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LASIOSEIUS MITES (ACARI: GAMASIDA: ASCIDAE) ASSOCIATED WITH HUMMINGBIRD-POLLINATED FLOWERS IN TRINIDAD, WEST INDIES

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Abstract. *Lasioseius chelaserratus,* a new species of ascid mite associated with hummingbirds and inflorescences of *Heliconia,* is described and illustrated from specimens collected in Trinidad and Venezuela. *Lasioseius elegans* is redescribed from all instars collected from *Heliconia* inflorescences in Trinidad. Information is summarized concerning the food habits and population biology of both species with respect to coinhabiting hummingbird flower mites and their *Heliconia* plant hosts. The taxonomy of the genus *Lasioseius* is briefly discussed and 2 new genus-group synonymies are proposed: *Crinidens* Karg, 1980 = *Borinquolaelaps* Fox, 1946 and *Criniacus* Karg, 1980 = *Hoploseius* Berlese, 1914.

Mites in the family Ascidae that inhabit flowers and disperse in the nares of hummingbirds have been assigned to 3 genera: *Rhinoseius* Baker & Yunker, 1964 (including *Tropicoseius* Baker & Yunker, 1964); *Proctolaelaps* Berlese, 1923; and *Lasioseius* Berlese, 1916. Of these 3 genera, *Rhinoseius* is the only genus whose species are known exclusively from hummingbirds or hummingbird-visited flowers (Colwell 1973, 1979, 1983; Colwell & Naeem 1979; Dobkin 1983). *Proctolaelaps* species are known from a variety of habitats (Lindquist & Evans 1965) and are recorded from a variety of associations with flower visitors such as sunbirds (Ryke 1964), bumblebees (Lindquist & Evans 1965), lepidopterans (Treat 1975), and the Australian Honey Possum (Domrow 1979). A single species of *Lasioseius, L. elegans* Fain, Hyland & Aitken, 1977, was described from 3 females collected from hummingbirds in Trinidad.

During a study of the hummingbird flower mite fauna on the island of Trinidad, a large number of individuals of *L. elegans* representing all developmental stages was collected. An undescribed species sharing a number of characteristics with *L. elegans* was also collected. In this paper, we redescribe *Lasioseius elegans* in all stages. We also describe the new species *Lasioseius chelaserratus* and provide life-history information for both species. Although they share phoretic hosts (i.e., hummingbirds) and the inflorescences of *Heliconia* host plants (see Dobkin 1984 for clarification of *Heliconia* host plant taxonomy) with *Rhinoseius* and *Proctolaelaps* species, these *Lasioseius* species have mouthparts indicative of predatory rather than nectarivorous food habits. In the following descriptions, the chaetotactic nomenclature of Lindquist & Evans (1965)

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is followed. Designations for glands and proprioreceptors follow Athias-Henriot (1975). All measurements are given in micrometres (μm).

Lasioseius elegans Fain, Hyland & Aitken, 1977 Fig. 1–27

Lasioseius elegans Fain, Hyland & Aitken, 1977a: 184; 1977b: 124.

Diagnosis. Tectum triramous with fine tapering extensions and central branch usually subdivided distally. Dorsal shield coarsely punctate posteriorly from seta *Z*4, *J*4 to end of shield; setae on ventral shields small (10 long). Two pairs of metapodal plates; metasternal sclerites absent. Legs II-III-IV have several conspicuously long and/or thickened modified setae. Setae *j*1, *r*3 (humeral seta), and *Z*5 larger and thicker than all other dorsal shield setae and more obviously tricarinate than others.

♀. *Dorsum.* Dorsal shield 590–625 long, 310–340 wide (10 specimens), reticulated over entire surface with coarsely punctate area posterior to setae *J*4 and *Z*4 to end of shield (Fig. 1). Dorsal shield with 36 pairs of setae, 21 pairs on anterior region, 15 on posterior region; 9 pairs on lateral membrane; *j-J, z-Z,* and *s-S* series of setae complete; first 3 pairs of marginal (*r*) setae on humeral region of shield; remaining 9 pairs of *r-R* marginals on lateral membrane. Setae on dorsal shield not short, *J*1–*J*4 about ½ as long as successive distances between their bases; setae *z*1, *s*1, and *J*5 equal in length, much shorter than all other dorsal shield setae; most dorsal setae slightly trifid at tip; *j*1, *r*3, and *Z*5 about 1.5× as long as all other setae, thicker, and more distinctly tricarinate at tip. Identity and relative positions of dorsal glands and proprioreceptors similar to those of other Ascidae and Phytoseiidae (Athias-Henriot 1975). *Venter.* Tritosternum normal, with moderately pilose lacinae fused along basal ¼ of their length. Presternal area with few transverse striations. Sternal shield with 3 pairs of short simple setae and 2 pairs of pores; ornamentation weakly developed and restricted to anterior and lateral regions. Third pair of sternal pores and 4 pairs of sternal setae on membrane. Endopodal plates normally formed between coxae II and IV. Genital shield with a large, inverted-V pattern, widened behind genital setae with posterior margin truncate. Postgenital strip thin, continuous, about as wide as anterior width of ventrianal shield. Two pairs of metapodal plates. Ventrianal shield with transverse striations with few interconnections; anal region coarsely punctate; lateral margins of shield concave at level of anal opening; anal opening not enlarged; ventrianal region with setae *Jv*1, *Jv*2, *Jv*3, and *Zv*2 on shield; *Zv*3 on or off shield; and *Zv*1, *Jv*4, and *Jv*5 on membranous integument. One pair of submarginal setae (*UR*7) on lateral membranous integument; paraanal setae ¾ to nearly as long as postanal setae, all simple. Other ventrianal setae short, filiform with *Jv*5 and submarginals longer than others. Eight pairs of proprioreceptors in ventral region, distributed as in Fig. 2. Peritremes extending from stigmata anteriad to vicinity of setae *z*1 (Fig. 2). Peritremal sclerites fused with exopodals posterior to stigmata. Spermatheca with cylindrical cervix, axis of which has a dorsoventral orientation; a long fine accessory duct empties at base of cervix. Maturation pouch spherical (Fig. 27). *Gnathosoma.* Anterior margin of tectum usually triramous with variably toothed, tapering extensions; central branch usually subdivided apically (Fig. 6); occasionally one branch may be absent (Fig. 11–17). Fixed chela with row of 11 teeth plus 2 at distal end beside a small concave groove presumably where distal tip of movable digit rests; movable digit tridentate (Fig. 5). Deutosternum with 7 connected transverse rows of denticles; anterior 4 rows with 9–12 teeth; posterior 3 rows with 12–16 teeth, no rows widened. Corniculi normal; internal malae extending beyond tips of corniculi (Fig. 7). Four pairs of subcapitular setae, most anterior pair longest. Palpal trochanter with internal ventral seta much longer than external ventral seta. Apotele of palp tarsus 2-tined. *Legs.* Leg I slightly shorter than length of dorsal shield, leg IV slightly longer. Coxae II-III-IV with faint lineations. Trochanters I–IV with *av*1 thickened. Setation of genua

