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SIX NEW SPECIES OF ANOETID MITES ASSOCIATED WITH NORTH AMERICAN SCOLYTIDAE

#48

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Abstract *Can. Ent.* 102: 1237–1257 (1970)

Only one species of Anoetidae was previously recorded associated with North American Scolytidae. Five new species of *Anoetus* and one new species of *Bonomoia* associated with North American bark beetles are described. Two nomen novum (due to homonymy) in the genus *Anoetus* are proposed. *Anoetus varia* is distinguished from *A. gordius*, a European species restricted to *Ips laricis*. *Anoetus varia* is recorded from 17 scolytids infesting 10 conifer species from 14 states and provinces. An annotated list, with new nomenclatorial combinations in many cases, of the 13 anoetids recorded associated with scolytids in the old world is given. *Histiostoma* is synonymized under *Anoetus*.

INTRODUCTION

The galleries of bark beetles afford a suitable environment, though rather specialized in certain regards, for mites of many families. The adult bark beetles or other insects associated with the subcortical niche, if even only occasionally, provide ample transport hosts for the mites. The total mite fauna of European bark beetle galleries was first studied by Vitzthum (1926), and later by Cooreman (1963). No study of anoetids can be conducted without the systemic–ecological summaries of Hughes and Jackson (1958) and of Scheucher (1957), which contain keys to genera and species. The association of an anoetid species with *Ips* beetles and their galleries was most recently studied in detail by Hunter and Davis (1963).

A world total of 19 species of Anoetidae (including the new species described herein) are known to occur regularly or sporadically associated with Scolytidae or their galleries. Until now only one anoetid (*A. gordius*) associated with North American Scolytidae was reported. Five of the six new species described here from North and Central America belong to the genus *Anoetus*. A monographic work on mites associated with the southern pine beetle is in preparation by Moser and Roton.

An annotated list of 13 species of anoetid mites associated with old world bark beetles is presented, and because the generic name *Histiostoma* is herein synonymized with *Anoetus*, 7 *new combinations* are indicated. *Anoetus sylvestris* and *A. virginiana* are proposed as nomen nova for what Hughes and Jackson (1958) described as *Histiostoma gordius* (Vitz. 1923) and *H. himalayae* (Vitz. 1923).

In the written description of the new species we have avoided exhaustive description of features that are clearly illustrated, and have attempted to mention characters not obvious in the illustrations and to point up noteworthy characters useful for distinguishing each stage from other anoetids. The total length was measured from the anterior edge of the propodosoma to the posterior edge of the hysterosoma, and excluded warts, setae, or mouth parts that projected beyond these limits. Diagnostic characters of each stage are given under remarks for each new species.

Holotype females as well as paratypes of males, females, and deutonymphs are deposited in the United States National Museum, Washington, D.C.; all are on slides. Where only the deutonymph is known, a holotype and paratype deutonymphs are deposited.

This work is quite preliminary, and it is very likely that future work will result in many more new species being described, and, more important, a better understanding of the relationships between anoetids and scolytids. We are greatly indebted to Drs. P. E. Hunter (University of Georgia), and D. N. Kinn (University of California) for providing many of the specimens used in this study.

Anoetus media new species

FEMALE (Figs. 1, 3, 4, 7). Average length 350 μ. Cuticular surface composed of very fine, densely packed cones (see inset square in Fig. 1). Propodosomal shield weakly developed. Most dorsal setae as long as femur I, and characteristically narrow very quickly from their base width to very fine, drawnout threads. Ventral setae as long as dorsal setae, but of different form. Terminal whip-like seta of legs I and II as long as tarsus I. Legs III and IV lack such a terminal seta. Leg setae in general massive. Pedipalpal setae (Pp_1) very blunt, strongly curved, and shorter than Pp_2. Distal cheliceral digit terminally strongly spooned in two directions, shaft cylindrical and bearing 2 very strong subapical spines. Proximal digit with 3 closely appressed teeth.

MALE (Figs. 2, 3, 4, 8). Average length 340 μ. Body form, general chaetotaxy, and cuticular texture as in female. Pedipalps and chelicerae as in female. Sternum I projects farther posteriorly than in female, and epimeres II joined instead of being free. Legs in general heavier than in female. Penis normal size, thin, and directed posteriorly.

DEUTONYMPH (Figs. 5, 6). Average length 200 μ. Cuticle smooth and unmarked. Fused pedipalps hardly longer than wide. Anterior edge of notogaster finely striated. Prodorsum overhangs camerostome. Coxal plates I and II not darker than surrounding cuticle. Terminal seta of leg I spooned, leg II rounded, leg III oval, and leg IV setose. A fine pore present mesad of coxal discs I and III.

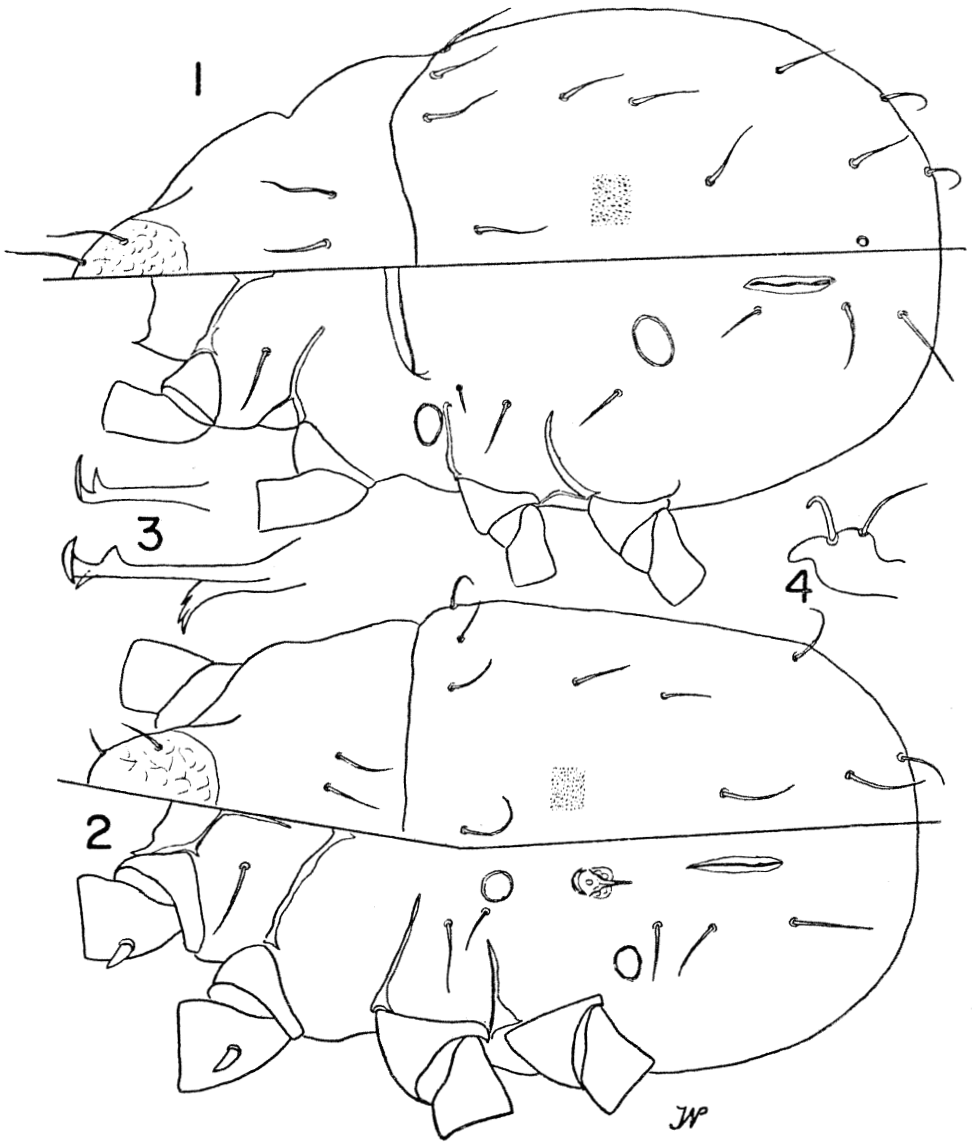
OCCURRENCE. All stages from galleries of *Dendroctonus terebrans* infesting *Pinus taeda* in Pineville and Winnfield, La. Deutonymphs from flying *D. terebrans* in Pineville, La., and from under elytra of *D. terebrans* found in *P. taeda* stumps in Winnfield, La. Deutonymphs phoretic on larvae and pupae of *D. terebrans* removed from bolts of *Pinus elliotti* from Florida.

TYPES. Holotype female from galleries of *D. terebrans* in *P. taeda* in Pineville, La., deposited in USNM. Two paratype females and 3 paratype males from the same locality, plus 2 paratype deutonymphs from flying *D. terebrans* in Pineville, La., also deposited in USNM. Additional paratypes of all stages retained in first author's collection.

REMARKS. The terminally spooned distal cheliceral digit with 2 subapical spines will distinguish the adults of *A. media* from all other anoetids. The very short fused pedipalps, the overhanging prodorsum, and the terminal setae of the legs will help distinguish this deutonymph.

