

THE EYELESS BEETLES OF THE  
GENUS *ARIANOPS* BRENDEL  
(COLEOPTERA, PSELAPHIDAE)

THOMAS C. BARR, JR.

BULLETIN  
OF THE  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
VOLUME 154 : ARTICLE 1  
NEW YORK : 1974





THE EYELESS BEETLES OF THE  
GENUS *ARIANOPS* BRENDEL  
(COLEOPTERA, PSELAPHIDAE)

THOMAS C. BARR, JR.

*Research Associate, Department of Entomology  
The American Museum of Natural History  
Professor of Biological Sciences  
The University of Kentucky, Lexington*

BULLETIN  
OF THE  
AMERICAN MUSEUM OF NATURAL HISTORY  
VOLUME 154 : ARTICLE 1      NEW YORK : 1974

**BULLETIN OF THE AMERICAN MUSEUM OF NATURAL HISTORY**  
Volume 154, article 1, pages 1-52, figures 1-28, table 1

Issued October 9, 1974

Price: \$2.25 a copy

ISSN 0003-0090



## ABSTRACT

The North American representatives of the tribe Amauropsini belong to a single known genus, *Arianops* Brendel, of which 31 species are recognized, arranged in seven species groups. Twenty-two species occur in the southeastern Appalachians, but other species are known from central Pennsylvania (1), central Tennessee (3), north Alabama (4), and northwest Arkansas (1). Twenty-six species are edaphobitic, and five species, known only from caves, are probably troglotic.

The *amplyoponica* group includes *amplyoponica* (Brendel and Wickham), Pennsylvania; *plectrops* Casey, North Carolina; *nodosa*, new species, North Carolina; *laminata*, new species, North Carolina; *spinicollis*, new species, North Carolina; and *sandersoni*, new species, Arkansas.

The *alticola* group includes two species from North Carolina, *alticola*, new species, and *barbata*, new species.

The *nantahalae* group includes *nantahalae nantahalae*, new species and subspecies, North Carolina; *nantahalae joanna*, new subspecies, North Carolina; *unicoi*, new species, North Carolina and

Tennessee; and *digitata*, new species, Tennessee.

The *neglecta* group includes *neglecta*, new species, North Carolina and Georgia; *coweeta*, new species, North Carolina; *parki*, North Carolina; *truncata*, Georgia; and *allatoona*, Georgia.

The *cavernensis* group includes *cavernensis* Park, Alabama; *jeanneli* Park, Virginia; *stygica* Park, Tennessee; *pecki*, new species, Tennessee; *steevesi*, new species, Alabama; *extera*, new species, Alabama; *sewanee*, new species, Tennessee; and *kingi*, new species, Alabama. The group is equivalent to subgenus *Arispeleops* Park, here considered a junior synonym of *Arianops*.

The *gigantea* group is monobasic, established for *gigantea*, new species, North Carolina.

The *henroti* group includes six small, flattened species from northeast Georgia and southwest North Carolina: *henroti* Park, Georgia; *thornei*, new species, North Carolina; *norithe*, new species, North Carolina; *fovealis*, new species, North Carolina; *teyahalee*, new species, North Carolina; and *obliqua*, new species, Georgia.

A key to species, illustrations, and distribution maps are provided.

## INTRODUCTION

The eyeless pselaphids of the genus *Arianops* Brendel inhabit deep soil and caves of the southern Appalachian Mountains, the southern Appalachian Valley, the Allegheny plateau from Pennsylvania to Alabama, and the Eastern Highland Rim of central Tennessee. A single species is known from western Arkansas. These relatively rare insects are readily distinguished from other pselaphids by the presence of a more or less prominent spine at the site of the eye, the absence of elytral foveae of any sort, and the much greater length of the first and fourth abdominal tergites in contrast to the very short second and third tergites. Six species have been previously described, four of them from uniques; two species described in the nineteenth century (*amplyoponica* and *plectrops*) are known from about 20 specimens each in their narrowly restricted ranges. In the present paper 25 additional species are described.

*Arianops* belongs to the batrisomorph tribe Amauropsini Jeannel (1948) (equivalent to subtribe Amauropsina, tribe Batrisini, of Park, 1960) and not to the Batrisini, *sensu stricto*, as stated by Jeannel (1948, 1950). The principal common features which suggest that *Arianops* belongs in the same tribe with *Amaurops* Fairemaire and related genera are (a) substantial inequality of length in the abdominal tergites, (b) complete absence of elytral foveae, (c) absence of even partial margins on abdominal tergites beyond the first, (d) greater prominence of the right paramere (or its homologues) of the aedeagus, together with general dissimilarity of the aedeagus to the batrisine pattern, and (e) obligatorily subterranean mode of life. From Palaearctic amauropsines *Arianops* differs in having (a) the first and fourth abdominal tergites, rather than only the first, exceptionally long, (b) a much finer, subparallel internal marginal stria and

usually much shorter basal carinae on the first abdominal tergite, (c) larger eleventh antennal segment, (d) males with a distinct genital depression and (except in one species and one subspecies) a median abdominal spine on the third or fourth sternite, and (e) different aedeagal pattern, with a conspicuous apical shelf and less developed right paramere. In his revision of the Palearctic amauropsines Jeannel (1948) recognized two groups of genera: in the *Amaurops* series the external stria of the first abdominal tergite is oblique, remote from the margin toward the base and approaching it apically; in the *Paramaurops* series the external stria closely parallels the margin. In any suprageneric classification of the Amauropsini *Arianops* should constitute a third series because of the differences cited; the feeble external stria is usually subparallel and close to the margin, except in the species *extera*, described below, in which it is strongly oblique.

One other North American pselaphid, *Texamaurops reddelli* (described and illustrated by Barr and Steeves, 1963), from caves of central Texas, has been tentatively assigned to the Amauropsini (Barr and Steeves, 1963). Further study suggests that it belongs in the Batrisini by virtue of its abdominal segmentation (fourth tergite short) and its aedeagal pattern. Although males and females have not yet been obtained from the same cave, one male *Texamaurops* specimen closely similar to and probably conspecific with *T. reddelli* has recently become available, and its aedeagus is illustrated in figure 2. The pattern is that of a typical batrisine. Consequently I have concluded that *Arianops* is the only known Nearctic genus of amauropsines. Its divergence from the European amauropsine stock may be rather remote, but in my opinion it certainly belongs in the same tribe.

The absence of a median fovea on the pronotum led Orlando Park (1951) to propose the subgenus *Arispeleops* for *A. cavernensis* Park, and to *Arispeleops* were relegated two subsequently described cave species without a median fovea: *jeanneli* Park (1956) and *stygica* Park (1960). At least two species of what I have called the *cavernensis* group (= *Arispeleops* Park) may have a small fovea or not (*A. pecki* and *A. kingi*, described below). The irregularity of the fovea in these spe-

cies, as well as in species of the *neglecta* and *gigantea* groups, destroys the diagnostic utility of this particular character. For this reason I have treated *Arispeleops* Park as a junior synonym of *Arianops* Brendel and have divided *Arianops* into species groups, none of which, in my opinion, merits subgeneric status.

Amauropsines are apparently absent from Asia and western North America. The substantial differences between European and North American amauropsines suggest that these two stocks diverged a rather long time ago. This view is supported by their present geographic distribution, their distinctly subterranean mode of life, and the considerable diversity existing in both southern Europe and the southern Appalachians. Jeannel (1948, 1950) noted that the *Paramaurops* series and *Amaurops* series occupy regions along the northern and southern sides of the early Tertiary Transaegian trough, respectively, and accordingly postulated that their divergence took place in early Tertiary. It is implied that restriction to a subterranean mode of life had already occurred to a greater or lesser extent, otherwise mixing of the two groups would have taken place in the later Tertiary. Such mixing has apparently occurred only for a relatively few species of the *Paramaurops* series which now exist in the Karst region of Yugoslavia. The *Arianops* series presumably diverged from the basal amauropsine stock somewhat earlier than the split between the two Palearctic series, because the genera of the *Paramaurops* and *Amaurops* series are more closely similar to each other than any of them are to *Arianops*. If Jeannel's theory is correct, the present morphology and distribution of European and North American amauropsines may possibly reflect the fragmentation of Laurasia, with slow, parallel evolution of the two phyletic lines in closely similar, sheltered, subterranean environments.

#### ACKNOWLEDGMENTS

I thank the following individuals and their respective institutions for lending me specimens: Mr. Henry Dybas, Field Museum of Natural History, Chicago; Dr. John M. Kingsolver, National Museum of Natural History, Smithsonian Institution, Washington; Mr. Harrison R. Steeves, Jr.,



private collection, Birmingham, Alabama; Dr. Milton W. Sanderson, Illinois State Natural History Survey Division, Urbana; Dr. Charles A. Triplehorn, Ohio State University, Columbus; and Dr. George Wallace, Carnegie Museum, Pittsburgh.

For field assistance and/or contribution of specimens I thank Mr. Harrison R. Steeves, Jr., and his associates Messrs. T. N. King, Jr., and J. D. Patrick, Jr.; Dr. Stewart B. Peck; Mr. M. C. Bowling; and my daughter, Melisa J. Barr, and son, Thomas C. Barr, III.

Dr. John A. Wagner, Kendall College, provided useful information on the collection of Father Jerome Schmitt, and Dr. Robert Gordon extracted passages from the journal of H. G. Hubbard on the discovery of *Arianops plectrops*. Professor E. O. Wilson, Harvard University, determined the ant hosts of *Arianops neglecta* and confirmed the identity of the host of *A. amplyoponica*. I greatly appreciate the comments of Dr. Wagner and Mr. Steeves on a preliminary manuscript of the present paper. Finally, I acknowledge with gratitude the debt owed to my late colleague and friend, Prof. Orlando Park, Northwestern University, for arousing my interest in the Pselaphidae and for establishing a firm basis for the further study of Nearctic pselaphids.

The bulk of the material assembled for this investigation was collected during the summers of 1969 and 1970 with the assistance of National Science Foundation grants-in-aid through the Highlands Biological Station (NSF 2496) and a grant from the Theodore Roosevelt Memorial Fund.

### BIONOMICS OF *ARIANOPS*

Father Jerome Schmitt, who collected the type species of *Arianops*, *A. amplyoponica*, near Saint Vincent's Archabbey, Westmoreland County, Pennsylvania, reported finding the beetles with *Amblyopone pallipes* (Haldeman) (Brendel and Wickham, 1890), and mounted specimens of this host ant are preserved in the Carnegie Museum collections along with Saint Vincent specimens of *A. amplyoponica*. The majority of *Arianops* specimens, however, have not been taken in or near the nests of ants. In August, 1970, I observed *Arianops neglecta*

(described below) walking about in shallow tunnels of *Amblyopone pallipes* on Satulah Mountain, near Highlands, North Carolina. Several specimens were obtained from *Amblyopone* nests in the floor of a white pine (*Pinus strobus*) forest on a relatively dry, well-drained spur of the mountain. Other specimens of *A. neglecta* collected near Rabun Bald, Georgia, or along Turtle Pond Creek near Highlands, or elsewhere on Satulah Mountain were not associated with ants. It seems probable that some species of *Arianops* may be facultative synoeketes, and that the shelter of the *Amblyopone* tunnels may offer the beetles respite from drier soil conditions at lower altitudes and in warmer, drier climates. The relationship is an interesting one that needs further study.

Five species of the *cavernensis* group are known exclusively from caves. Their extreme rarity (two species known from uniques and two from only three specimens each) suggests that possibly the cave habitat is not a usual one and that the beetles may have wandered into the caves fortuitously, perhaps from surrounding rock crevices. Repeated efforts to obtain more specimens in three caves from which single specimens of *Arianops* were known have not yet been successful. On the other hand, 10 specimens of *A. steevesi* have been collected in Horseshoe Cave, Alabama, and another species of the *cavernensis* group, *A. extera*, has been taken only in the sinkhole surrounding the cave entrance, in an essentially epigeal habitat. The three known noncave species of the *cavernensis* group—*extera*, *sewanee*, and *kingi*—all appear to be more closely related to each other than to the cave species of the group.

The species of *Arianops* in the Appalachian Mountains were almost all taken in moist, forested ravines under large, deeply embedded stones, at altitudes of 2500 to 5500 feet. When the stones are turned, the beetles are almost invariably found clinging to the underside in typical pselaphid fashion. The most favorable collecting sites are on well-drained slopes. Damp, rainy weather unquestionably enhances the likelihood of finding *Arianops* as well as *Anillinus* (Carabidae), and other edaphobitic beetles, and this becomes especially critical at the lower elevations where the climate is warmer and drier.

Associated with *Arianops* are various carabid beetles, including species of *Anillinus*, *Pterostichus*, and *Maronetus*; spiders, pseudoscorpions, phalangodid opilionids, mites, centipedes, millipedes, symphylans, and occasional salamanders. Other beetle families, such as Staphylinidae, Leioldidae, and Cryptophagidae, are rather uncommon and sporadic in the same microenvironments. The only other pselaphids of regular occurrence in similar habitats are various species of *Batriasymmodes* and *Batrisodes* (especially those of subgenus *Babnormodes* Park), and even these are usually found in drier situations under rocks which are more shallowly and more loosely embedded. *Arianops* specimens are almost never associated with ant nests, with the important exception of the tunnels of *Amblyopone pallipes*, as noted above.

Food probably consists of a variety of soft-bodied arthropods in the appropriate size range. A single case of feeding was observed: a female *A. coweeta* was taken from beneath a rock carrying a portion of a symphylan in its mandibles. Exposure to predators is probably reduced by the habit of resting in narrow crevices of the rock close to the underlying soil, although this may also reflect a degree of stenohygroby. Centipedes, spiders, carabids, and salamanders all constitute potential predators of regular occurrence in or near the *Arianops* microhabitat, but no direct observations of predation have been made. Fungus parasites of the order Laboulbeniales were noted on the femora of a female *A. coweeta*, but the infestation was minor, and the absence of these fungi from all other *Arianops* which have come to my attention suggests that laboulbeniacean parasitism is not an ecologically important problem in the habitats collected.

