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Three Species of *Proctolaelaps* (Acarina, Mesostigmata) from Noctuid Moths

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The present paper reports the occasional occurrence on noctuid moths of three species of ascid mites, two of which are described as new, and one which has been known previously from a single specimen.

Mites of the genus *Proctolaelaps* Berlese (1923), *sensu lato*, occur in many different habitats. Karg (1966) regarded them as primitively soil-dwelling phytoseioids, although several species are found in tropical flowers, on foliage, or on dead trees, whereas others are regularly associated with insects. A few have been taken from birds or mammals and their nests, or from other vertebrates. Lindquist and Evans (1965) discussed the ecology and systematic relationships of these and other Ascidae; Lindquist and Hunter (1965) added several new records and three new species to those previously listed from North America (Chant, 1963). Most representatives of the genus are probably predators upon other arthropods and their eggs or upon nematodes or other small invertebrates, although one species has also been reared on fungus mycelia, and a few are believed to be pollen feeders. None is known to be truly parasitic.

At least four species have been recorded in association with moths.³

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³ Mr. Vikram Prasad of Wayne State University has kindly permitted us to examine representatives of one additional species, the description of which he is now preparing.

A mite now commonly believed to belong to some species of *Proctolaelaps* was described and figured, though not named, by Pierre Lyonet in a work published posthumously in 1829. In his notes, which are said to date from 1760, he wrote that he found the mites and their eggs in considerable numbers on the wood-boring larvae of *Cossus cossus* Linnaeus. Oudemans (1902) reported [as *Hypoaspis cossi* (Dugès, 1834)] three specimens of a mite which he believed to be conspecific with those seen by Lyonet. "Lyonet's drawings and descriptions," Oudemans wrote, "are sufficient to recognize the animal. Though Ant. Dugès has named the animal, and though further Gervais, Haller, Canestrini and Berlese mention it, nobody has ever seen it again." One of Oudemans' specimens came from a caterpillar of *C. cossus*; another was taken from a caterpillar of *Sesia formicaeformis* Laspeyres, and the third, surprisingly, was found under a scale of the lizard *Lacerta agilis* Linnaeus.

Evans (1958) redescribed the first of Oudemans' specimens as *Proctolaelaps* (*P.*) *cossi* (Dugès), tacitly accepting Oudemans' interpretation of its identity. Recently, at our request, Dr. Evans was kind enough to re-examine this specimen from the Oudemans collection. Unfortunately it suffered disintegration during an attempt at remounting, and, since Oudemans' figures and description are inadequate in certain respects, Evans' account is now the sole evidence with regard to many details. In his re-examination, Evans (personal communication) found seven rather than the six rows of deutosternal denticles mentioned in his publication of 1958. The only significant specific character that can be seen in Lyonet's drawing is the form of the cheliceral digits, both of which appear to be multidentate. In the Oudemans specimen the fixed digit bore only three teeth, all on the distal half. It is unlikely that the mite seen by Lyonet and named (without having been seen) by Dugès can now be positively identified. It may or may not have been conspecific with the "*Hypoaspis cossi* (Ant. Dug.)" of Oudemans.

Chant (1963) wrote that *Proctolaelaps pygmaeus* (Müller), a widely distributed predator and saprophage, has been found in Belleville, Ontario, in a "winter moth culture." *Proctolaelaps bickleyi* (Bram, 1956) was described from specimens found in association with the eggs of the gelechiid *Sitotroga cerealella* (Olivier), the Angoumois grain moth. It has also been recorded (Chant, 1963) from other habitats. Lindquist and Hunter (1965) described *P. dioryctriae* from material found in Florida in association with the phycitid moth *Dioryctria amatella* (Hulst) infesting a pine cone.

The mites recorded and described below were collected by the senior author. Except where noted, all were found under the heads of living noctuids, between the labial palpi at the base of the proboscis.