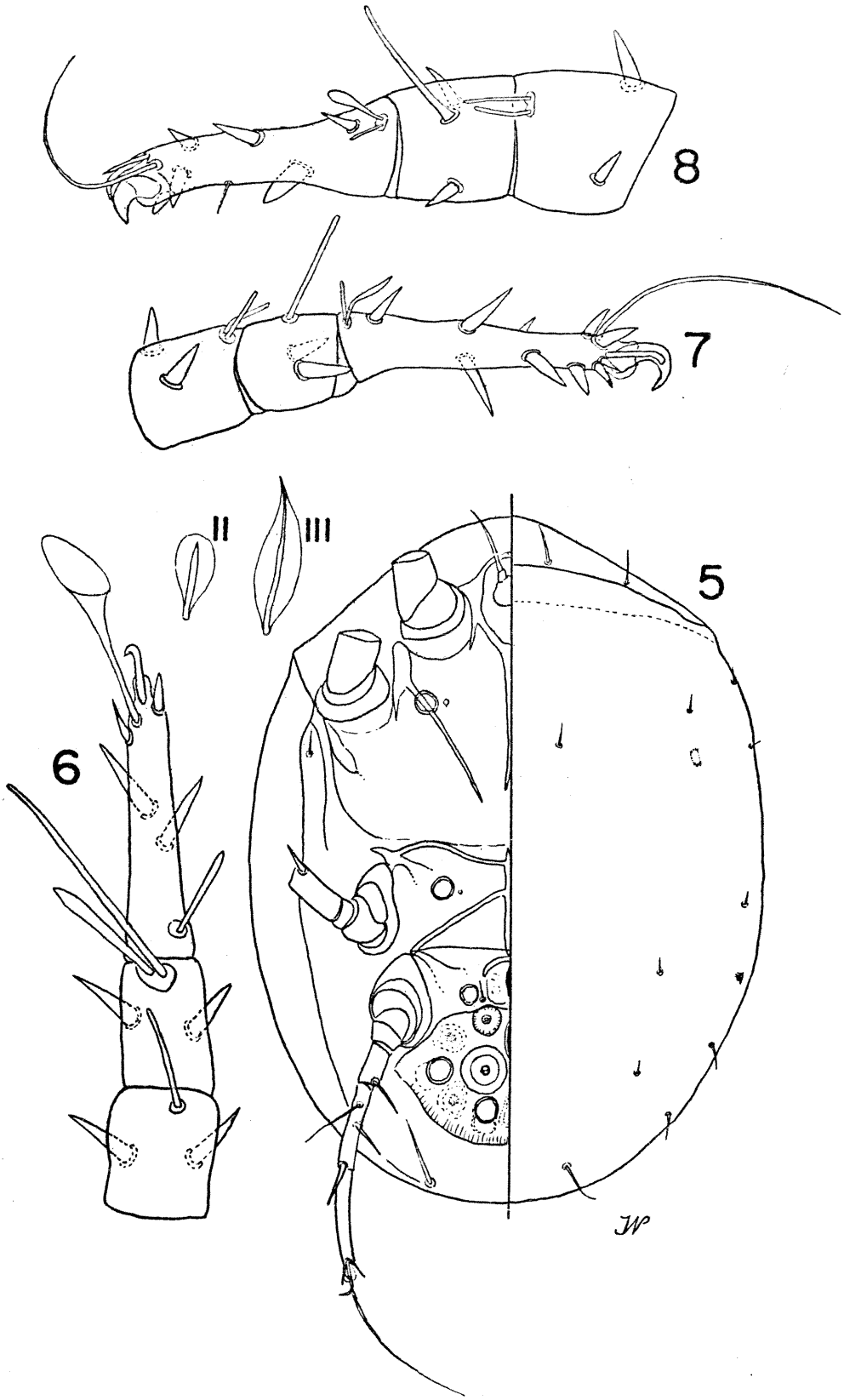
Anoetus sordida new species

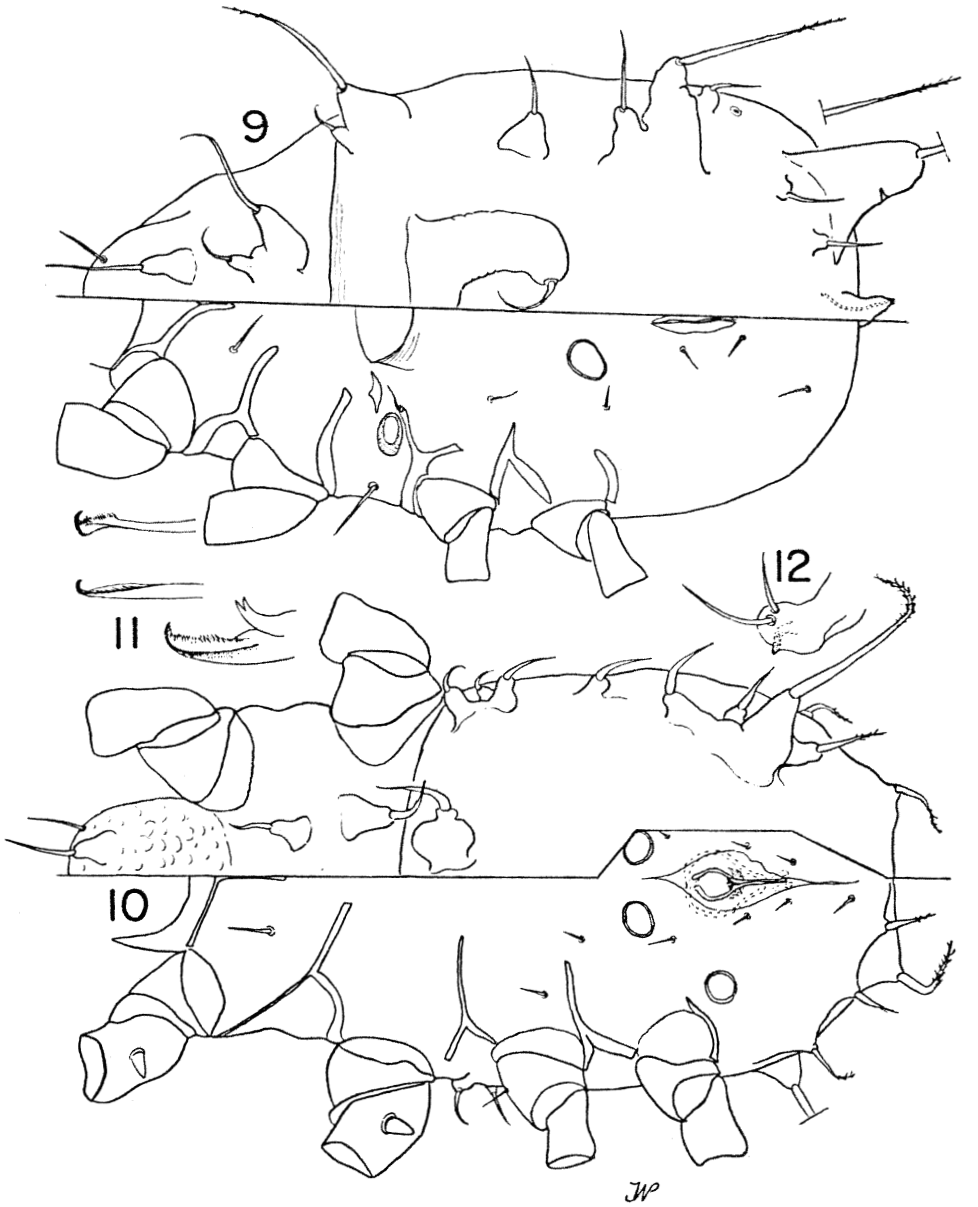
FEMALE (Figs. 9, 11, 12, 15). Average length 320 μ. Color of cuticle in living specimens white, and cuticle texture smooth. Body and legs thickly



FIGS. 1–4. *Anoetus media* n. sp. 1, ventral/dorsal view of female; 2, ventral/dorsal view of male; 3, dorsal and lateral view of chelicera; 4, pedipalp.