Reproduction is probably on a more or less annual basis, but most of the specimens were collected in August, 1969 and 1970, and the desired indirect information is not really seasonally suffi-

cient to draw firm conclusions. In copulo pairs were taken of *A. neglecta* (August), *A. coweeta* (August), *A. extera* (August), *A. unicoi* (May), and *A. alticola* (May), consequently one may tentatively conclude that copulation in *Arianops* takes place some time during a four-month period from late spring to late summer or early fall. About 20 percent of the August and early September collections are teneral, whereas the collections in May and late September to October include no tenerals. The available evidence thus suggests an eclosion peak in late summer.

The individuals of a local population of *Arianops* are never gregarious, with the possible exception of a group of three *spinicollis* taken beneath the same rock. In exceptionally favorable circumstances (whatever these may be) moderately large populations can apparently build up in a limited area, as observed for *coweeta* in the upper Bearpen Creek basin and *alticola* at the head of Buck Creek, both in Macon County, North Carolina.

Eight cases of sympatry are known among the species recognized in the present paper. These are listed in table 1. Precise locations of the collection sites may be found in the systematic accounts. Seven of the cases are pairs, but the remarkable site at Leatherman Gap produced four different species belonging to four different species groups and four size classes. Five of the seven pairs are made up of species in different species groups and size classes, but the pairs *alticola-spinicollis* and *extera-steevesi* include species of subequal size, and *extera* and *steevesi* are both assigned to the *cavernensis* group. The latter pair is included here because one species occurs inside a cave and the other in the sinkhole outside the cave entrance. Both external morphology and aedeagal morphology imply that the two species are not very closely related within their species group.

## SYSTEMATIC ACCOUNTS

### ARIANOPS BRENDDEL

*Arianops* Brendel, 1893, p. 278 (type species *Anops amplyoponica* Brendel and Wickham, 1890, by original designation). Park, 1951, p. 40; 1953, p. 315; 1960, p. 84.

*Anops* Brendel and Wickham, 1890, p. 80, not *Anops* Oken, 1815.

*Eusanops* Brendel, 1893, p. 278 (*nomen nudum*). *Arispeleops* Park, 1951, p. 41 (subgenus; type species *Arianops cavernensis* Park, 1951, by original designation).



TABLE 1  
SYMPATRY IN *ARIANOPS*

Locality	State	Species	Species Group
Beegum Gap	Georgia	<i>neglecta</i> <i>henroti</i>	<i>neglecta</i> <i>henroti</i>
Coweeta Hydrologic Laboratory	North Carolina	<i>coweeta</i> <i>thornei</i>	<i>neglecta</i> <i>henroti</i>
Turkey Mountain	Georgia	<i>truncata</i> <i>obliqua</i>	<i>neglecta</i> <i>henroti</i>
Leatherman Gap	North Carolina	<i>parki</i> <i>fovealis</i> <i>barbata</i> <i>gigantea</i>	<i>neglecta</i> <i>henroti</i> <i>alticola</i> <i>gigantea</i>
Teyahalee Bald	North Carolina	<i>nantahalae</i> <i>teyahalee</i>	<i>nantahalae</i> <i>henroti</i>
Buck Spring Trail	North Carolina	<i>gigantea</i> <i>spinicollis</i>	<i>gigantea</i> <i>amplyoponica</i>
Mount Pisgah	North Carolina	<i>alticola</i> <i>spinicollis</i>	<i>alticola</i> <i>amplyoponica</i>
Horseshoe Cave	Alabama	<i>extera</i> <i>steevesi</i>	<i>cavernensis</i> <i>cavernensis</i>

Form generally slender and elongate. Pale castaneous to dark brown, pubescence moderately heavy, flavous, generally semiappressed except for beard. Length 2.2-4.2 mm., medium to relatively large size for pselaphids. Eyes absent, their site indicated by tubercle or sharp spine. Metathoracic wings absent.

Head rounded, dorsoventrally flattened; lateral vertexal carinae usually present, extending posteriorly on either side of vertex a variable distance from antennal tubercles, in some species obsolete; occipital (= mid-vertexal) carina in median line from cervicum to level of vertexal foveae, usually present but obsolescent or completely absent in some species; vertexal foveae small to medium, perforate, set in more or less conspicuous, pubescent depressions; circumambient sulcus often absent, at best rather weakly defined; supra-antennal tubercles flattened, granulate above, externally angulate and elevated above interantennal ridge, which may or may not be carinate and continuous with mid-frontal longitudinal ridge, which may be carinate or not or absent; antennal cavities shallow; frontal declivity with moderate to gentle slope;

clypeus angular at middle, its margins prolonged laterally as fine carinae to ocular spines; sides of head continuously convex with posterior part of vertex; gula simple in both sexes, longitudinal carina usually absent but represented in a few species by an irregular, finely beaded ridge in apical half, with single basal fovea; mentum with apical margin usually arcuate, entire, but toothed in some species; labrum short, emarginate, with bisetose lateral lobes and more or less crenelate middle margin; both postocular and genal beards very well developed, their longer setae one-fourth to one-third as wide as head; maxillary palps with second segment slightly sigmoid, third subquadrate and as wide as fourth, fourth three and one-half to four times longer than wide, fusiform to slightly falcate, cone minute.

Antenna similar in both sexes, moderately pubescent, attaining elytral humeri or beyond when laid back; segment I large and slightly flattened; II through VII usually obconical, generally decreasing in length but with a few individual or specific exceptions, VIII or rarely X smallest; club three-segmented; IX usually larger than X, ranging from a little longer than wide to slightly

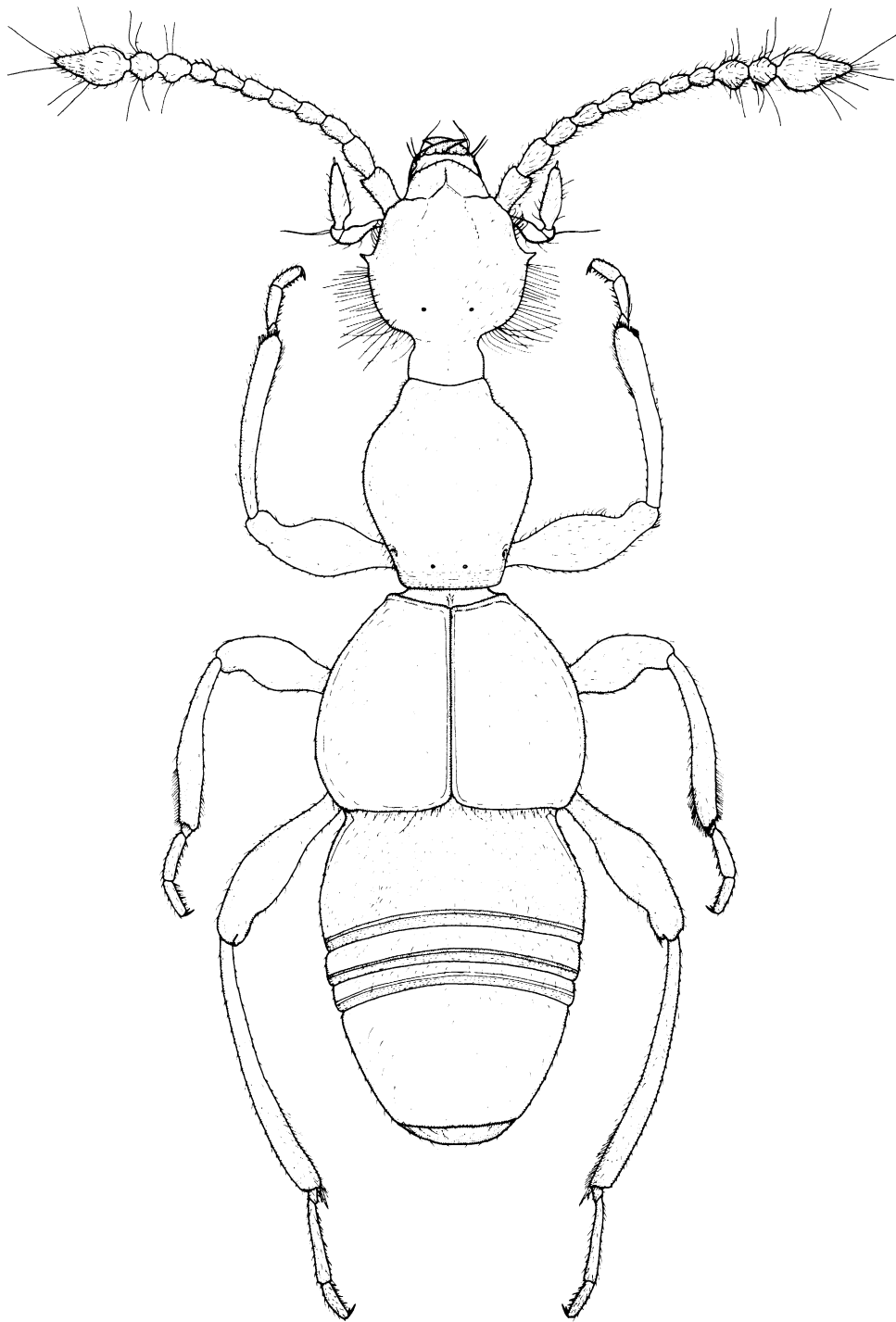


FIG. 1. *Arianops neglecta*, new species, male. Rabun Bald, Georgia. Length 3.0 mm.



transverse, X rounded or transverse, either IX or X or both asymmetrically swollen or even subcarinate on ventral side, modification usually more pronounced in IX than X; segment XI very large, pedunculate and usually a little asymmetrical, as long as two and one-half to three and one-half preceding segments, apical conical region paler, more densely setose, distinctly contrasting with basal globose region.

Pronotum convex, length and maximum width subequal in most species but slightly longer than wide in a few species, widest before middle (about apical 0.35-0.45), sides convergent behind to rounded, unmarginated basal angles; disc usually with median fovea at basal fourth, but median fovea irregular or absent in a few species, variously flanked by acute spines, rounded eminences, or short, longitudinal ridges, feeble longitudinal carinae, or simply declivous slopes; all species with pair of small paramedian basal foveae and usually one to three additional basolateral foveae on each flank, first two often fused into elongate, oblique groove, third fovea above procoxa and often irregular or absent; microsculpture near base a narrow band of darker, finely and densely transverse meshworks.

Elytra simple, without foveae at base or on flanks; sutural stria fine and closely parallel to suture, no discal stria; humeral angle inconspicuous; marginal stria well developed at sides. Metathoracic wings completely lacking.

Abdomen with five tergites and seven sternites in male, six tergites and six sternites in female; first tergite more than twice as long as second, second slightly longer than third; fourth tergite very long, as long as or longer than first, very convex and becoming vertical at apex in male, slightly shorter than first in female; fifth tergite about as long as third in male, scarcely visible in dorsal view, shorter than third tergite in female; sixth tergite (present in female only) much longer than fifth (about one and one-half to three times) and with deep apical emargination. First sternite partially fused to second, usually about 0.3-0.4 as long as second; third sternite subequal in length to first, fourth and fifth progressively shorter; sixth sternite slightly shorter than fifth in male, two to three times as long as fifth in female; seventh sternite (present in male only) triangular, forming aedeagal plate hinged

and exerted on left side (fig. 14C), usually about as long as fifth sternite and slightly longer than sixth. First tergite entirely margined at sides, internal stria very fine and closely subparallel to marginal carina, joining it in apical fourth; base of first tergite with four pubescent foveae, inner two joined by sulcus; basal longitudinal carina lateral to each inner fovea extending at most to basal third of tergite, absent in some species.

Prosternum simple, almost horizontal, not carinate, procoxae large and conical. Mesosternum long and narrow, with one median and two lateral foveae at apexes of broad longitudinal grooves, all foveae densely pubescent; one pubescent fovea lateral to each mesocoxa at junction of mesosterna and metasterna. Metacoxae separated, not contiguous, with median slot into which fits spine from first abdominal sternite.

Legs elongate; femora spindle-shaped, tibiae slightly bowed; mesotibiae and metatibiae distally with internal brush of dense setae; tarsus three-segmented, first segment minute, second longer than third, third with one claw and shorter, accessory parungual spine.

Male without secondary sex characters modifying head, antenna, tarsus, or femur, but differing as follows: third or fourth abdominal sternite usually with more or less prominent median spine protruding from apical margin (no spine in two species), fourth or fifth sternite in a few species with pair of minute tubercles at center of apical margin; fifth tergite with median fovea; apex of abdomen with large, rounded depression formed as part of fifth tergite and fifth and sixth sternites, with aedeagal plate in center; sixth sternite with lateral marginal stria; aedeagal plate triangular, hinged by ligament attached to left corner of base and exerted to left during copulation; entire depression and its margin often heavily sclerotized and blackened; mesotrochanter with small (often minute) spine at posterolateral corner in most species. Females without described secondary sex characters, at most with shallow median depression in apical half of fifth abdominal sternite.

Aedeagus highly variable, about 0.3-0.6 mm. long; basal capsule an oval or rounded box, broadly open dorsally and ventrally, usually strongly convex above but somewhat flattened in a few species, right wall usually slightly higher

than left wall toward apex; apical shelf present as posteroventral extension of capsule, forming transverse, bladelike lamina, usually produced at both corners and thus more or less forked, often asymmetrically so, usually with variable number of fixed setae or margins or ventral surface; one paramere present at most, usually no obvious paramere at all, in some species paramere apparently fused to dorsal right wall of basal capsule forming hook or spine, rarely present on left side, freely articulating with basal capsule in only one known species; internal sac large, much folded in basal capsule and surrounded by eversion musculature; armature variable: usually apical fold armed with minute spines, some species with more or less complex copulatory piece and/or slender, membranous or sclerotized tube; copulatory piece, when present, consisting of sclerotized rod bearing one to many finger-like terminal processes; tube, when present, simple and membranous or sclerotized and finely bifurcate at apex.

#### CLASSIFICATION OF *ARIANOPS* BRENDEL

The 31 known species of *Arianops* may be arranged in seven species groups.

