs of legs. The capitulum of the female and the male is similar and usually as broad as or broader than long. The members of this genus are phytophagous. The key below is a revision of Beer's work (*31*).

KEY TO THE MALES OF THE GENUS *Steneotarsonemus* FOR THE WESTERN HEMISPHERE

1. With three pairs of dorsal propodosomal setae. . . . *phyllophorus* (Ewing)
   With four pairs of dorsal propodosomal setae. 2
2. Fourth pair of dorsal propodosomals the longest. . . . . *hyaleos* Beer
   Third pair of dorsal propodosomals conspicuously longer than others 3
3. Second pair of dorsal propodosomals longer than the first pair by one and one-half times or more. 4
   First pair of dorsal propodosomal setae longer than or equal in length to second pair of propodosomals. 5
4. Tactile seta of tibia IV as long as femur IV; second ventral seta of femur IV slightly longer than first ventral seta; flange on femur IV approximately a semicircle. . . . . *ananas* (Tryon)
   Tactile seta of tibia IV two-thirds as long as femur IV; second ventral seta of femur IV twice as long as first ventral seta; flange on femur IV approximating a semiparabola. . . . . *bancrofti* (Michael)

5. Tactile seta of tibia IV longer than leg IV..... 6
   Tactile seta of tibia IV shorter than leg IV..... 8
6. Femur IV lacking flange.....*chionaspivorous* (Banks)
   Femur IV with flange..... 7
7. Fourth pair of dorsal propodosomal setae shorter than second pair; greatest width of femur IV above setal base of second ventral seta *pallidus* (Banks)
   Fourth pair of dorsal propodosomal setae one and one-third times longer than second pair; greatest width of femur IV below setal base of second ventral seta.....*martorelli*, n. sp.
8. Femur IV lacking flange.....*laticeps* (Halbert)
   Femur IV with flange..... 9
9. Femur IV with first ventral seta longer than second ventral seta *latipes* (Ewing)
   Femur IV with second ventral seta one and one-half times longer than first ventral seta..... 10
10. Second dorsal propodosomal seta subequal in length to fourth *fulgens* Beer
    Second dorsal propodosomal seta conspicuously shorter than fourth 11
11. Femur IV with large lobelike flange; third pair of dorsal hysterosomal setae one and one-half times longer than second pair *spirifex* (Marchal)
    Femur IV with flange small and somewhat angulate; second pair of dorsal hysterosomal setae subequal in length to the third pair *perezi*, n. sp.

Steneotarsonemus martorelli, NEW SPECIES

The male of *Steneotarsonemus martorelli* (fig. 42) could be confused with the male of *S. pallidus* (Banks). However, the greater length of the fourth pair of dorsal propodosomal setae over the second pair of propodosomals in *martorelli* easily distinguishes it from *pallidus*. In addition to the key characters, there is a long, lanceolate annulated seta on tarsus I of the male of *martorelli*; whereas, this seta is clavate in *pallidus*. The pseudostigmatic organ of the female of *martorelli* is elliptically shaped, while that of *pallidus* is globose.

Female.—The body is elongate, elliptical and widest at coxae III. The transverse apodeme is indistinct; the genital apodeme is V-shaped. The pseudostigmatic organ is globose with a pedicel equal to the diameter of the organ. There are two pairs of dorsal propodosomal setae, the first pair being one-third the length of the second pair. The first pair of dorsolateral hysterosomal setae is over twice the length of the second pair of dorso-

laterals. The third pair of dorsolaterals is equal in length to the second pair. The first pair of dorsolaterals is over twice the length of the first pair of dorsocentral hysterosomals. The second pair of dorsocentrals is one and one-half times longer than the first pair of dorsocentrals and two-thirds the length of the first pair of dorsolaterals. The third pair of dorsocentrals is equal in length to the second pair. The terminal seta of tarsus IV is twice the length of the subterminal seta. The length is 0.172–0.195 mm.; the width is 0.052-0.062 mm.

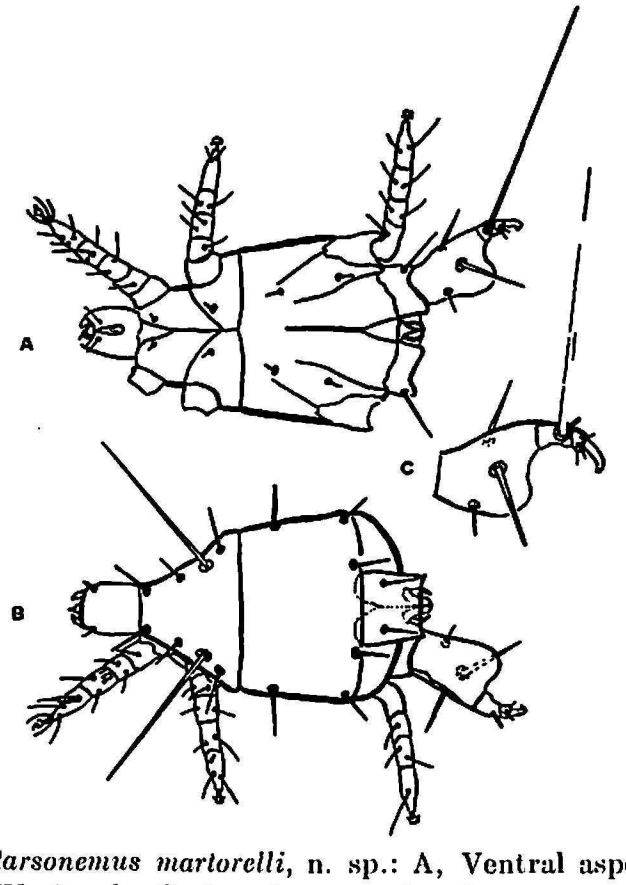


FIG. 42.—*Stenotarsonemus martorelli*, n. sp.: A, Ventral aspect of male; B, enlarged view of leg IV of male; C, dorsal aspect of male.

Male.—The body is oval and widest at level of coxae III. Apodemes III and IV are distinct. The first pair of dorsal propodosomal setae is one and one-half times longer than the second pair. The third pair of propodosomals is over twice the length of the first pair; the fourth pair of dorsal propodosomals is subequal in length to the first pair. The first pair of dorsal hysterosomals is longer than the first pair of dorsal propodosomals. The second pair of hysterosomal setae is one-half as long as the first pair; the third pair is equal to the length of the second pair. The fourth pair of hysterosomals is equal in length to the second pair. There is a long, lanceolate annulated seta on tarsus I. Femur IV has a semiparabolic flange. There are three femoral seta; the first ventral seta is one-third as long as the

second, and the dorsal seta is two-thirds as long as the second ventral seta. The greatest width of the femur is at the level of the setal socket of the second ventral seta. The tactile seta of tibia IV is longer than the leg. The claw is broad for most of its length and tapers acutely at its tip. The length is 0.138–0.142 mm.; the width is 0.065–0.085 mm.

Holotype.—Male, collected on *Pluchea purpurascens*, Peñón del Collao, Cayey, P. R., altitude 2,000 feet, August 13, 1954, by L. F. Martorell; in collection at Department of Entomology, North Carolina State College.

Paratypes.—One male and seven females, collected on *Pluchea purpurascens*, Peñón del Collao, Cayey, P. R., altitude 2,000 feet, August 13, 1954, by L. F. Martorell; in collection at U. S. National Museum.

This species is named in honor of Luis F. Martorell for his assistance in field collections as well as for his considerable help in the identification of plant specimens.

Stenotarsonemus perezi, NEW SPECIES

The male of *Stenotarsonemus perezi* (fig. 43) resembles that of *S. spirifex* (Marchal), but it is separated from the latter by relative lengths of dorsal hysterosomal setae and the shape of the flange on femur IV. The female of *perezi* can be distinguished easily from that of *spirifex* by the characters of the transverse apodeme and the shape of the pseudostigmatic organs. In *perezi* the transverse apodeme is single and entire, and the pseudostigmatic organs are elliptical with acuminate tips. However, in *spirifex* there are two short transverse apodemes, and the pseudostigmatic organs are ovoid.

Female.—The body is elongate, elliptical and widest at coxae III. The transverse apodeme is indistinct; the genital apodeme is very slightly rounded. The pseudostigmatic organ is elliptical, with an acuminate tip, and a pedicel less than the length of the organ. There are two pairs of dorsal propodosomal setae; the second pair is two and one-half times longer than the first pair. The first pair of dorsolateral hysterosomals is one and one-half times longer than the second pair of dorsocentral hysterosomals. The three pairs of dorsocentrals are approximately equal in length. The terminal seta of tarsus IV is one and one-half times longer than the subterminal seta. The length is 0.252–0.280 mm.; the width is 0.105–0.122 mm.

Male.—The body is elongate and broadest at the anterior margin of apodemes III. Apodemes III and IV are conspicuous and distinct; apodeme III is joined anteriorly to apodeme IV. The first pair of dorsal propodosomal setae is two and one-half times longer than the second pair. The third pair of propodosomals is approximately twice as long as the first pair. The fourth pair of propodosomal setae is subequal in length to the first pair. The first three pairs of dorsal hysterosomal setae are approximately equal

in length. The fourth pair of hysterosomals is two-thirds as long as the first pair. There is a clavate, annulated seta on tarsus I. There is an angulate, almost rudder-shaped flange on femur IV. There are three femoral IV setae; the first ventral seta is one-half as long as the second ventral seta, and the dorsal seta is longer than the second ventral seta. The tactile seta of tibia IV is shorter than the femur. The claw is long and acuminate. The length is 0.182–0.190 mm.; the width is 0.082–0.088 mm.