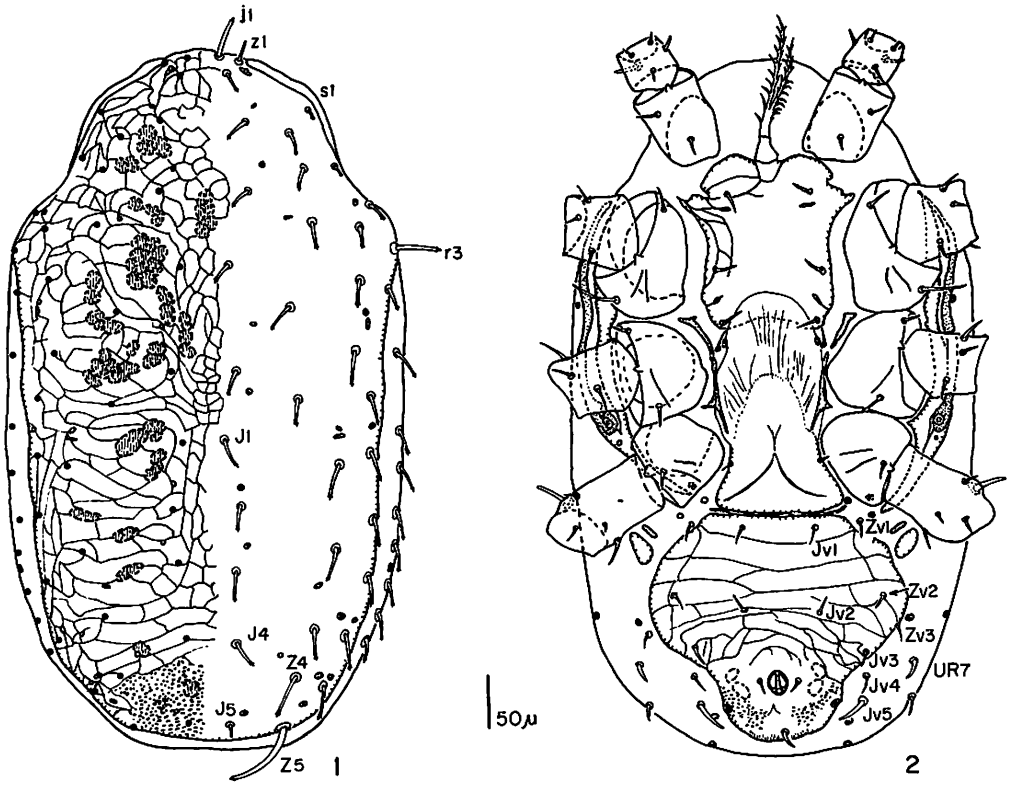

FIG. 1–2. *Lasioseius elegans*, ♀: **1**, dorsum; **2**, venter.

of legs I-II-III-IV, respectively, 13-11-9-9; that of tibiae, 13-10-8-10; all leg setae smooth. Tarsus II with *ad*2 and *pl*2 elongate and ribbonlike; tarsus III with *ad*2 and tarsus IV with *al*2 also elongate and ribbonlike. Basitarsus of leg IV with all setae thickened and *pl*3 elongate, telotarsus of leg IV with *pd*2 and *pl*2 thickened and enlarged (Fig. 18–22).

♂. Dorsal shield 490–522 long, 285–325 wide (10 specimens), reticulated as on ♀ except with 22 pairs of setae on anterior portion (including *r*5) (Fig. 3). Porotaxy as in ♀. Sternogenital shield striated laterally and posteriorly, with 5 pairs of setae and 3 pairs of pores (Fig. 4). Ventrianal shield wide, extending over areas occupied by metapodal plates, transversely lineate over entire surface, slightly punctate over anal region; setation variable, normally bearing 6 pairs of setae (*Jv*4 absent) plus anal and postanal setae and with *Zv*3 off plate; occasionally *Jv*4 present and/or *Zv*3 on plate; ventral and anal setae as in ♀ with respect to size and shape. Anal shield contacting, but not connected with, sternogenital and exopodal plates. Exopodal sclerite with anterior portion not fragmented from rest of plate. Gnathosoma: tectum triramous, with irregularly serrated tapering extensions, central branch usually simple, rarely divided distally; lateral branches thicker than in ♀ (Fig. 9). Fixed chela with row of 6–7 teeth; movable chela unidentate, with moderately long, ventrally curving, elephant-trunk-like spermadactyl (Fig. 8). Corniculi more widely spaced than in ♀; mediad of corniculi, hypostome terminating with a pair of membranous processes with rounded apices (Fig. 10); these are ventrad of, and not a part of, internal malae. Other features of gnathosoma as in ♀ except 5th row of deutosternal

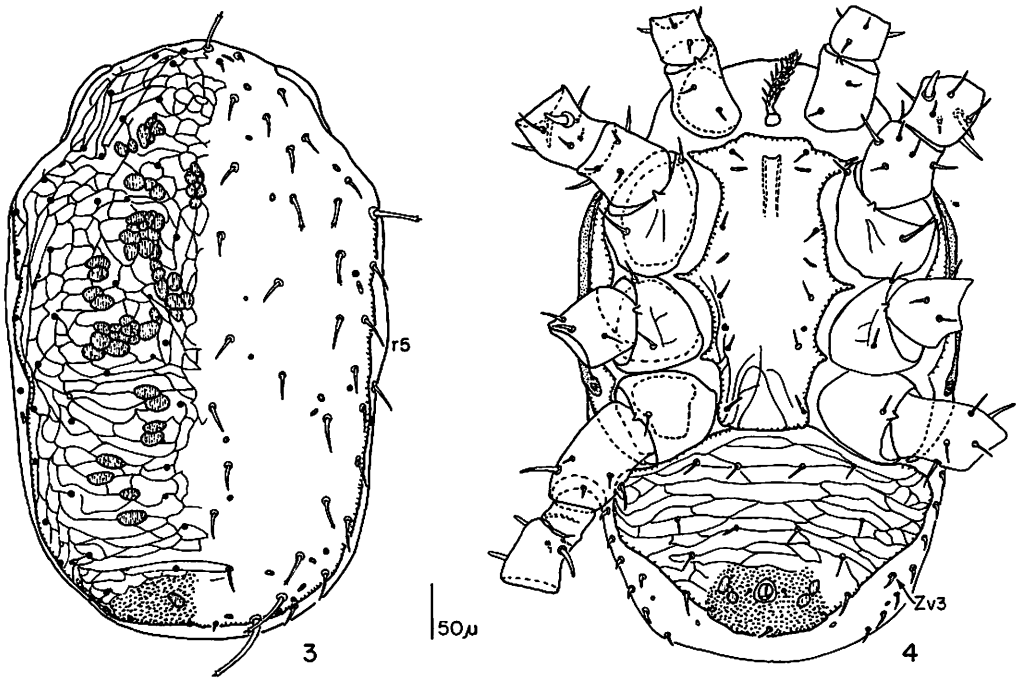

FIG. 3–4. *Lasioseius elegans*, ♂: **3**, dorsum; **4**, venter.

teeth, which is slightly wider in proportion to other rows than in ♀. Legs: legs I and IV shorter than dorsal shield, as long as distances between setae *j*1 and *j*4. Leg II slightly shorter and stouter than that of ♀, with *av*1 of femur short, stout, spinelike, *pd*1 and *pl*2 of femur thickened, with *pl*2 about 1.5× length of *pd*1, *av*1 of genu thickened and *av*1 of tibia thickened. Leg III with *al*1 and *al*2 of femur, *pl*3 of tarsus all thickened, spinelike, longer than all other setae on leg. Leg IV with all of trochanter, *al*1 and *al*2 of femur, *pl*1 and *pv*1 of genua, *pl*2 and *pl*3 of tarsi all thickened, spinelike, and longer than other setae on their respective segments; tarsus IV with *mv*, *av*2 and *pv*2 attenuate, much longer than corresponding setae of ♀ (Fig. 22).

Deutonymph. Dorsal shield 418–515 long, 218–285 wide (10 specimens), with lateral incisions reaching to a midpoint between setae *z*6, *s*6, and *Z*1; shield reticulate over entire surface but only slightly so anteriorly (Fig. 23). Dorsal shield normally with 29 pairs of setae: 14 pairs on anterior region, 15 pairs on posterior region; *s*2, and all marginal (*r*-*R*) setae on membranous region; *z*1, *s*1 occasionally on sclerite; 1 pair of submarginals (*UR*7) may be present or absent. Relative lengths of all dorsal setae as in adult. Number and position of gland opening and proprioreceptors as in adult. Sternogenital shield smooth, without endopodal extensions, with 4 pairs of setae and 3 pairs of pores, genital portion narrow, more heavily sclerotized and with marked, irregular incisions at level of *st*4 nearly separating genital region from sternal region (Fig. 11). Genital setae on membrane. One pair of metapodal plates. Seven or 8 pairs of ventral setae on membrane around anal shield (*Jv*4 may be absent) (Fig. 23). Anal shield oval, faintly lineate, with paraanal setae almost as long as postanal seta. Peritremes beginning at stigmata at level about midway between *S*1 and *Z*3 extending anteriorly to level of seta *s*1; peritremal sclerites extending anteriorly slightly beyond tips of peritremes, not united with dorsal shield; no extension of peritremal sclerites posteriad of stigmata. Exopodal plates evident only around