##### *amplyoponica* group

- amplyoponica* (Brendel and Wickham) 1890—Westmoreland County, Pennsylvania  
*plectrops* Casey, 1897—McDowell and Yancey counties, North Carolina  
*nodosa*, new species—McDowell and Yancey counties, North Carolina  
*laminata*, new species—Buncombe County, North Carolina  
*spinicollis*, new species—Buncombe, Haywood, and Transylvania counties, North Carolina  
*sandersoni*, new species—Logan County, Arkansas

##### *alticola* group

- alticola*, new species—Haywood and Macon counties, North Carolina  
*barbata*, new species—Macon and Swain counties, North Carolina

##### *nantahalae* group

- nantahalae nantahalae*, new species and subspecies—Clay and Macon counties, North Carolina

- nantahalae joanna*, new subspecies—Cherokee and Graham counties, North Carolina  
*unicoi*, new species—Graham County, North Carolina, and Monroe County, Tennessee  
*digitata*, new species—Sevier County, Tennessee

##### *neglecta* group

- neglecta*, new species—Rabun County, Georgia, and Macon County, North Carolina  
*coweeta*, new species—Macon County, North Carolina  
*parki*, new species—Macon and Swain counties, North Carolina  
*truncata*, new species—Rabun County, Georgia  
*allatoona*, new species—Cherokee County, Georgia

##### *cavernensis* group

- cavernensis* Park, 1951—Marshall County, Alabama  
*jeanneli* Park, 1956—Lee County, Virginia  
*stygica* Park, 1960—Warren County, Tennessee  
*pecki*, new species—Cannon County, Tennessee  
*steevesi*, new species—Jackson County, Alabama  
*extera*, new species—Jackson County, Alabama  
*sewanee*, new species—Franklin County, Tennessee  
*kingi*, new species—Blount County, Alabama

##### *gigantea* group

- gigantea*, new species—Macon, Swain, and Transylvania counties, North Carolina

##### *henroti* group

- henroti* Park, 1956—Rabun County, Georgia  
*thornei*, new species—Macon County, North Carolina  
*norithe*, new species—Graham County, North Carolina  
*fovealis*, new species—Macon and Swain counties, North Carolina  
*teyahalee*, new species—Cherokee and Graham counties, North Carolina  
*obliqua*, new species—Towns, White, Union, and Rabun counties, Georgia

#### KEY TO KNOWN SPECIES OF *ARIANOPS*

The following key has been arranged so that the first six couplets can be used to sort specimens into the seven species groups recognized in the present study. Although I have preferred characters in the key that are applicable to both sexes, an occasional reference to secondary sex



modifications of the male abdominal sternites and even to aedeagal structure has been necessary. The most reliable method of identifying a species of *Arianops* is to compare its aedeagus with the illustrations (figs. 3-28). All known species have rather small geographic ranges. The reader should be aware that most of the Appalachian region has not been carefully searched for species of *Arianops*, consequently there is a high probability that specimens with a provenance remote from any of the localities listed in the systematic accounts may be undescribed.

1. Abdomen convex, about 0.8 as thick as wide; smaller, often cavernicolous species (2.3-2.9 mm.) and larger, convex species in Appalachian or Ouachita mountains (2.7-4.2 mm.) . . . 2
- Abdomen depressed, rather subparallel, about 0.6 as thick as wide; smaller (2.2-2.9 mm.), flattened species known only from southwestern North Carolina and northeastern Georgia . . . . . (*henroti* group) 7
- 2(1). Head without lateral vertexal carinae . . . 3
- Head with distinct lateral vertexal carinae extending posteriorly at least a short distance from antennal tubercles . . . . . 6
- 3(2). Pronotum longer than wide . . . . . 4
- Pronotum length and width subequal . . . 5
- 4(3). Length 3.1-3.6 mm.; larger, darker species inhabiting higher mountains of southwestern North Carolina; pronotum with prominent median fovea . . . . . (*alticola* group) 13
- Length 2.3-3.0 mm.; smaller, paler species inhabiting caves and ravines of southwest Virginia to central Tennessee and Alabama; pronotum usually without median fovea, rarely with shallow, irregular fovea . . . . . (*cavernensis* group) 14
- 5(3). Size large, 3.6-4.2 mm., robust; aedeagus about 0.6 mm. long . . . . . (*gigantea* group) *gigantea*, new species
- Size medium, 2.9-3.2 mm., more slender; aedeagus about 0.4 mm. long . . . . . (*neglecta* group) 21
- 6(2). Pronotum longer than wide, median fovea flanked either side by elevated, sometimes feebly carinate ridge; paler, more slender species, males with small spine on third or fourth abdominal sternite or no spine at all, genital depression not heavily sclero-

- tized and blackened; Great Smoky, Unicoi, and Nantahala mountains, North Carolina and Tennessee . . . . . (*nantahala* group) 25
- Pronotum as long as wide, median fovea flanked either side by prominent tubercle, usually with small spine; darker, more robust species, male with large spine or shelf on third abdominal sternite; western Pennsylvania to Black Mountains and Pisgah Ledge, North Carolina; one species in central Arkansas . . (*amplyoponica* group) 28
- 7(1). Pronotum with small but distinct median fovea near base . . . . . 8
- Pronotum without median fovea near base . . . . . 10
- 8(7). Head with lateral vertexal carinae short or interrupted . . . . . 9
- Head with long, conspicuous, lateral vertexal carinae continuing behind level of vertexal foveae; Rabun, Towns, Union, and White counties, Georgia . . . . . *obliqua*, new species
- 9(8). Head with lateral vertexal carinae short; occipital carina moderately long; no median longitudinal ridge behind median fovea of pronotum; Cheoah Bald area, Graham County, North Carolina . . . . . *norithe*, new species
- Head with long, interrupted lateral vertexal carinae; occipital carina limited to short crest between vertexal foveae; median longitudinal ridge behind fovea of pronotum; Cowee Bald area, Macon and Swain counties, North Carolina . *fovealis*, new species
- 10(7). Head with lateral vertexal carinae very short; occipital carina irregular, present or not; no median longitudinal ridge in basal fifth of pronotum . . 11
- Head with lateral vertexal carinae prominent, attaining level of vertexal foveae or beyond; occipital carina long and prominent; median longitudinal ridge in basal fifth of pronotum . . 12
- 11(10). Head with very short lateral vertexal carinae; face with low, transverse or V-shaped interantennal ridge; male with median spine on third abdominal sternite and pair of tubercles on fourth sternite; Teyahalee Bald area, Graham and Cherokee counties, North Carolina . . . . . *teyahalee*, new species
- Head with lateral vertexal carinae

- longer; face declivous; male with median spine on fourth abdominal sternite; Nantahala Mountains, southern Macon County, North Carolina . . . . . *thornei*, new species
- 12(10). Head with lateral vertexal carinae attaining level of vertexal foveae; face with V-shaped interantennal ridge; Rabun Bald area, Rabun County, Georgia . . . . . *henroti* Park
- Head with very prominent lateral vertexal carinae extending well beyond level of vertexal foveae; facial ridge Y-shaped; western Rabun, Towns, Union, and White counties, Georgia . . . . . *obliqua*, new species
- 13(4). Head with finely beaded occipital carina, vertexal foveae in rounded depressions, postocular beard about one-fourth as long as width of head; male with widely bifurcate spine on fourth abdominal sternite; Macon, Jackson, Transylvania, and Haywood counties, North Carolina (Highlands plateau to Pisgah Ledge) . . . . . *alticola*, new species
- Head without occipital carina, vertexal foveae in elongate-oval depressions, postocular beard one-third or more as long as width of head; male with slender, narrowly emarginate spine on fourth abdominal sternite; Cowee Bald area, Macon and Swain counties, North Carolina . *barbata*, new species
- 14(4). Pronotum with one to three foveae each side near base . . . . . 15
- Pronotum without median, basal, or basolateral foveae; Marshall County, Alabama, in cave . . *cavernensis* Park
- 15(14). Abdomen elongate-elliptical (normal); antenna with segment XI about as long as preceding three segments . 16
- Abdomen with sides subparallel along first tergite, then rather abruptly convergent to apex; antenna with segment XI almost as long as preceding four segments; St. Clair County, Alabama, epigeal . . . *kingi*, new species
- 16(15). Pronotum with 2 or 3 foveae each side near base . . . . . 17
- Pronotum with one minute fovea each side at basal third; Lee County, Virginia, in cave . . . . . *jeanneli* Park
- 17(16). Eye spine represented by minute, blunt tumulus; occipital carina present; caves in central Tennessee . . . . . 18
- Eye spine sharp, small but prominent; occipital carina absent . . . . . 19
- 18(17). Facial carina sharp, entire; vertexal foveae confluent with interantennal depression via shallow grooves; pronotum with two pairs of basolateral foveae; Cannon County, Tennessee, in cave . . . . . *pecki*, new species
- Facial carina interrupted at middle; vertexal foveae isolated; pronotum with 3 pairs of basolateral foveae; Warren County, Tennessee, in cave . . . . . *stygica* Park
- 19(17). Interantennal ridge Y-shaped, not carinate; margin of first abdominal tergite normal, not strongly oblique . 20
- Interantennal ridge V-shaped (without midfrontal carina), carinate; margin of first abdominal tergite strongly oblique; Jackson County, Alabama, epigeal . . . . . *extera*, new species
- 20(19). Vertexal foveae isolated, large; first abdominal tergite without stria internal to margin; Jackson County, Alabama, in cave . . . . . *steevesi*, new species
- Vertexal foveae small, confluent with shallow grooves running to interantennal depression; first abdominal tergite with well-developed stria internal to and subparallel to margin; Franklin County, Tennessee, epigeal . . . . . *sewaneae*, new species
- 21(5). Pronotum base 0.75 maximum width, three basolateral foveae each side; male with spine on third abdominal sternite and minute spine on mesotrochanter . . . . . 22
- Pronotum base 0.85 maximum width, four basolateral foveae each side separated by finger-like ridges of transversely meshing microsculpture; male with spine on fourth abdominal sternite and no spine on mesotrochanter; Cherokee County, Georgia . . . . . *allatoona*, new species
- 22(21). Facial ridge Y-shaped or V-shaped, entire . . . . . 23
- Facial ridge interrupted at middle; southern Nantahala Mountains, Macon County, North Carolina . . . . . *coweeta*, new species
- 23(22). Aedeagus with heavily sclerotized, finger-like copulatory pieces arming internal sac (figs. 15, 16) . . . . . 24
- Aedeagus without sclerotized copulatory pieces, armature of internal sac

- consisting of membranous tube and a few minute denticles on posterior fold; Blue Ridge near Highlands, Macon County, North Carolina, and adjacent Rabun County, Georgia . . . . . *neglecta*, new species
- 24(23). Male with small, triangular spine on third abdominal sternite; Cowee Mountains, Macon and Swain counties, North Carolina . . . . . *parki*, new species  
Male with broadly truncate, slightly emarginate spine on third abdominal sternite; Rabun County, Georgia . . . . . *truncata*, new species
- 25(6). Head with lateral vertexal carina extending to level of vertexal fovea or beyond; knobs flanking median fovea of pronotum usually finely and longitudinally carinate; male with or without small spine on fourth abdominal sternite . . . . . 26  
Head with lateral vertexal carina short, not attaining level of vertexal fovea; knobs flanking median fovea of pronotum not carinate; male with small spine on third abdominal sternite; Great Smoky Mountains, Tennessee . . . . . *digitata*, new species
- 26(25). Male with or without small spine on fourth abdominal sternite and fine, transverse carinula in middle of fifth sternite; aedeagus with prominent, recurved hook in right hind margin of basal capsule wall . . . . . 27  
Male without spine on fourth abdominal sternite and without transverse carinula on fifth sternite; aedeagus with small, not recurved process in right hind margin of basal capsule wall; Unicoi Mountains, Graham County, North Carolina, and Monroe County, Tennessee . . . . . *unicoi*, new species
- 27(26). Male with small median spine on fourth abdominal sternite; Clay and Macon counties, North Carolina. . . *nantahalae nantahalae*, new species and subspecies  
Male without median spine on abdominal sternites, secondary sex characters anterior to genital depression limited to fine, transverse carinula on fifth sternite; Teyahalee Bald area, Graham and Cherokee counties, North Carolina . . . . .  
. . . *nantahalae joanna*, new subspecies
- 28(6). Pronotum with spine on either side of median fovea . . . . . 29  
Pronotum with large and deep median fovea flanked by prominent knob on each side, but without spines; Buck Creek Gap area, Yancey and McDowell counties, North Carolina . . . . . *nodosa*, new species
- 29(28). Pronotum with only two basolateral foveae each side, outer one elongate and oblique; North Carolina . . . . 30  
Pronotum with three distinct basolateral foveae each side; Arkansas or Pennsylvania . . . . . 32
- 30(29). Interantennal ridge carinate; occipital carina obsolescent; males without spine on mesotrochanter . . . . . 31  
Interantennal ridge not carinate; finely beaded occipital carina present; male with small spine on mesotrochanter; Black Mountains, Buncombe and Yancey counties, North Carolina . . . . . *plectrops* Casey
- 31(30). Outer basolateral fovea of pronotum with narrow, canaliculate groove extending from fovea toward base; antennal club looser, segments IX and X not transverse; male with triangular median spine on third abdominal sternite, two minute tubercles at center of apical margin of fourth sternite; Mount Pisgah vicinity, Buncombe, Haywood, and Transylvania counties, North Carolina . . . . .  
. . . . . *spenicollis*, new species  
Outer basolateral fovea of pronotum an elongate groove not abruptly narrowed toward base; antennal club tighter, segments IX and X transverse; male with broad, truncate, projecting shelf on third sternite, fourth sternite without tubercles; Round Mountain, eastern Buncombe County, North Carolina . . . . . *laminata*, new species
- 32(29). Length 2.6-3.2 mm.; with occipital carina; interantennal ridge carinate, at least at sides; antennal segment X swollen on ventral side; Westmoreland County, Pennsylvania . . . . .  
*amplioyonica* (Brendel and Wickham)  
Length 3.8 mm.; no occipital carina; interantennal ridge not carinate; antennal segment IX swollen on ventral side, X shorter and transverse; Logan County, Arkansas . . . . .  
. . . . . *sandersoni*, new species

### DISCRIMINATION OF SPECIES GROUPS

The 31 species recognized in the present paper have been arranged in seven species groups. The principal diagnostic characters employed in discriminating the species groups are size (total length); color and thickness of integuments, best expressed in the heavily sclerotized and blackened margins of the genital depression in males of certain groups; presence of lateral vertexal carinae on the sides of the head, extending backward from the antennal tubercles; the relative width of the pronotum with respect to its length; the presence or absence of a median fovea on the pronotum, along with associated knobs, ridges, or spines on either side of the median fovea; the relative convexity of the abdomen, expressed as the approximate thickness/width ratio; and the presence of a median spine or shelf on the third or fourth abdominal sternite of the male. Preliminary sorting of most specimens, including females, into species groups can be accomplished by running them through the first six couplets of the key.