Holotype.—Male, collected on *Ananas sativus* (Red Spanish Pineapple

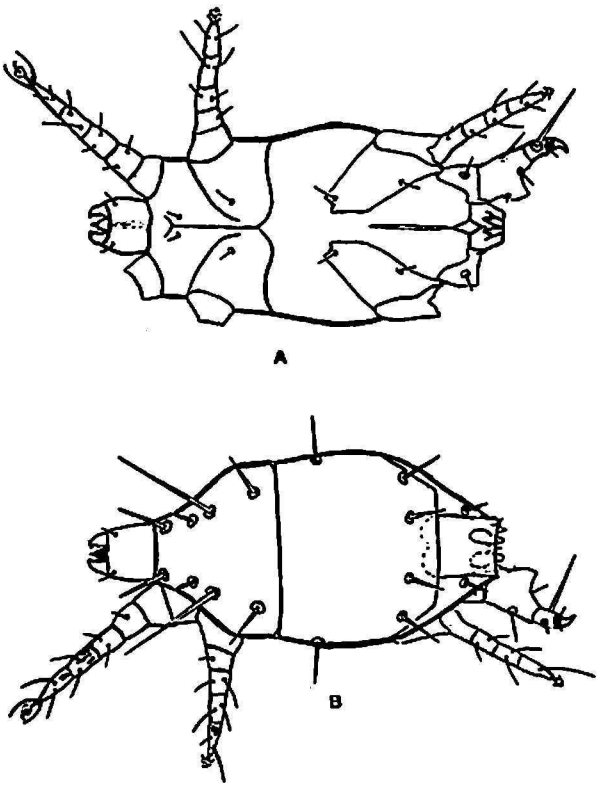


FIG. 43.—*Steneotarsonemus perezi*, n. sp.: A, Ventral aspect of male; B, dorsal aspect of male.

variety), Manatí, P. R., June 6, 1955, by M. Pérez; in collection at Department of Entomology, North Carolina State College.

Paratypes.—Three males and ten females, collected on *Ananas sativus* (Red Spanish Pineapple variety), Manatí, P.R., June 6, 1955, by M. Pérez; in collection at the U. S. National Museum.

This species is named in honor of Mario Pérez who was so helpful in field collecting work.

Genus Hemitarsonemus EWING

Hemitarsonemus Ewing, (*79*) 51; Beer, (*31*) 1291. Type of genus: *Tarsonemus tepidariorum* Warburton, by original designation of Ewing.

The characters of this genus are as follows: The body of the male is

laterally compressed, and that of the female is strongly convex dorsally. Leg IV of the male is composed of three segments, the coxa, the femur and the tibiotarsus. The female propodosomal shield projects anteriorly, covering most of the capitulum. The mites of this genus are plant feeders.

KEY TO THE MALES OF THE GENUS *Hemitarsonemus* FOR THE WESTERN HEMISPHERE

1. Leg IV with terminal claw reduced to a small tubercle. . *latus* (Banks)[7]
   Leg IV terminating in a strong, curved claw. . *tepidariorum* (Warburton)

Hemitarsonemus latus (BANKS)

Tarsonemus latus Banks, (*21*) 615; Banks, (*27*) 108; Moznette, (*164*) 121; Smith, (*213*) 1; Smith, (*214*) 91; Marle, (*161*) 26.

Acarus translucens Green, (*90*) 12.

Tarsonemus translucens (Green), Green, (*91*) 2; Rutherford, (*201*) 490; Carpenter (*52*) 286; Mann, *et al*, (*160*) 282; Hirst, (*98*) 797; Hutson, (*104*) 378; Kulkarni, (*133*) 51; Hirst, (*99*) 995; Fajardo and Bellosillo, (*80*) 523.

Hemitarsonemus latus (Banks), Ewing, (*79*) 54; Lavoipierre, (*138*) 116; Vrydagh, (*226*) 1; Massee, (*163*) 64; Gadd, (*83*) 157; Beer, (*31*) 1293.

This species (fig. 44) may be readily distinguished from other members of the Western Hemisphere Tarsonemidae in having a pair of ventral hysterosomal setae situated in the interapodemal area delimited by apodeme IV and the posterior median apodeme. The female is distinguished by the presence of an extra pair of ventral hysterosomal setae situated between coxae IV. In addition, in the female of *latus* the first pair of dorsal propodosomals is longer than the second pair; whereas, in other species the second pair of propodosomals is twice the length of the first pair.

Female.—The body is oval and widest at the midlength. The transverse apodeme is indistinct; the genital apodeme is very long and V-shaped. The pseudostigmatic organs are globose with slender pedicels longer than the diameters of organs. There are two pairs of dorsal propodosomal setae; the first pair of setae is one and one-half times longer than the second pair. The first pair of dorsolateral hysterosomal setae is approximately twice as long as the second pair. The second pair of dorsolaterals is equal in length to the third pair. The first pair of dorsocentral hysterosomal setae is subequal in length to the first pair of dorsolaterals. The second pair of dorsocentrals is equal in length to the third pair of dorsocentrals and the second pair of dorsolaterals. The terminal seta of tarsus IV is three times longer than the subterminal seta.

Male.—The body is short, oval, and broadest at the midlength. Apodemes

III and IV are distinct; apodeme III and apodeme IV are joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is approximately one-third as long as the second pair. The third pair of propodosomals is subequal in length to the fourth pair. The fourth pair of propodosomals is twice as long as the first pair. There are five pairs of dorsal hysterosomal setae. The first pair of hysterosomals is equal in length to the second pair. The third pair of hysterosomal setae is one and one-fourth times longer than the first pair. The fourth pair of hysterosomals is

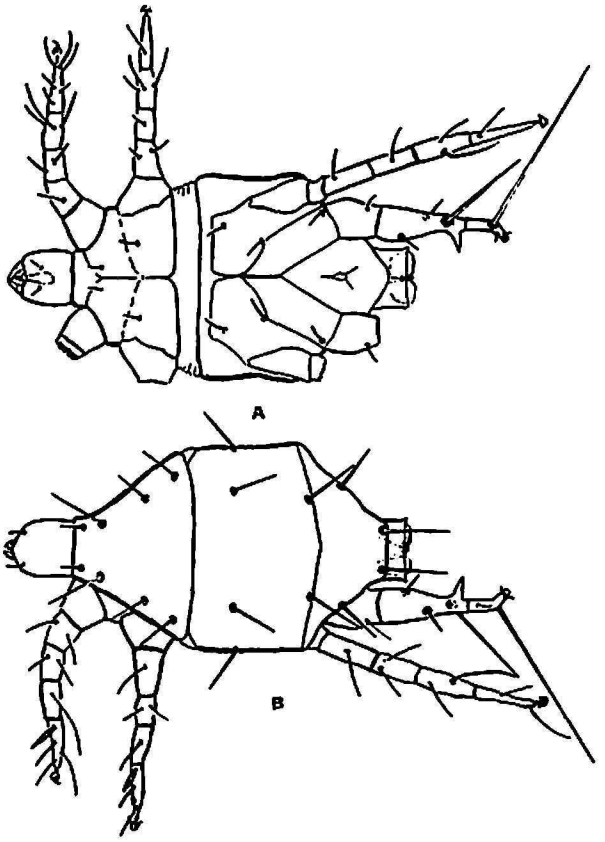


FIG. 44.—*Hemitarsonemus latus*, n. sp.: A, Ventral aspect of male; B, dorsal aspect of male.

equal in length to the length of the first pair. The fifth pair of hysterosomals is slightly longer than the third pair. There is a long, lanceolate annulated seta on tarsus I. There is a sharp distal spur on the inner margin of femur IV which projects at a right angle to the femur. There are three femoral IV setae; the first ventral seta is approximately one-fifth the length of the second, and the dorsal seta is one-fourth the length of the second ventral seta. Tibiotarsus IV is elongate, narrow and incurved sharply at the distal end; the tactile seta is slightly longer than the leg. The claw is small, blunt, and buttonlike.

Collected on *Lycopersicon lycopersicon*, in Puerto Rico at the Agricultural Experiment Station, Río Piedras, August 26, 1956, by H. L. Crom-

roy; on May 3, 1955, by J. Bird and H. L. Cromroy; on *Solanum tuberosum*, at the same Station, August 26, 1956, by H. L. Cromroy; on *Asclepias curassavica*, Vega Alta to Corozal Road, Kilometer 3.6, May 18, 1955, by M. Pérez and H. L. Cromroy; on *Centrosema pubescens*, Vega Alta to Corozal Road, Kilometer 3.6, May 18, 1955, by M. Pérez and H. L. Cromroy; on *Dolichos lablab*, at Río Piedras, May 18, 1955, by G. N. Wolcott.

Fungitarsonemus, NEW GENUS

The generic characters of this group are: There are four segments in leg IV of the male; i.e., the coxa, the femur, the tibia and the tarsus. The body of the male is laterally compressed, and that of the female is strongly convex dorsally. The mites in this genus are presumed fungus feeders. Type of genus: *Hemitarsonemus peregrinus* Beer.

In 1957 M. H. Muma in discussion with E. W. Baker indicated that *H. peregrinus* Beer is a fungus feeder. This led the author to believe that there is a biological breakdown within the genus, *Hemitarsonemus*, into two groups, plant feeders and fungus feeders, as well as a morphological generic separation. Therefore, a new genus, *Fungitarsonemus* is designated to include the fungus feeders.

KEY TO THE MALES OF THE GENUS *Fungitarsonemus* FOR THE WESTERN HEMISPHERE

1. First pair of dorsal hysterosomal seta subequal to length of third pair of dorsal propodosomal setae; second pair of dorsal hysterosomal setae equal in length to the third pair..... *borinquensis*, n. sp.[7]
   First pair of dorsal hysterosomal setae twice the length of third pair of dorsal propodosomals; second pair of dorsal hysterosomals conspicuously longer than the third pair..... *peregrinus* (Beer)

Fungitarsonemus borinquensis, NEW SPECIES

The male *Fungitarsonemus borinquensis* (fig. 45) resembles the male of *peregrinus* (Beer) in that there is a strong claw on leg IV and the absence of a spurlike process on the inner margin of femur IV. However, the male differs distinctly from *peregrinus* in the relative lengths of the dorsal propodosomal and hysterosomal setae. The first pair of dorsal hysterosomals is subequal in length to the third pair of propodosomals in *borinquensis*, while the first pair of dorsal hysterosomal setae is twice the length of the third pair of dorsal propodosomals.