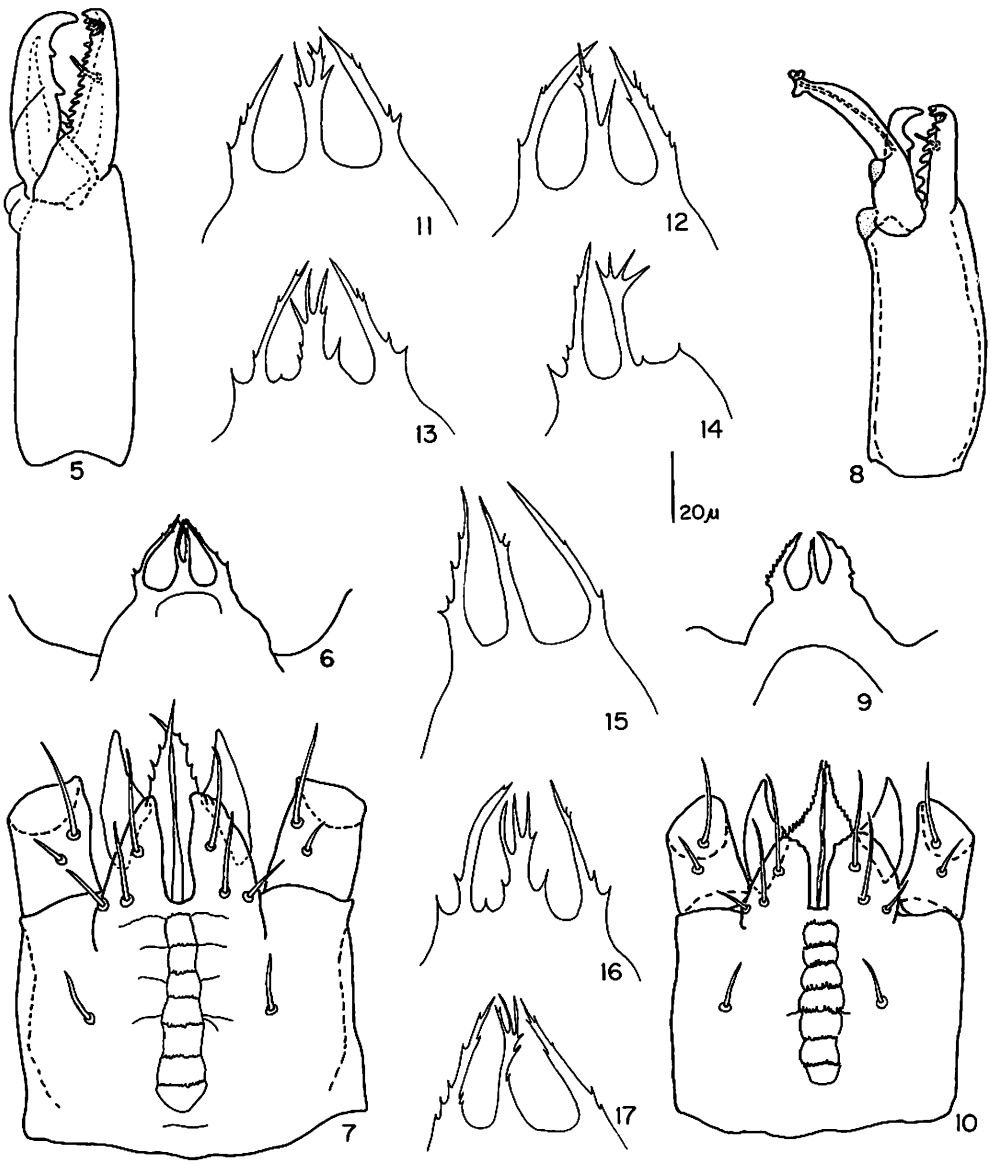

FIG. 5–17. *Lasioseius elegans*: **5,** ♀ chelicera; **6,** ♀ tectum; **7,** ♀ subcapitulum; **8,** ♂ chelicera; **9,** ♂ tectum; **10,** ♂ subcapitulum; **11–17,** variation in ♀ tectum.

coxae IV. Tectum with 3–5 irregular tapering extensions of margin. Fixed chela with row of 13 teeth; chelicera, corniculi, deutosternal teeth, and other features of gnathosoma as on ♀. Legs and leg setation as those of ♀.

Protonymph. Idiosoma 380–415, 220–295 wide at levels of Legs III (10 specimens) with well-separated podonotal and pygidial shields. Podonotal shield faintly reticulated, pygidial shield lineate and coarsely punctate over entire surface. Body dorsum with 30 pairs of setae:

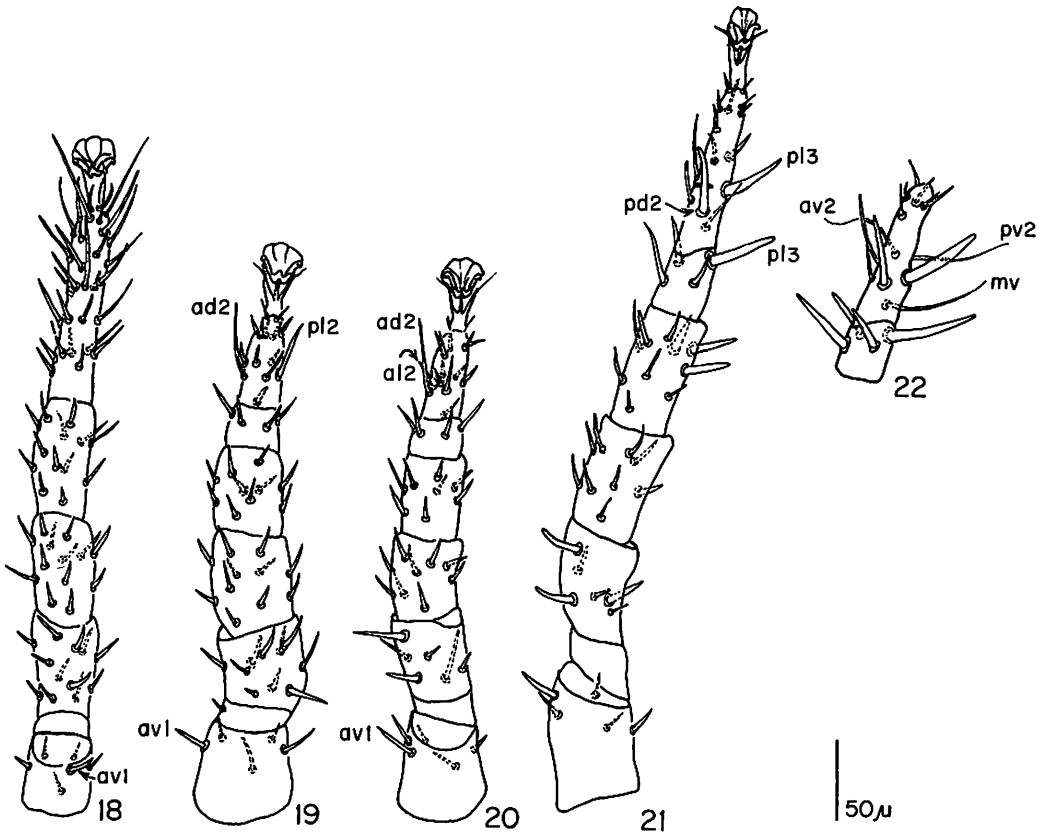

FIG. 18–22. *Lasioseius elegans*: **18–21**, ♀ legs I, II, III, IV, respectively; **22**, ♂ tarsus IV.

