INTRASPECIFIC VARIATION IN PHYTOSEIIDAE
(ACARINA—MESOSTIGMATA)¹

MARTIN H. MUMA² AND HAROLD A. DENMARK³

One of the more intriguing problems confronting the systematist is intraspecific variation. The ability to distinguish, segregate or associate individual specimens at the species level is largely dependent on the stability of the selected diagnostic characters. When stability is lacking, a knowledge of the range of variability is essential to accurate work.

As mite studies have been intensified, it has become increasingly evident that mites exhibit varying degrees of intraspecific variation. In some groups a remarkable stability is found, in others variation seems to be the norm. Interest in the problem is evidenced in discussions presented by Goksu et al. (1960) on Trombiculidae, Newell (1958) on Trombidiidae, Summers (1960) on Stigmaeidae, Wharton (1957) on parasitic Acarina and Yunker (1955) on a species of *Knemidocoptes*.

In the family Phytoseiidae numerous variants have been reported. Seasonal variation of *Kamptonomus aberrans* (Oud.) as evidenced by degree of sclerotization and spinal length and serration was recorded by Chant (1955). Variation of dorsal scutal reticulation on *Amblyseius peregrinus* (Muma) was reported by Muma (1955). DeLeon (1957, 1958, 1959) recorded apparent variation in the number of lateral setae on *Clavidromina cernua* (DeLeon) and *C. elliptica* (DeLeon) caused by the occurrence of *S₃* on the dorsal scutum. In 1959 Chant stated “Phytoseid mites show little intraspecific variation and the criteria for specific separation, though appearing to be of minor importance, can usually be used with confidence.” but in the same work he cited variation of diagnostic characters for *Meta-seiulus validus* (Chant), *Galendromus occidentalis* (Neobitt), *Typhlodromella rhenana* (Oud.), *Dubininellus macropilis* (Banks) and *D. bakeri* (Chant). While synonymizing *T. kazachstanticus* Wainstein with *T. rhenana* (Oud.), Chant also stated that “Intra-specific variation accounts for the few small differences that seem to be evident.” Later Chant and Athias-Henriot (1960) made a detailed presentation of character variation in species of *Phytoseius Ribaga* and *Dubininellus* Wainstein. As yet, however, no discussion of the systematic impact of such variations has been presented.

In this report we intend to demonstrate a wide range of variation in diagnostic characters for two species of Phytoseiidae, *Macroseius bicusatus* Chant, Denmark and Baker and *Amblyseius peregrinus* (Muma), to describe this range as it pertains to species segregation, and to discuss the importance of a knowledge of such variation in the description of new species. Descriptions of observed atypical or abnormal specimens of other species, which may also be intraspecific variations, are also included.

¹ Florida Agricultural Experiment Stations Journal Series No. 1323. Contribution No. 4 Entomology Section, Division of Plant Industry.
² Entomologist, University of Florida, Citrus Experiment Station, Lake Alfred.
³ Chief Entomologist, Florida State Department of Agriculture, Division of Plant Industry, Gainesville.
Plate 1. *Macroseius biscutatus* Chant, Denmark and Baker. Figs. 1-16—variations in the length of $L_1$ and $L_2$ and in the form of the anterior portion of the anterior dorsal scutum on females. Figs. 17-22—variations in the fragmentation of the male ventrianal scutum.
All specimens referred to in this study were collected from their natural habitats and examined under a phase-contrast microscope.

**Macrosetius biscutatus** Chant, Denmark and Baker

**Figures 1 to 22**

The subfamily Macrosetiinae and genus *Macrosetius* were erected by Chant, Denmark and Baker (1959) for this phytoseid mite because it has two dorsal scuta. A diagnosis and redescription of the species is given so that intraspecific variations can better be presented and discussed. The modified Garman system as presented by Muma (1961) is used for setal designation.

**Diagnosis:** This distinctive species is readily recognized by its large size, divided dorsal scutum, and the presence of seven pairs of dorsal (D) setae. The species seems to have affinities with both the Digamasellidae and Phytoseiidae of which it may well be a primitive link. It is retained in the latter family for the present.