Male.—The body is roughly oval and widest at the transverse apodeme. Apodemes III and IV are distinct; apodeme III is joined anteriorly to apodeme IV, and apodeme IV is joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is approximately

seven times longer than the second pair. The third pair of propodosomals is almost twice the length of the first pair. The fourth pair of propodosomals is equal in length to the second pair and one-seventh as long as the first pair. The first pair of dorsal hysterosomal setae is one and one-half times longer than the first pair of dorsal propodosomals. The second pair of dorsal hysterosomals is one and one-half times longer than the second pair of propodosomals and one-sixth the length of the first pair of hysterosomals. The third pair of hysterosomals is as long as the second pair. The fourth

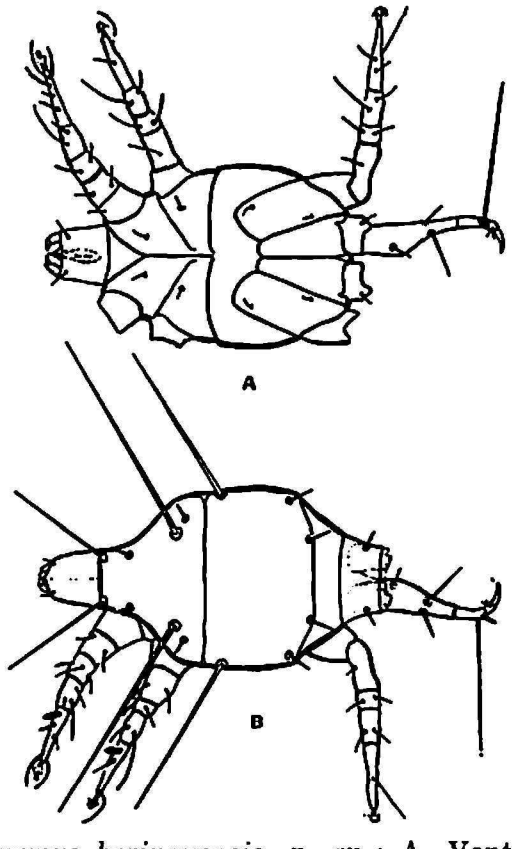


FIG. 45.—*Fungitarsonemus borinquensis*, n. sp.: A, Ventral aspect of male; B, dorsal aspect of male.

pair of hysterosomals is equal in length to second pair of dorsal propodosomals and two-thirds as long as the second pair of hysterosomals. There is a long, lanceolate annulated seta on tarsus I. Leg IV has four segments, coxa, femur, tibia, and tarsus. Femur IV is broadest at the mid-length and tapers abruptly to the tibiotarsus. The femur lacks a spur. There are three femoral IV setae, the first ventral seta is subequal to the dorsal seta; the dorsal seta is one-half as long as the second ventral seta. Tibiotarsus IV is elongate, narrow, and incurved sharply at the distal end; the tactile seta of the tibiotarsus is longer than the femur, but shorter than the leg. The claw is long and slender. The length is 0.157 mm.; the width is 0.103 mm.

Holotype.—Male, collected on *Coffea arabica*, Maricao Insular Forest,

P. R., April 19, 1955, by L. F. Martorell and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Genus Xenotarsonemus BEER

Xenotarsonemus Beer, (*31*) 1314. Type of genus: *Tarsonemus viridis* Ewing, by original designation of Beer.

This genus is characterized as follows: The males have leg IV divided into three sections, coxa, femur and tibiotarsus, the latter expanded bulbously at the tip and bearing a stout, curved spine on the outer margin near the base, and one long and stout, and two short, apical setae. The propodosomal shield of the female projects forward and covers most of the capitulum; the inner margins of coxae IV are separated by a distance less than the width of the coxa, and legs IV never extend to the caudolateral margins of body.

KEY TO FEMALES OF THE GENUS *Xenotarsonemus* FOR THE WESTERN HEMISPHERE

1. Transverse apodeme distinct; pseudostigmatic organ elliptical with flattened apex on a pedicel shorter than longest diameter of organ; third pair of dorsolateral hysterosomal setae equal to length of second pair of dorsocentral hysterosomals ..... *cadeae*, n. sp.[7]
   Transverse apodeme apparently absent; pseudostigmatic organ ovate with diameter greater than length of pedicel; third pair of dorsolateral hysterosomal setae twice as long as second pair of dorsocentrals
   viridis (Ewing)

KEY TO MALES OF GENUS *Xenotarsonemus*

1. First ventral seta of femur IV one and one-half times longer than dorsal femoral seta ..... *cadeae*, n. sp.[7]
   Dorsal seta of femur IV twice the length of the first ventral seta of femur IV ..... *viridis* (Ewing)

Xenotarsonemus cadeae, NEW SPECIES

The outstanding differences between *Xenotarsonemus viridis* (Ewing) and *X. cadeae* (fig. 46) are given in the key. In addition to the key characters, there is a small, lanceolate, annulated seta on tarsus I of the male of *cadeae*, while the setae on tarsus I of the male of *viridis* is long, broad and blunt.

Female.—The body is oval and widest at the transverse apodeme. The transverse apodeme is distinct; the genital apodeme is acutely V-shaped. The pseudostigmatic organ is elliptical with a flattened apex on a pedicel which is shorter than the longest diameter of the organ. There are two

pairs of dorsal propodosomal setae; the first pair is one-half the length of the second. The first pair of dorsolateral hysterosomal setae is one and one-half times longer than any of the other dorsal hysterosomal setae. The second pair of dorsolaterals is equal in length to the third pair and is two-thirds as long as the first pair. The first pair of dorsocentral hysterosomal setae is equal in length to the second pair of dorsolaterals. The second pair of dorsocentrals is equal in length to the first pair of dorsocentrals. The third pair of dorsocentrals is equal in length to the first pair. The terminal seta of tarsus IV is one and one-half times longer than the subterminal seta. The length is 0.173 mm.; the width is 0.100 mm.

Male.—The body is roughly oval and widest at the level of coxae III.

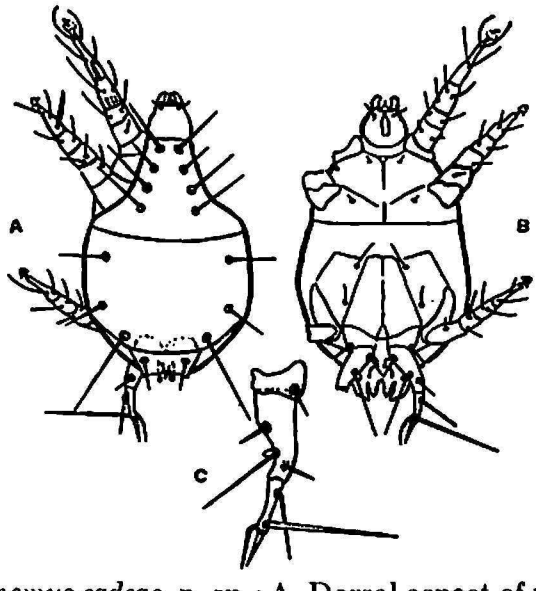


FIG. 46.—*Xenotarsonemus cadeae*, n. sp.: A, Dorsal aspect of male; B, ventral aspect of male; C, enlarged view of leg IV of male.

Apodemes III and IV are distinct; apodeme III is joined anteriorly to apodeme IV, and apodeme IV is joined anteriorly to the posterior median apodeme. The first pair of dorsal propodosomal setae is one and one-half times longer than the second pair, and is subequal to the third pair. The fourth pair of propodosomals is equal in length to the third pair. The first pair of dorsal hysterosomals is subequal to the length of the first pair of dorsal propodosomals. The second pair of hysterosomals is slightly shorter than the first pair. The third pair is over one and one-half times longer than the first pair, and the fourth pair is one-half as long as the first pair. There is a small, lanceolate annulated seta on tarsus I. There is a spur on Femur IV; the second ventral seta arises at the base of the spur; the first ventral seta is one and one-half times longer than the dorsal seta; the second ventral seta is twice as long as the first ventral seta. Tibiotarsus IV is constricted medially, with its distal end bulbous. The tactile seta of

tibiotarsus IV is slightly shorter than the leg. The length is 0.153 mm.; the width is 0.086 mm.

Holotype.—Male, collected on *Centrosema virginiana* Maricao Insular Forest, P.R., April 19, 1955, by H. L. Cromroy, in collection at the Department of Entomology, North Carolina State College.

Allotype.—Female, collected on *Centrosema virginiana*, Maricao Insular Forest, P.R., April 19, 1955, by H. L. Cromroy, in collection at Department of Entomology, North Carolina State College.

This species is named in honor of my wife, Cade S. Cromroy, for her inspiration, encouragement, and assistance in the preparation of this dissertation.

FAMILY ERIOPHYIDAE NALEPA, 1898

As early as 1737, Reaumur (Hassan, (*95*)) recorded his observations of minute wormlike animals in galls on the leaves of the linden tree. It was his belief that those animals were responsible for the gall formation, but he considered them to be the larvae of a small insect.

In 1834, Duges found mites in the galls on the leaves of the linden and the white willow, and considered them insect larvae. He also found eggs in the galls but supposed that the adults laid them and then escaped through the free opening of the galls. In 1850, von Siebold considered the mites as larvae and suggested that they possibly propagated asexually and that the adult form was yet to be found. He gave the name *Eriophyes* to the mites he found. Dujardin (*66*) determined the true nature of the mites and considered them adults and named them *Phytoptus*. Dujardin was apparently unaware of the fact that von Siebold had already given them the name *Eriophyes*.