11 pairs on podonotal shield (*j*2 and *s*5 added to larval complement; *z*6 absent), 3 pairs on lateral membrane beside podonotal shield (*r*2, *r*3, *r*5), 8 pairs on interscutal membrane (*J*1, *Z*1, *Z*2, *S*2 added to larval complement), and 8 pairs on pygidial shield. Most dorsal body setae simple, spinelike, and of similar lengths (20–25), but with *j*1, *s*4, and *r*3 thickened, longer (35) and weakly tricarinate, setae *Z*5 longest (50) and *J*5 very short (Fig. 24). Number and arrangement of gland openings and proprioreceptors probably as in adult (*gd*9 and *idl*4 not clearly observed). Sternal shield weakly sclerotized, without endopodal extensions, with 3 pairs of sternal setae and 2 pairs of pores. Metasternal setae and pores absent. Genital setae minute and on membrane. Four pairs of setae on membrane around anal shield as in larva. Anal shield ovate, smooth (except posteriorly), with lateral incisions on margins at about level between paraanal setae and postanal setae. Anal setae short, about equal in length (Fig. 24). Stigmata present, peritremes reaching to about midlevel of coxae III. Ventral porotaxy as in adult except metasternal pores and genital pores absent. Tectum as on deutonymph. Fixed chela with row of 10–11 teeth; movable chela tridentate. Other gnathosomal features as on deutonymph except palpi with normal protonymphal complement of setae as described for the Gamasina by Evans (1964). Legs I-II-III-IV with setation normal for protonymph, that of coxae, 2-2-2-1; trochanters, 4-4-4-4; femora, 8-8-5-4; genua, 8-6-6-5; tibiae, 8-7-7-7.

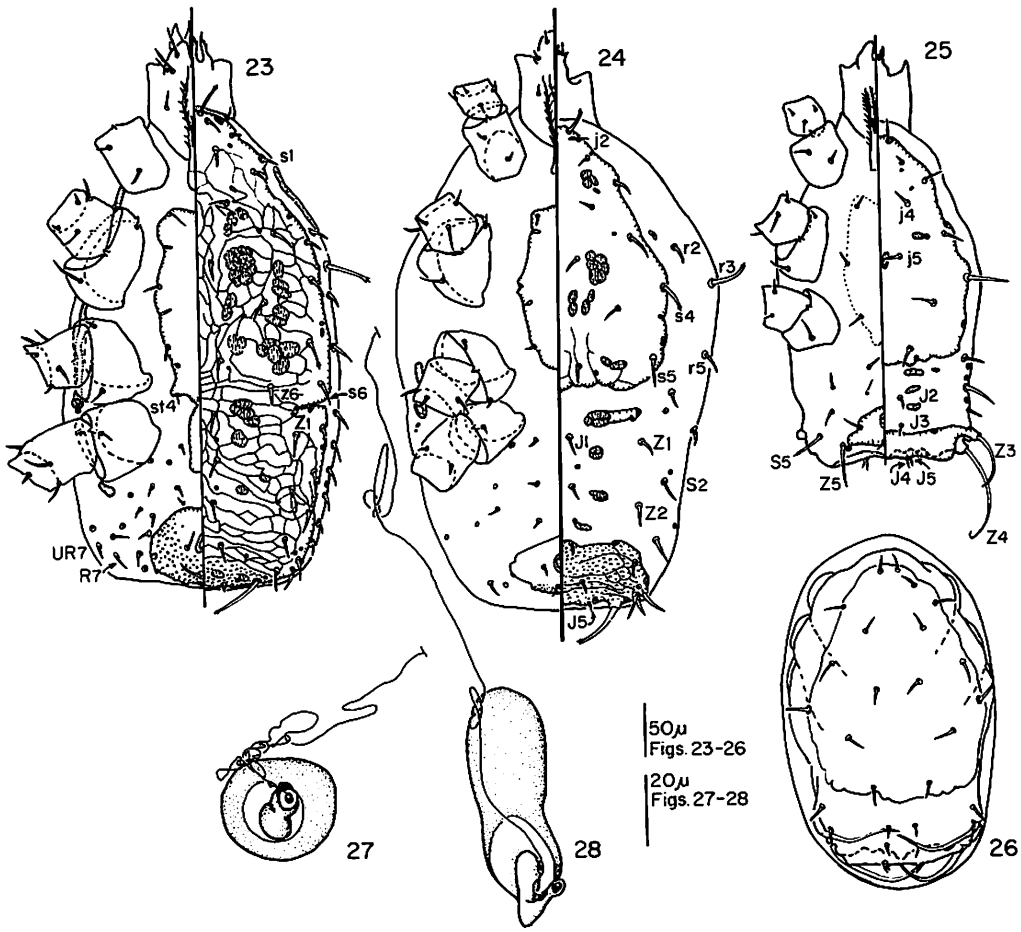

FIG. 23–28. **23–27,** *Lasioseius elegans*: **23,** deutonymph; **24,** protonymph; **25,** larva; **26,** egg containing fully developed larva; **27,** ♀ spermatheca. **28,** *L. chelaserratus,* ♀ spermatheca.

Larva. Idiosoma 270–340 long, 170–220 wide at level of legs III (10 specimens), with well separated podonotal and pygidial shields. Body dorsum with 18 pairs of setae: 9 pairs of moderate length (20–30, except *s*4 which is 40) on podonotal sclerite and none on lateral membrane beside it, 5 pairs on interscutal membrane, of which *J*2 and *J*3 are short (12–15), and 4 pairs on pygidial shield, of which *J*4 and *J*5 are minute (less than 10) and *Z*3 (60) and *Z*4 (90) are long, thickened and curved. Setae *Z*5 (35–40) and *S*5 (30) present on ventrolateral membrane behind anal shield. All dorsal setae smooth, simple (Fig. 25). Porotaxy probably as indicated for ascid larvae by Lindquist & Evans (1965) although proprioreceptors of posterior pygidial region not observed in specimens examined. Body venter holotrichous with 3 pairs of sternal setae on indistinctly outlined sternal shield, 4 pairs of opisthogastric setae, 3 anal setae, and a pair of vestigial euanal setae; paraanal setae of moderate length (18–20), over 2× as long as postanal seta. Anal shield weakly sclerotized, with rounded anterior margin (Fig. 25). Stigmata and peritremes absent. Anterior margin of tectum triramous; dorsal surface of

tectum smooth. Fixed chela with a row of 6–8 teeth; movable chela bidentate. Gnathosomal venter with 2 pairs of rostral setae; deuterosternal denticles not clearly discernible from material available. Palpi with normal larval complement of setae. Legs I-II-III with setation normal for larva, that of coxae, 2-2-2; trochanter, 4-4-4; femora, 10-7-5; genua, 8-6-6; tibiae, 8-7-7.

Egg. Ovoid, 300 long, 200 wide, found singly in adult ♀, occasionally containing a fully developed larva (Fig. 26).

Specimens examined. W INDIES: TRINIDAD: Northern Range, Arima Val, Lalaja Plantation, 1.8 km N of Simla Research Stn, 10°42'N, 61°18'W, 500 m. Specimens (collected by D.S. Dobkin) from flowers and cincinnal bracts of *Heliconia trinidatis* inflorescences: 96♀, 45♂, 56DN, 44PN, 77L, 14 & 15.III.1979; 83♀, 54♂, 30DN, 39PN, 50L, 21 & 22.III.1980. Collected (by R.K. Colwell) from hummingbird hosts in the same vicinity; Lalaja Trace, ex *Glaucis hirsuta*; 1♀, 25.II.1979; 2♀, 26.II.1979; same loc., ex *Phaethornis guy*, 1♀, 23.II.1976.

Specimen deposition. The holotype was stated to be deposited in the U.S. National Museum (Fain et al 1977a, 1977b). At this writing, the specimen has not been received by that institution (E.W. Baker, pers. commun.) and presumably remains in the collection of Dr Fain. Voucher specimens from the present study are deposited in the U.S. National Museum of Natural History, Washington, D.C.; Canadian National Collection, Ottawa, Ontario; Museum of Zoology, The University of Michigan, Ann Arbor, Michigan; the collection of Dr A. Fain, Antwerp, Belgium; the collection of Dr W. Karg, Kleinmachnow, DDR; and in the collections of S. Naeem and D.S. Dobkin.

Biology

In collaboration with R.K. Colwell and A.J. Heyneman, we conducted an extensive survey of the mites of all species of hummingbird-visited flowers in Trinidad's Northern Range. Our data indicate that *L. elegans* is found only on *Heliconia trinidatis* inflorescences. All hummingbird host records for *L. elegans* come from 2 species of hermit hummingbirds that feed commonly at *H. trinidatis* flowers. Thus the mite's relationship to the hummingbirds is a phoretic one. The mite climbs aboard the bird's bill when the bird is taking nectar from *H. trinidatis* flowers, rides in the bird's nares, and disembarks at some subsequently visited *H. trinidatis* inflorescence. This relationship has been described for *Rhinoseius* and *Proctolaelaps* species that inhabit hummingbird-visited inflorescences (Colwell 1973, 1979).