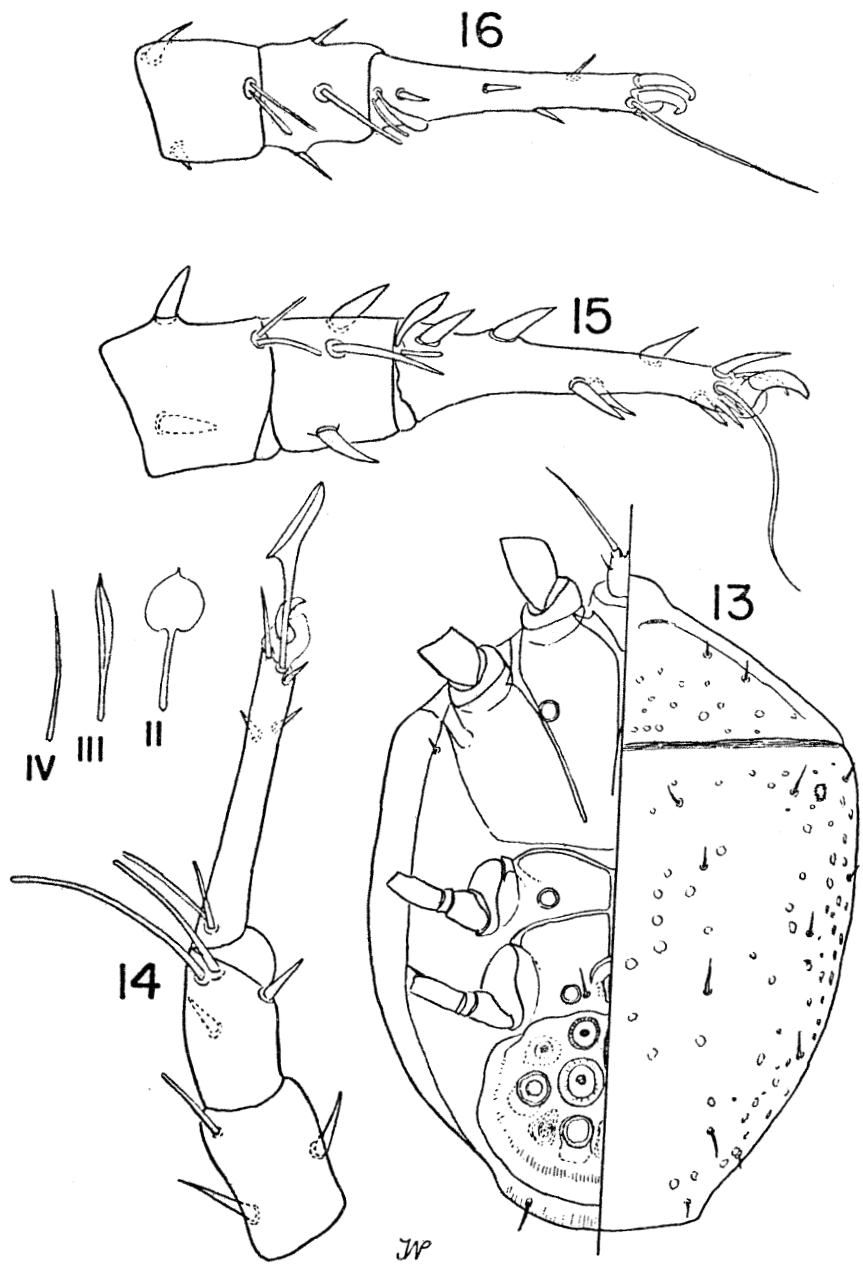
covered with debris, which tenaciously sticks to cuticle and setae. Bursa copulatrix at the end of a conical projection from the body. Appearance of the body warts and the direction from which the setae arise from these warts on a moderately cleared specimen is shown in Fig. 9. Complete clearing tends to distort these warts, either bending or swelling them abnormally. Larger body setae with terminal setules. Large median wart on anterior notogaster consistently curves mesally and the seta it bears is strongly curved. Legs I and II distinctly heavier than III and IV. Terminal whip-like seta of tarsi I and II almost as long as tarsus, and much shorter on tarsi III and IV. Distal cheliceral digit slightly


8
7
II
III
5
6



FIGS. 9–12. *Anoetus sordida* n. sp. 9, ventral/dorsal view of female; 10, ventral/dorsal view of male; 11, three views of distal digit of chelicera; 12, pedipalp.

FIGS. 5–8. *Anoetus media* n. sp. 5, ventral/dorsal view of deutonymph; 6, genu-tarsus I of deutonymph (with terminal setae of legs II and III); 7, genu-tarsus I of female; 8, genu-tarsus I of male.



FIGS. 13–16. *Anoetus sordida* n. sp. 13, ventral/dorsal view of deutonymph; 14, genu-tarsus I of deutonymph (with terminal setae of legs II–IV); 15, genu-tarsus I of female; 16, genu-tarsus I of male (to smaller scale than Fig. 15).

spooned at distal end, the shaft strongly flattened, and a row of very fine teeth present on inside curve of shaft. Proximal digit bidentate.

MALE (Figs. 10, 11, 12, 16). Average length 200 μ. Cuticular color, texture, and characteristic covering of debris are as in female. Penis long and thin and directed posteriorly. Position and shape of dorsal body warts similar to those of female, except that anterior and posterior-median notogasteral warts are much smaller and posterolateral wart not developed. Posteriormost notogastral seta bent 90°. Femora I and II (but not III and IV) each with a heavy ventral seta. Terminal whip-like setae of tarsa as in female. Tarsus I bears a dorsal terminal seta resembling the claw. Chelicercae are as in female.

DEUTONYMPH (Figs. 13, 14). Average length 165 μ. Living hypopus cream-white. Dorsum strongly and irregularly punctated. Figure 13 shows the typical distribution and size variations of punctations. With very little apparent pro-dorsal overhang, the fused pedipalps project strongly beyond body outline. Sternum I of normal thickness for about half its length, then continuing as a fine line. Sometimes this fine line is very faint and sternum I appears short. Terminal tarsal seta of each leg of a different form. Coxal plates I and II not strongly sclerotized. Sucker plate very large.

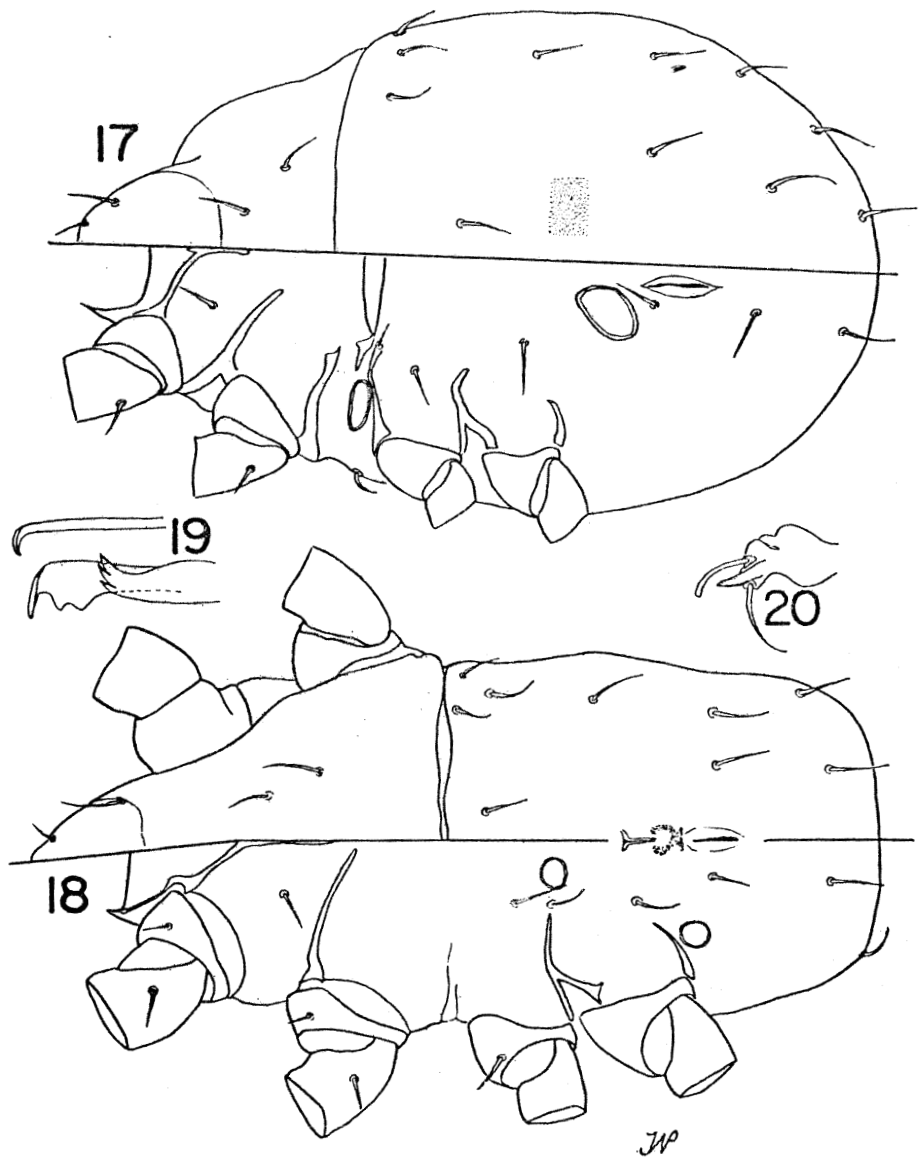
OCCURRENCE. All stages of development and both sexes from the stripped inner bark of *Pinus taeda* containing galleries of *Ips avulsus*, *I. calligraphus*, and *Dendroctonus frontalis* from Elizabeth, La. Deutonymphs and females from soupy boring dust of *Ips avulsus* in *P. taeda* from Elizabeth, La. Larvae and females from galleries of *Ips calligraphus* in (?) *P. taeda* from Athens, Ga. Females from galleries of *D. frontalis* in *P. taeda* from Hardin County, Texas, and Elizabeth, La. Deutonymphs from boring dust of *Ips cribricollis* and *D. frontalis* in *Pinus oocarpa* from Tegucigalpa, Honduras. Deutonymphs phoretic on *Carcinops* sp. (Histeridae) and *Corticeus coynei* (Tenebrionidae) beetles associated with *Ips cribricollis* and *D. frontalis* galleries in *P. oocarpa* from Tegucigalpa and Cedros, Honduras. Deutonymphs phoretic on *Scolytus unispinosus* boring in *Pseudotsuga menziesii* from Radium, British Columbia, Canada. Deutonymphs phoretic on *Cossonus corticola* (Curculionidae) in *P. taeda* from Starksville, Miss.

TYPES. Holotype female from inner bark of *Pinus taeda* (cut Aug. 1965) infested with *I. avulsus*, *I. calligraphus*, and *D. frontalis* in Elizabeth, La., deposited in USNM. Paratypes of 6 females, 1 male, and 4 deutonymphs from same locality (and date) are also deposited in USNM. Additional paratypes of all stages retained in first author's collection.