Scheuten (*205*) opposed Dujardin's views and again confirmed the views of Duges by redescribing what he considered larvae. During the same year Pagenstecher disagreed with Scheuten's views, insisting that the mites were adults and gave names to a few species, among them *Eriophyes vitis* (Pgst.) and *Eriophyes pyri* (Pgst.) with some notes on their life histories and habits. It was not until 1864 (*95*) that Landois studied *Eriophyes vitis* (Pgst.) and conclusively showed the true nature of these mites. He and previous workers had concluded that there were two pairs of aborted legs present on these mites, in addition to the two usual pairs. Garman (*84*) was the first in the United States to study these mites more carefully, describing several species.

Modern eriophyid taxonomy originates from the foundation laid down by the Austrian, Alfred Nalepa, who worked on these mites from 1887 to 1929 and whose descriptions were the first adequate ones. All names given to these mites previous to the beginning of his work are based on inade-

quate descriptions at best. It would not be possible to recognize any of the species were it not for the specific host plant relationships. An example of this is the work done by Melville T. Cook (*54*) in Puerto Rico who described 12 new species on the basis of the size and shape of their galls without ever viewing the mites. Since the time of Nalepa there have been very few outstanding workers in this field. Hassan, in 1928, made a biological study of the species *Eriophyes tristriatus* Nalepa. However, there have only been three outstanding taxonomists in the group since Nalepa. In Europe Liro and Roivainen have done the most work in this group. Liro (*143*, *144*, *145*, *146*) worked on the eriophyids of Finland, Sweden, and the northern countries. He and Roivainen worked together for a short period and published an excellent manual (*147*). Roivainen (*199*) has extended his field of study beyond northern Europe into Spain. However, acarologists consider the finest eriophyid worker to be an American, H. H. Keifer. Keifer's descriptions and figures (1938———) have been far superior to any of the others published. He has done one of the most comprehensive of all biological studies on *Oxypleurites aesculifoliae* Keifer (*118*), a species which has alternation of generations.

Nalepa (*167*) divided the family Eriophyidae into two subfamilies, Eriophyinae and Phyllocoptinae. This division remained unchanged until 1944, when Keifer added two new subfamilies, Phytoptinae and Sierraphytoptinae. Keifer based his subfamily arrangement on a number of characters which Nalepa had used as distinctive specific or generic features only. These characters; i.e., the structure of the genitalia, rostrum, chelicerae, and markings of the shield appear to have an especially fundamental position in eriophyid taxonomy. Roivainen (*199*), on the basis of these same characters, added four more new subfamilies.

The eriophyids damage several plants of economic importance. Many species have never been considered to be of serious economic importance until recently. In 1952, Slykhuis (*210*) began his work on the transmission of virus diseases by eriophyids. In 1955, he definitely ascertained that *Aceria tulipae* Keifer definitely transmitted the virus of wheat streak mosaic. This species alone causes millions of dollars worth of damage.

GENERAL EXTERNAL MORPHOLOGY

The eriophyids (fig. 47) are characterized by the presence of only four legs. They average about one-fifth of a millimeter in length. The genitalia of the eriophyids are located proximally just behind the coxae. The abdomen is elongate and its surface is characterized by the presence of narrow, transverse rings which are typically set with small, rounded or pointed, beadlike structures called by Keifer, microtubercles.

The chelicerae of the eriophyids are a pair of slender stylets which punc-

ture the plant tissue without causing the death or immediate death of the affected cells. These stylets rest in a groove on the dorsal anterior side of the rostrum. The palpi are short and simple. The anal opening is on the venter at the posterior end of the body.

The legs are similar and considered by Keifer to be six-segmented; the

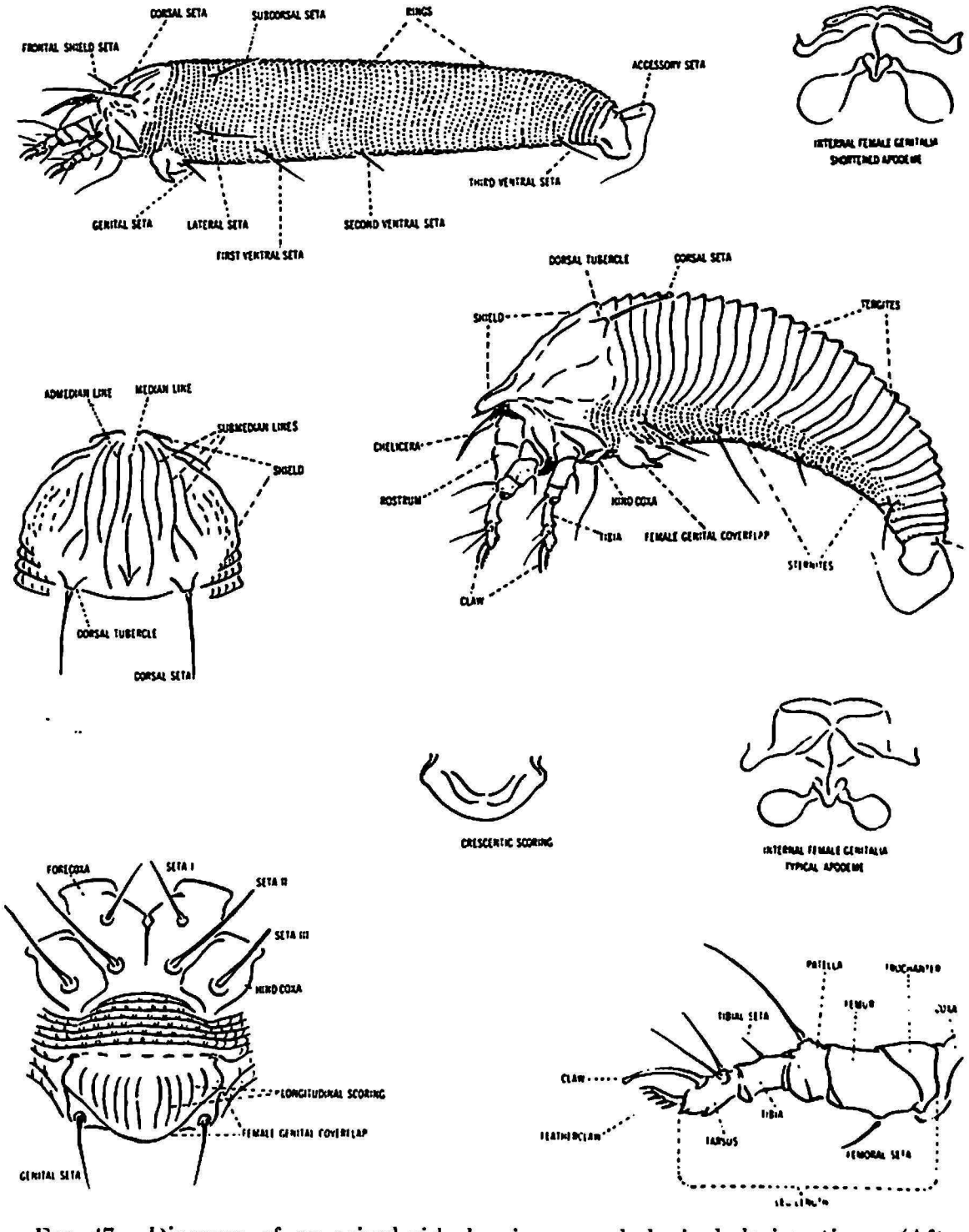


FIG. 47.—Diagram of an eriophyid showing morphological designations. (After Keifer, 1952).

segments are successively known as the trochanter, femur, patella, tibia, tarsus, and pretarsus. The pretarsus was designated by Nalepa as the feathered claw, "Fiederklaue." Keifer utilized the feathered claw as one of the specific characters for the family Eriophyidae. The feathered claw is probably the empodium since in the course of evolution the claws have disappeared.

BIOLOGY

Biological studies of Hassan (*95*), Baker (*6*) and Keifer (*118*) indicate that eriophyids in general have a simple direct development after hatching. They pass through two nymphal instars, the second producing the adult after a resting period or "pseudopupa."

However, not all eriophyid histories are simple. In the case where there are two types of females in one species the condition is known as deuterogyny. Deuterogyny is present, so far as is known, only in phyllocoptine species on the deciduous trees and shrubs. Deuterogynous species have a primary form, the protogynes, which are females resembling males, and which exist only on the leaves of their host plant. The protogyne and the male make up the perfect form of the species. The secondary female or deutogyne is the imperfect form and is specialized for hibernation. Deutogynes appear in response to leaf maturing or the coming of the lower fall temperatures. They cannot reproduce in the year in which they grow and must quit the leaves when fully fed, regardless of the time of year. They usually become dormant in bark crevices, but some gather or collect themselves around lateral buds. In the spring these deutogynes come out of hibernation and lay eggs on the new leaves, and these eggs hatch into the perfect form of the species.

Eriophyid mites basically feed on perennial plants since annuals do not afford a stable basis for the development of colonies. In some cases an eriophyid will kill its host (*i.e.*, tomato russet mite) but this relation is unnatural. Host relations of eriophyids are intimate and nearly always show a high degree of specificity. Most eriophyids cause no noticeable injury to their hosts. The plant deformations that a minority of the species cause are well known. The following is a list of types of deformations and injury taken from Keifer (*127*):

1, Leaf discoloration such as browning or silvering; 2, leaf erineum, which is the development of patches of hairs or papillae; 3, leaf-pocketing, such as bead galls and purse galls; 4, leaf blisters in which the tissue becomes spongy and dies between the epidermal layers; 5, leaf folds, diagonal or longitudinal; 6, leaf edge-rolling; 7, leaf stunting and leaf deformation extending to the fruit at times; 8, woody galls around buds; 9, development of hairs on all leaves on an infested branch; 10, stunted shoots be-

coming a cluster of buds harboring numerous mites; 11, drying of bulbs; 12, bud-blasting.