Lasioseius elegans shares *H. trinidatis* inflorescences with *Rhinoseius trinitatis* Fain, Hyland & Aitken, 1977, and usually, with astigmatid mites of the family Histiostomatidae (=Anoetidae) (Dobkin 1983). Individual mites were found both in flowers and throughout the cincinnal bracts of all *H. trinidatis* inflorescences examined. A complete census of 10 inflorescences collected during the dry seasons of 1979 and 1980 yielded populations ranging from 16 to 125 ($\bar{x} = 58$) individuals (Dobkin 1983). In contrast, the coinhabiting *Rhinoseius* populations were always larger, often by an order of magnitude, ranging from 110 to 815 ($\bar{x} = 467$) individuals. A detailed analysis of the population structure of both species and their movement patterns on inflorescences is presented elsewhere (Dobkin 1983).

Although it is not certain what the individual *L. elegans* fed upon, it appears that they had little effect on *Rhinoseius* numbers. Possibly their food consisted of histiostomatid mites and, perhaps, *Rhinoseius* eggs and larvae. Dobkin (1983) found a significant negative correlation between the number of *L. elegans* and the number of histiostomatid mites co-occurring on inflorescences. Based on their distribution within inflorescences, larvae and nymphs may feed on nectar and/or pollen, as well; unlike the adults, immature mites tended to be associated with cincinnal bracts having open flowers (Dobkin 1983). Our collecting techniques did not enable us to determine whether nematodes were present on the inflorescences, but they have been reported as potentially important food sources for other predatory ascid mite species (Lindquist 1969).

We have only 4 records of this species from birds but all of these plus the 3 described by Fain et al. (1977b) are of adult females. These data, in combination with our knowledge of dispersal patterns in other gamasid mites [reviewed by Dobkin (1983)], imply that only females of this species move between inflorescences by phoresy on hummingbirds.

Lasioseius chelaserratus Naeem, Dobkin & OConnor, **new species** Fig. 28–45

Diagnosis. Tectum has 4 to 5 irregular, tapering extensions. Fixed digit of chelicera finely serrated with 40 or more minute teeth. Ventrianal shield with 3 pairs of ventrianal setae. Tarsi of legs II–IV with 1 or 2 long, fine, whiplike setae. Only dorsal seta *j*1 tricarinate. On ♂, *j*1, *j*3, *z*2, *r*3, and *s*5 (at least) 1.5 to 2× long and thick as neighboring setae.

♀. Dorsal shield 635–690 long, 400–470 wide (10 specimens), moderately reticulated over most of dorsal shield except posteriorly (below line formed by *J*4, *Z*3, *Z*2, and *S*2), without coarsely punctate areas (Fig. 29). Dorsal shield with 37 pairs of setae, 22 on anterior portion and 15 on posterior portion; 9 pairs on lateral membrane, *j-J, z-Z, s-S* series of setae complete; *r*6, *R*1–*R*7 on lateral membrane. [One pair of short submarginal setae (*UR*7) in ventral position.] Setae on dorsal shield moderately long (32–52), *J*1–*J*4 nearly as long as successive distances between their bases, *Z*4 reaching to base of *Z*5; setae *z*1, *s*1, *s*2, and *J*5 short and smooth, *j*1 slightly tricarinate, all other dorsal setae smooth; all setae on membrane smooth, shorter (32–35 long) than posterior dorsal shield setae. Porotaxy similar to preceding species, except proprioreceptor *idl*3 absent. Tritosternum normal, with moderately pilose laciniae fused along basal ¼ to ⅓ of their length. Presternal area without ornamentation. Sternal shield with 3 pairs of setae and 2 pairs of pores, shield unornamented except for 1 pair of longitudinal striations in lateral area (Fig. 30). Third pair of sternal pores with 4 pairs of sternal setae on metasternal platelets. Endopodal plates normally formed between coxae III and IV. Genital shield without ornamentation, widened posterior to genital setae, with posterior margin truncate. Postgenital strip consisting of 1 narrow, irregular platelet. Two pairs of metapodal plates, inner pair much smaller than outer. Ventrianal shield transversely lineate with few interconnections; anal region not punctate; lateral margins of shield concave at level of anterior extremity of anal opening; anal opening not enlarged; shield with 3 pairs of ventral setae (*Jv*1, *Jv*2, *Jv*3) plus anal setae; paraanal setae shorter (32–37) than postanal seta (45–53), all smooth, simple. Paraanal setae situated near posterior margin of anus. Six pairs of setae on membrane around ventrianal shield (*Zv*1, *Zv*2, *Zv*3, *Jv*4, *Jv*5, and *UR*7), most posterior pair (*Jv*5) larger, though not greatly so. Peritremes extending anteriorly to level of setae *z*1, not extending posterior to stigmata. Exopodal plate a continuous strip between coxae II and IV, fused

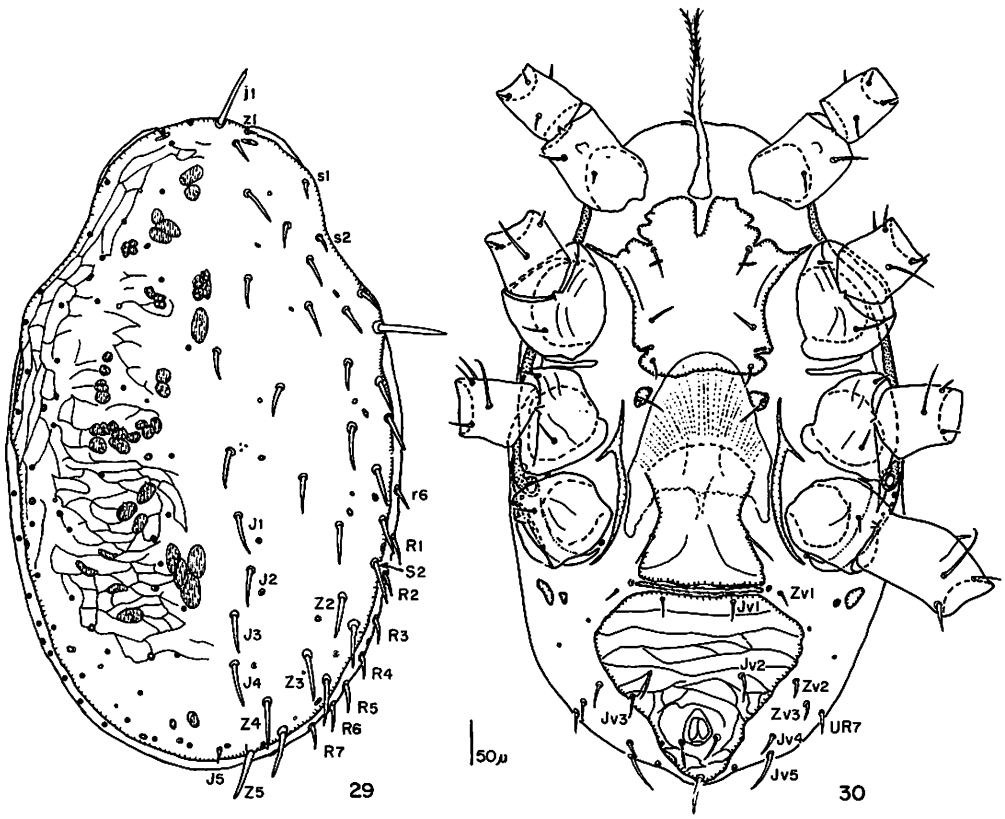

FIG. 29–30. *Lasioseius chelaserratus*, ♀: **29**, dorsum; **30**, venter.

posteriorly with peritremetal sclerite and extending posterior to coxae IV, with separate anterior fragment between coxae I and II. Spermatheca with cervix short and cylindrical, with a large cylindrical maturation pouch; and with a long, fine accessory duct emptying at base of cervix (Fig. 28). Anterior margin of tectum with 3 long medial and 2 shorter lateral projections; projections with few irregularly spaced barbs (Fig. 34). Fixed chela serrate, with row of 40 or more minute teeth and a short pilus dentilus; movable chela tridentate (Fig. 33). Deutosternum with 7 transverse rows of denticles [anterior 6 rows connected laterally]; anterior 5 arched anteriorly, 6th row with 20–24 teeth (Fig. 35). Subcapitulum with 4 pairs of ventral setae, most anterior being considerably longer than others. Internal ventral seta of palp trochanter also elongate. Apotele of palptarsus 2-tined.