Six of the groups occur in the mountainous area of western North Carolina, eastern Tennessee, and northern Georgia. In that area small, depressed species belong to the *henroti* group; the pronotum is longer than wide in species of the *nantahalae* and *alticola* groups, and about as long as wide in the *gigantea*, *neglecta*, and *amplyoponica* groups. Lateral vertexal carinae occur in the *nantahalae* and *amplyoponica* groups but are absent in the other three. *Arianops gigantea* is distinguished from species of the *neglecta* group by greater total length and aedeagal length.

Outside the mountain area three species groups are represented from widely separated localities. *Arianops amplyoponica* is known from Westmoreland County, Pennsylvania; if additional species are discovered between Pennsylvania and North Carolina, I predict that many, if not all of them will fit into the *amplyoponica* group. *Arianops sandersoni*, also in the *amplyoponica* group, occurs in Logan County, Arkansas, and is the only known species outside the Appalachian area. *Arianops allatoona* occurs in Cherokee County, Georgia much closer to Atlanta than to the mountain area; additional species of the *neglecta* group, to which *allatoona* belongs, will

probably be found in north Georgia. The remaining species not occurring in the mountain region all belong to the *cavernensis* group, and are distinguished by very small eye spines, no lateral vertexal carinae, and usually no median fovea on the pronotum. Species of the *cavernensis* group have been described from Lee County, Virginia (Appalachian Valley), Warren and Franklin counties, Tennessee (Cumberland Plateau), Cannon County, Tennessee (Central Basin at edge of Eastern Highland Rim), and from three counties in north Alabama (Cumberland Plateau and Appalachian Valley).

Distribution of all the species groups is shown in figures 29 and 30, and all localities from which specimens of *Arianops* have been taken are numbered and identified (except for the type localities of *amplyoponica* and *sandersoni*). Detailed locations are given under the appropriate species accounts. Geographical and altitudinal data were obtained from the pertinent topographic maps issued by the United States Geological Survey, in most cases from the 1:24,000 series.

#### *amplyoponica* group

**Diagnosis.** Size medium to medium-large, 2.6-3.8 mm.; integuments normally dark, genital depression in males heavily sclerotized and blackened. Head with lateral vertexal carinae. Pronotum as long as wide, with prominent median fovea flanked on each side by small, acute spine or conspicuous knob. Abdomen convex, 0.8 as thick as wide. Male with large spine or truncate shelf on third abdominal sternite.

**Description.** Eye spine prominent and acute; lateral vertexal carinae usually short, but attaining level of vertexal foveae in two species; facial ridges carinate or not. Pronotum with deep median fovea flanked each side by conspicuous knob which bears in five out of six species small, sharp spine at its summit; each side with one small paramedian basal fovea, and two rounded or one elongate, oblique basolateral foveae; procoxal foveae not distinctly developed. Antenna with segments II through VII obconic to submoniliform, VIII small and subquadrate or rounded, IX and X larger, XI as long as preceding three to three and one-half segments; IX, X, and XI more or less asymmetrically swollen on ventral side.

Aedeagus 0.40-0.54 mm. long by 0.29-0.39 mm. wide; basal capsule rather large, apical shelf usually small and rather short with few fixed setae; various modifications present with respect to right paramere (apparently fused to basal capsule), spiny apical lobe of internal sac, tube, and copulatory pieces.

**Discussion.** The group includes six known species. *Arianops amplyoponica*, the generotype, is known only from ant nests in western Pennsylvania, *A. sandersoni* is from Magazine Mountain, Arkansas, and the other four species occur in a small area, about 40 miles long, along the Blue Ridge front and eastern Unaka province east of Asheville. *Arianops plectrops* and *A. nodosa* inhabit the Black Mountains, *A. spinicollis* occurs on Pisgah Ledge, and *A. laminata* is known from an outlier of the Swannanoa Mountains.

In all probability a number of undiscovered species of this group inhabit geographically intermediate areas, especially in the eastern Allegheny plateau of West Virginia. Stewart Peck and I collected a single *Arianops* specimen on Spruce Knob, Pendleton County, West Virginia, in 1964, but unfortunately the specimen has been lost. Nevertheless, it does indicate that the apparently vast distributional gap between Pennsylvania and North Carolina is probably an artifact of collecting.

*Arianops amplyoponica* (Brendel and Wickham)

Figures 3A, 3B

*Anops amplyoponica* Brendel and Wickham, 1890, p. 80 (type locality, vicinity of St. Vincent's Archabbey, Latrobe, Westmoreland County, Pennsylvania; type deposited in Field Museum of Natural History).

*Arianops amplyoponica*: Brendel, 1893, p. 278. Park, 1951, p. 40.

*Arianops amblyoponica*: Leng, 1920, p. 129.

**Diagnosis.** Distinguished from other members of group by long, lateral vertexal carinae and presence of three rounded basolateral foveae on each side of pronotum; occipital carina present; interantennal ridge carinate but slightly interrupted at middle; pronotum with spines flanking median fovea; male with moderate spine on third abdominal sternite.

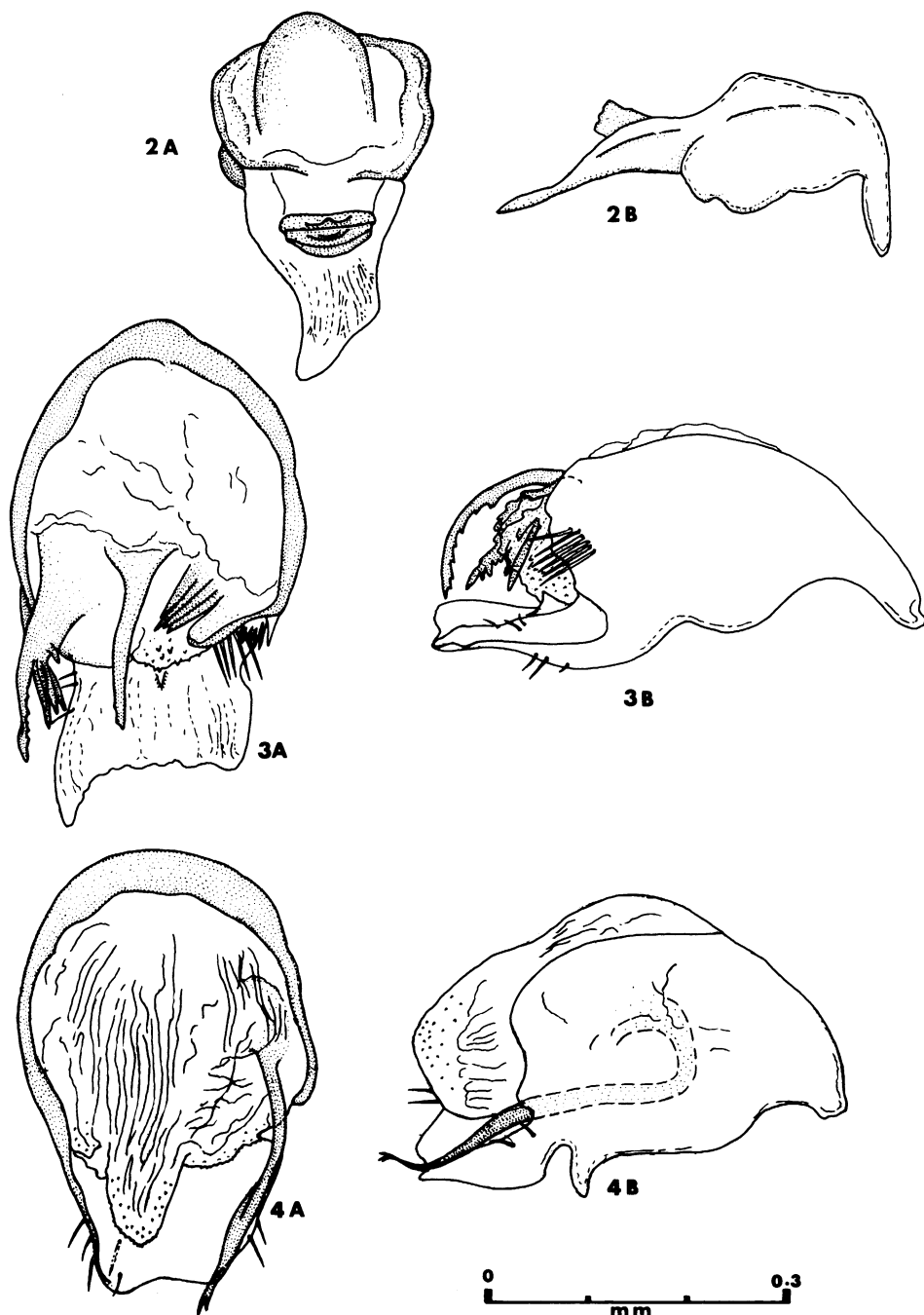
**Description.** Length 2.6-3.2 mm. Head with lateral vertexal carinae long, attaining level of

vertexal foveae; fine occipital carina present; vertexal foveae prominent, perforate, in broad, shallow depressions which are not distinctly connected with two elongate, anterior depressions convergent between antennal tubercles; interantennal ridge carinate, interrupted at middle; midfrontal ridge irregular, at most briefly carinate, not attaining clypeal margin. Pronotum with prominent median fovea in basal fourth and sharp spine on each flanking knob; three distinct, small, rounded foveae each side of base. Antenna with segments VIII, IX, and X rounded, X conspicuously asymmetrical with protuberance on lower side, IX and XI slightly asymmetrical, latter pedunculate. Male with medium-sized, triangular, median spine on third abdominal sternite; mesotrochanter with small spine. Aedeagus 0.49 by 0.29 mm. (topotype); basal capsule a little longer than wide, convex but not strongly so, right wall rather abruptly declivous behind; right posterior wall turned inward and bearing six setae; apical shelf with left lobe more produced and attenuate than right, lateral margins broadly and gently reflexed, left margin with three setae near base, right margin with one seta, small vertical spine in middle of shelf near base; internal sac with a few small spines on lower posterior lobe; tube central in position, lightly sclerotized, bearing fine teeth on ventral surface; two distinct copulatory pieces, left one with many finger-like branches, right one consisting of four or more closely appressed spines; without free paramere.

**Material Seen.** Holotype female (Field Museum of Natural History); eight males and nine additional females (Field Museum of Natural History, Carnegie Museum, University of Kansas, Ohio State University, and collection of Jerome Schmitt at St. Vincent's Archabbey, Latrobe, Pennsylvania). All specimens from type locality.

**Discussion.** This is the only previously described species of the genus outside the southern Appalachian mountain area, and it is known only from the series collected near St. Vincent's Archabbey, Westmoreland County, Pennsylvania, by P. Jerome Schmitt during the last 15-20 years of the nineteenth century. All the specimens were said to be taken from nests of *Amblyopone pallipes* (Haldeman), and specimens of the ant host are preserved in the Carnegie Museum and Schmitt collections.





FIGS. 2A-4B. Aedeagi of Pselaphidae. A. Dorsal view. B. Right lateral view. 2A, B. *Texamaurops ? reddelli* Barr and Steeves, Inner Space Caverns, Williamson County, Texas. 3A, B. *Arianops amplyonica* (Brendel and Wickham), St. Vincent, Pennsylvania. 4A, B. *Arianops plectrops* Casey, Round Knob, North Carolina.

*Arianops amplyoponica* is apparently the only species of *Arianops* examined by Jeannel (1948, pp. 1-2), who asserted that *Arianops* has the same type of aedeagus as a batrisine (1950, p. 348). However, the illustrations of the aedeagus of *amplyoponica* and all other *Arianops* for which the male is known (figs. 3-28) clearly show a very different pattern from that observed in *Batrisus* or *Batrisodes*. It should be noted that the *Arianops* pattern is also rather different from that of the European Amauropsini (see, for example, Jeannel, 1950, pp. 358-377).

*Arianops plectrops* Casey  
Figures 4A, 4B

*Arianops plectrops* Casey, 1897, p. 582. Park, 1951, p. 40 (type locality, "Round Knob, North Carolina"; type deposited in National Museum of Natural History, Smithsonian Institution).

**Diagnosis.** Distinguished from other members of group by short lateral vertexal carinae, pronotum with spines flanking median fovea and two basolateral foveae on each side, and broad, slightly emarginate, shelflike median spine on male third abdominal sternite; occipital carina present; interantennal ridge not carinate; male with small spine on mesotrochanter.

**Description.** Length 2.9-3.3 mm. Head with lateral vertexal carinae short, not attaining level of vertexal foveae; occipital carina present; interantennal ridge not carinate, face slope gentle, midfrontal ridge obsolescent; vertexal foveae and circumambient sulcus about as in *amplyoponica* but latter a little deeper. Pronotum with prominent median fovea in basal fourth and sharp spine on each flanking knob; a pair of small foveae near middle of base but lateral foveae confluent into an elongate, oblique depression, not separately rounded as in *amplyoponica*. Antenna about as in *amplyoponica*. Male with broad, slightly emarginate shelflike median spine on third abdominal sternite; mesotrochanter with small spine. Aedeagus 0.40 by 0.31 mm. (topotype); basal capsule rounded, convex, right wall abruptly declivous behind, dorsal aperture large; apical shelf rather short, sides broadly reflexed and somewhat convergent, apex scarcely emarginate, corners blunt, two or three setae at each

side margin; internal sac apparently unarmed, no evident paramere or copulatory sclerite; prominent, lightly sclerotized tube emerging from extreme right wall of sac, arcuate, finely bifurcate at apex.