KEY TO GENERA OF FAMILY ERIOPHYIDAE FOUND IN PUERTO RICO (AFTER KEIFER, (*127*)[8])

1. In general, mites with fusiform bodies and some combination of the following characters; anterior shield lobe over rostrum; or with tergites broader and less numerous than sternites especially anteriorly; or with rostrum large, tapering, and chelicerae abruptly bent downward at right angles.....2
   Abdomen usually wormlike, with rings similar above and below, at least anteriorly; shield never with anterior lobe over rostrum; when rostrum is large, the chelicerae evenly curved down.....4
2. Rostrum with the chelicerae evenly downcurved; dorsal tubercles on rear margin of dorsal shield.....*Vasates* Shimer
   Rostrum with chelicerae abruptly bent down at right angles a short distance from base; dorsal tubercles anterior to rear margin.....3
3. Feather claw divided.....*Diptacus* Keifer
   Feather claw simple.....*Rhyncaphytoptus* Keifer
4. Dorsal shield setae pointing caudad over abdomen from tubercles situated on posterior margin of shield.....*Aceria* Keifer
   Dorsal shield setae pointing up, centrally, or forward, from tubercles usually distinctly ahead of posterior margin of shield
   Eriophyes von Siebold

GENUS *Vasates* SHIMER

Vasates Shimer, (*207*) 319; Hodgkiss, (*102*) 16; Keifer, (*120*) 25. Type of genus: *Vasates quadripedes*, by subsequent designation of Keifer (*120*).

Although Shimer made a valid designation in 1869, it was overlooked by Nalepa (*167*). Liro and Roivainen (*147*) dropped *Vasates* to a subgeneric rank. Roivainen (*200*) apparently reconsidered his original ideas and concurred with Keifer and re-elevated *Vasates* to generic level.

Vasates is a typical Phyllocoptine genus. The anterior shield lobe projects over the rostrum. The tergites are smooth and are not undulated, and are only half as numerous as the microtuberculate sternites. The dorsal shield tubercles are on the rear shield margin and direct the setae caudad

[8] The keys apply only to primary types since secondary types or deutogynes will not fit in the keys—*i.e.*, the big-beaked forms will run to the Diptilomiopini, and the others will all go to the genera *Phyllocoptes* or *Vasates*. It is possible to recognize deutogynes by the suppression or absence of the microtubercles, plus their association with the primary forms.

over the abdomen. The female genitalia are a moderate distance behind the coxae and there is a smooth cover flap.

Included in this genus are the silver peach mite *Vasates cornutus* (Banks) and the tomato russet mite *Vasates lycopersici* (Massee), both of economic importance. With the exception of the genotype which is a gall-former, this group causes silvering, browning or russeting to leaves or buds. Only one species was found in Puerto Rico.

Vasates domingensis, NEW SPECIES

Vasates domingensis (fig. 48) superficially resembles *V. ambrosiae* (Keifer) in body shape and arrangement of tergites and sternites. The two species

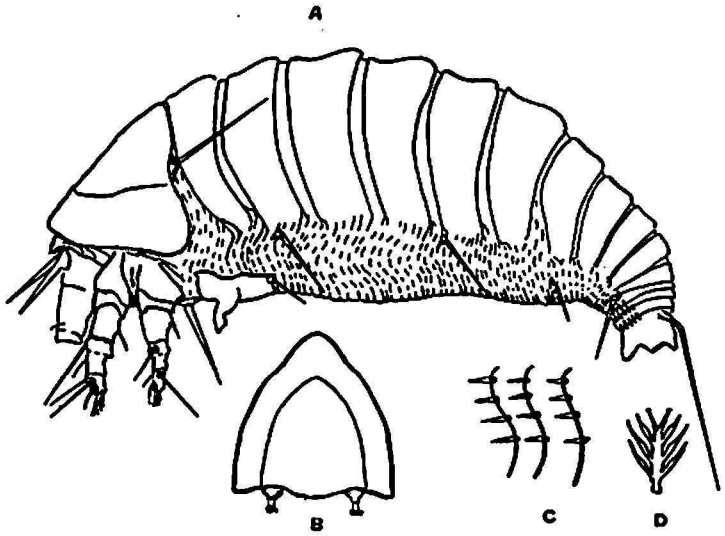


FIG. 48.—*Vasates dominguensis*, n. sp.: A, Lateral view of female; B, dorsal aspect of dorsal shield of female; C, enlarged view of microtubercles of female; D, enlarged view of empodium of female.

are easily differentiated in that *domingensis* has a four-rayed empodium; whereas, the empodium of ambrosiae is five-rayed.

Female.—The body is robust and light brown in color. The rostrum is large and the chelicerae are abruptly bent downward. The anterior shield lobe projects over the rostrum and lacks terminal spines. The dorsal shield design is very simple, consisting of a large semicircle and lacking median and admedian lines. The dorsal tubercles are situated on the rear margin of the shield with the setae directed caudad over the abdomen. The empodium is four-rayed. The tergites are much broader than the sternites. There are 10 to 13 tergites and 55 to 60 sternites. The sternites are microtuberculate and the microtubercles are indistinct on the tergites. The microtubercles are very slender and pointed at the anterior tip. The dorsal seta is over one and one-half times longer than the lateral seta. The first ventral seta is subequal to the lateral seta. The second ventral seta is one-half as

long as the lateral seta. The third ventral seta is subequal to the lateral seta and is the same length as the first ventral seta. The accessory setae are absent. The cover flap of the female genitalia is smooth. The length is 0.130–0.155 mm.; the width is 0.050–0.055 mm.; the depth is 0.130–0.155 mm.; the width is 0.050–0.055 mm.; the depth is 0.050–0.056 mm.

Male.—The male is similar to the female, but shorter. The length is 0.125–0.130 mm.

Allotype.—Female, collected on *Petitia domingensis*, Susúa Forest, Yauco, P. R., May 26, 1955, by L. F. Martorell and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Three males and 45 females, collected on *Petitia domingensis*, Susúa Forest Yauco, P. R., May 26, 1955, by L. F. Martorell and H. L. Cromroy; in collection at the U. S. National Museum.

These mites are leaf vagrants on the underside of the leaves and cause a browning.

GENUS *Diptacus* KEIFER

Diptacus Keifer, (*124*) 99; Keifer, (*127*) 60. Type of genus: *Diptilomiopus sacramentae* Keifer, by original designation.

This genus is characterized by an elongate, spindleform body. The rostrum is large and set at a right angle to the propodosoma, and the large chelicerae are abruptly bent down. The shield is subtriangular with the anterior shield lobe projecting over the rostral base. The dorsal tubercles are anterior to the rear margin of the shield and direct the setae forward. The sternites are more numerous than the tergites. All abdominal setae are present. The empodium is divided. The cover flap of the female genitalia is generally smooth.

The mites of this genus are leaf vagrants. One species was found in Puerto Rico.

Diptacus borinquensis, NEW SPECIES

Diptacus boringuensis (fig. 49) is distinct from other members of the genus in that the empodium is divided into two branches of three rays.

Female.—The body is elongate and robust. The color is brown. The rostrum is large and the chelicerae are abruptly bent downward. The anterior shield lobe projects over the rostrum. The dorsal shield design is simple consisting of two admedian lines joining at the apex of the shield. There is no median line. The dorsal tubercles are anterior to the rear margin of the shield and direct dorsal setae forward and up. The empodium is divided and each branch is three-rayed. The tergites are broader than the sternites. There are 30 to 42 tergites and 80 to 90 sternites. The sternites are microtuberculate. The microtubercles are slender and pointed at anterior tip.

The dorsal seta is one-fourth the length of the lateral seta. The first ventral seta is subequal to the length of the lateral seta. The second ventral seta is approximately one-half as long as the lateral seta. The third ventral seta is two-thirds the length of the lateral seta. The accessory setae are absent. There are two ranks of longitudinal scoring on the cover flap of the female genitalia. The length is 0.138–0.165 mm.; the width is 0.040–0.050 mm.; the depth is 0.055–0.060 mm.

Male.—No males are known.

Holotype.—Female, collected on royal palm, Vega Alta-Corozal Road, P. R., Kilometer 8.6, May 18, 1955, by H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

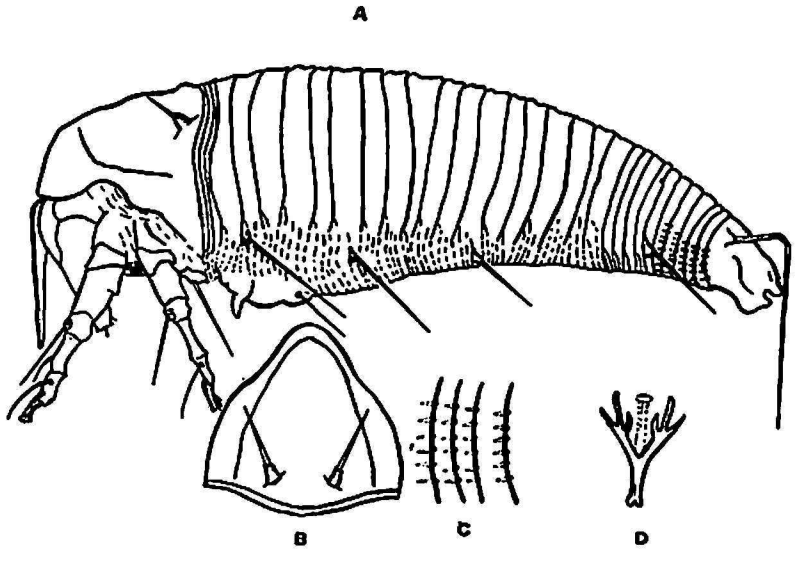


FIG. 49.—*Diptacus boringuensis*, n. sp.: Lateral view of female; B, dorsal aspect of dorsal shield of female; C, enlarged view of microtubercles of female; D, enlarged view of empodium of female.

Paratypes.—Seventeen females, collected on royal palm, Vega Alta-Corozal Road, P. R., Kilometer 8.6, May 18, 1955, by H. L. Cromroy; in collection at U. S. National Museum.