REMARKS. Though adults were only collected from Texas, Louisiana, and Georgia (and the Georgia specimens differ somewhat from the Louisiana specimens), the rather positive identification of deutonymphs from Canada, Louisiana, and Honduras indicates a very wide geographic range for this species. The deutonymphs apparently are not restricted to one scolytid species or even to Scolytidae. The pattern of warts on the adults readily distinguishes *A. sordida* from other anoetids. The deutonymph sternum I is unique among described deutonymphs with the anterior half thick and the posterior half thin.

Anoetus varia new species

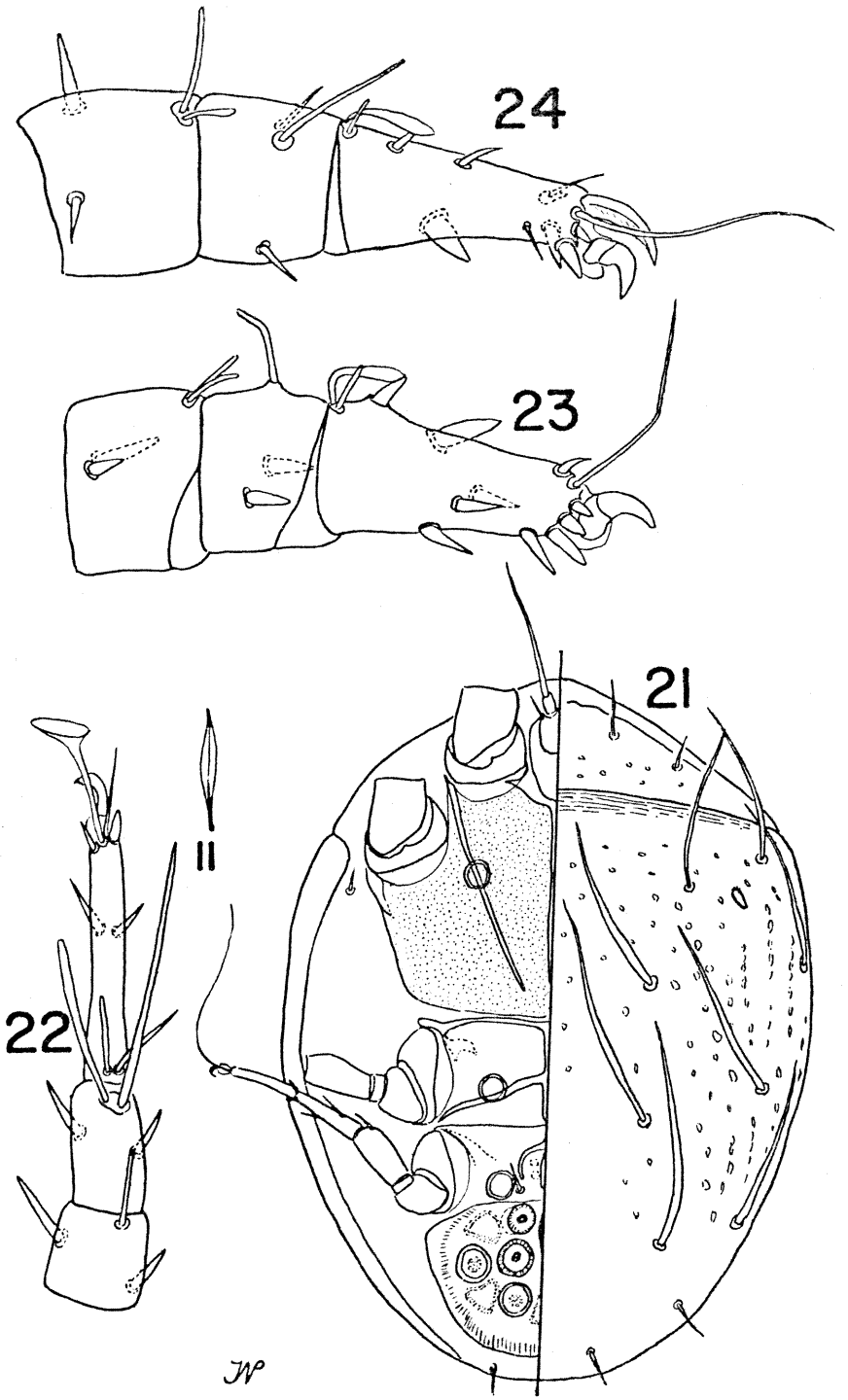
FEMALE (Figs. 17, 19, 20, 23). Average length 320 μ. Cuticular surface composed of dense covering of very fine raised points (see rectangular inset on Fig. 17). Propodosomal shield faint. All dorsal setae of approximately same



FIGS. 17–20. *Anoetus varia* n. sp. 17, ventral/dorsal view of female; 18, ventral/dorsal view of male; 19, dorsal and lateral view of chelicera; 20, pedipalp.

length and shape. Leg I slightly heavier than leg II, and both are much stouter than legs III and IV. Terminal whip-like seta of legs I and II as long as tarsi, while that of legs III and IV not longer than tarsal claw. Leg setae in general short and stout. Distal cheliceral digit distinctly spooned at tip, and shaft is strongly flattened. In the broad plane, the distal digit shows a broad tooth above a round outswelling on one side. The proximal digit is likewise flattened and bears distally 3 teeth.

MALE (Figs. 18, 19, 20, 24). Average length 260 μ. Cuticle smooth or with extremely fine points. Body shape posteriorly distinctly rectangular (not an



FIGS. 21–24. *Anoetus varia* n. sp. 21, ventral/dorsal view of deutonymph (with a punctation pattern of a specimen from Elizabeth, La.); 22, genu-tarsus I of deutonymph with terminal seta of leg II; 23, genu-tarsus I of female; 24, genu-tarsus I of male.

artifact of mounting or of age of male), and dividing line between hysterosoma and proterosoma very distinct. Epimere II and sternum almost touch, but clearly separate at tips. All legs more massive than in female, and legs I and II are heavier than III and IV. Tarsus I with 1 heavy ventral spine, and tarsus II with 2 such spines. All legs appear slightly curved through their entire length, but leg IV most noticeably. A thick, flattened, curved setae overhangs the claw on leg I. On leg II this seta is large, but conical, and on legs III and IV this seta is much smaller. Chelicerae and pedipalps are as in female. Penis very small.

DEUTONYMPH (Figs. 21, 22, 25). Average length 147 μ. Cuticle smooth except for highly variable intensity and distribution of punctations (see under remarks). The lateral punctations tend to merge into longitudinally running furrows, and in some forms, especially type 6 from Honduras, faint lines join groups of 4–6 punctations together into geometrical designs. Sometimes a very faint arcing pattern of the punctations is apparent on the anterior notogaster. Punctations are few or lacking on prodorsum. Anterior notogaster striated. Dorsal setae long, thick, smooth, and range in color from light brown to almost black. Fused pedipalps normally do not project beyond anterior edge of body. Coxal plates I and II slightly darker than remainder of venter. Sternum and epimere I end free. All sucker plate discs of near equal size, and coxal plate discs almost as large as sucker plate discs. Terminal seta of tarsus I sucker-like; terminal seta of tarsus II lanceolate; and terminal seta of tarsi III and IV whip-like and as long as tibia plus tarsus or longer.

OCCURRENCE. Larvae, proto- and trito-nymphs, deutonymphs (type 0), and adults of both sexes were collected from the inner surface of bark stripped from *Pinus taeda* infested with *Ips avulsus*, *I. calligraphus*, and *Dendroctonus frontalis* from Elizabeth, La. (type locality). In the following list of additional localities, the morphological variant of the deutonymph (dn), see Fig. 25, is given in parentheses.

♀ ♂ dn (2)	galleries of	*I. avulsus*	in *P. taeda*, Elizabeth, La.
♀ ♂	galleries of	*D. terebrans*	in *P. taeda*, Pineville, La.
♀ dn (4)	galleries of	*I. avulsus* *I. calligraphus*	in *P. taeda*, Athens, Ga.
♀ ♂ dn (6)	boring dust	*D. frontalis* *I. cribricollis*	in *P. oocarpa*, Tegucigalpa, Honduras
dn (1)	boring dust	*I. avulsus* *I. cribricollis*	in *P. taeda*, Elizabeth Ga.
dn (4)	galleries of	*D. frontalis*	in *P. palustris*, Accomac, Va.
dn (1)	phoretic on	*Gnathotrichus materiurius* and *Trypodendron scabricollis*	in *P. taeda*, Elizabeth, La.
dn (0)	phoretic on	*D. simplex*	in *Larix larcina*, Grande Prairie, Alta., Canada
dn (0)	phoretic on	*Lonchaeidae* (Diptera)	in *P. taeda* from Rapides Parish, La.
dn (4)	phoretic on	*I. avulsus* *I. grandicollis*	from Athens, Ga.
dn (4)	phoretic on	*I. calligraphus*	in *P. echinata*, Oxford, N.C.
dn (4)	phoretic on	*I. calligraphus*	from Clarke Co. and Athens, Ga.
dn (4)	phoretic on	*I. avulsus*	in *P. palustris*, Bolcon, N.C.
dn (1)	phoretic on	*Aulonium ferrugineum* (Colydiidae: Coleoptera)	in *P. taeda*, Elizabeth, La.
dn (0)	phoretic on	*Aulonium ferrugineum*	in *P. palustris*, Auburn, Ala.