**Material Seen.** Holotype male (National Museum of Natural History), four additional males, three females (National Museum of Natural History, Ohio State University, Field Museum of Natural History).

**Discussion.** *A. plectrops* is known from three localities in the Black Mountains, in McDowell, Yancey, and Buncombe counties, North Carolina. "Round Knob," the type locality, was apparently near the present site of Graphite, in the western edge of McDowell County just west of Swannanoa Gap. H. G. Hubbard recorded that he and E. A. Schwarz traveled east to Round Knob from Asheville on the railroad, a distance of 20 miles, on June 21, 1893. In his journal Hubbard noted, "Beautiful mountain scenery. Altitude 2700 ft. The Pinnacle, one of the spurs of Mt. Mitchell, rises 4 miles north of us." Consultation of topographic maps suggests that the site lay in the valley of Mill Creek, about 3 miles south of the Pinnacle, by airline distance. Between June 23 and 28, Hubbard and Schwarz obtained a number of "Anops," largely by sifting leaves and forest floor litter, near the site of the old hotel.

The Orlando Park collection (Field Museum of Natural History) includes a male *A. plectrops* from Montreat, Buncombe County, and a pair from the vicinity of Hamrick, in the valley of the South Toe River across the Black Mountains from Round Knob and Montreat, scarcely 3 miles from the type locality of *A. nodosa* (described below). I have seen all of these specimens and made an aedeagal preparation of the male from Hamrick.

*Arianops laminata*, new species  
Figures 5A, 5B

**Etymology.** Latin *lamina*, plate, blade, referring to the very broad, platelike median shelf on the male third abdominal sternite.

**Diagnosis.** A member of *amplyoponica* group with short lateral vertexal carinae, pronotal spines, and only two pairs of basolateral foveae;

distinguished from *plectrops* and *spinicollis* (which share above characters) by antennal basal segments, which are submoniliform, and segments IX and X, which are transverse and obliquely carinate beneath, and by very broad, truncate median shelf on male third abdominal sternite; occipital carina obsolescent; interantennal ridge carinate; male with no spine on mesotrochanter.

**Description.** Length 2.9-3.6 mm. Head with lateral vertexal carinae short, not attaining level of vertexal foveae; occipital carina obsolescent; interantennal ridge carinate; vertexal foveae in small, distinct depressions, rather evanescently confluent with anterior portion of circumambient sulcus. Pronotum with prominent median fovea in basal fourth and sharp spine on each flanking knob; pair of small foveae near middle of base but lateral foveae confluent into elongate, oblique depression, not separately rounded. Antenna with segments II to VIII thick with rounded shoulders, more submoniliform than obconic, IX and X transverse with oblique, almost carinate ridge on lower side, XI as long as three preceding segments. Male with very broad, truncate shelf on third abdominal sternite; no spine on mesotrochanter. Aedeagus 0.54 by 0.31 mm. (paratype); basal bulb longer than wide, flattened above, right wall two-thirds as high as long, right paramere fused to right wall and forming long, hooklike process directed ventrally and medially; apical shelf short, not so long as paramere, consisting principally of triangular lobe on left side, with two or three fixed setae; internal sac voluminous, apical lobe minutely spined and protruding beyond apex of paramere; tube and copulatory piece absent.

**Type Series.** Holotype male (the American Museum of Natural History) and six paratypes, Round Mountain, Buncombe County, North Carolina, September 6, 1969, T. C. Barr, Jr.

**Material Seen.** The type series only, consisting of three males and four females.

**Discussion.** This is a rather large species, exceeded in size only by *gigantea*, *sandersoni*, and *barbata*. The ninth and tenth antennal segments are more conspicuously modified than in any of the other species, and the abdominal spine of the male third sternite is the largest known for the genus. The type series was obtained from beneath rocks on the sides of a steeply sloping

ravine on the south side of the mountain at an elevation of 2600 feet.

The distinction between "Round Mountain" (type locality for *laminata*) and "Round Knob" (type locality for *plectrops*) should be emphasized to avoid future confusion. "Round Mountain" is in Buncombe County, North Carolina, 9 miles south of Round Knob and 7 miles southwest of Old Fort. It is the type locality for *A. laminata*, new species, collected there in September, 1969, by T. C. Barr, Jr. "Round Knob" was in McDowell County, North Carolina, near the present site of Graphite, in the valley of Mill Creek about 3 miles south of the Pinnacle. It is the type locality for *A. plectrops* Casey, collected there in June, 1893, by H. G. Hubbard and E. A. Schwarz. Aside from similarity in the names of the type localities, the respective species found there are closely similar.

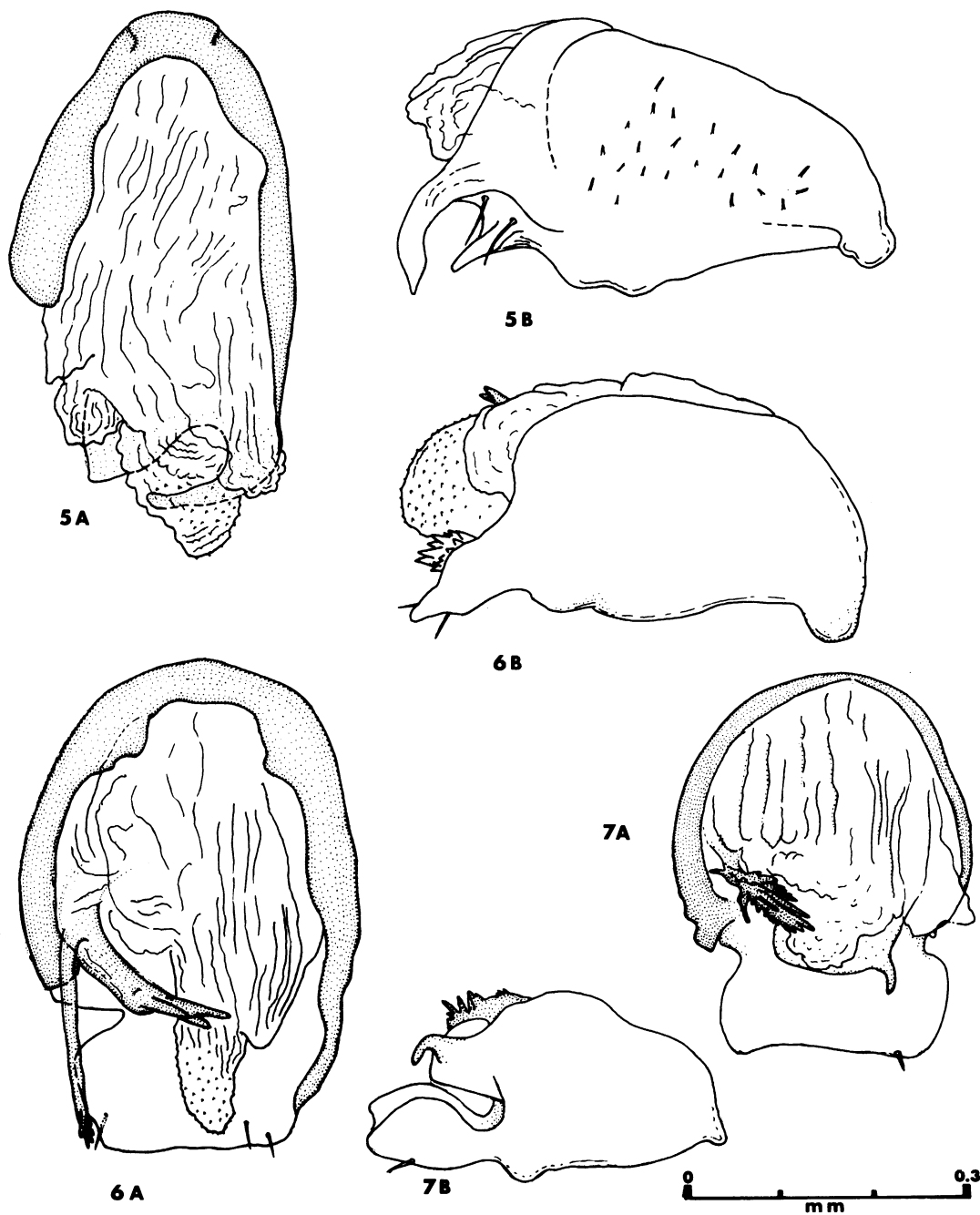
#### ***Arianops spinicollis*, new species**

Figures 6A, 6B

**Etymology.** Latin *spina*, spine + *collum*, neck, referring to the spines on the pronotal disc.

**Diagnosis.** A member of *amplyoponica* group with short lateral vertexal carinae, pronotal spines, and only two pairs of basolateral foveae; distinguished from *plectrops* and *laminata* (which share above characters) by slender form, looser antennal club, and male abdominal modifications: spine on third sternite and pair of tubercles on fourth; no occipital carina; interantennal ridge carinate; male with no spine on mesotrochanter.

**Description.** Length 3.1-3.4 mm. Head with lateral vertexal carinae short, not attaining level of vertexal foveae; occipital carina absent; interantennal ridge carinate; vertexal foveae and circumambient sulcus about as in *laminata*. Pronotum with prominent median fovea in basal fourth and sharp spine on each flanking knob; pair of small foveae near middle of base but lateral foveae confluent into an elongate depression that is broad apically and rather abruptly narrowed and canaliculate basally. Antenna with segments II through VIII obconic, more slender than in *laminata*, IX about five-sixths as wide as long, X as wide as long, XI as long as three preceding segments, both X and XI a little asymmetrical. Male with small, triangular, median



FIGS. 5A-7B. Aedeagi of *Arianops*. A. Dorsal view. B. Right lateral view. 5A, B. *A. laminata*, new species, Round Mountain, North Carolina. 6A, B. *A. spinicollis*, new species, Mt. Pisgah, North Carolina. 7A, B. *A. nodosa*, new species, Buck Creek Gap, North Carolina.

spine on third abdominal sternite and two closely approximate tubercles on fourth sternite; mesotrochanter without spine. Aedeagus 0.54 by 0.39 mm. (paratype), massive and robust; basal capsule rounded, moderately convex, without evident parameres; apical shelf short, deeply notched at left where it joins capsule, posterior margin wholly entire, corners rounded, two or three fixed setae; internal sac with prominent posterior lobe minutely and sparsely spinulate; thinly sclerotized tube emerging at extreme left side and terminating in mass of stout spines, copulatory piece emerging from left side and directed medially, terminating in three or four short, stout spines.

**Type Series.** Holotype male (the American Museum of Natural History) and 11 paratypes, Mount Pisgah, elevation 5200 feet, Buncombe County, North Carolina, August 5, 1970, Harrison R. Steeves, Jr., T. C. Barr, Jr., and T. C. Barr, III. One additional paratype from the same locality, August 2, 1969, T. C. Barr, Jr. Four paratypes from Buck Spring Trail, Transylvania County, North Carolina, August 19, 1969, T. C. Barr, Jr.

**Material Seen.** The type series only, consisting of five males and 12 females.

**Discussion.** The type locality is a very steeply sloping ravine on the north side of the ridge connecting Mount Pisgah with Little Pisgah. The rocks beneath which the beetles were found are large, deeply embedded, and often covered with carpets of damp moss. Four specimens were taken along the Buck Spring Trail about 1.15 miles southeast of the type locality at an elevation of 4900 feet, 2000 feet south of Buck Spring, in the corner of Transylvania County. A single male *A. gigantea* was obtained on the Buck Spring Trail and a male *A. alticola* was encountered at the Mount Pisgah site.

*Arianops spinicollis* is the most slender species of the *amplyoponica* group, with roughly the same proportions and habitus as those of *A. alticola*. It is readily separated from *alticola* by the short lateral vertexal carinae (*alticola* has none) and the pronotal spines (*alticola* has none).

***Arianops nodosa*, new species**  
Figures 7A, 7B

**Etymology.** Latin *nodosus*, knobbed, refer-

ring to the protuberances on either side of the median pronotal fovea.

**Diagnosis.** Distinguished from other members of *amplyoponica* group by absence of small spines on knobs which flank median pronotal fovea, and from other North Carolina species by having three basolateral foveae on each side of pronotum; lateral vertexal carinae short; occipital carina weak; interantennal ridge not carinate, no midfrontal ridge; male with large triangular median spine on third abdominal sternite, mesotrochanter with spine.

**Description.** Length 3.0-3.1 mm. Head with lateral vertexal carinae short, not attaining level of vertexal foveae; feebly raised occipital carina barely discernible; interantennal ridge not carinate, midfrontal ridge absent, face simply and gently declivous; vertexal foveae and circumambient sulcus as in *plectrops*. Pronotum with prominent median fovea in basal fourth flanked on either side by strongly convex knob rather than spine; three basolateral foveae on each side, outer two not confluent. Antenna with club loose, segments IX and X rather small and swollen asymmetrically on lower surface. Male with large, triangular, median spine on third abdominal sternite; mesotrochanter with stout spine. Aedeagus 0.41 by 0.31 mm. (paratype), short and robust, almost entirely without setal armature; basal capsule a little wider than long, convex, dorsal aperture large, right wall continued behind as inner shelf, right margin of which bears small hook (? paramere homologue); apical shelf short, twice as wide as long, apical margin entire, corners bluntly rounded; internal sac without spiny lobe or tube but with rather large and much branched copulatory piece emerging from extreme left wall.

**Type Series.** Holotype male (the American Museum of Natural History) and four paratypes, Buck Creek Gap, elevation 3400 feet, 1.2 miles east of Busick on the Blue Ridge escarpment at the Yancey-McDowell county line, North Carolina, September 6, 1969, T. C. Barr, Jr.

**Material Seen.** The type series only, consisting of two males and three females.

**Discussion.** Despite the presence of bumps instead of spines on either side of the pronotal median fovea, *nodosa* fits well within the *amplyoponica* group. The unusually large spine on the male third abdominal sternite recalls the large,



truncate spines of *plectrops* and *laminata*. The extensively branched and spined left copulatory piece is encountered elsewhere only in *amplyoponica* itself, and the very short apical shelf of the aedeagus is similar to that of *spinicollis*. The hooked right paramere may be the reduced homologue of the big spine in *laminata*.