Proctolaelaps hurlbutti Chant

Figure 1

Proctolaelaps hurlbutti CHANT, 1963, p. 263, figs. 33-35.

Through the courtesy of Dr. Evert E. Lindquist we have been able to examine the remounted holotype of this species (No. 7269 in the Canadian National Collection), which was taken by Henry W. Hurlbutt in November, 1958, in Hyattsville, Maryland.¹ We concur in Lindquist's opinion (personal communication) that this mite is conspecific with our material, which consists of 23 females from 15 moths of 13 species, taken (with one exception which is noted below) in Tyringham, Massachusetts, at various times between 1956 and 1966.

Chant described and figured the tectum (epistome) of *P. hurlbutti* as bispinate. Because in most of our specimens it is clearly trispinate (fig. 1B), we gave particular attention to this character in the remounted holotype. Although it is true that in this specimen no median spine can be seen, the region that such a spine would occupy, if present, is partly obscured, and it is difficult to judge whether a spine is there or not.

In 11 of our specimens the dorsal shield ranges in length from 509 to 588 microns; in width, from 339 to 378 microns. Although it was not specifically mentioned in Chant's description and is only suggested in his figure 33, there is a distinctive reticular pattern (fig. 1D) in the area bounded by setae j5, j6, and J1, which aids in the recognition of this species. The reticulations in this region are long and narrow, with their greater dimension parallel to the longitudinal axis of the mite. They contrast sharply with the jigsaw-puzzle pattern of the surrounding areas and with the scalelike pattern on the opisthonotum.

The chelicerae, when fully extended, are exceptionally long and slender, strikingly like those in Lyonet's drawing of his "*pou d'une chenille du bois de saule*," and like those of Oudemans' "*Hypoaspis cossi*," which *P. hurlbutti* resembles also in many other respects. The fixed digit in *P. hurlbutti* (fig. 1A), however, is multidentate, as described by Chant, while that of Oudemans' specimen (Evans, 1958, confirmed in his re-examination) had only three well-spaced teeth. In this respect, then, *P. hurlbutti* resembles Lyonet's figure more closely than did Oudemans' "*H. cossi*."

The internal malae extend about 12 microns beyond the corniculi,

¹ Chant mentioned "another female," which was originally mounted on the same slide as the holotype, but which, according to Lindquist, represents another species, namely, *P. lewisi* (Garman and McGregor). This specimen has now been remounted on another slide.