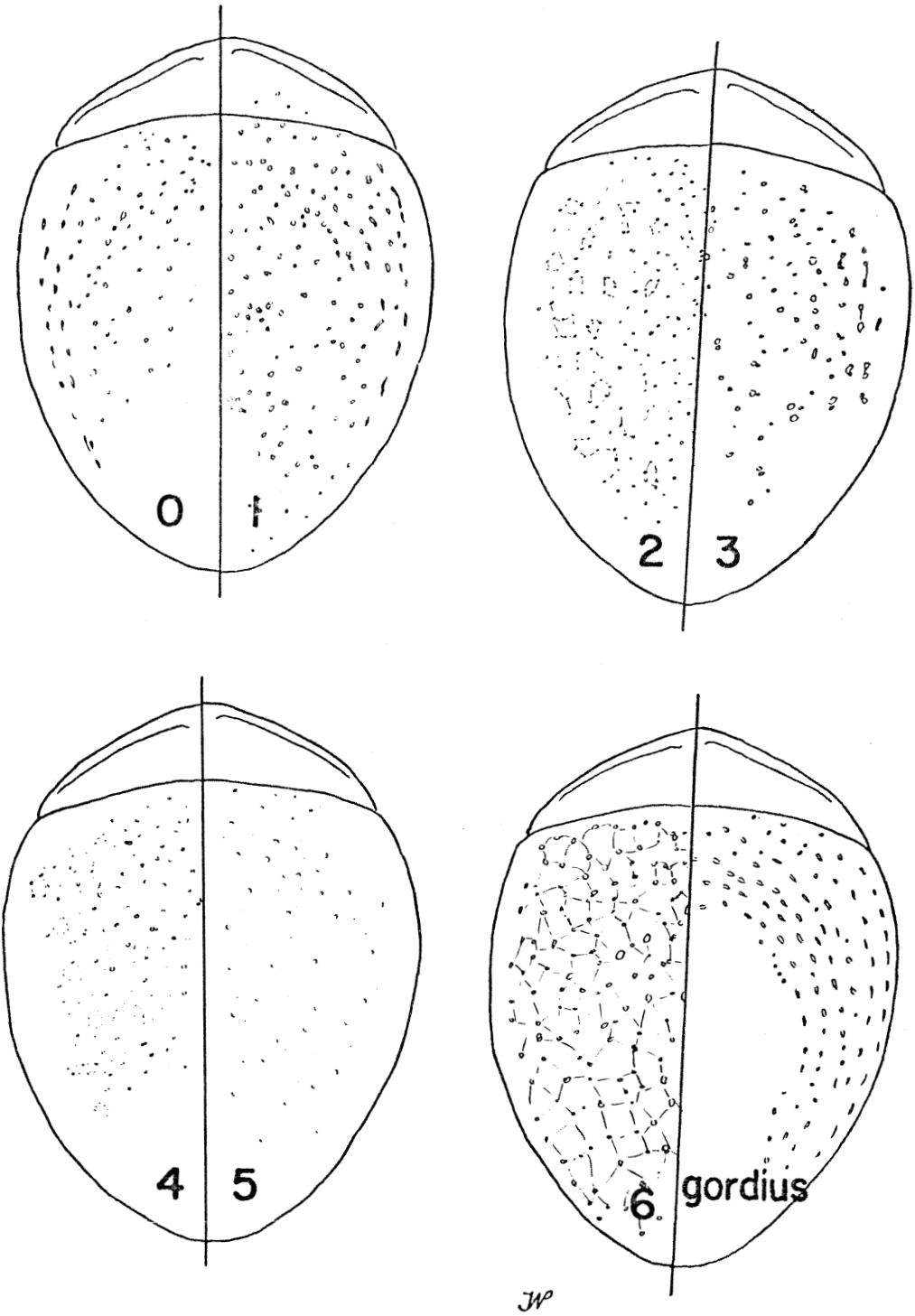


FIG. 25. *Anoetus varia* n. sp., deutonymphs. Schematic representations of notogastral punctation variation (see text for explanation).

dn (1, 4)	phoretic on *I. grandicollis*	from Clarke Co. and Athens, Ga.
dn (2)	phoretic on *Pityokteines minutus*	in *Abies lasiocarpa,* Tidler, Alta., Canada
dn (2)	phoretic on *I. pini*	in *P. resinosa,* Thessalon, Ont., Canada
dn (2)	phoretic on *Orthotomicus latidens* *Orthotomicus sabiniana*	from near San Diego, Cal.
dn (2)	phoretic on *I. pini*	from Oneida Co., Wis.
dn (3)	phoretic on *I. confusus*	in *P. ponderosa,* Middletown, Cal.
dn (3)	phoretic on *I. plastographus*	from Oakland, Cal.
dn (3)	phoretic on *Pityophthorus carmeli*	in *P. torreyana,* San Diego Co., Cal.
dn (5)	phoretic on *D. frontalis* *I. cribricollis*	from Pueblo, Mexico
dn (5)	phoretic on *I. mexicanus*	in *P. radiata,* San Francisco, Cal.
dn (5)	phoretic on *I. pini*	from Oregon
dn (6)	phoretic on *I. cribricollis*	in *P. oocarpa,* Tegucigalpa, Honduras
dn (6)	phoretic on unknown beetles assoc. with *D. frontalis*	in *P. oocarpa,* Honduras

Hunter and Davis (1963) found what they called *H. gordius* deutonymphs phoretic on a number of adult *Ips* species. Dr. Hunter kindly sent me some of these deutonymphs and several females, and I have determined them to be *A. varia* (the Georgia localities in the above list). Hunter and Davis (1963) gave the following additional localities and phoretic hosts for what they called *H. gordius* (undoubtedly *A. varia*): from Minnesota deutonymphs were found on *I. grandicollis, I. perturbatus,* and *I. pini*; and from Colorado deutonymphs were found on *I. emarginatus* and *I. calligraphus.*

Types. Holotype female, 7 paratype females, 6 paratype males, and 4 paratype deutonymphs (type 0) collected from the inner surface of bark stripped from *P. taeda* infested with *Ips avulusus, I. calligraphus,* and *Dendroctonus frontalis* from Elizabeth, La., are deposited in USNM. Additional paratypes of all stages (including the 7 variations of the deutonymph stage) are retained in first author's collection.

Remarks. The most useful characters to distinguish adult *A. varia* are the chelicerae and pedipalps. The rectangular body form of the male is also helpful. Deutonymphs of *A. varia* are difficult to distinguish from *A. gordius* Vitzthum, 1923, as redescribed by Cooreman (1963) and Scheucher (1957). The *A. gordius* Vitz., 1923, described and illustrated by Hughes and Jackson (1958), is definitely not the *A. gordius* of European workers, and I propose the name *Anoetus sylvestris* nomen novum for the species of Hughes and Jackson (1958). *Anoetus sylvestris* was collected from compost and in woods and has never been found associated with bark beetles or their galleries.

As Scheucher (1957) pointed out, what Vitzthum in 1926 redescribed as *A. julorum* (Koch 1842) male and female are in fact the adults of Vitzthum's earlier described (1923) deutonymph of *A. gordius.* Both Scheucher's and Vitzthum's illustrations show the adults of *A. gordius* with spooned chelicerae, blunt pedipalpal setae, and the posterior pair of chitinous rings of the female being

extremely large and flanking the anal slit. *Anoetus sylvestris* nom. nov. is completely different in all these regards (see Hughes and Jackson, 1958).

The name *gordius* is based on the deutonymph. Scheucher (1957) not only found for the first time the adults of *A. gordius* in galleries of *Ips laricis*, but she also reared adults from deutonymphs removed from adult *I. laricis*. *Anoetus gordius* deutonymphs have three outstanding features: 8 pairs of long, dark notogastral setae (Scheucher shows 9 pairs); a distinct sweeping pattern of notogastral cuticular punctations; and the terminal tarsal seta of legs III and IV whip-like and as long as the entire leg. Though superficially similar to *A. gordius*, *A. sylvestris* deutonymphs have the first 3 pairs of notogastral setae in a horizontal line far removed from the sejugal line, and the terminal seta of tarsi III and IV is shorter than the tarsus.

After this definition of *A. gordius* (Vitz. 1923) and *A. sylvestris* nomen novum, we may proceed to distinguish *A. varia*. *Anoetus varia* resembles *A. gordius* very closely, but is quite distinct from *A. sylvestris*. The posterior chitinous ring of *A. varia* females lies adjacent to the anal slit, but it is not especially large. *Anoetus gordius* females are larger (350–500 μ) than *A. varia* (290–350 μ). Both Vitzthum and Scheucher show *A. gordius* males with epimeres II fused for a short distance, while in *A. varia* males epimeres II are distinctly separate. The chelicerae of *A. gordius* (both sexes) are terminally spooned in two directions and the shaft bears but 1 spine, whereas in *A. varia* the distal digit is spooned in one direction and the shaft bears a spine plus a rounded projection.

The separation of *A. gordius* and *A. varia* deutonymphs is morphologically based on two features; a swirled pattern of notogastral punctations is absent or very weak in *A. varia* and the base of tarsus I bears a long spine (Fig. 22) adjacent to the solondium. Cooreman (1963) clearly shows this spine to be absent in *A. gordius*, and both Cooreman (1963) and Scheucher (1957) emphasize the "pattern" of notogastral punctations of *A. gordius*. *Anoetus gordius* deutonymphs appear to be slightly larger (160 μ) than *A. varia* (147 μ) deutonymphs.