The type locality is at the head of Buck Creek on the east side of the Blue Ridge Parkway, on a steep, wooded ravine slope, 9 miles northeast of the type locality for *A. plectrops* and only 3.3 miles southeast of Hamrick, where *plectrops* has been collected.

#### *Arianops sandersoni*, new species

*Etymology.* Patronymic honoring Dr. Milton W. Sanderson, discoverer of the species.

*Diagnosis.* Resembles *amplyoponica* in having long lateral vertexal carinae and three pairs of basolateral foveae; differs from *amplyoponica* in larger size, no occipital carina, noncarinate interantennal ridge, no midfrontal ridge, and more prominent internal stria of first abdominal tergite; antennal segment IX, rather than X (as in *amplyoponica*), swollen on ventral side, X shorter and transverse.

*Description.* Length 3.8 mm. (holotype). Head with lateral vertexal carinae long and prominent, attaining level of vertexal foveae; occipital carina absent; vertexal foveae deep, connected with interantennal depression by broad, shallow grooves; interantennal ridge V-shaped, not carinate, somewhat indistinct near middle but not clearly interrupted; midfrontal ridge absent; eye spine rather prominent, sharp, and slightly recurved; genal beard rather full. Pronotum with prominent median fovea in basal fourth and small, sharp spine on each flanking knob; three pairs of basolateral foveae, outer two foveae deep, approximate, joined by narrow, shallow groove. Antenna with segment VIII short and rounded, IX larger and conspicuously swollen on ventral side, X short and transverse, XI slightly longer than three preceding segments and slightly asymmetrical. Abdomen with first tergite bearing very prominent internal stria, subparallel to margin. Male unknown.

*Type Series.* Holotype female (Illinois Natural History Survey Division collections, Urbana), a unique, "in damp debris, base of

bluff," Magazine Mountain, Logan County, Arkansas, July 16, 1949, M. W. Sanderson.

*Material Seen.* The unique female holotype.

*Discussion.* This is the only species of *Arianops* known west of the Mississippi River, taken on Magazine Mountain, the summit of which is the highest point in Arkansas. Its assignment to the *amplyoponica* group is, of course, provisional, because no aedeagus could be examined, but it is so closely similar to other members of the group that I have little doubt about its affinities.

#### *alticola* group

*Diagnosis.* Size medium-large, 3.1-3.6 mm.; integuments normally dark, genital depression in males heavily sclerotized and blackened. Head without lateral vertexal carinae. Pronotum seven-eighths as wide as long, with small, distinct median fovea but without spines or knobs on either side. Abdomen convex, 0.8 as deep as wide. Male with large, deeply emarginate spine on fourth abdominal sternite.

*Description.* Eye spine prominent and acute; lateral vertexal carinae absent; interantennal and midfrontal ridges not or at most very feebly carinate. Pronotum with small, slightly elongate median fovea, not flanked by spines, knobs, or ridges of any sort, sides simply declivous around fovea; each side with one small paramedian basal fovea, one oblique, elongate fovea, and small, rounded fovea above procoxa. Antenna with segments II through VII slender, obconic, VIII obconic or rounded but smaller than VII; IX and X slightly longer than wide but IX a little wider and also longer than X, both IX and X slightly and asymmetrically swollen on lower side; XI as long as three previous segments combined, strongly asymmetrical and pedunculate. Aedeagus 0.41-0.43 mm. long by 0.26-0.28 mm. wide; basal capsule slightly elongate and rather flattened above, right wall extended backward and much higher than left; apical shelf with few setae, right corner slightly produced more than left; internal sac with slender tube at extreme left margin, with apical spiny lobe in one species, but without copulatory pieces.

*Discussion.* Two species of this group are known. *Arianops alticola* is widely distributed from the vicinity of Mount Pisgah through the

Great Balsam Mountains to the vicinity of Highlands, North Carolina, near the southeast terminus of the Cowee Mountains. *Arianops barbata*, on the other hand, is known from a single locality along the crest of the Cowee Mountains some 18 miles northwest of the nearest *alticola* locality. Neither species has been found below an elevation of 4000 feet, and *alticola* ranges up to 5500 feet in the Great Balsams.

In their rather large, dark, and slender habitus these two species most closely resemble *spinicollis*, a species also known only from higher elevations. The form of the aedeagus and large abdominal spines of the male in the *alticola* group suggest that it is phylogenetically closest to the *amplyoponica* group.

***Arianops alticola*, new species**

Figures 8A, 8B

**Etymology.** Latin *altus*, high + *colo*, dwell, referring to the upland habitats of this species.

**Diagnosis.** Distinguished from *barbata* by smaller size, noncarinate interantennal ridge, shorter depressions around vertexal foveae, shorter postocular beard, and broader and bifurcate spine on male fourth abdominal sternite.

**Description.** Length 3.1-3.3 mm. Head without lateral vertexal carinae; occipital carina very fine, beaded; vertexal foveae small, perforate, situated at posterior end of slightly elongate depressions, from which shallow grooves extend forward and converge between antennal tubercles; interantennal ridge obsolete, face simply declivous. Pronotum with small, slightly elongate median fovea in basal fourth, remainder of disc simple; each side with small paramedian basal fovea, an oblique, elongate basolateral fovea, and small fovea above procoxa. Antenna elongate and slender, segments II-VII obconic, progressively shorter, VIII nearly as wide as long, IX and X slightly longer than wide but IX a little more so, XI as long as previous three segments combined; IX and X slightly swollen on lower side, XI strongly asymmetrical, pedunculate. Male with rather wide, deeply emarginate spine, appearing almost bifurcate, at middle of fourth abdominal sternite; fifth sternite with median, imperforate, foveoid depression at middle of basal margin; mesotrochanter with stout spine on posterolat-

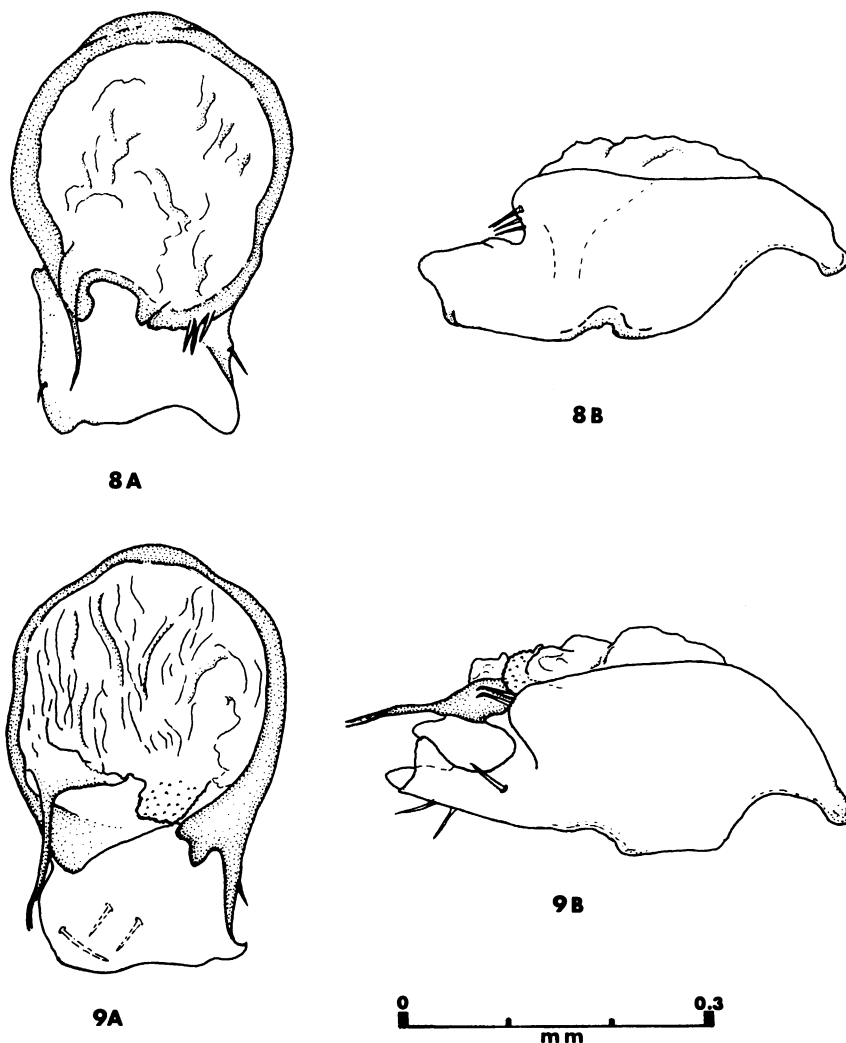
eral face. Aedeagus 0.43 by 0.28 mm. (paratype); basal capsule subconvex, slightly longer than wide, dorsal aperture large, right wall continued as high, rounded posterior extension, bearing three setae; apical shelf slightly emarginate, right corner a little more produced than left; internal sac without armature except for thin-walled tube protruding at extreme left.

**Type Series.** Holotype male (the American Museum of Natural History) and two paratypes, along Buck Creek Road 4.5 miles north of Highlands, elevation 4000 feet, Macon County, North Carolina, May 14, 1971, T. C. Barr, Jr. Eighteen additional paratypes from same locality, August 2, 1969, August 7, 1969, and June 20, 1970, Harrison R. Steeves, Jr., and T. C. Barr, Jr. Five paratypes from Cliffside Vista Trail, near Cliffside Lake, 3 miles northwest of Highlands, Macon County, North Carolina, August 16-19, 1970, T. C. Barr, Jr., and T. C. Barr, III.

**Material Seen.** Twenty-four males and 15 females.

**Discussion.** Thirteen additional specimens of *alticola* were obtained July 31 to August 6, 1970, by Harrison R. Steeves, Jr., and me along the Blue Ridge Parkway in Haywood and Transylvania counties, North Carolina. Although they are indistinguishable from the Highlands series in all characters examined, I have not made them paratypes. Nine of these specimens were taken at Bearpen Gap, on the Haywood-Jackson county line, at an elevation of 5500 feet; three specimens were collected just west of Devils Courthouse near the Haywood-Transylvania county line, elevation 5400 feet; and a single male was taken with the type series of *A. spinicollis* at Mount Pisgah, near the Buncombe-Haywood county line, elevation 5200 feet. *Arianops alticola* thus has one of the widest distributions of any known species of the genus, ranging from the Highlands plateau through the Great Balsams and onto Pisgah Ledge, a distance of about 38 miles.

Most specimens of this species were obtained under stones on steep, wooded slopes, but two were taken at the edge of an old clearing in the Great Balsam Mountains. The Highlands material includes a pair *in copulo* (May 14) and 10 tenebrals (August, 1969, 1970). Throughout most of its range *alticola* does not seem to be syntopic with other species of the genus, the only excep-



FIGS. 8A-9B. Aedeagi of *Arianops*. A. Dorsal view. B. Right lateral view. 8A, B. *A. alticola*, new species, Buck Creek Road, North Carolina. 9A, B. *A. barbata*, new species, Leatherman Gap, North Carolina.

tion being the single male taken with *spinicollis* at Mount Pisgah. Near Highlands the ranges of *neglecta* and *alticola* approach each other to a distance of 1.5 miles on opposite sides of the Cullasaja gorge, but apparently do not overlap.

***Arianops barbata*, new species**  
Figures 9A, 9B

**Etymology.** Latin *barbatus*, bearded, referring to the long postocular beard of this species.

**Diagnosis.** Distinguished from *alticola* by larger size, feebly carinate interantennal ridge, elongate depressions around vertexal foveae, longer postocular beard, and slender, finely truncate and deeply and narrowly emarginate spine on male fourth abdominal sternite.

**Description.** Length 3.6-3.8 mm. Head without lateral vertexal carinae; occipital carina very fine, obsolescent; vertexal foveae situated at posterior end of elongate depressions which are about twice as long as those of *alticola* and are

indistinctly connected by shallow grooves to anterior head depression between antennal tubercles; interantennal ridge feebly carinate at sides, interrupted at middle, mid-frontal ridge obsolete, face simply declivous. Pronotum with small, slightly elongate median fovea in basal fourth, remainder of disc simple; each side with small paramedian basal fovea, oblique, elongate basolateral fovea, and small fovea above procoxa. Antenna about as in *alticola* except segment VIII is distinctly longer than wide. Male with prominent, rather slender spine on fourth abdominal sternite, apex of spine finely truncate and narrowly, barely perceptibly emarginate; fifth sternite with median, imperforate, foveoid depression at middle of basal margin; mesotrochanter with stout spine on posterolateral face. Aedeagus 0.43 by 0.28 mm. (holotype); closely similar to that of *alticola*, with slightly elongate, depressed basal capsule; right wall extension produced into short spine; right corner of shelf acute, slightly reflexed; posterior lobe of internal sac minutely spined, tube at extreme left as in *alticola*.

**Type Series.** Holotype male (the American Museum of Natural History) and three female paratypes, Leatherman Gap, elevation 4000 feet, along Cowee Bald Road, Swain and Macon counties, North Carolina, August 15, 1970, T. C. Barr, Jr., and T. C. Barr, III. Two female paratypes from same locality, August 19, 1969, T. C. Barr, Jr.

**Material Seen.** The type series only, consisting of one male and five females.

**Discussion.** The type locality lies approximately 18 miles northwest of the Buck Creek locality for *A. alticola*, along the crest of the Cowee Mountains. There are no obvious extrinsic barriers separating these rather distinct but closely similar species. Most of the type series was obtained from under large rocks in the road fill immediately west of Leatherman Gap. Sympatric and syntopic with *barbata* at Leatherman Gap were *Arianops gigantea*, *A. parki*, and *A. fovealis*.

#### *nantahalae* group

**Diagnosis.** Size medium, 2.5-3.3 mm.; integuments rather pale, genital depression in males not heavily sclerotized and blackened. Head with

lateral vertexal carinae. Pronotum slightly longer than wide (width/length ratio about 0.87-0.95), with prominent median fovea flanked on each side by small, sometimes carinate knob, but without spines. Abdomen convex, 0.8 as deep as wide. Male with small median spine on third or fourth abdominal sternite, or completely without modification of these sternites.