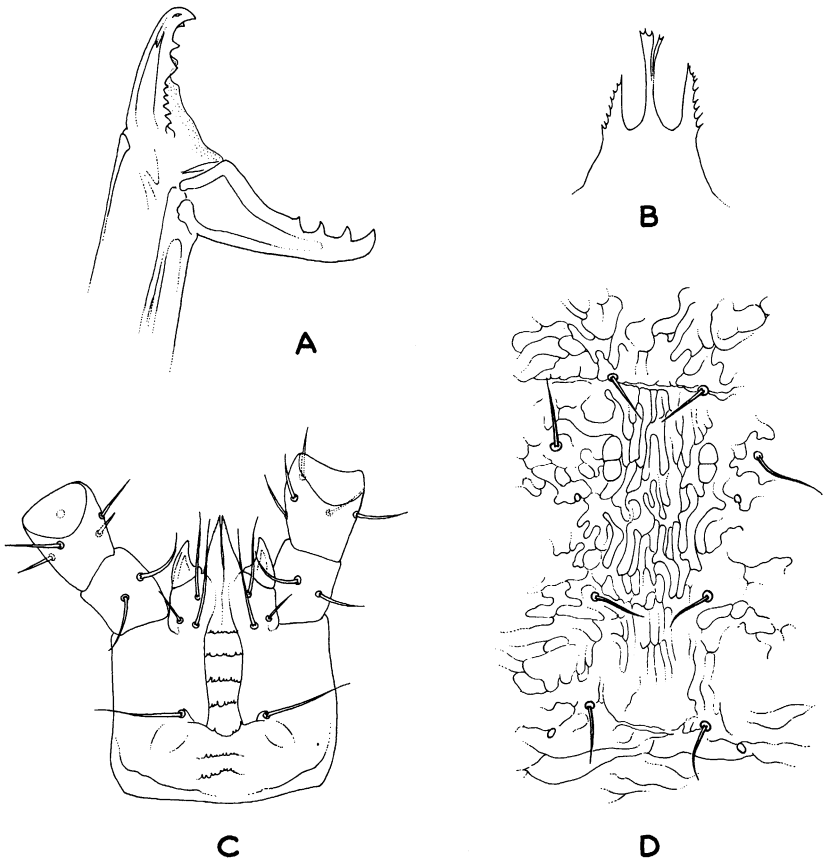


FIG. 1. *Proctolaelaps hurlbutti* Chant, female. A. Left chelae, medial view. $\times 330$. B. Tectum; the cleft in the median spine is atypical. $\times 330$. C. Portion of gnathosoma, ventral view. $\times 268$. D. Reticular pattern of dorsal shield in region of setae j5 to J1. $\times 268$.

which measure about 25 microns from base to tip along their lateral borders. There are seven rows of deutosternal denticles (fig. 1C). The palpal genua each bear a slightly thickened anterior seta with a faintly discernible lanceolate tip. The setae of the femora are normal.

COLLECTION RECORDS: *New York*: Long Island, Southold, July 24, 1946, one female, from a female of *Zale undularis* (Drury) (the mite was taken from a pinned specimen collected by Roy Latham, in the collection of the American Museum of Natural History). *Massachusetts*: Berkshire County, Tyringham, July 1, 1956, one female, from a female of *Acro-*

nycta hasta Guenée; July 4, 1956, two females, from a male of *A. sperata* Grote; August 26, 1956, one female, from a male of *A. hasta*; July 25, 1958, one female, from *A. americana* (Harris); July 28, 1962, two females, from a male of *Catocala ultronia* Hübner; July 12, 1964, one female, from leg of a female of *A. hasta*; July 22, 1965, one female, from a male of *A. morula* Grote and Robinson; August 2, 1965, one female, from a male of *Catocala ilia* (Cramer); September 24, 1965, one female, from a male of *Catocala parta* (Guenée); July 25, 1966, five females, from a male of *Conservula anodonta* Grote; August 11, 1966, two females, one from a male of *Catocala relecta* Grote, the other from the collecting tube containing the same moth; September 5, 1966, three females, from a male of *Catocala concumbens* Walker; September 9, 1966, one female from a male of *Catocala concumbens*.

Observations on the behavior of living mites of this species, made at the time of collection, may shed light upon their ecological relation to their hosts. Moths freshly taken from a lighted screen were immobilized with carbon dioxide and examined under an entomological microscope. The mites were usually discovered when the proboscis was passively uncoiled for inspection. Occasionally a mite was seen creeping about on the shaft of the proboscis, but commonly they occupied the region between the palpal bases, facing either forward (relative to the moth) or rearward. As a rule they moved freely within this restricted area. Although discolorations resembling feeding scars were seen in some cases on the soft cuticle at the bases of the mouth parts of the moth, the mites were never observed in the act of feeding. When prodded with a bristle, they shifted their position, but did not leave the interpalpal area. The tongue of one moth (*Catocala amica*) was passively brought into contact with a phlox flower, whereupon the mite (which was later lost) immediately left the moth, boarded the flower for a moment, but then returned to the moth and resumed its former position, facing rearward between the palpi. It could not again be induced to leave this situation.

One mite remained between the palpi of its host (*Catocala concumbens*) for a week. The moth was kept for part of this time under refrigeration at 5° C., and for part at room temperature. When the proboscis was passively extended and moistened with fruit juice, the mite sometimes appeared to apply its mouth parts to the median groove of the proboscis, but no uptake of liquid could be seen. At the end of the week the mite was somewhat flattened in appearance, but still active. No feeding scars were evident.