Vitzthum (1923) described *A. gordius* deutonymphs from *Ips laricis* and *I. proximus* from Austria and Czechoslovakia. Scheucher (1957) found *Ips laricis* collected from different areas around Erlangen, Germany, almost always bearing *A. gordius* deutonymphs, and just prior to renewed boring in the spring, she found 90% of the adult beetles infested. She suggested that there may be some sort of obligatory relationships or dependency of *A. gordius* to this one species of beetle. Cooreman (1963), in an extensive study of the mites associated with Scolytidae in Belgium, likewise found *A. gordius* deutonymphs only on *I. laricis*.

In contrast, *A. varia* has been collected phoretic upon 16 bark beetle species, and from several other associates that occur in bark beetle galleries. Adult *A. varia* were taken from the galleries of four different bark beetle species infesting two different pine species. The adult bark beetle hosts bearing *A. varia* deutonymphs were taken in flight or in any one of eight different species of evergreen trees. The geographic range of *A. varia* appears to be at least throughout the range of pines in Central and North America.

Adult *A. varia* from Louisiana and Georgia are indistinguishable, while adults from Honduras generally differ slightly. The two pairs of chitinous rings of Honduran specimens are smaller, and the pointed tooth on the distal cheliceral digit is slightly smaller than on Louisiana specimens. There may be a number of subspecies of *A. varia* throughout this wide geographic range. No correlation of beetle species and the variant of *A. varia* deutonymphs was apparent (see Fig. 25).

Deutonymph type 6 (Honduran) is farthest removed morphologically and geographically from the other types than are the other types from one another.

Anoetus conjuncta new species

DEUTONYMPH (Figs. 26, 27). Average length 147 μ. Notogastral setae moderately long, at least some longer than tibia I. Coxal plates I and II only slightly darker than surrounding cuticle. Dorsal cuticle smooth, and striations on anterior edge of hysterosoma light. Coxal discs fairly large, only slightly smaller than anterior plate disc. Terminal tarsal setae of leg I trumpet shaped, that of leg II lanceolate, and the terminal seta on legs III and IV whip-like and not longer than the tarsus.

MALE AND FEMALE. Unknown.

OCCURRENCE AND TYPES. A holotype and 1 paratype slide with a deutonymph from boring dust of *D. frontalis* and *Ips cribricollis* in *Pinus oocarpa* from Tegucigalpa, Honduras, are deposited in USNM. One paratype specimen from the same localities retained in first author's collection. Five specimens taken from inner bark of *P. taeda* infested with *Ips avulsus, I. calligraphus,* and *D. frontalis* in Elizabeth, La.

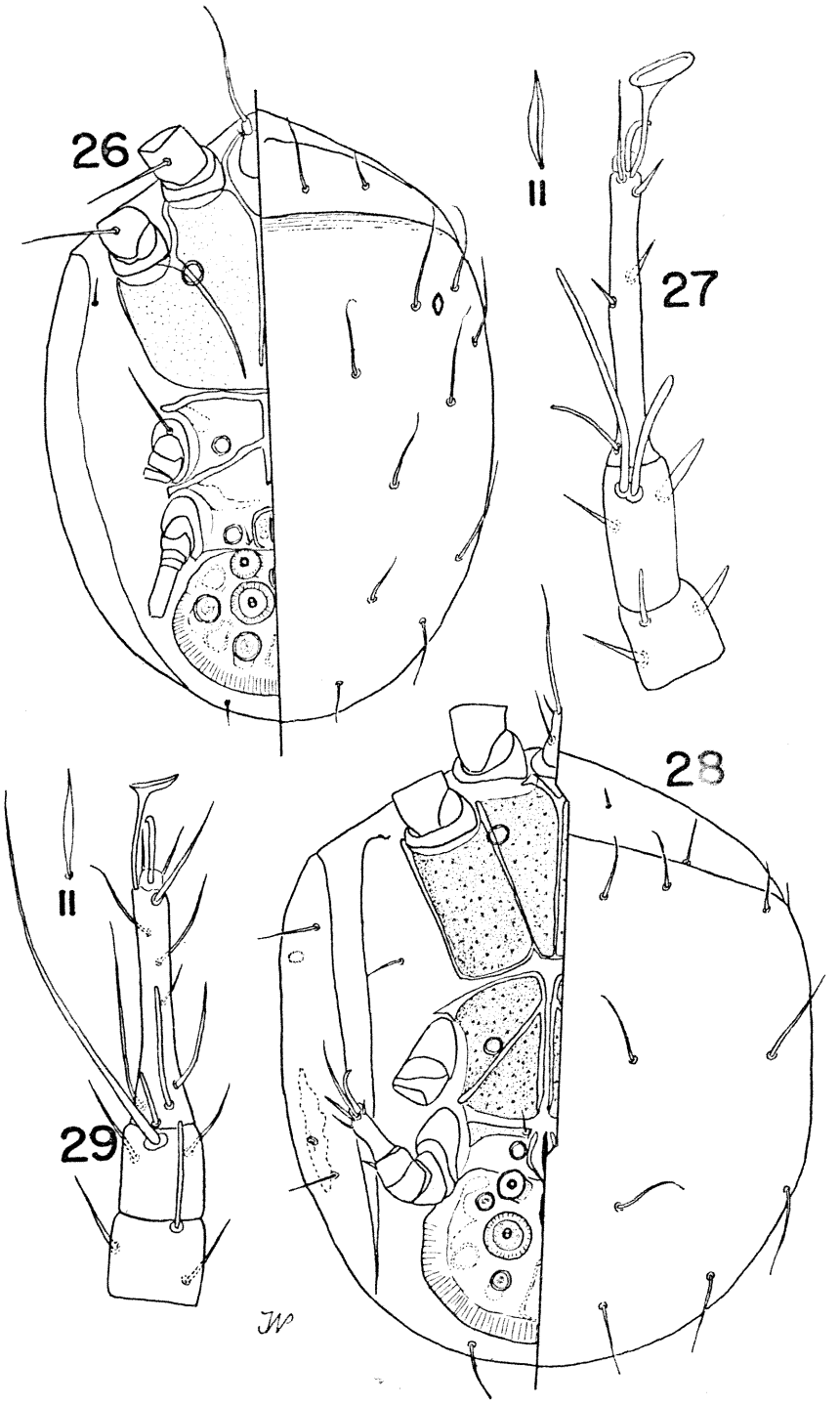
REMARKS. This is one of the long-haired *Anoetus* deutonymphs, and as Mahunka (1963) aptly pointed out, "dieser Gruppe herrscht ein gewisses Durcheinander." The species diagnosis for *A. conjuncta* is brief, for, as is often the case for anoetid deutonymphs, there are few outstanding or distinctive features. Mahunka (1967) constructed a key to the 19 species of long-haired *Anoetus* (*Histiostoma*) deutonymphs, in which the inclusive feature was where at least one pair of notogastral setae exceeded the length of tibia I. *Anoetus conjuncta* could not be properly placed in this key nor in the more inclusive keys to anoetid deutonymphs by Scheucher (1957) or Hughes and Jackson (1958).

Anoetus insolita new species

DEUTONYMPH (Figs. 28, 29). Average length 177 μ. Dorsal cuticle soft, weakly sclerotized, and smooth. Dorsal chaetotaxy normal. All notogastral setae whip-like and longer than tibia I. Each coxal field is completely enclosed, and considerably darker than the surrounding cuticle. A distinct space present between the fused anterior coxal plates (I, II) and the posterior coxal shields (III, IV). Cuticle of coxal plates I and II dark and covered with tiny punctations. A very unusual space present between the fused left coxae III–IV and the right fused coxae III–IV. Lateral disc of sucker plate on almost same level as anterior disc. Legs I and II much longer than III and IV, the latter being unusually stubby and barely projecting beyond body margin. Tarsal claw of all legs long and thin and only slightly curved at tip. Tarsus I bears terminally a trumpet-shaped seta, tarsus II a lanceolate seta, and tarsi III and IV a short whip-like seta.

FIGS. 26–27. *Anoetus conjuncta* n. sp. 26, ventral/dorsal view of deutonymph; 27, genu-tarsus I of deutonymph (with terminal seta of leg II).

FIGS. 28–29. *Anoetus insolita* n. sp. 28, ventral/dorsal view of deutonymph; 29, genu-tarsus of deutonymph (with terminal seta of leg II).


26
II
27
28
II
29

MALE AND FEMALE. Unknown.

OCCURRENCE AND TYPES. A holotype and 3 paratype deutonymphs from th boring dust of *D. frontalis* in *P. taeda* from Elizabeth, La., are deposited in USNM One paratype from the same locality is retained in first author's collection.