**Description.** Eye spine prominent and acute; lateral vertexal carinae long in two species, shortened in one species; at least interantennal ridge more or less carinate, midfrontal ridge weak or obsolescent. Pronotum with deep median fovea flanked each side by small knob, each knob in two species with very short longitudinal carinula; each side with large paramedian basal fovea, one elongate or two subconfluent basolateral foveae, and fovea above procoxa. Antenna with segments II through V obconic, longer than wide, II longest and III through V subequal; VI and VII subequal, as long as wide, shorter than V; VIII smallest, as long as wide; IX and X subequal in length but IX as long as wide and X transverse, both prominently swollen on lower side; XI as long as preceding three or three and one-half segments. Aedeagus 0.39-0.42 mm. long by 0.25-0.31 mm. wide; basal capsule convex, right paramere vestige apparently present as hook fused to right posterior wall of capsule in one species but doubtfully present in other species; apical shelf with hind margin scarcely emarginate, corners prominently reflexed, left and hind margins heavily setose in two species; internal sac unarmed or with a few minute spines on lower lobe; two species with slender, apically bifurcate tube, and much-branched copulatory piece in one species.

**Discussion.** The three species of the *nantahalae* group are distributed from the Nantahala and Snowbird mountains of southwestern North Carolina to the Unicoi and Great Smoky mountains along the North Carolina-Tennessee border. They are pale, slender species larger than members of the *henroti* group and about the same size as members of the *neglecta* group, but are readily distinguished from the former by their convex abdomen and from the latter by the presence of lateral vertexal carinae. The deep median fovea and flanking knobs of the pronotum are encountered elsewhere in the genus only in the

*amplyoponica* group, which includes darker species in which (with the exception of *nodosa*) the knobs each bear a small spine. At present the *nantahalae* and *amplyoponica* groups are strictly allopatric, with the group ranges in the southern mountain area divided along the eighty-third meridian.

*Arianops nantahalae* has distinct geographic races in (a) the Nantahala and Tusquitee mountains and (b) the Snowbird Mountains, respectively. *Arianops uniconi* occurs in the Unicoi Mountains, and *A. digitata* is the only species of the genus thus far known from the Great Smoky Mountains. In external morphology the three species are about equally distinct, but examination of aedeagi shows a close affinity between *uniconi* and *nantahalae* and a unique aedeagal structure for *digitata*.

***Arianops nantahalae nantahalae*,**  
new species and subspecies  
Figures 10A, 10B

**Etymology.** Cherokee *nantahala*, geographic place name.

**Diagnosis.** Similar to *uniconi* in long lateral vertexal carinae, feebly carinate pronotal knobs, and narrowly convergent abdomen, differing in minute median spine on fourth abdominal sternite, finely impressed transverse carinula of fifth sternite, and more prominent hook in right posterior wall of aedeagal basal capsule.

**Description.** Length 3.0-3.1 mm. Head with lateral vertexal carinae long, extending beyond level of vertexal foveae; occipital carina variable, ranging from strong crest to shallow groove, rarely absent; vertexal foveae moderate, perforate, set in broad depressions that are wide and rather deep near foveae and vaguely and very shallowly connected with trapezoidal depression between antennal tubercles; interantennal ridge usually weakly to moderately carinate and connected to short, usually not carinate midfrontal ridge that does not attain clypeal margin. Pronotum with prominent median fovea in basal fourth, flanking knobs usually and rather feebly longitudinally carinate; each side of pronotum with large basal fovea, two broadly confluent basolateral foveae, and fovea above procoxa. Antenna as described for group. Male with minute median tubercle on fourth sternite of

abdomen and finely impressed, transverse carinula near middle of fifth sternite; mesotrochanter with minute spine. Aedeagus 0.40 by 0.25 mm. (paratype); basal capsule rounded, strongly and evenly convex, right posterior wall bearing prominent hook (possibly paramere); apical shelf elongate, right corner acute and reflexed, ten or more setae along left side and left apical margin; internal sac apparently unarmed, but with slender tube, finely bifurcate at apex, protruding at extreme left margin.

**Type Series.** Holotype male (the American Museum of Natural History) and eight paratypes, ravine at head of Dirty John Creek on slopes of Winespring Bald, elevation 4800 feet, Macon County, North Carolina, August 15, 1969, T. C. Barr, Jr., and Melisa J. Barr. One paratype, same locality, June 27, 1970, T. C. Barr, Jr.

**Material Seen.** Five males and nine females.

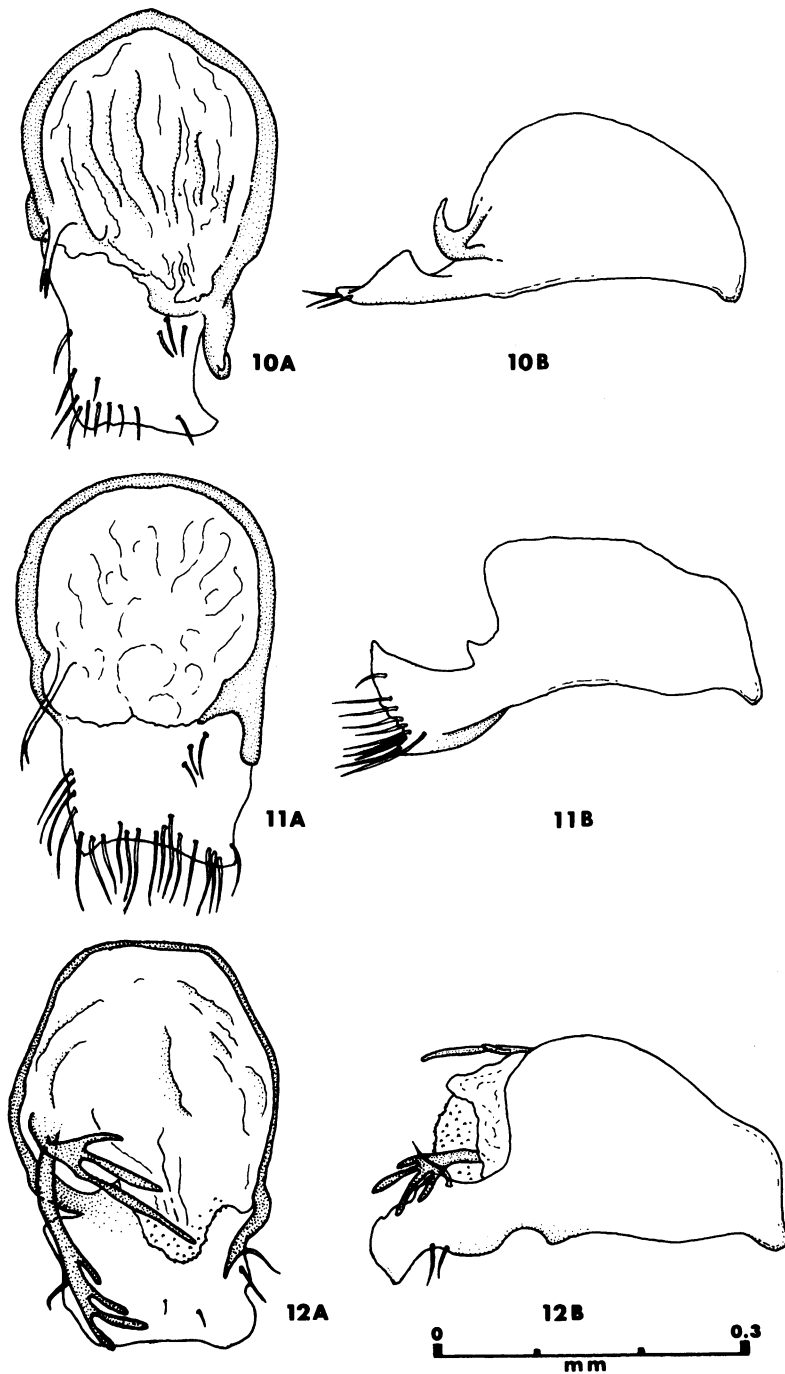
**Discussion.** In addition to the type locality, this species occurs at Old Road Gap, Macon County, North Carolina, near the junction of the Valley River and Tusquitee mountains, where I collected two males and two females on May 15, 1971, at an elevation of 3600 feet. A small series from the Snowbird Mountains, still farther west, is subspecifically distinct and is described below, but the populations at Winespring Bald and Old Road Gap appear identical in all significant characters. These two localities are scarcely more than 8 miles apart, and in both of them *A. n. nantahalae* occurred under medium to small rocks on rather steep, thinly wooded slopes. The soil with which the beetles were associated contained much less humus than usual for *Arianops* collecting sites and was wet and crumbly.

***Arianops nantahalae joanna*, new subspecies**

**Etymology.** Cherokee *Joanna*, a proper name alternatively applied to the type locality, Teyahalee (or Joanna) Bald.

**Description.** Length 2.5-3.0 mm. Identical with *nantahalae nantahalae* except in secondary sex characters. Male without spine or tubercle on third or fourth abdominal sternite, but with finely impressed, transverse carinula near middle of fifth sternite. Both sexes with minute spine on mesotrochanter. Aedeagus as in *nantahalae nantahalae*.





FIGS. 10A-12B. Aedeagi of *Arianops*. A. Dorsal view. B. Right lateral view. 10A, B. *A. nantahalae* *nantahalae*, new species and subspecies, Dirty John Creek, North Carolina. 11A, B. *A. unicoi*, new species, Johns Knob, North Carolina/Tennessee. 12A, B. *A. digitata*, new species, Buckeye Nature Trail, Great Smoky Mountains, Tennessee.

*Type Series.* Holotype male (the American Museum of Natural History) and three paratypes, head of Panther Creek at Tatham Gap, elevation 4000 feet, Teyahalee (=Joanna) Bald area, Cherokee and Graham counties, North Carolina, August 15, 1969, T. C. Barr, Jr., and Melisa J. Barr.

*Material Seen.* The type series only, consisting of three males and one female.

*Discussion.* The type locality is in the Snowbird Mountains about 12 miles north-northwest of Old Road Gap, where nominate *nantahalae* was collected, and about 15 miles southeast of Stratton Meadows, where the related species *A. unicoi* (described below) was discovered. The upland areas where the two geographic races of *nantahalae* occur are separated by the Valley River, along which lies the town of Andrews (elevation about 1800 feet). *Arianops nantahalae joanna* is sympatric and syntopic at the type locality with *A. teyahalee*, a small species belonging to the *henroti* group.

#### *Arianops unicoi*, new species

Figures 11A, 11B

*Etymology.* Named for the Unicoi Mountains, in which the type locality is situated.

*Diagnosis.* Similar to *nantahalae* in long lateral vertexal carinae, feebly carinate pronotal knobs, and narrowly convergent abdomen, differing in a) absence of secondary sex characters of male third, fourth, and fifth sternites, and b) more heavily setose aedeagal apical shelf and less prominent hook in right wall of basal capsule.

*Description.* Length 3.1-3.2 mm. Head with lateral vertexal carinae long, extending beyond level of vertexal foveae; occipital carina obsolete; vertexal foveae and circumambient sulcus as in *nantahalae*; facial ridge Y-shaped, rather weakly carinate. Pronotum with prominent median fovea in basal fourth, flanking knobs with feeble longitudinal carinae, as *nantahalae*; each side of pronotum with large basal fovea, two broadly confluent basolateral foveae, and fovea above procoxa. Antenna as described for group. Male abdomen without secondary modifications of third, fourth, or fifth sternites; mesotrochanter with long, slender spine. Aedeagus 0.39 by 0.31 mm. (holotype); basal capsule rounded, very con-

vex, right posterior wall higher and with small hook at lower right posterior margin, no distinct paramere discernible; apical shelf with broadly reflexed lateral flanges, left and apical margins with about twice as many long setae (20 or more) as in *nantahalae*, three setae in anterior right corner on ventral surface; internal sac apparently unarmed, copulatory pieces absent, but with long, slender, apically bifurcate tube at extreme left margin of sac.

*Type Series.* Holotype male (the American Museum of Natural History) and one female paratype, 0.5 mile south of Stratton Meadows along an old road around Johns Knob, elevation 4650 feet, Graham County, North Carolina, just east of the Monroe County, Tennessee, line, May 16, 1971, T. C. Barr, Jr. Male and female paratype, same locality, August 30, 1964, T. C. Barr, Jr.

*Material Seen.* The type series only, consisting of two males and two females.

*Discussion.* *Arianops unicoi* closely resembles *nantahalae* but is easily distinguished by the complete absence of secondary sex characters of the male abdomen. Although *nantahalae joanna* has no spine or tubercle on either the third or fourth sternite, it does have a fine carinula across the middle of the fifth sternite. The spine on the mesotrochanter of male *unicoi* is longer and more easily seen. The two species are readily distinguished on the basis of aedeagal differences.

The male of *unicoi* is best distinguished from the female by the presence of the genital depression, the boxlike fifth tergite with median fovea, and the long, slender spine on the mesotrochanter. The integument in and around the genital depression in the *nantahalae* group is not heavily sclerotized and blackened in the male, consequently this feature cannot be relied upon for sexing specimens.

#### *Arianops digitata*, new species

Figures 12A, 12B

*Etymology.* Latin *digitus*, finger, referring to the finger-like ramifications of the aedeagal copulatory piece.

*Diagnosis.* Distinguished from *nantahalae* and *unicoi* by short lateral vertexal carinae, noncarinate pronotal knobs, and broadly convergent

abdomen; male with small median spine on third abdominal sternite and crenelate, transverse median carina on fourth sternite; aedeagus with conspicuously branched copulatory piece.