Legs I and IV longer than dorsal shield, leg I nearly 1.2× as long, leg IV nearly 1.5× as long. Pretarsi of legs I with elongate, thin stalk; other pretarsi with thicker stalks. Pretarsal paradactyli thin, about as long as claws. Coxae II–IV with ventral lineate markings (Fig. 30). Setation of genua of legs I-II-III-IV, respectively, 13-11-9-9; that of tibiae, 13-10-8-10; all leg setae smooth. Tarsus II with *ad*2 and *pl*2 elongate, ribbonlike; tarsus III with *ad*2 elongate, ribbonlike; tarsus IV with *al*2 elongate, ribbonlike, and *pd*2, *ad*3, *al*3, and *pl*3 elongate, stout and spinelike (Fig. 40–45).

♂. Dorsal shield 483–532 long, 285–310 wide (8 specimens), reticulated near anterior mar-

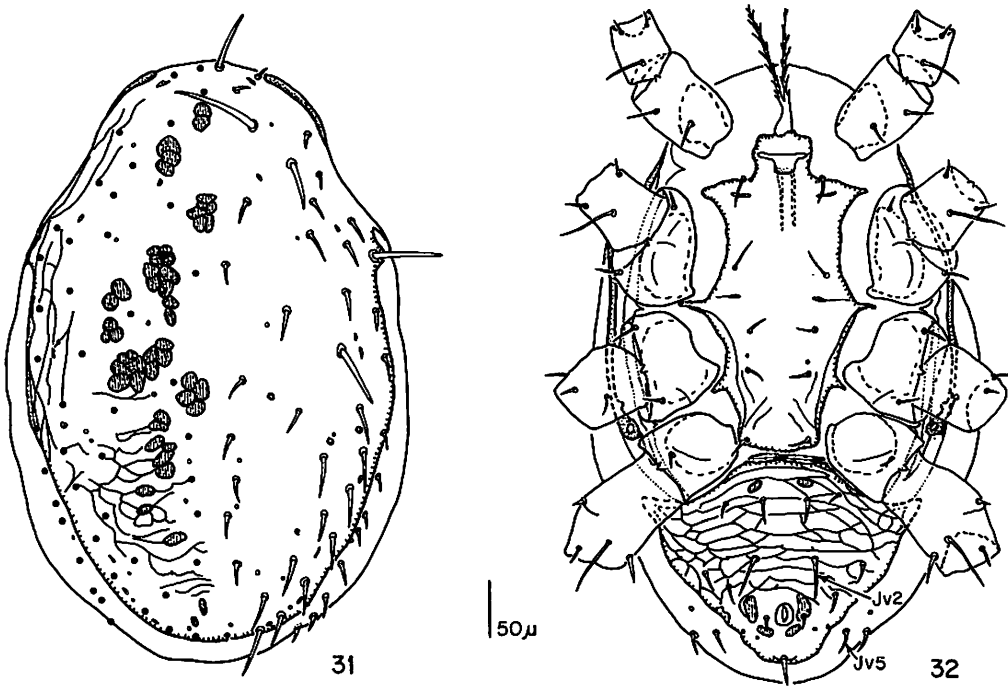

FIG. 31–32. *Lasioseius chelaserratus*, ♂: **31**, dorsum; **32**, venter.

gin and midposterior ½ of shield, similar to ♀, with setation as on ♀ except *r*6 on shield and some anterior setae enlarged; *j*1 (48–53), *j*3 (66–79), *z*2 (37–51), *s*5 (53–64), *r*3 (55–61); other podonotal setae less than 35 in length. Presternal area without conspicuous ornamentation. Sternogenital shield weakly lineate along posterolateral margins and posteromedial region; no other conspicuous ornamentation. With 5 pairs of setae and 3 pairs of pores (Fig. 32). Ventrianal shield wide, extending over areas occupied by metapodal plates, reticulate over entire surface, central area transversely reticulate, without punctate areas, bearing 5 pairs of ventrianal setae (*Jv*4 and *Zv*3 absent, *Jv*5 off shield) plus anal setae; ventrianal setae with size and shape as on ♀ except *Jv*2, which is nearly 2× as long as neighboring setae. Paraanal and anal setae as on ♀. Stigmata and peritremes as on ♀. Exopodal plates with anterior fragment, curving posteriorly and fused with peritrematal sclerite as on ♀. Tectum generally similar to that of ♀, normally with 5 tapering extensions of margin (Fig. 37–38). Fixed chela with row of 8 teeth and a normal pilus dentilus; movable chela bidentate, with short spermadactyl, curving ventrally (Fig. 36). Gnathosomal features as on ♀ except for 4th row of denticles extended and 7th row horizontal (not anteriorly arched as in ♀) (Fig. 39). Leg I about 1.5× as long as dorsal shield. Leg II about as long as dorsal shield, with *av*1 of femur stout, thickened and *ad*2 and *pl*2 of tarsus elongate and ribbonlike. Leg III about as long as dorsal shield, slightly longer than leg II, with *av*1 of femur thickened, and with *ad*2 of tarsus elongate and ribbonlike. Leg IV about 2× as long as dorsal shield, *av*1 and *pv*1 of trochanter, *av*1, *ad*1, and *ad*2 of femur all stout and thickened, and *al*2 of tarsus elongate and ribbonlike.

Types. Holotype ♀, W INDIES: TRINIDAD: Northern Range, Arima Val, 0.2–0.4 km S of Simla Research Station, 180–200 m, from flowers and cincinnal bracts of *Heliconia wagner-*