When infested moths were placed in a killing jar containing ethyl acetate vapor, mites of this species often quickly left them and later

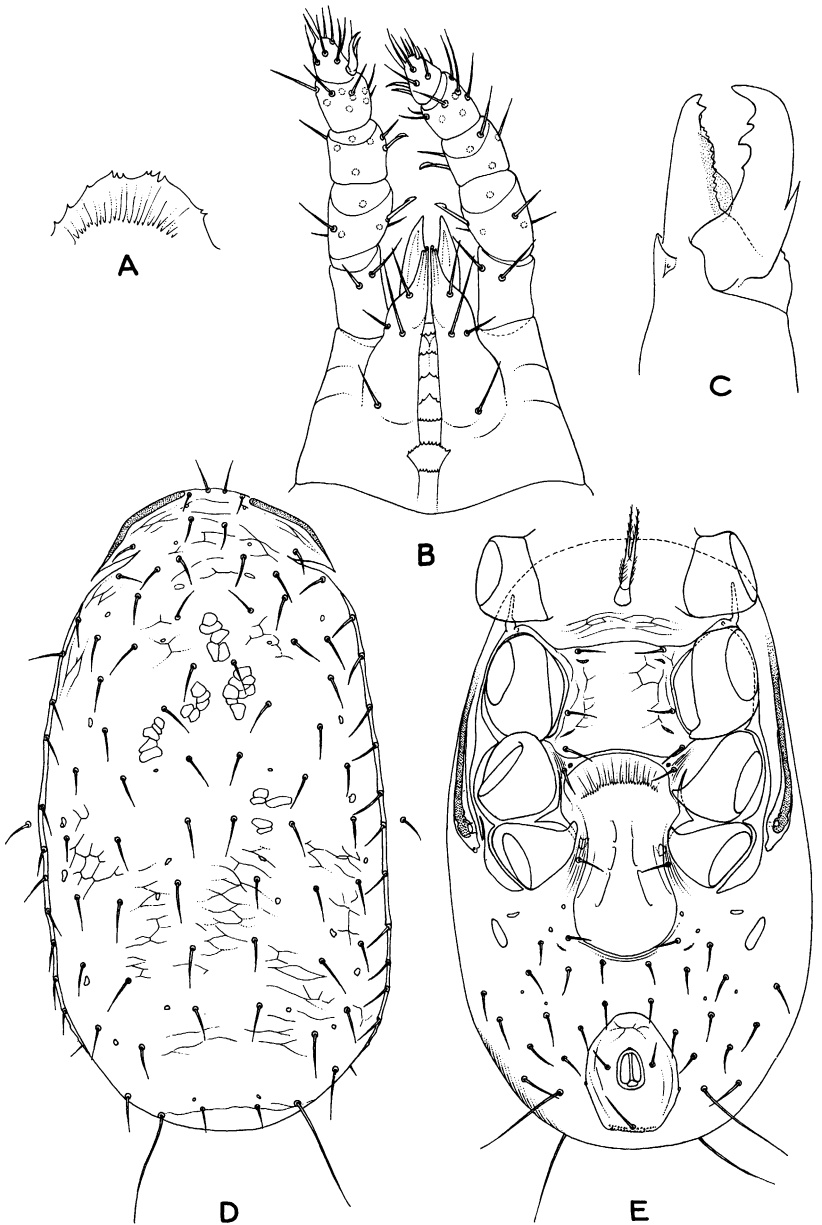


FIG. 2. *Proctolaelaps cancellarius*, new species, female. A. Tectum. $\times 330$. B. Gnathosoma (except chelicerae), ventral view. $\times 268$. C. Left chelae, medial view. $\times 330$. D. Dorsal shield. $\times 134$. E. Ventral surface of idiosoma. $\times 134$.

were found dead on the floor of the jar. This behavior has not been noted in moth mites of other genera. The fruity odor of ethyl acetate, however, is sometimes attractive (Treat, 1958) to the moth ear mite *Dicrocheles phalaenodectes* (Treat).