GENUS *Rhyncaphytoptus* KEIFER

Rhyncaphytoptus Keifer, (*109*) 149; Liro and Roivainen, (*147*) 256; Keifer, (*127*) 58. Type of genus: *Rhyncaphytoptus filicifoliae* Keifer, by original designation.

The genus is characterized by a large rostrum which is long and attenuate distally and set at a right angle to the propodosoma. The chelicerae are long extending beyond the maxillae and are often recurved, anteriorly. The shield is rather short, more or less declivitous toward the anterior lobes. The dorsal seta are ahead of rear margin and are projected anteriorly.

The empodium is undivided. All abdominal setae are present. The body is wormlike to spindleform with the sternites more numerous than the tergites. The cover-flap of the female genitalia is usually smooth.

This group of mites are leaf vagrants. Only one species was found in Puerto Rico.

Rhyncaphytoptus harrii, NEW SPECIES

Rhyncaphytoptus harrii (fig. 50) resembles *R. ulmivagrans* Keifer. They differ considerably in shield designs, *harrii* possessing a median line on the dorsal shield which *ulmivagrans* lacks.

Female.—The body is robust and brown in color. The rostrum is large

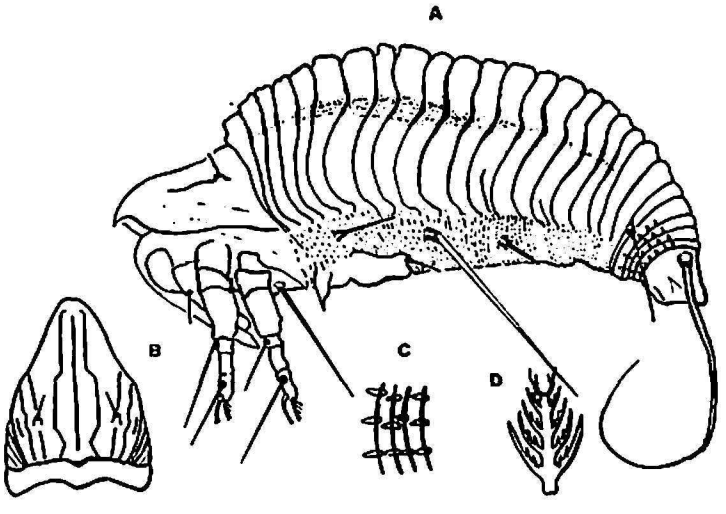


FIG. 50.—*Rhyncaphytoptus harrii*, n. sp.: A, Lateral aspect of female; B, dorsal aspect of dorsal shield of female; C, enlarged view of microtubercles of female; D, enlarged view of empodium of female.

and recurved distally. The anterior lobe of the dorsal shield projects over the rostrum. The dorsal shield design consists of a straight median line, two admedians, and two submedians. The dorsal tubercles are anterior to the rear margin of the shield and direct dorsal setae upward and to the center. The empodium is five-rayed and the foretibia is as long as the foretarsus. The tergites are broader than the sternites. There are 26 to 29 tergites and 68 to 75 sternites. The sternites are microtuberculate and microtubercles are slender and pointed anteriorly. The dorsal seta is less than one-half as long as the lateral seta. The lateral seta is one-fourth the length of the first ventral seta. The second ventral seta is two-thirds the length of the lateral seta. The third ventral seta is one and one-half times longer than the lateral seta. The accessory setae are absent. There is no scoring on the coverflap of female genitalia. The length is 0.170–0.190 mm.; the width is 0.065–0.075 mm.; the depth is 0.060–0.068 mm.

Male.—No males studied.

Holotype.—Female, collected on *Asclepias curassavica*, Vega Alta-Corozal Road, P. R., Kilometer 3.6, May 18, 1955, by H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—14 females, collected on *Asclepias curassavica*, Vega Alta-Corozal Road, P. R., Kilometer 3.6, May 18, 1955, by H. L. Cromroy; in U. S. National Museum.

This species is a leaf vagrant.

This species is named in honor of my father whose encouragement and assistance made possible this research.

GENUS *Aceria* KEIFER

Aceria Keifer, (*120*) 22; Keifer, (*127*) 23. Type of genus: *Eriophyes tulipae* Keifer, by original designation.

The mites of this genus have wormlike bodies which are circular or nearly so in cross section. The dorsal shield is usually subtriangular. The dorsal setae project directly backwards from tubercles on the rear margin of the shield. The long axis of the dorsal tubercles is transverse to the body length. The abdominal rings are not differentiated into tergites and sternites, and are nearly always microtuberculate. The coverflap of the female genitalia may be furrowed or smooth, but usually has a single row of longitudinal scoring.

This genus consists of mites which cause galls and erinea. Three new species were found in Puerto Rico.

KEY TO SPECIES OF *Aceria* FOUND IN PUERTO RICO

1. Third ventral seta longer than the second ventral seta. . .*odorata*, n. sp.
   Second ventral seta longer than the third ventral seta. 2
2. Microtubercles pointed at anterior tip; rays of the empodium branches; first ventral seta is two and one-half times longer than second ventra seta. . . . . *purpuracenis*, n. sp.
   Microtubercles blunt at anterior tip; rays of empodium unbranched; first ventral seta four times longer than second ventral seta . . . . . *osmia*, n. sp.

Aceria odorata, NEW SPECIES

Aceria odorata (fig. 51) resembles *A. enceliae* (Keifer) in that both possess crescentic scoring on the genital coverflap and both have foretibial setae. *A. odorata* can be distinguished from *A. enceliae* on the relative lengths of the abdominal setae. The second ventral seta of *odorata* is longer than the third ventral seta, and the dorsal seta is one and one-half times longer than the lateral seta. The second ventral seta of *enceliae* is shorter than the

third ventral, and the lateral seta is one and one-half times longer than the dorsal seta.

Female.—The body is robust and an opalescent white in color. The rostrum is short and evenly downcurved. The dorsal shield design is very complex with a median line which branches at posterior margin of the shield, two curving admedians, and a number of submedian lines, some of which are multibranches. The dorsal tubercles are situated on the rear margin of the shield directing the dorsal setae caudad over the abomen. The foretibial setae are present. The empodium is four-rayed. There are 75 to 80 abdominal rings with no differentiation between the tergites and sternites.

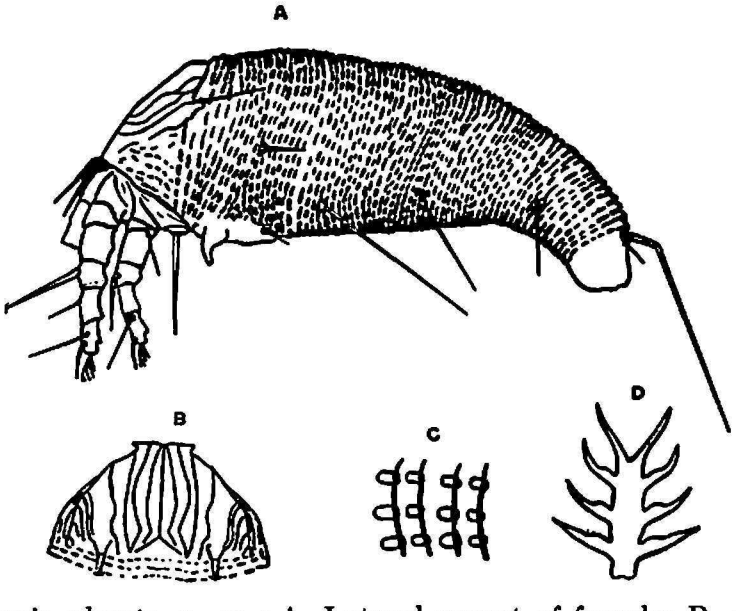


FIG. 51. *Aceria odorata*, n. sp.: A, Lateral aspect of female; B, dorsal aspect of dorsal shield of female; C, enlarged view of microtubercles of female; D, enlarged view of empodium of female.

The rings are entirely microtuberculate, and the microtubercles are oval-shaped. The dorsal seta is one and one-half times longer than the lateral seta. The first ventral is four and one-half times longer than the lateral seta. The second ventral seta is two and one-half times longer than the lateral seta and one and one-half times longer than the third ventral. The third ventral seta is equal to the length of the dorsal seta. The accessory setae are present. The coverflap of the female genitalia is scored with a single crescentic line. The length is 0.130–0.140 mm.; the width is 0.050–0.055 mm.; the depth is 0.55–0.060 mm.

Male.—No males studied.

Holotype.—Female, collected on *Pluchea odorata*, Río Piedras, P. R., May 19, 1955, by M. Pérez; in collection at Department of Entomology, North Carolina State College.

Paratypes.—Forty-five females, collected on *Pluchea odorata*, Río Piedras, P.R., May 19, 1955, by M. Pérez; in the U. S. National Museum.