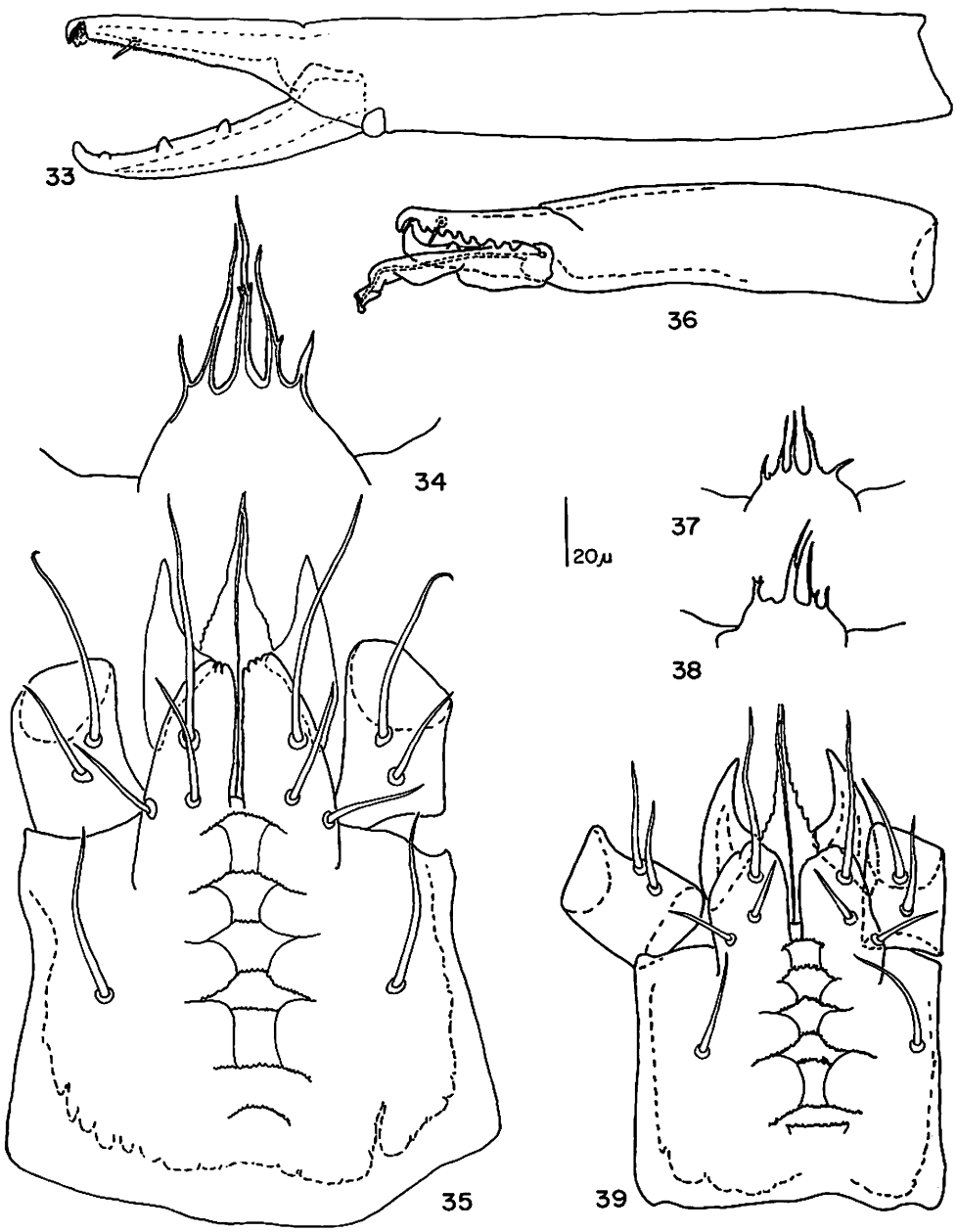

FIG. 33–39. *Lasioseius chelaserratus*: **33,** ♀ chelicera; **34,** ♀ tectum; **35,** ♀ subcapitulum; **36,** ♂ chelicera; **37–38,** variation in ♂ tectum; **39,** ♂ subcapitulum.

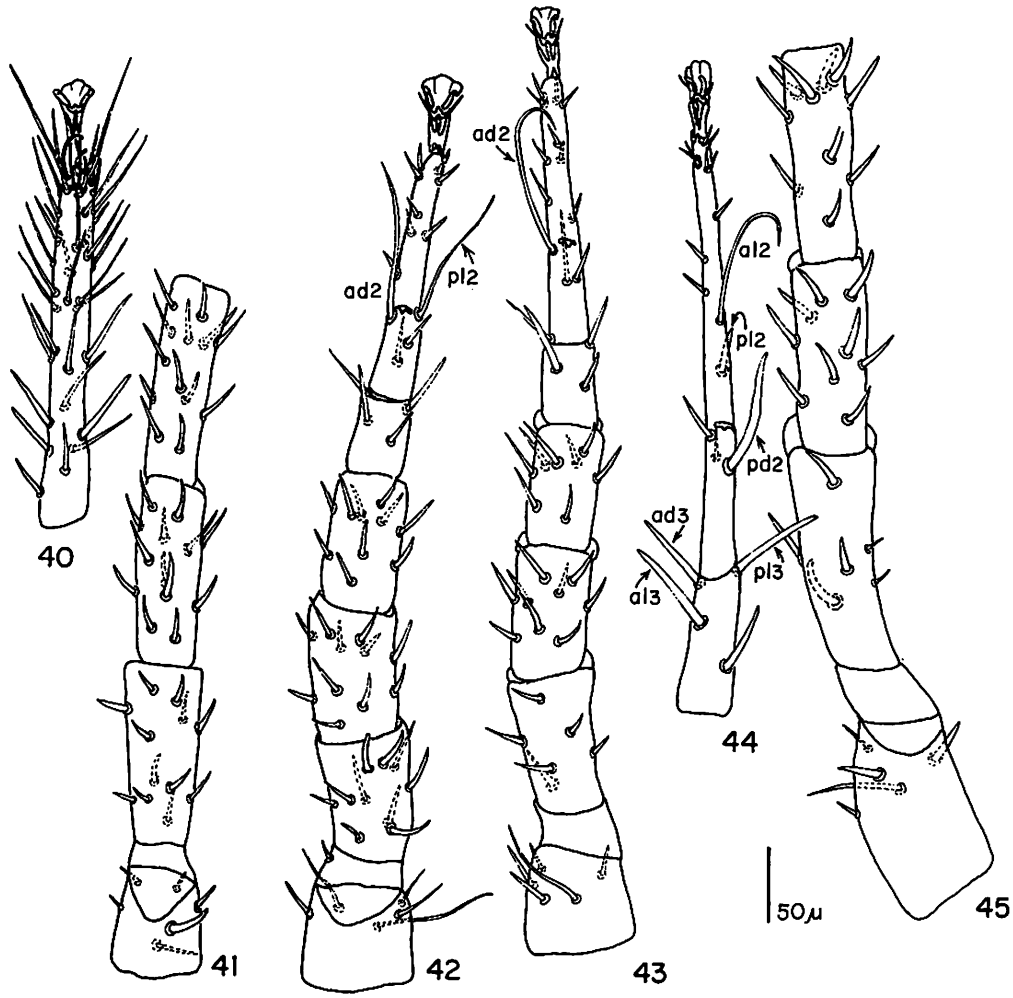

FIG. 40–45. *Lasioseius chelaserratus*, ♀: **40–41**, leg I; **42–43**, legs II–III, respectively; **44–45**, leg IV.

iana, 31.VIII.1980 (D.S. Dobkin), deposited in the U.S. National Museum of Natural History, Washington, D.C. Paratypes, same host plant species, same locality, as follows: 1♀, 16.III.1980; 2♂, 19.III.1980; 10♀, 1♂, 31.VIII.1980; 4♀, 7♂, 4DN, 7PN, 1.IX.1980. Paratypes to be deposited in the Canadian National Collection, Ottawa (type number 18346) and the Museum of Zoology, University of Michigan, Ann Arbor.

Additional specimens. Collected from hummingbird hosts as follows: W INDIES: TRINIDAD: Simla, 1♀, 21.VII.1975, 1♀, 22.VII.1975, 1♀, 22.VIII.1975, ex *Glaucis hirsuta* (P. Feinsinger); same loc., 2♀, 11.III.1980, ex *Glaucis hirsuta* (R. Dagleish); Lalaja, 1♀, 8.VIII.1975, ex *G. hirsuta* (R.K. Colwell); Guanapo Val, 1♀, 25.II.1979, ex *G. hirsuta* (Colwell). VENEZUELA: Zulia; 10 km W and 18 km S of Machiques, 1♀, 19.IV.1968, ex unidentified hummingbird (C.E. Yunker) (specimen in the Canadian National Collection).

Biology

This species, compared to *L. elegans,* is quite uncommon. It is found on inflorescences of *Heliconia wagneriana* with an unnamed species of *Proctolaelaps* (Dobkin 1985) and occasionally with an unnamed species of *Rhinoseius.* Descriptions of the latter 2 species are in preparation (OConnor, Colwell & Naeem, in prep.). However, of 65 inflorescences censused completely, only 5 harbored *L. chelaserratus* (Dobkin 1983).

Resident *Proctolaelaps* and *Rhinoseius* populations on *H. wagneriana* were much smaller than their counterpart *R. trinitatis* populations inhabiting *H. trinidatis* (Dobkin 1983), but *L. chelaserratus* "populations" were exceedingly small: 1, 2, 1, 10, and 22. No larvae have been collected. Wet-season samples tended to be associated with histiostomatid mite populations, and we assume that food habits are similar to those of *L. elegans.* Nymphal instars were found in the cincinnal bracts of a single, rather old inflorescence. Adults were collected from both flowers and bracts.

As with *L. elegans,* all phoretic records are of adult females ($n = 8$) and all Trinidad specimens were collected from the hermit hummingbird *Glaucis hirsuta,* a common visitor to *H. wagneriana* flowers. Thus the adult female appears to be the only phoretic stage in this species as well.