***Proctolaelaps cancellarius*, new species**

Figure 2

DIAGNOSIS: The genital setae are on the striated integument rather than on the margin of the shield as in other species of *Proctolaelaps*. Mites of this species differ from *P. vanderbergi* (Ryke, 1954) and from *P. scolyti* Evans (1958) in their greater size, in the absence of genital and reduction of sternal reticulations, and in the lack of well-developed pre-endopodal and of metasternal plates, as well as in the position of the genital setae. They are also distinguishable from *P. vanderbergi* by the conical rather than molariform teeth of the fixed cheliceral digits.

FEMALE: Dorsal shield (fig. 2D) in five specimens ranging in length from 534 to 578 microns; in width, from 292 to 329 microns, reticulated throughout, though but faintly in the mid-podosomal region, and bearing 44 pairs of setae mostly shorter than the distance between their bases.

Pre-endopodal plates not defined, though cuticle in this region reticulated rather than striated, thereby suggesting some sclerotization. Sternal shield smooth medially, faintly reticulated laterally, and fused with what appear to be endopodal plates in region of second leg bases; anterior border well defined, posterior border slightly concave, with posterolateral corners slightly emarginate. Three pairs of setae and two pairs of pores on shield, the fourth pair of setae and third pair of pores on membrane posterior to shield, there being no metasternal plates. Endopodal plates only moderately developed in region of coxae III and IV. Genital shield smooth, rounded and broadened posteriorly, with apodemes of genital muscles (which appear under phase contrast as pale, porous areas) not extending to its lateral margins. Genital setae on striated integument lateral to margins of shield, not on shield itself. One pair of genital pores near posterolateral angles of shield. Two pairs of metapodal plates, the more medial ones the smaller. One pair of small subcuticular plates posterolateral to setae Jv1. Anal shield very faintly reticulated, smoothly rounded or only slightly flattened in outline at posterior border and bearing a pair of minute lateral pores. Ten pairs of opisthogastric setae, including Lv2. Peritremes extending almost to paravertical setae; peritremal plates free posteriorly.

Tectum (fig. 2A) broadly rounded, coarsely and irregularly denticulate. Fixed digit of chelicera (fig. 2C) with a large subapical tooth and a

series of 11 or 12 small, conical teeth on ventral margin. Movable digit with a large recurved tooth flanked by two smaller teeth. Hypostomal setae slender (fig. 2B). Seven rows of deutosternal denticles, the sixth broad and fan-shaped. Palpal femur and genu each with an anterior seta having thick shaft and faintly discernable lanceolate tip. Corniculi pointed, lightly incurved, longer than blunt-tipped, grooved, internal malae.

All legs with claws and pulvilli. Leg form and setation normal for genus; no macrosetae. Average length of leg I, 440 microns; leg II, 390 microns; leg III, 377 microns; leg IV, 480 microns.

MALE AND DEVELOPMENTAL STAGES: Unknown.

TYPE DATA: Seven females, all from Tyringham, Berkshire County, Massachusetts. The holotype, in the collection of the American Museum of Natural History, was taken July 4, 1956, from a male of *Acronycta sperata* Grote. Paratypes, in the collection of the senior author unless otherwise noted, comprise the following: two females taken June 25, 1960, from a female of *Acronycta americana* (Harris); one female, in the collection of the United States National Museum, taken July 2, 1960, from a male of *Zale horrida* Hübner; one female, in the Canadian National Collection, taken September 11, 1965, from a male of *Amphipyra pyramidoidea* Guenée; two females taken August 9, 1966, one of these from a female of *Catocala relictata* Walker, the other from the collecting tube containing the same moth.