**Females:** Length, D1 to D5, of twenty randomly selected specimens 470.8 to 577.8μ, anterior dorsal scutum 226.4 to 283.0μ wide, posterior dorsal scutum 267.0 to 328.1μ wide. The modal length is 533.6μ and modal widths 248.2 and 301.0μ respectively. Dorsum covered with two variable subequal scuta, anterior and posterior, with the suture between D1 and D2. Anterior scutum with 10 pairs of setae, posterior median areas slightly imbricate. Setae L1 and L6 minute to large and variable in comparison to each other. Setae L3, L5, and S long, smooth and thick. Setae D1, D4, D5, and M1 minute.

Entire posterior dorsal scutum slightly imbricate, with 9 pairs of setae. Setae L1 long, smooth and thick; L2 and M3 long, serrate and thick. Setae D3, D4, M, and L1 minute. Seta S3 on interseptal membrane.

Spermathecae with cervix bell-shaped. Sternal scutum slightly longer than wide with 3 pairs of setae. Metasternal scutum elongate, each with a seta. Genital scutum truncate posteriorly, longer than wide, with 1 pair of setae. Two pairs of metapodal scutata. Ventrianal scutum approximately triangular with 1 pair of preanal setae.

Fixed digit of chelicerae with 12 to 15 teeth and *pila dentilis*; movable digit with 2 or 3 large teeth. Leg IV with 3 macrosetae ( genu, tibia and basitarsus).

**Males:** Length, D1 to D5, of ten randomly selected specimens 291.6 to 538.4μ, anterior dorsal scutum 274.4 to 325.9μ wide, posterior dorsal scutum 240.1 to 298.4μ wide. The modal length is 445.9μ and the modal widths 284.7μ and 260.7μ respectively. Dorsum as in female except seta S2 on anterior dorsal scutum. Ventrianal scutum separated from sternigentinal scutum, fragmented and with 4 pairs of preanal setae. Fragmentation variable, often resulting in two major and one or more minor scuta. Chelicera with spur-shaped spermatophore bearer. Leg IV with macrosetae as in female.

**Variations:** In the original description L1 is given as slightly longer than L2. This diagnostic character is highly variable as illustrated in Figures 1-16. One hundred females were randomly selected and L1 and L2 measured to establish the ratio of L1/L2. The ratio ranged from 0.27 to
3.45μ with 77 per cent of the specimens having L₀ shorter than Lₐ. As shown in Figures 1-16 the lengths and ratios may vary between the right and left side of the same specimen. A lesser number of males were observed and also found to have a high degree of variation in the lengths and comparative lengths of L₀ and Lₐ.

The anterior dorsal scutum is highly variable. A spur may or may not be present at the junction of the peritremal scutum and anterior dorsal scutum as shown in Figures 1-16. Figures 14 and 15 show other occasional variations in the shape of the anterior dorsal scutum.

The male ventrianal scutum is fragmented into two large variable scuta with an occasional third and fourth smaller scutum present as shown in Figures 17 to 22. One of the 4 pairs of preanal setae is sometimes found on the membrane between the two larger fragments as in Figure 18.

_Amblyseius peregrinus_ (Muma)

Figures 23 to 31

In order to fix the identity of this species prior to an examination of intraspecific variation, the following diagnosis and redescription of the species is presented.

**Diagnosis:** This is the typical species of the subgenus _Typhlodromalus_ Muma and is closely related to _A. newsami_ (Evans), _A. africanus_ (Evans), _A. mesembrinus_ (Dean), _A. scutalis_ (Athias-Henriot) and _A. planetarius_ (DeLeon) from which it differs in having M₁ serrated and much longer than L₀ and Lₐ. Other near relatives include _A. jucundus_ (Chant), _A. robiniae_ (Chant), _A. evansi_ (Chant) and _A. primulae_ (Chant). Of these species, _A. jucundus_ is distinctive by the three long macrosetae on Leg IV. The remaining three species, however, seem to possess no distinguishing characters that cannot be demonstrated to fall within the range of variation of _A. peregrinus_.

**Females:** Dorsal scutum of twenty randomly selected specimens 330 to 385μ long and 210 to 235μ wide, with the modal length 365μ and the modal width 225μ. Scutum faintly to strongly reticulate.