SYSTEMATICS OF FLOWER-INHABITING *LASIOSEIUS* SPECIES

The genus *Lasioseius* is the largest genus in the family Ascidae. In his recent review of the genus, Karg (1980) listed 71 species, although a number of additional named species were not included in his discussion or keys. Because the size of this group precludes detailed phylogenetic analysis at this time, and since Karg (1980) provides the most recent groupings of species within the genus *Lasioseius,* we will discuss the systematic position of the flower-inhabiting species in the context of Karg's groups. The genus *Lasioseius* can be hypothesized as belonging to a monophyletic group characterized by the ancestral possession of at least some tricarinate dorsal idiosomal setae. This monophyletic group includes the genera *Lasioseius, Zercoseius,* and *Hoploseius* among genera recognized by most prior revisers. The genus *Aceosejus,* which was considered as a synonym of *Lasioseius* by Evans (1958) and Lindquist & Evans (1965), has been recognized as a distinct genus by Karg (1980) and other revisers. Additional generic names considered as synonyms of *Lasioseius* by Karg (1980) and others include *Borinquolaelaps* Fox, 1946, and *Hyattella* Krantz, 1962. Further names were proposed by Karg (1980), who divided the genus *Lasioseius* into 3 subgenera: *Lasioseius* Berlese, 1916 (s.s.) (type-species, *Seius muricatus* Berlese, 1887, not *Sejus muricatus* Koch, 1839 = *Typhlodromus berlesei* Oudemans, 1938); *Crinidens* Karg, 1980 (type-species, *Lasioseius corticeus* Lindquist, 1971); and *Criniacus* Karg, 1980 (type-species *Lasioseius drosophili* Chant, 1963). The proposal of the new subgeneric names *Crinidens* and *Criniacus,* however, is contrary to the International Code of Zoological Nomenclature, because previously proposed genus-group names were available for the designated taxa. Karg (1980: 353) included in his new subgenus *Crinidens* the species "*L. dentatus* (Fox, 1946)." This species is the type-species of the

genus *Borinquolaelaps,* by original designation, a generic name considered in synonymy with *Lasioseius* by all prior revisers, including Karg. Thus, in the concept of Karg (1980), the name *Crinidens* must be regarded as a synonym of *Borinquolaelaps* (**new synonymy**). Although Karg indicated the synonymy of the genus *Hyattella* with *Lasioseius,* he did not include the type-species, *Hyattella epicrioides* Krantz, in his discussion or key. We have examined a paratype of this species provided by Dr G.W. Krantz and determined that this species would also key to Karg's subgenus *Crinidens.* This indicates that *Hyattella* is also an available senior synonym of *Crinidens.* A similar problem exists for Karg's new subgenus *Criniacus,* which has as its type-species *Lasioseius drosophili.* In his revision of the genus *Hoploseius* Berlese, 1914 (type-species, *Zercon cometa* Berlese, 1910), Lindquist (1963) demonstrated that *L. drosophili* is very closely related to the type-species of *Hoploseius* on the basis of a large number of character states that we regard as synapomorphies. Thus, in the concept of Karg (1980), the name *Criniacus* should be considered as a synonym of *Hoploseius* (**new synonymy**). This synonymy raises the further problem of phylogenetic relationships within the *Lasioseius* group of genera because if *Hoploseius* is considered at a subgeneric rank within a larger *Lasioseius* (s. lat.), the name of the genus must be *Hoploseius,* as that name has priority over *Lasioseius.* Prior workers have suggested that this will eventually be the case: "It is possible that the genus *Lasioseius* Berlese is synonymous with *Hoploseius* . . ." (Evans 1958: 223); "Species of the genus *Hoploseius* very probably are a specialized offshoot of the genus *Lasioseius* . . ." (Lindquist 1963: 1177). Because it is beyond the scope of our present studies to consider the monophyly of the various supraspecific taxa in the *Lasioseius* group, we stress the need for a thorough phylogenetic analysis of this entire group at the species level.

The flower-inhabiting *Lasioseius* species will key to Karg's subgenus *Crinidens* (=*Borinquolaelaps*). However, there are some difficulties in assigning these species to species-groups using Karg's groups. *Lasioseius elegans* keys to Karg's *ometes*-group, having 5 pairs of ventrianal setae in the female, a small anus, and legs I shorter than the idiosoma. *Lasioseius chelaserratus,* on the other hand, has only 4 pairs of ventrianal setae and will not go through Karg's couplet 4. However, passing that couplet, this species would key to the *glomerulus*-group, having legs I longer than the idiosoma.

Several character states suggest that *L. elegans* and *L. chelaserratus* share a common ancestor and perhaps do not belong in different species groups. Character states in the 2 species suggesting this relationship include the elongation of the anterior subcapitular setae and internal palp trochanteral setae and the elongate, flattened form of tarsal setae *ad*2 and *pl*2 of tarsus II and *ad*2 of tarsus III. As these character states were not generally considered by Karg (1980) or the describers of most species now included in *Lasioseius,* a complete phylogenetic analysis is needed to test whether Karg's groupings reflect actual phylogenetic relationships.

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LITERATURE CITED

Athias-Henriot, C. 1975. Nouvelles notes sur les Amblyseiini I. Le releve organotaxique de la face dorsale adulte (Gamasides Protoadeniques, Phytoseiidae). *Acarologia* **17:** 20–29.

Baker, E.W. & C.E. Yunker. 1964. New blattisociid mites (Acarina: Mesostigmata) recovered from Neotropical flowers and hummingbirds' nares. *Ann. Entomol. Soc. Am.* **57:** 103–26.

Colwell, R.K. 1973. Competition and coexistence in a simple tropical community. *Am. Nat.* **107:** 737–60.

1979. The geographical ecology of hummingbird flower mites in relation to their host plants and carriers, p. 461–68. In: Rodriguez, J.G., ed., *Recent advances in acarology.* Vol. 2. Academic Press, New York.

1983. *Rhinoseius colwelli* (Acaro floral del colibri, totolate floral de colibri, hummingbird flower mite), p. 767–68. In: Janzen, D.H., ed., *Costa Rican natural history.* Univ. Chicago Press, Chicago.

Colwell, R.K. & S. Naeem. 1979. The first known species of hummingbird flower mite north of Mexico: *Rhinoseius epoecus* n. sp. (Mesostigmata: Ascidae). *Ann. Entomol. Soc. Am.* **72:** 485–91.

Dobkin, D.S. 1983. Ecology of hummingbird flower mite (Gamasida: Ascidae) populations and their *Heliconia* (Heliconiaceae) host plants in Trinidad, West Indies. Ph.D. dissertation. University of California, Berkeley, California.

1984. Flowering patterns of long-lived *Heliconia* inflorescences: implications for visiting and resident nectarivores. *Oecologia* **64:** 245–54.

1985. Heterogeneity of tropical floral microclimates and the response of hummingbird flower mites. *Ecology* **66:** 536–43.

Domrow, R. 1979. Ascid and ameroseiid mites phoretic on Australian mammals and birds. *Rec. West. Aust. Mus.* **8:** 97–116.

Evans, G.O. 1958. A revision of the British Aceosejinae (Acarina: Mesostigmata). *Proc. Zool. Soc. Lond.* **131:** 177–229.

1964. Some observations on the chaetotaxy of the pedipalps in the Mesostigmata (Acari). *Ann. Mag. Nat. Hist.*, Ser. 13, **6:** 513–27.

Fain, A., K.E. Hyland & T.H.G. Aitken. 1977a. Nouveaux acariens Ascidae (Mesostigmates) phoretique dans les fosses nasales de Colibris (note preliminaire). *Bull. Ann. Soc. R. Belge Entomol.* **113:** 184–86.

1977b. Flower mites of the family Ascidae phoretic in nasal cavities of birds (Acarina: Mesostigmata). *Acta Zool. Pathol. Antverp.* **69:** 99–154.

Karg, W. 1980. Die Raubmilbengattung *Lasioseius* Berlese, 1916. *Zool. Jahrb. Abt. Syst. Oekol.* **107:** 344–67.

Lindquist, E.E. 1963. A taxonomic review of the genus *Hoploseius* Berlese (Acarina: Blattisocidae). *Can. Entomol.* **95:** 1175–85.

1969. Mites and the regulation of bark beetle populations, p. 389–99. In: Evans, G.O., ed., *Proc. 2nd Int. Congr. Acarology, Sutton Bonington (England), 1967.*

Lindquist, E.E. & G.O. Evans. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). *Mem. Entomol. Soc. Can.* **47:** 1–64.

Ryke, P.A.G. 1964. Acarina associated with *Protea* flowers in the Cape Province. *J. Entomol. Soc. S. Afr.* **26:** 337–54.

Treat, A.E. 1975. *Mites of moths and butterflies.* Cornell University Press. Ithaca, New York.