Aceria purpurascenis, NEW SPECIES

Aceria purpurascenis (fig. 52) resembles *A. orthomera* Keifer in that the empodium is four-rayed, the genital coverflap is longitudinally scored, and the foretibial setae are absent. *Purpurascenis* is differentiated from *orthomera* by the relative lengths of the ventral setae, the second ventral shorter than the third in *purpurascenis* and the second ventral seta longer than the

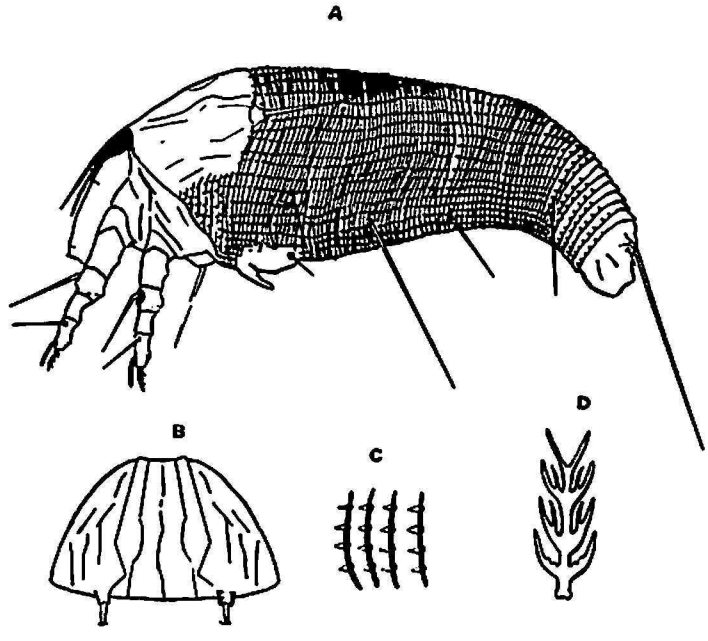


FIG. 52.—*Aceria purpurascenis*, n. sp.: A, Lateral aspect of female; B, dorsal aspect of dorsal shield of female; C, enlarged view of microtubercles of female; D, enlarged view of empodium of female.

third in *orthomera*. In addition, the microtubercles of *purpurascenis* are pointed at the anterior tip and those of *orthomera* are rounded at the anterior tip.

Female.—The body is robust and light-cream in color. The rostrum is short and evenly downcurved. The dorsal shield design consists of a curving median line, two admedians and four submedians. The dorsal tubercles are situated on the rear margin of the shield with the dorsal setae pointing directly caudad. The foretibial setae are absent. The empodium is four-rayed and the rays branch. There are 75 to 80 abdominal rings with no differentiation between tergites and sternites. The rings are entirely microtuberculate and the microtubercles are nearly triangular in shape. The dorsal seta is approximately one and one-half times longer than the lateral seta. The lateral seta is one-third the length of the first ventral seta and

five-sixths as long as the second ventral. The third ventral seta is longer than the second ventral and one and one-third times longer than the lateral seta. The accessory setae are present. The coverflap of the female genitalia is scored with six longitudinal striae. The length is 0.110–0.125 mm.; the width is 0.027–0.030 mm.; the depth is 0.048–0.050 mm.

Males.—No males studied.

Holotype.—Female, collected on *Pluchea purpurascens*, Peñón del Collao, Cayey, P. R., August 13, 1954, by L. F. Martorell; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Twenty-seven females, collected on *Pluchea purpurascens*,

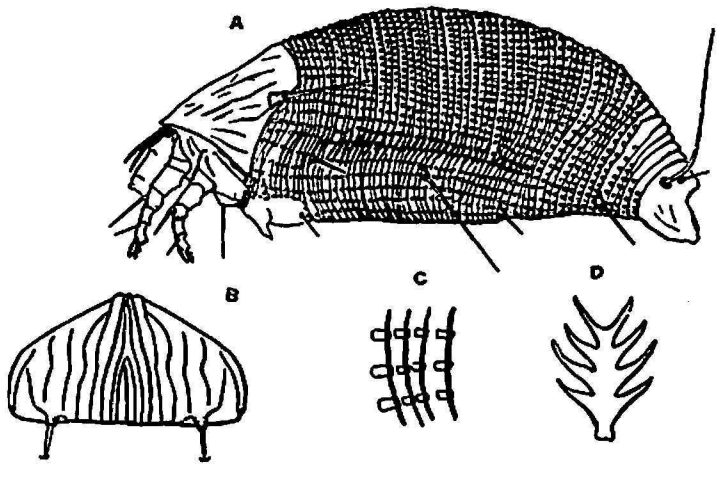


FIG. 53.—*Aceria osmia*, n. sp.: A, Lateral aspect of female; B, dorsal aspect of dorsal shield of female; C, enlarged view of microtubercles of female; D, enlarged view of empodium of female.

Peñón del Collao, Cayey, P. R., August 13, 1954, by L. F. Martorell; in the U. S. National Museum.

This species forms galls with the major portion of the gall on the lower surface of the leaf.

Aceria osmia, NEW SPECIES

Aceria osmia (fig. 53) resembles *A. essigi* (Hassan) in lacking foretibial setae and possessing a four-rayed empodium. It differs from *essigi* in that the genital coverflap is smooth; whereas, *essigi* has crescentic scoring on the coverflap.

Female.—The body is robust and opalescent white in color. The rostrum is short and evenly downcurved. The dorsal shield design is very complex with a short median line, two curving admedians, and a number of wavy submedians. The dorsal tubercles are situated on the rear margin of the shield and direct the dorsal setae caudad. The foretibial setae are absent.

The empodium is four-rayed. There are 62 to 68 abdominal rings with no differentiation between the tergites and sternites. The rings are entirely microtuberculate and the microtubercles are oblong in shape. The dorsal seta is twice the length of the lateral seta. The lateral seta is one-third the length of the first ventral seta, and is one and one-third times longer than the second ventral seta, and is subequal to the third ventral seta. The accessory setae are present. The coverflap of the female genitalia is smooth. The length is 0.088–0.110 mm.; the width is 0.035–0.050 mm.; the depth is 0.042–0.050 mm.

Male.—No males studied.

Holotype.—Female, collected on *Osmia odorata*, Cayey, P. R., June 14, 1955, by L. F. Martorell and H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Twenty-six females, collected on *Osmia odorata*, Cayey, P. R., June 14, 1955, by L. F. Martorell and H. L. Cromroy; in U. S. National Museum.

These mites cause erineal mats on the underside of the leaves.

GENUS *Eriophyes* VON SIEBOLD

Eriophyes von Siebold, (*209*) 89; Nalepa, (*167*) 5; Keifer, (*107*) 301; Keifer, (*120*) 21; Liro and Roivainen, (*147*) 141. Type of genus: *Eriophyes vitis* (Pgst.) Keifer, by subsequent designation of Keifer, 1938.

The mites of this genus are characterized by wormlike bodies which are circular in cross-section or nearly so. The dorsal shield is usually subtriangular. The dorsal tubercles are situated anterior to the rear margin of the shield which direct the setae forward, centrad, or upwards. The abdominal rings are not differentiated into tergites and sternites and are nearly always microtuberculate. The coverflap, in general, of the female genitalia is longitudinally furrowed.

This group consists of gall and bud mites. One species was found in Puerto Rico.

Eriophyes buceras, NEW SPECIES

Eriophyes buceras (fig. 54) is similar to *E. convolvens* (Nalepa) in possessing a five-rayed empodium and having the dorsal setae directed dorsocentrally. It differs from *E. convolvens* in that there are distinct linear markings on the dorsal shield rather than a shield design of lines of granules as in *convolvens*. In addition, the second ventral seta of *buceras* is longer than the first ventral seta; whereas, in *convolvens* the first ventral seta is longer.

Female.—The body is robust and a very pale white in color. The rostrum

is short and evenly down-curved. The dorsal shield has a central median line, 2 admedians and 10 submedians. The dorsal tubercles are situated a distance of twice their own lengths anterior to the rear margin of the dorsal shield. The dorsal shield setae point upward and centrad. The empodium is five-rayed. There are 46 to 52 abdominal rings which are not differentiated into tergites and sternites. The rings are entirely microtuberculate and the microtubercles are semicircular in shape. The dorsal seta is one and one-fourth times longer than the lateral seta. The first ventral seta is two and one-half times longer than the lateral seta. The second ventral seta is four times longer than the lateral and is the longest ventral seta. The third

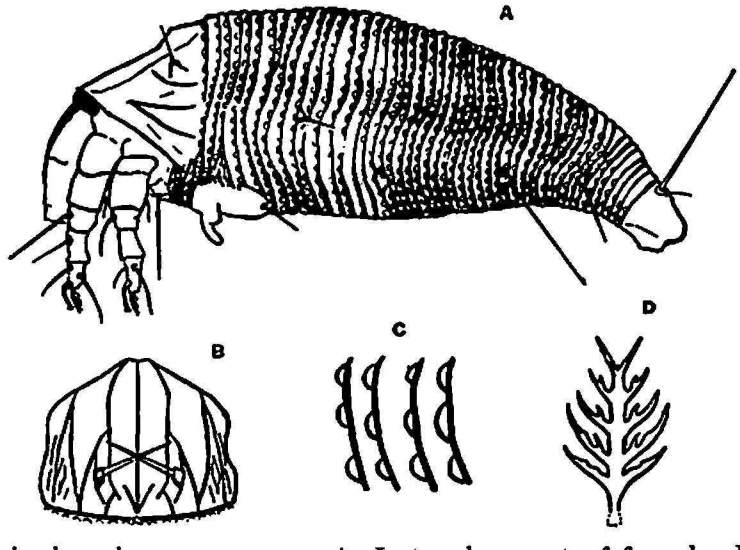


FIG. 54.—*Eriophyes buceras*, n. sp.: A, Lateral aspect of female; B, dorsal aspect of dorsal shield of female; C, enlarged view of microtubercles of female; D, enlarged view of empodium of female.

ventral seta is twice the length of the lateral seta. The accessory setae are present. The coverflap of the female genitalia has 12 longitudinal furrows. The length is 0.098–0.115 mm.; the width is 0.040–0.045 mm.; the depth is 0.040–0.045 mm.

Male.—No males studied.

Holotype.—Female, collected on *Bucida buceras*, Agricultural Experiment Station, Río Piedras, P. R., August 25, 1954, by H. L. Cromroy; in collection at the Department of Entomology, North Carolina State College.

Paratypes.—Collected on *Bucida buceras*, 24 females, Agricultural Experiment Station, Río Piedras, P. R., August 25, 1954; 10 females, Cabo Rojo, P. R., August 28, 1954, by H. L. Cromroy; in U. S. National Museum.

These mites cause four distinct types of injury to the tree. There is a deformation of the fruit, erinea on the leaves, and two different types of galls.