Dorsal setae except for D₁ small to minute; D₁ slightly to distinctly larger than other dorsals. M₁ and M₂ small; M₃ two to four times longer than other medians and distinctly serrate. Lateral setae L₀, Lₐ and Lₙ distinctly longer than other laterals with Lₐ shortest; Lₚ distinctly serrate. Lateral setae L₁, L₀, Lₐ, Lₙ, Lₐ and Lₙ small with Lₐ smallest; Lₙ slightly to distinctly smaller than L₀; Lₚ slightly to distinctly larger than Lₐ. S₁ and S₃ small to minute.

Fixed digit of chelicerae with 8 to 10 teeth and _pilis dentilis_; movable digit with 3 to 4 teeth. Sternal scutum distinctly longer than wide, smooth and lobate posteriorly. Ventrianal scutum elongate, constricted laterally and smooth; preanal setae arranged in anteriomarginal triangles; preanal pores elliptical and nearer posterior preanal setae than each other.

Macrosetae on Leg IV short, that on tarsus longest, that on tibia shortest; genual and tarsal macrosetae not to distinctly knobbed.

Spermathecae with cervix cup shaped internally, abruptly narrowed into an elongate, slender tube which terminates in a knobbed atrium.

**Males:** Dorsal scutum of twenty randomly selected specimens 235 to
300\(\mu\) long and 150 to 180\(\mu\) wide with the modal length 265\(\mu\) and the modal width 150\(\mu\).

Scutum and setation of scutum as in females except the scapular setae occur on the scutum.

Ventral anal scutum roughly triangular and reticulate with three pairs of preanal setae and a pair of elliptical preanal pores.

Macrosetae as in females except they are not knobbed.

Plate 2. Amblyseius perigrinus (Muma). Figs. 23-38—variations in the ratios of \(M_5/L_5\) and \(M_6/L_6\) on females. Figs. 29-31—variations in the female ventrianal scutum.

Spermatophore bearer provided with a broad lobate lip, an opposing short acute spur and a slight constriction just behind these apical processes.

Variations: Because of the wide range in size, setal lengths and host plants of the above described specimens, there was some doubt as to the conspecificity of the material. In order to determine homogeneity or heterogeneity of this randomly selected sample, 100 mounted females, including the above described specimens, were examined and the lengths and ratios
Graph 1. Relationships of the logarithms of the accumulated frequencies and ratios of $M_2/L_5$ and $M_3/L_6$ in a randomly selected series of 100 specimens of *Amblyseius peregrinus* (Muma).

of $M_2/L_5$, and $M_3/L_6$ were obtained. When the resulting logarithms of the ratios and logarithms of accumulated frequencies of the ratios were computed and plotted against each other, two straight line relationships were obtained. These are shown in Graph 1. They indicate that as far as comparative lengths of these setae are concerned, the specimens examined were from the same population and conspecific. Intersection of the two graph lines indicates a high degree of variation in the combination of the ratios of $M_2/L_5$ and $M_3/L_6$ from specimen to specimen. Figures 23 to 28 give several examples that include maximum, minimum and modal lengths of the 4 setae. Although the comparative relationships of the above cited setae were the only ones treated numerically, variations in many other characters were studied. Most striking were those dealing with ventral anal scuta, macrosetae of Leg IV and comparative sizes of $L_5$ and $L_6$. Ventral anal scuta varied from the *robiniae* type through the *peregrinus* type to the *primulae* type as shown in Figures 29 to 31. Macrosetae varied from acutely
pointed to broadly knobbed. Setae L₄ varied from slightly longer than L₅ to nearly three times as long.

Other variations noted were the occasional loss of the right or left D₅ or D₆, the occasional occurrence of three D₈s and in one case a malformed ventrianal scutum, horn-shaped on the right side with four pairs of preanal setae but normal on the left side.

**Miscellaneous Species**

Observations on varying numbers of specimens of other species indicate variation in characters usually cited as diagnostic. A few of these are cited below.

In a long series of *Amblyseius limonicus* Garman and McGregor from Florida, M₃ was smaller than L₃ and L₄ on most specimens but larger on a few; L₅ was commonly equal to L₆ in size but distinctly larger on some; D₄ was distinctly smaller than L₄, but on several specimens was sub-equal; the ventrianal shield was usually vane-shaped but occasionally was nearly parallel-sided.

Ten specimens of *A. mesembrinus* (Dean) from Mexico have L₅ equal to L₆ except on two specimens on which L₅ was distinctly larger; the ventrianal scutum was broad posteriorly and narrow anteriorly with concave sides on most specimens but vane-shaped on two; most specimens had the anterior end of the ventrianal scutum irregular, so much so on one specimen that only two preanal setae occurred on one side of the scutum.