REMARKS. This species could fit equally well in *Anoetus, Spinanoetus,* or a new genus. *Spinanoetus,* erected by Scheucher (1957), contains three European species associated with carrion and dung, and the deutonymphs of these specie were collected on beetles from this habitat. Though *A. insolita* may possibly occur in dung or on carrion, it is currently only known from *D. frontalis* boring dust. The arrangement of ventral epimeres, epimerites, and sterna, and especially the longitudinal separation of fused coxae III–IV would seem to warrant the erection of a new genus. The chaetotaxy of tibia and tarsus I are also distinctive However, until adult *A. insolita* are described, we will retain the species in *Anoetus*

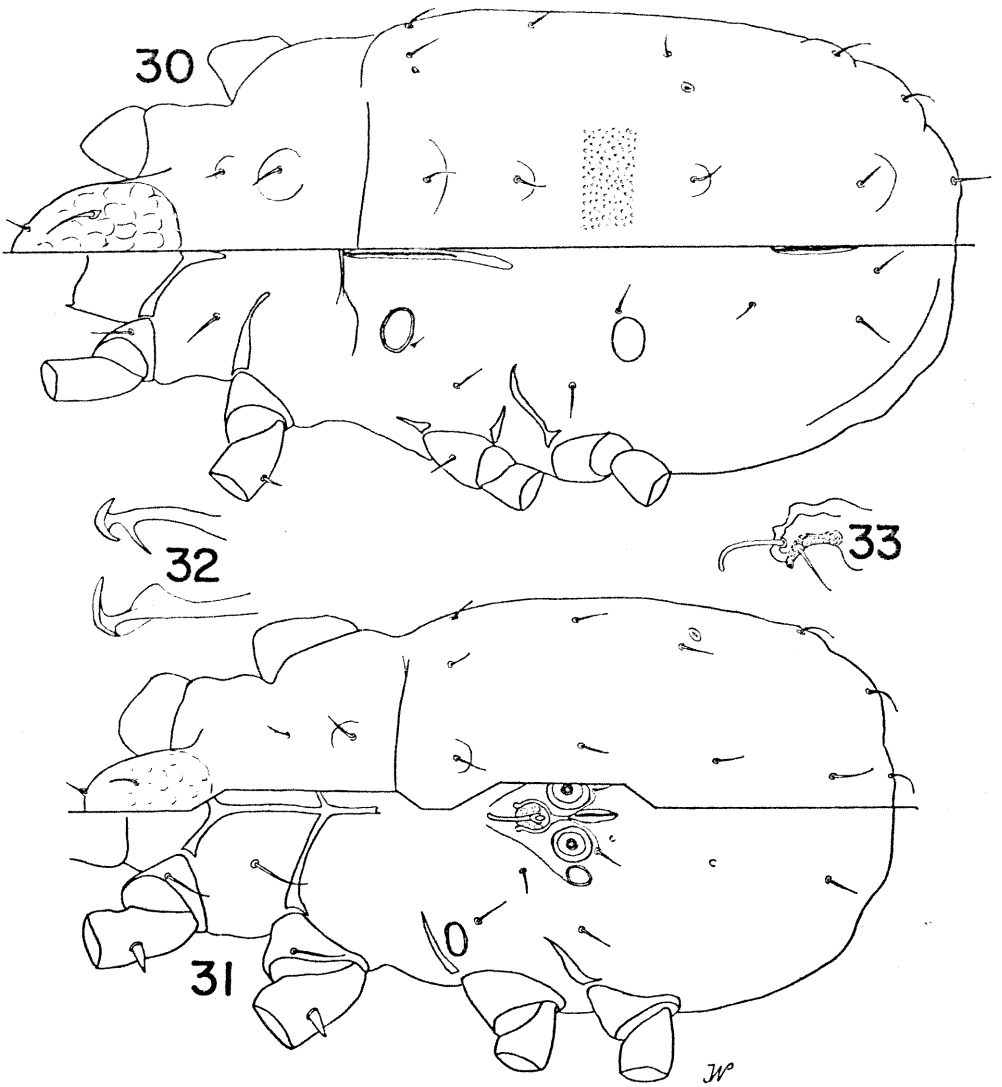
Bonomoia certa new species

FEMALE (Figs. 30, 32, 33, 36). Average length 370 μ. Cuticular surface composed of dense, evenly spaced, very fine cones (see inset of Fig. 30) giving the cuticle a rough texture. Most dorsal setae arise from flattened warts of various sizes. The posteriormost warts are usually more conspicuous than others, but the size of these warts varies among individuals. As is typical of this genus, the anterior chitinous rings are as close to one another as the posterior rings to each other, and the genital slit is longitudinal. Legs I and II are heavier than III and IV, and tarsi I and II bear terminally a long whip-like seta which is lacking on tarsi III and IV. Membranous portion of pretarsus IV projects to a point. Distal cheliceral digit distally strongly spooned, shaft moderately flattened and bears a long, sharp spine.

MALE (Figs. 31, 32, 33, 37). Average length 300 μ. Smaller than the female, the general body form, cuticular texture, and dorsal chaetotaxy of male are essentially as in the female. Characteristic of this genus, epimeres I and II all joined together into one unit, and a pair of conspicuous genital suckers are present. Penis long, strong, and directed forward. Legs I and II only slightly heavier than III and IV. Tibia I with a concave tapering ventral-preaxial seta. Setal socket (ba) on tarsus I drop-shaped and very strongly sclerotized. Dorsal-distal seta of tarsus I enlarged, slightly flattened and curved, and resembling a second claw. Dorsal-distal seta of tarsus II as large as claw but not flattened nor strongly curved. Chelicerae and pedipalps as in female.

DEUTONYMPH (Figs. 34, 35). Length of the single available specimen 170 μ. Dorsum and ventral coxal plates evenly covered with very fine, dense, microcones. All notogastral setae present and small. Large conspicuous eye characteristic of this genus near anterior edge of notogaster. Prodorsal setae not discernible. Sterna, epimeres, and epimerites all very thin. The junction of sterna II and III with epimere IV forms a diamond. Neither coxal plate sucker IV nor the adjacent setae clearly discernible. Coxal suckers I and III replaced by long, strong setae. Sucker plate normal. Terminal seta of tarsi III and IV whip-like and longer than entire leg, and terminal seta of tarsus II knob-like. Terminal seta of leg I not discernible.

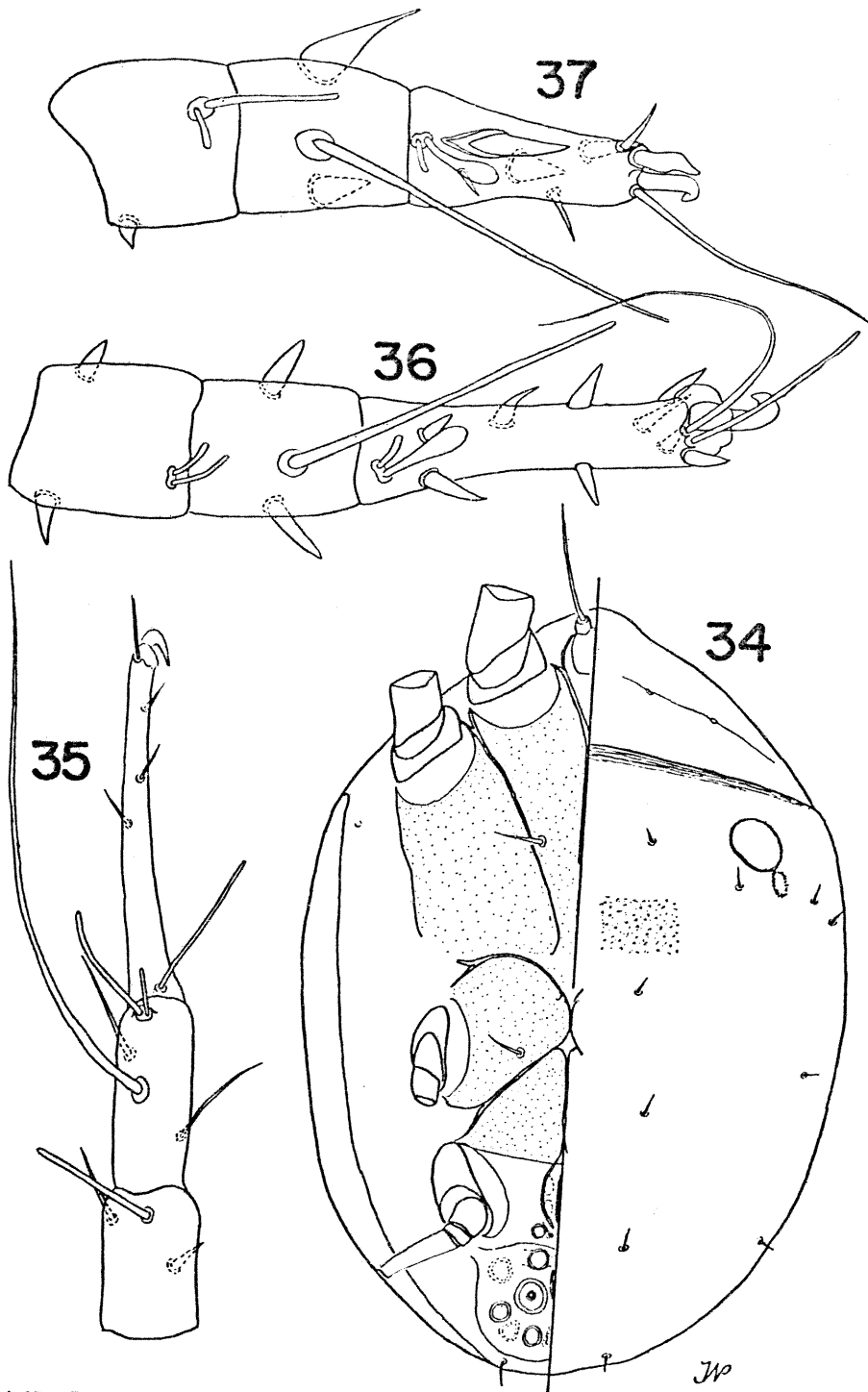
OCCURRENCE AND TYPES. Holotype female associated with *D. pseudotsugae* from Moscow Mtn., Moscow, Idaho, deposited in USNM. Paratype females and males (on one slide) from *Pseudotsuga menziesii* in Camp Creek, Idaho, deposited



FIGS. 30–33. *Bonomoia certa* n. sp. 30, ventral/dorsal view of female; 31, ventral/dorsal view of male; 32, dorsal and lateral view of chelicera; 33, pedipalp.

in USNM. Paratype deutonymph phoretic on *Dendroctonus brevicomis* in *Pinus ponderosa* in Blodgett Forest, Eldorado Co., Cal., deposited in USNM. Paratype female in galleries of *Scolytus ventralis* in white fir in Blodgett Forest, Eldorado Co., Cal., retained in first author's collection.