The specific name *cancellarius* is a Latin noun meaning a doorkeeper, chosen in fanciful reference to the situation in which the mites were found upon their hosts, that is, between the palpi, ventral to the base of the proboscis. The only evidence that might suggest parasitism is the finding of black spots with the appearance of feeding scars near the palpal bases on the host last named above. It is noteworthy that, of the five hosts from which the seven mites were taken, three also carried mites of other species. From the host of the holotype were taken also two females of *Proctolaelaps hurlbutti*; the specimen of *Zale* carried an undetermined species of *Tydeus* Koch, and that of *Amphipyra* yielded two males of *Blattisocius patagiorum* Treat (1966). In no instance, however, was there any indication of a predator-prey relationship among any of the mites.

***Proctolaelaps antiquus*, new species**

Figure 3

DIAGNOSIS: This species resembles *P. cancellarius* except as follows: it is smaller by about one-seventh; it has only 41 or 42 pairs of setae on the dorsal shield; the genital shield is straight-sided and not broadened

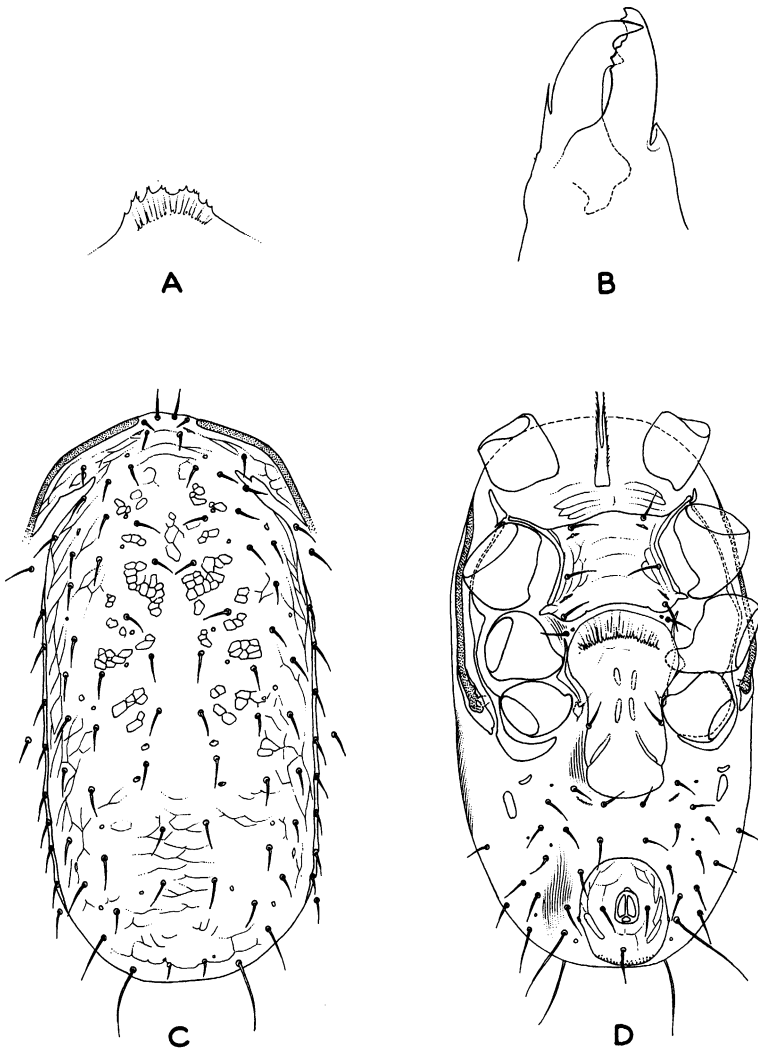


FIG. 3. *Proctolaelaps antiquus*, new species, female. A. Tectum. $\times 330$. B. Right chelae, medial view. $\times 330$. C. Dorsal shield. $\times 134$. D. Ventral surface of idiosoma. $\times 134$.

posteriorly; the genital setae are on the margin of the shield and not on the soft integument; the movable digits of the chelicerae have only one tooth, and the fixed digits only five or six, all on the distal half. The cheliceral digits differ also in the above respects from those of *P. van-*

denbergi, mites that are also distinguishable by having well developed pre-endopodal and metasternal plates, and reticulated genital shields.