Among 15 specimens of *Calendromus annocotone* (DeLeon) from Florida, two had only three preanal setae on the left side of the ventrianal scutum. The presence of three and/or four preanal setae on the ventrianal scutum was a common occurrence on 10 specimens of *G. occidentalis* (Nesbitt) from California. On the other hand, examination of more than 50 specimens of *G. floridanus* (Muma) revealed no variation in the number of preanal setae. On one specimen of *G. floridanus*, one D₅ was missing.

**Discussion**

The demonstration of a wide range of variability in the lengths and comparative lengths of L₄ and L₅ on *M. biscutatus* indicates the unreliability of these characters in this genus and species. Primitive genera and species in the Amblyseini should be investigated carefully for a similar variation before too many additional species are described. Suspect genera include *Phytoseiulus* Evans, *Proprioseius* Chant and *Amblyseius* Muma.

Although form of the dorsal scutum is seldom cited as diagnostic, most workers accurately figure and describe seemingly intraspecific variations of this structure. The observed intraspecific variation of the anterior dorsal scutum on *M. biscutatus* suggests that such may exist in other species. If so, detailed description of the character may be superfluous, unless the range can be described. Diagnoses and keys should be based on static characters or describe ranges of variations.

Muma (1961) expressed doubt that a fragmented male ventrianal scutum was a valid criterion for generic separation. Variation of this structure in *M. biscutatus* from partly fragmented in the alotype to variously fragmented in other specimens indicates that the character may be of minor
importance even in specific segregation. Applications of this knowledge are important in dealing with highly sclerotized Amblyseines and species of *Typhlodromus* DeLeon.

A wide range of intraspecific variation of diagnostic characters apparently exists within the large heterogenous genus *Amblyseius* Berlese. Examination of *A. peregrinus* (Muma) has revealed such a variation that it may be necessary to synonymize the names *A. robiniae* (Chant), *A. evansi* (Chant) and *A. primulæ* (Chant). Furthermore, the range in lengths and comparative lengths of lateral and median setae seems to invalidate precise setal lengths and comparative lengths as diagnostic characters. Also, the description of precise ventral anal and macrosetal form for species recognition is of doubtful value. When setal variation is observed, numerical description should be used to indicate the range of variation. All species of *Amblyseius* and possibly those of *Amblyseidius* and *Cydnodromus* Muma should be tested mathematically.

Preliminary investigation of other species of Phytoseiidae has revealed a wide range of intraspecific variation in some forms and practically none in others. It would seem that each species should be studied to determine its inherent range of intraspecific variation. Until such is done, at least for the common or important forms, species descriptions based upon minor questionable diagnostic characters should be dealt with cautiously.

**Literature Cited**


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Anyone interested in the study of United States beetles will find this book to be "the one indispensable reference". Certainly it will assume a most prominent position on the library shelves of every professional coleopterist, along with other classical treatises. We anxiously await the parts to be published since several of the larger families have not yet been treated. No publication during the past 30 years will have such a profound desirable effect on the study of beetles in the United States!

The author states in the introduction that this is an up-to-date version of Bradley's *A Manual of the Genera of Beetles of America, North of Mexico*, with a completely revised form. He is conservative in his appraisal of his own work because this book certainly surpasses any similar works on U. S. beetles. Since our latest catalogue of beetles has had five supplements, the last of which was issued 14 years ago, there is no current comprehensive reference on the U. S. beetle fauna. With this treatise, including its extremely useful references, we can once again feel nearly "up-to-date" at the generic level.

In contrast to the Dillon book reviewed later, this book treats the genera of the U. S. (occasionally keys to species are also given for some of the smaller families). The latest keys to species are cited after each genus thus eliminating an extensive search of the literature. From the professional standpoint, this one advantage is well worth the price of the book.

It is printed on good quality 6x9 looseleaf paper to fit an optional three-post binder. Although the paper quality is good, it is very thin, which causes pages to tear out of the binder easily and makes turning of individual pages clumsy. The format of the book is an innovation which should be more widely used. Each family is treated as a separate fascicle with individual as well as continuous pagination. Each fascicle has its own index and bibliography, all of which contributes to the flexibility of this

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