REMARKS. This is the sixth species of *Bonomoia* to be described, and the first from North America. In only two other species are adults known, *B. pini* Scheucher, 1957, and *B. spinifera* Scheucher, 1957. The unlined notogaster and very thin epimere I will distinguish deutonymphs of *B. certa* from other species in the genus. The female *B. certa* differs from the other two known species by the presence of a strong subapical spine on the distal cheliceral digit. The mid-dorsal tarsal spine (ba) of male *B. certa* is unlike this spine in the males of other *Bonomoia*.



FIGS. 34–37. *Bonomoia certa* n. sp. 34, ventral/dorsal view of deutonymph; 35, genu-tarsus I of deutonymph; 36, genu-tarsus I of female; 37, genu-tarsus I of male.

It is not conclusive that the deutonymph described here belongs to the adults herein described, since in no case were they found together. Because *Bonomoia* is uncommon and both the deutonymph and one female were found in a restricted area (Blodgett Forest, Eldorado Co., Cal.), though in different trees and associated with different bark beetle species, we tentatively hold them to be one species.

ADDITIONAL ANOETIDS ASSOCIATED WITH BARK BEETLES

Other species of anoetids that have been recorded in the literature as being associated with any bark beetle species or its galleries are listed below alphabetically with the new nomenclatorial combinations. Deutonymph is abbreviated as dn and stages described are shown in parentheses.

1. *A. abietus* (Scheucher 1957) *new combination* (only 2 dn) p. 335. Phoretic on *Ips curvidens* in the region around Erlangen, Germany.
2. *A. crassipes* (Oudemans 1912) (dn only) Oudemans' unpublished drawing in Hughes and Jackson (1958) p. 58. Phoretic on a species of *Platypus* and on a species of Histeridae from East Africa (Oudemans' specimens), and phoretic on *Ips stebbingi* from Kutu, Himalaya (Vitzthum's specimens). Possibly two species are involved here.
3. *A. dryocoeti* (Scheucher 1957) *new combination* (♀, dn) p. 315. Deutonymphs phoretic on *Dryocoetes autographus* in spruce and sometimes on other beetles occurring in these galleries in the region around Erlangen, Germany. The females were reared from the dn by Scheucher.
4. *A. crypturgi* (Scheucher 1957) *new combination* (♀, ♂, dn) p. 310. All stages collected from galleries of *Rhagium* sp. in a spruce stump. Deutonymphs phoretic on about 80% of the *Crypturgus pusillus* collected from regions around Erlangen and Regensburg, Germany.
5. *A. gladiger* (Vitzthum 1926) (dn only) p. 490. Redescription by Cooreman (1963) p. 39. Phoretic on *Ips subelongatus* from Siberia (Vitzthum's specimens) and phoretic on *Ips sexdentatus* and *I. cembrae* in Belgium and Germany. A very striking species.
6. *A. gordius* (Vitzthum 1923) (♀, ♂, dn). See remarks under *H. varia* n. sp. Deutonymphs phoretic on *Ips laricis* from Austria, Germany, Bosnia, and Belgium. Males and females were reared by Scheucher (1957) and were also collected from *I. laricis* galleries around Erlangen, Germany.
7. *A. himalayae* (Vitzthum 1923) (dn only). Phoretic on *Polygraphus minor* collected from Jaunsar Makrata, Himalaya. Hughes and Jackson (1958) used Vitzthum's name *H. himalayae* for anoetids (♀, ♂, and dn) collected from swamp, forest litter, compost heaps, and orchards in Virginia, Florida, and Tennessee. They admit that Vitzthum's figure of *H. himalayae* deutonymph differs in many regards from the deutonymphs they collected. It seems clear that a homonym exists. For the *H. himalayae* of Hughes and Jackson (1958), I propose the name *H. virginiana* nomen novum.
8. *A. pannonicus* (Mahunka 1968) (only one dn) p. 251. Phoretic on *Dryocoetes villosus* from Hungary.
9. *A. piceae* (Scheucher 1957) *new combination* (♀, ♂, dn) p. 304. All stages and both sexes collected from galleries and from boring dust of *Ips typographus* in spruce from a number of locations in Germany. Deutonymphs phoretic on *I. typographus* and some Staphylinidae that also occurred in the galleries. *H. picae* may, according to Scheucher (1957), be restricted to *I. typographus* and their galleries.
10. *A. pini* (Scheucher 1957) *new combination* (♀, dn) p. 317. Deutonymphs redescribed by Cooreman (1963) p. 35. Deutonymphs found phoretic on *Hylastes ater* in Belgium, Hungary and Germany, and on *H. cunicularius* in Belgium. Females were reared from the deutonymphs by Scheucher.

11. *A. ulmi* (Scheucher 1957) *new combination* (♀, ♂, dn) p. 318. Deutonymp found phoretic on *Hypophloeus bicolor* (Tenebrionidae) collected fr galleries of *Scolytus* sp. in fallen elm trees in the region around Erlang Germany, but never on the *Scolytus* sp. Scheucher obtained the adults rearing the deutonymphs.
12. *A. vitzthumi* (Scheucher 1957) *new combination* (♀, ♂, dn) p. 313. Deu nymphs phoretic on *Dendroctonus micans*. All stages from galleries and fr in galleries of *D. micans* from Sitka spruce samples from Schleswig-Holste Germany. Vitzthum (1923) described this species (calling it *A. trichophor* Oud., 1912) from *D. micans* galleries from Austria. Deutonymphs found l Scheucher (1957) also on *Dryocoetes autographus*; but, as she points out, t reared adults from the deutonymphs collected from *D. autographus* diff slightly from the adults associated with *D. micans* (though the deutonymp from both hosts appear identical), and it may involve either a geograph variation or a different species.
FURTHER NOTE: *Anoetus trichophorus* Vitz. 1923 (not Oud. 1912) = *A. vitzthumi* (Scheucher 1957). *Anoetus trichophorus* (Scheucher 1957) neither *A. trichophorus* Oud., 1912 nor *A. trichophorus* Vitz., 1923, but a ne species named *A. scheucheri* by Mahunka (1963).
13. *Bonomoia pini* Scheucher 1957 (♀, ♂, dn) p. 366. All stages collected under th bark of pines and in the galleries of *Hylastes ater* from the region aroun Erlangen, Germany. Deutonymphs phoretic on the many species of beetl infesting dead pines and occasionally also on *H. ater*.

THE ANOETUS–HISTIOSTOMA PROBLEM

Which name to use may never be unquestionably resolved because of th meager description and unclear illustration of the type species (a deutonympl collected on a halictine bee!) of *Anoetus*, *Hypopus alicola* Duj. 1849, whicl cannot with satisfaction be placed in the present day concept of either *Histiostom* Kramer, 1876 (type species *Hypopus feroniarum* Dufour 1839) or *Anoetu* Dujardin 1842. Michael, Berlese, Oudemans, Vitzthum, and Hughes and Jackson all struggled to recognize two separate genera, where the distinction rested solely on the deutonymphs. *Histiostoma* deutonymphs were said to bear suckers (o discs) in coxal plates I and III, and *Anoetus* deutonymphs setae (or at least setal sockets) in place of the discs. As Scheucher (1957) pointed out, the adults of these two types of deutonymphs (discs or setae) can in no way be consistently distinguished. *Hypopus alicola*, however, seems clearly to have borne setae (or setal sockets) on coxal plates I and III. Scheucher (1957) suggested, because of the unusual phoretic host, that *H. alicola* may be neither *Anoetus* nor *Histiostoma*. She placed all the species involved (about 80% of all anoetid species) in *Histiostoma*. Mahunka up to about 1963 used *Histiostoma–Anoetus* in the sense of Oudemans and Vitzthum, but in more recent papers he used *Anoetus* exclusively.

Coxal plates I and III bear either a seta or a disc, which may not be homologous structures. Rather, the primitive *Anoetus* deutonymphs may have borne both discs and setae on plates I and III. Three points support this idea. First, when discs are present they tend to be touching or partially overlapping the epimeres, while when setae are present they tend to arise more mesad of these epimeres. Second, *A. media* (Fig. 5) bears large discs on coxae I and III, and mesad to each disc is what appears to be a setal socket. Third, coxal plate IV of virtually all anoetids described to date bears both a seta and a disc.

In conclusion, I feel there is insufficient distinction between the concept of *Anoetus* and *Histiostoma* to warrant the maintenance of two separate groups at the generic level. In this case the older name *Anoetus* has priority over *Histiostoma*, and *Histiostoma* Kramer 1876 must be synonymized under *Anoetus* Duj. 1842, which is the type and name-bearing genus of the family Anoetidae.

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