HOST LIST

Plant Host *Scientific Name*	*Common Name*	*Mites on Plant*
Abelmoschus esculentus	okra	*Tetranychus marianae*
		T. tumidus
Acalypha wilkesiana	acalifa	*Brevipalpus australis*
Adenoropium gossypifolium	túa-túa	*Tetranychus cinnabarinus*
		T. tumidus
Alchornea latifolia	achiotillo	*Tarsonemus rebros*
Amaranthus bispinosus		*Tetranychus tumidus*
Amaranthus spinosus		*Brevipalpus australis*
Ananas sativus	piña	*Steneotarsonemus rufus*
Artocarpus communis	panapén	*Tarsonemus labrus*
Asclepias curassavica		*Tetranychus tumidus*
		Hemitarsonemus latus
		Rhyncaphytoptus harrii
Bauhinia purpurea	palo de orquidea	*Tetranychus cucurbitae*
Bidens cynapiifolia		*Brevipalpus phoenicis*
Bidens pilosa		*Brevipalpus australis*
Bixa orellana	achiote	*Tarsonemus modicus*
Bucida buceras	ucar	*Eriophyes buceras*
Cajan cajan	gandures or pigeon peas	*Tetranychus cucurbitae*
Caladium colocasia	malanga	*Tetranychus tumidus*
Centrosema pubescens		*Tetranychus tumidus*
		Hemitarsonemus latus
Centrosema virginiana		*Eotetranychus planki*
		Xenotarsonemus cadeae
Cleome gynandra		*Tetranychus cucurbitae*
Coffea arabica	café or coffee	*Fungitarsonemus borinquensis*
Cordia alliodora		*Tetranychus cucurbitae*
		Tetranychus desertorum
Cordia sulcata		*Tenuipalpus simplychus*
Guarea ramiflora	guaraguao	*Brevipalpus bakeri*
Datura stramonium		*Tetranychus cucurbitae*
Dolichos lablab	chícharos	*Tetranychus cucurbitae*
		Hemitarsonemus latus
Elaeis guineensis		*Tarsonemus tertiapilus*
Elephantopus mollipes		*Tetranychus tumidus*
Erythrina sp.	bucare	*Eutetranychus banksi*
Gardenia jasminoides	gardenia	*Tetranychus tumidus*

Plant Host *Scientific Name*	*Common Name*	*Mites on Plant*
Golden Dwarf Palm of Sumatra		*Tarsonemus prominens*
Gossypium barbardense	algodón or sea island cotton	*Tetranychus tumidus*
Ipomoea batatas	batata or sweet potato	*Tetranychus tumidus*
Ipomoea learii	morning glory	*Tetranychus tumidus*
Ipomoea sp.		*Tetranychus ludeni*
		Tetranychus desertorum
Leonotis nepetaefolia	molinillo	*Tetranychus tumidus*
Lycopersicon esculentum	tomato	*Tetranychus cucurbitae*
		Hemitarsonemus latus
Macroptilium lathyroides		*Tetranychus tumidus*
Mangifera indica	mango	*Oligonychus punicae*
Manihot utilissima		*Tetranychus cinnabarinus*
		Eotetranychus caribbeanae
Osmia odorata		*Brevipalpus australis*
		Aceria osmia
Parthenium hysterophorus		*Brevipalpus australis*
Paspalum fimbriatum		*Oligonychus pratensis*
Paspalum paniculatum		*Tarsonemus gramineus*
Persea sp.	avocado or aguacate	*Oligonychus punicae*
Petitia domingensis		*Vasates domingensis*
Petiveria alliacea	anamú	*Tetranychus marianae*
Phyllanthus niruri		*Tetranychus cucurbitae*
		Brevipalpus australis
Pluchea odorata		*Aceria odorata*
Pluchea purpurascens		*Steneotarsonemus martorelli*
		Aceria purpuracenis
Pterocarpus sp.		*Tarsonemus rotundus*
Pueraria hirsuta	kudzú	*Tetranychus cucurbitae*
Rapanea ferruginea		*Tarsonemus purpurus*
Rauwolfia lamarckii		*Tetranychus tumidus*
Royal Palm	palma real	*Diptacus borinquensis*
Saccharum officinarum	caña de azucar or sugar cane	*Oligonychus sacchari*
Salvia splendens		*Tetranychus tumidus*
		Brevipalpus inornatus
Sida carpinifolia		*Tetranychus tumidus*
Solanum tuberosum	potato	*Hemitarsonemus latus*

Plant Host		
Scientific Name	*Common Name*	*Mites on Plant*
Synedrella nodiflora		*Tetranychus tumidus*
Tetrazygia elaeagnoides		*Oligonychus smithi*
Tree fern (unidentified)		*Tenuipalpus frondosus*
Trichachne insularis		*Tetranychus ludeni*
Trichilia pallida		*Tetranychus marianae*
		Eutetranychus banksi
Urena lobata		*Tetranychus marianae*
Xanthosoma violacea	yautía	*Tetranychus tumidus*

SUMMARY

This is a taxonomic study of the plant-feeding mites of Puerto Rico. These mites belong to the Class Arachnida, Order Acarina, Suborder Trombidiformes, and the families Tetranychidae, Tenuipalpidae, Tarsonemidae and Eriophyidae. General morphology, general biology, and keys to species are given for each family, as well as written and pictorial descriptions of the species.

Thirteen species of spider mites or tetranychids are described. One of these, *Oligonychus smithi* Cromroy is described as a new species. The other species are: *Eutetranychus banksi* (McGregor), *Eotetranychus caribbeanae* (McGregor), *Eotetranychus planki* (McGregor), *Oligonychus pratensis* (Banks), *O. punicae* (Hirst), *O. sacchari* (McGregor), *Tetranychus cinnabarinus* (Boisduval), *T. cucurbitae* Rahman and Punjab, *T. desertorum* Banks, *T. ludeni* Zacher, *T. marianae* McGregor, and *T. tumidus* Banks. *T. tumidus* was the most abundant of all species on the Island.

One species of Tenuipalpidae, *Brevipalpus longisetosus* Baker, had been reported previously from the Island. Three species common to the United States were found, *Brevipalpus australis* (Tucker), *B. inornatus* (Banks), and *B. phoenicis* (Geijskes). Three new species are also described: *Brevipalpus bakeri* Cromroy, *Tenuipalpus frondosus* Cromroy, and *Tenuipalpus simplychus* Cromroy.

Hemitarsonemus latus (Banks) was the most common tarsonemid found on the Island. In addition, 12 new species are described. Revised keys to the species of the genera *Steneotarsonemus* and *Tarsonemus* for the Western Hemisphere are given. A new genus, *Fungitarsonemus*, was erected. The following are the new species of tarsonemids described: *Tarsonemus graminicus* Cromroy, *T. labrus* C., *T. modicus* C., *T. prominens* C., *T. purpurus* C., *T. rebros* C., *T. rotundus* C., *T. tertiapilus* C., *Steneotarsonemus martorelli* C., *S. perezi* C., *Fungitarsonemus borinquensis* C., and *Xenotarsonemus cadeae* C.

Seven new species of Eriophyidae are described. They are *Vasates do-*

mingensis C., *Diptacus borinquensis* C., *Rhyncaphytoptus harrii* C., *Aceria osmia* C., *Aceria odorata* C., *Aceria purpurascenis* C. and *Eriophyes buceras* C.

RESUMEN

El presente trabajo es un estudio taxónomico de los ácaros que atacan las plantas en Puerto Rico. Estos artródos pertenecen a la Clase Arachnida, Orden Acarina, Suborden Trombidiformes y a las familias Tetraniquidae, Tenuipalpidae, Tarsonemidae y Eriofiidae. Para cada familia se da su morfología, biología general y una clave para indentificar las especies. También se proveen descripciones en detalle y dibujos de las especies.

Se describen 13 especies de ácaros. Uno de estos, *Oligonychus smithi* Cromroy se informa como una nueva especie. Las otras especies son *Eutetranychus banksi* (McGregor), *Eotetranychus caribbeanae* (McGregor), *Eotetranychus planki* (McGregor), *Oligonychus pratensis* (Banks), *O. punicae* (Hirst), *O. sacchari* (McGregor), *Tetranychus cinnabarinus* (Boisduval), *T. cucurbitae* Rahman y Punjab, *T. desertorum* Banks, *T. ludeni* Zacher, *T. marianae* McGregor, y *T. tumidus* Banks. *T. tumidus* resultó ser el más abundante en Puerto Rico de todas las especies estudiadas.

Una especie de Tenuipalpidae, *Brevipalpus longisetosus* Baker había sido informada con anterioridad en la Isla. Tres especies comunes en Estados Unidos fueron encontradas en la Isla, a saber: *Brevipalpus australis* (Tucker), *B. inornatus* (Banks), y *B. phoenicis* (Geijskes). Se describen tres nuevas especies: *Brevipalpus bakeri* Cromroy, *Tenuipalpus frondosus* Cromroy, y *Tenuipalpus simplychus* Cromroy.

El tarsonémido más común encontrado en Puerto Rico fué *Hemitarsonemus latus* (Banks). Además, se describen 12 nuevas especies. Se incluyen claves revisadas de las especies en los géneros *Steneotarsonemus* y *Tarsonemus* para el Hemisferio Occidental. Se erigió un nuevo género, *Fungitarsonemus*.

Las nuevas especies de tarsonémidos descritas son las siguientes: *Tarsonemus gramineus* Cromroy, *T. labrus* C., *T. modicus* C., *T. prominens* C., *T. purpurus* C., *T. rebros* C., *T. rotundus* C., *T. tertiapilus* C., *Steneotarsonemus martorelli* C., *S. perezi* C., *Fungitarsonemus borinquensis* C. y *Xenotarsonemus cadeae* C.

Se describen siete nuevas especies de Eriofiidae. Estas son *Vasates domingensis* C., *Diptacus borinquensis* C., *Rhyncaphytoptus harrii* C., *Aceria osmia* C., *Aceria odorata* C., *Aceria purpurascenis* C. y *Eriophyes buceras* C.

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