FEMALE: Dorsal shield (fig. 3C) in the four type specimens ranging in length from 476 to 491 microns, in width, from 238 to 273 microns; setation and reticulation similar to those of *Proctolaelaps cancellarius* except that setae r2, R6, and, in some cases, r3 are off the shield.

Ventral surface (fig. 3D) as in *P. cancellarius* except genital shield, bearing genital setae on its margin, narrower, straight-sided, not broadened posteriorly, so that pale porous-appearing areas nearly reach margins which are slightly indented at these points.

Tectum (fig. 3A) and gnathosoma similar to those of *P. cancellarius* except size and form of cheliceral digits (fig. 3B), as stated in diagnosis.

All legs with pretarsi and claws, and probably pulvilli, though no pulvilli are visible in any of the four specimens. Leg form and setation normal for genus; no macrosetae. Average length of leg I, 402 microns; leg II, 352 microns; leg III, 339 microns; leg IV, 427 microns.

MALE AND DEVELOPMENTAL STAGES: Unknown.

TYPE DATA: The holotype and three paratype females are in the collection of the American Museum of Natural History. All were found under the proboscis of a female of *Acronycta clarescens* Guenée, one of several specimens bearing the accession number 9653 in the American Museum of Natural History. The host was collected by Lintner at Schenectady, New York, on May 29, 1876.

The specific name *antiquus* was chosen in reference to the age of the specimens, which was nearly 80 years in 1955, when they were discovered and mounted.

DISCUSSION

In view of the paucity of the material that serves as the basis for the above account, it may well be doubted that the mites in question are regularly associated with moths. It could be that all three species are euryphagic or euryxenic and that their occurrence on moths is the exception rather than the rule. If the mites are normally bark-dwellers, perhaps predatory, mycophagous, or feeders on plant exudates, their dispersal might be brought about through phoresy on any available insects, moths included. Among the recorded hosts are some moths, particularly species of *Catocala*, that commonly rest on tree trunks and that might therefore be expected to carry such riders on occasion.

On the other hand, the consistent finding of the mites in the proboscidal region might suggest that these ascids are flower-dwellers like *Proctolaelaps vandenbergi*, or that they frequent fallen fruits as was re-

ported by Lindquist and Hunter (1965) of *P. bickleyi*. Indeed the holotype of *P. hurlbutti* was taken from a rotting apple. Moths of the genus *Catocala* are often taken by sugaring, and might easily acquire symbionts via the extended proboscis during feeding. The collection dates, however, ranging from May through September, suggest that if fallen fruits are concerned at all they are not the only sources of infaunation.

The close resemblance between the two species here described as new may raise doubt as to whether they should not be considered as conspecific despite their differences. It would be difficult if not impossible, however, to characterize a single species partaking of the features of both series. The lapse of nearly 80 years between the taking of the host of *Proctolaelaps antiquus* and the first collection of *P. cancellarius* suggests the possibility of evolutionary change in the interim. Although this could not be readily confirmed by additional collections, it could quickly be ruled out either by the finding of *P. cancellarius* on hosts contemporary with that of *P. antiquus*, or by a new finding of *P. antiquus* on currently or recently collected hosts. The collection of the American Museum of Natural History contains 153 specimens of *Acronycta clarescens* and the closely related *A. pruni* Haworth. Neither these nor many other specimens examined have yielded additional mites of the genus *Proctolaelaps*, but interpalpal mites are not easily revealed by the routine examination of dry, pinned moths, and further evidence may await a closer inspection of such material.

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