*Description.* Length 3.1-3.3 mm. Head with lateral vertexal carinae short, not attaining level of vertexal foveae; occipital carina very fine, barely discernible from cervicum to point between foveae; foveae and circumambient sulcus as in *nantahalae*; interantennal ridge sharply carinate, continuous with weakly carinate midfrontal longitudinal carina, which does not attain clypeal margin. Pronotum with prominent median fovea in basal fourth, flanking knobs not longitudinally carinate; each side of pronotum with large basal fovea, an elongate, irregular basolateral fovea, and fovea above procoxa. Antenna as described for group. Male with third abdominal sternite bearing small spine; apical margin of fourth sternite crenelate and carinulate near middle; mesotrochanter without spine. Aedeagus 0.42 by 0.29 mm. (paratype); basal capsule slightly longer than wide, strongly convex, posterior margin of right wall abruptly declivous, without obvious paramere present; apical shelf with lateral margins reflexed but corners rounded, deeply notched on left at juncture with capsule, two setae on right margin, two on lower surface, one at left margin; internal sac with lower lobe armed with minute spines, large biramous copulatory piece protruding from left margin of sac, dorsal ramus with three finger-like processes and ventral branch with four.

*Type Series.* Holotype male (the American Museum of Natural History) and three paratypes, ravine above Buckeye Nature Trail, elevation 4000 feet, Great Smoky Mountains National Park, Sevier County, Tennessee, September 8, 1969, T. C. Barr, Jr.

*Material Seen.* The type series only, consisting of two males and two females.

*Discussion.* The type locality is the only place in the Great Smoky Mountains from which *Arianops* species have been collected, although this is almost certainly the result of limited collecting for edaphic insects. A few other sites in the Smokies have been examined for *Arianops*, but only one of these was even marginally suitable in comparison with other localities where I have found these insects. The Buckeye Trail lies in the lower end of a ravine on the east side of U.S.

441, tributary to the West Prong of Little Pigeon River. Three specimens were taken on a very steep slope in the yellow buckeye forest a hundred yards or more above the nature trail, and one specimen was taken under a large, flat rock at the base of the cliff at the head of the ravine.

As indicated in the key and in the diagnoses, *digitata* is less closely similar to *nantahalae* and *unicoi* than they are to each other. It is also more widely separated geographically and has a rather different aedeagus, which contrasts strongly with the aedeagal pattern in the other two species.

#### *neglecta* group

*Diagnosis.* Size medium, 2.9-3.2 mm.; integuments normally dark, genital depression in males heavily sclerotized and blackened. Head without lateral vertexal carinae. Pronotum as long as wide, usually without median fovea, but small, shallow fovea may be irregularly present; no spines, ridges, or other ornamentation flanking median fovea. Abdomen convex, 0.8 as deep as wide. Male with small spine on third or fourth abdominal sternite.

*Description.* Eye spine prominent and acute; lateral vertexal carinae completely absent; occipital carina usually present, although irregular: very fine and complete, limited to neck only, or completely absent, mid-vertexal region sometimes occupied by shallow longitudinal groove; interantennal ridge and midfrontal ridge (if present) more or less sharply carinate, interrupted at middle in one species. Pronotum usually without but occasionally with distinct median fovea, in some specimens with low median eminence or short longitudinal ridge near base; pair of small foveae at base, two rounded or one elongate foveae each side, and single small, somewhat irregular fovea each side above procoxa. Antenna with segments II-VIII obconic to submoniliform, VIII smallest; IX as long as or slightly longer than X and longer than VIII, X or both IX and X slightly transverse, both swollen asymmetrically on lower side; XI as long as preceding two and one-half to three and one-half preceding segments. Aedeagus 0.39-0.42 mm. long by 0.26-0.30 mm. wide; basal capsule rounded or slightly wider than long, subconvex to convex; apical shelf asymmetrical, lobed on only one side (usually the right), rather short and

with only a few lateral setae; internal sac variously modified with short, curved, slender tube and/or one or two digitiform copulatory pieces; no distinct paramere present.

**Discussion.** This group consists of five known species, four closely similar and geographically approximate, the other aberrant both morphologically and geographically. The type localities of *neglecta*, *coweeta*, *truncata*, and *parki* form a triangle in Macon County, North Carolina, and Rabun County, Georgia. Members of the group inhabit the Blue Ridge escarpment area, the Cowee Mountains, and the southern Nantahala Mountains. *Arianops allatoona* is known from a unique male 100 miles southwest of the other three species in Cherokee County, Georgia.

The four closely similar species appear to be extrinsically isolated by the valleys of the Little Tennessee River and its tributary, the Cullasaja. They are sympatric and syntopic with four species of the *henroti* group, coexist with one species of the *alticola* group and abut against the peripheral range of the other, and overlap the range of *A. gigantea*. *Arianops nantahalae* occurs in the central Nantahala Mountains in the vicinity of Wayah Bald, scarcely 10 miles northwest of the type locality of *A. coweeta*, but neither of the two species has been taken at an intermediate point. The peripheral ranges of *neglecta* and *alticola* are 1.5 miles apart on opposite sides of the Cullasaja gorge northwest of Highlands, North Carolina.

The members of the *neglecta* group are readily distinguished from the species of the *henroti* group by larger size and convex abdomen. They share the absence of lateral vertexal carinae with *gigantea* and the two species of the *alticola* group. From *gigantea* they are distinguished by mutually exclusive size ranges, and from the *alticola* group by the much smaller spine on the third (fourth in Cherokee County, Georgia, only) abdominal sternite of males; the abdominal spine is bifurcate or narrowly emarginate and finely truncate in the *alticola* group, and occurs on the fourth sternite.

***Arianops neglecta*, new species**

Figures 1, 13A, 13B

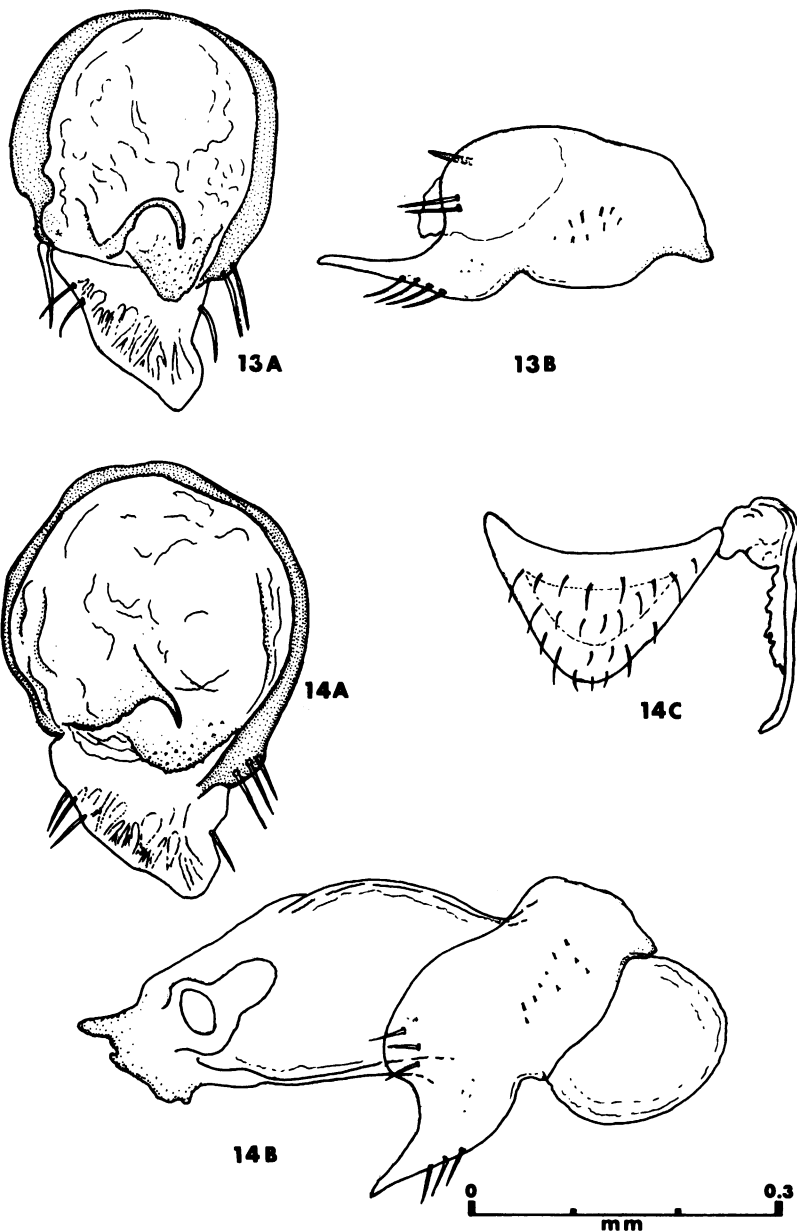
***Etymology.*** Latin *neglectus*, overlooked,

referring to the prior discovery of *Arianops henroti* Park at the same locality.

**Diagnosis.** Distinguished from *allatoona* by narrower pronotum with only three basolateral foveae on each side; from other members of group by combination of (a) interantennal carina not interrupted at middle, (b) male with triangular abdominal spine, and (c) internal sac of aedeagus without copulatory sclerites.

**Description.** Length 2.9-3.2 mm. Head with lateral and occipital carinae obsolete, latter irregularly present on neck only or represented by longitudinal groove between vertexal foveae; vertexal foveae minute, in rather shallow depressions that are at best evanescently joined to anterior depression between antennal tubercles; facial ridge carinate, forming acute median angle, usually clearly Y-shaped. Pronotum without median fovea in about three-fourths of specimens examined, but with small, shallow fovea in remainder; each side with small fovea near base, an elongate and oblique basolateral fovea, and small fovea above procoxa; base width three-fourths maximum width. Antenna with segments II-VIII obconic, progressively smaller; IX and X asymmetrically swollen beneath, IX a little longer than wide and longer than X, which is as long as wide; XI as long as preceding three segments. Male with third abdominal sternite bearing small, triangular median spine; mesotrochanter with small spine on posterolateral face. Aedeagus 0.39 by 0.26 mm. (paratype); basal capsule rounded and moderately convex, right wall higher, abruptly declivous behind, bearing two long setae, left wall with single slender spine; apical shelf skewed strongly to right, apex blunt and attenuate, one seta on right margin, two on left, three or four on ventral surface; internal sac with slender, curved tube protruding from upper hind margin but without other evident armature.

**Type Series.** Holotype male (the American Museum of Natural History) and five paratypes, 0.35 mile southeast of Beegum Gap, elevation 3900 feet, near Rabun Bald, Rabun County, Georgia, August 11, 1970, T. C. Barr, Jr. Twenty-seven additional paratypes, August, 1969, and August, 1970, T. C. Barr, Jr., and Harrison R. Steeves, Jr., as follows: 12 from Beegum Gap (type locality); 10 from south spur of Satulah Mountain, elevation 3300 feet, 3 miles south of Highlands, Macon County, North Caro-



FIGS. 13A-14C. Male genitalia of *Arianops*. 13A, B. *A. neglecta*, new species, Rabun Bald, Georgia. A. Dorsal view. B. Right lateral view. 14A-C. *A. coweeta*, new species, Coweeta Hydrologic Laboratory, North Carolina. A. Dorsal view. B. Right lateral view, internal sac exserted. C. Genital plate.

lina; and five from slope south of Turtle Pond Creek, elevation 3450 feet, 4 miles west-northwest of Highlands, Macon County, North Carolina. Paratypes distributed in the collections of the American Museum of Natural History and

the Field Museum of Natural History, H. R. Steeves, Jr., and T. C. Barr, Jr.

*Material Seen.* Thirteen males and 20 females.

*Discussion.* *Arianops neglecta* is distributed along the Blue Ridge escarpment at the North



Carolina-Georgia border in the vicinity of Highlands and Rabun Bald. The Beegum Gap locality is a stony, steeply sloping ravine which is covered by a mature, rather open, deciduous forest. All the specimens collected here occurred under rocks of large to medium size. A copulating pair was taken at this locality August 6, 1969. Along Turtle Pond Creek the species is relatively rare, occurring under large boulders in second-growth deciduous forest on a more gentle slope above the stream. On Satulah Mountain *A. neglecta* was found in a drier forest, either alone or in the tunnels of unroofed nests of the ant *Amblyopone pallipes* (Haldeman). The ant nests were limited to a small flat area covered with *Pinus strobus*. The area was repeatedly searched for *Arianops* and anilline carabids between June 20 and August 15, but the *Arianops* appeared only after a series of heavy rains.

***Arianops coweeta*, new species**  
 Figures 14A, 14B, 14C

**Etymology.** Named for the type locality, which occurs within the Coweeta Hydrologic Laboratory of the United States Forest Service.

**Diagnosis.** Closely similar to *Arianops neglecta* but differing in interrupted interantennal carina and wider apical shelf of aedeagus.

**Description.** Length 3.1-3.2 mm. Head with lateral and occipital carinae obsolete; vertexal foveae and circumambient sulcus as in *neglecta*; interantennal ridge carinate at sides but interrupted at middle by broadly sloping declivity, below which is trace of midfrontal carina. Pronotum without median fovea; two small basal foveae, each side with elongate and oblique basolateral fovea and small fovea above procoxa; base width three-fourths maximum width. Antenna about as in *neglecta*. Male with third abdominal sternite bearing small, triangular median spine; mesotrochanter with small spine on posterolateral face. Aedeagus 0.42-0.29 mm. (paratype); closely similar to that of *neglecta* but with three or four setae on right wall, without spine on left wall, and apical shelf broader and less strongly skewed to right.

**Type Series.** Holotype male (the American Museum of Natural History) and 14 paratypes, upper Bearpen Creek basin on west side of Big

Butt, elevation 4800 feet, Coweeta Hydrologic Laboratory, Macon County, North Carolina, August 17, 1969, Harold Burdsall and T. C. Barr, Jr. One paratype, August 13, 1969, and 16 paratypes, August 14, 1969, same locality, T. C. Barr, Jr. Two paratypes, May, 1965, and September, 1970, Coweeta, H. R. Steeves, Jr.

**Material Seen.** Fifteen males and 19 females.

**Discussion.** *Arianops coweeta* inhabits a locality near the southern end of the Nantahala Mountains across the valley of the Little Tennessee River from its closest morphological relative, *A. neglecta*. A short distance farther north in the Nantahalas is the type locality for *A. nantahalae*, a member of a different species group which has not yet been taken at Coweeta Hydrologic Laboratory. Sympatric and syntopic with *coweeta* at the type locality but much less abundant is *A. subterranea*, a small species belonging to the *henroti* group.

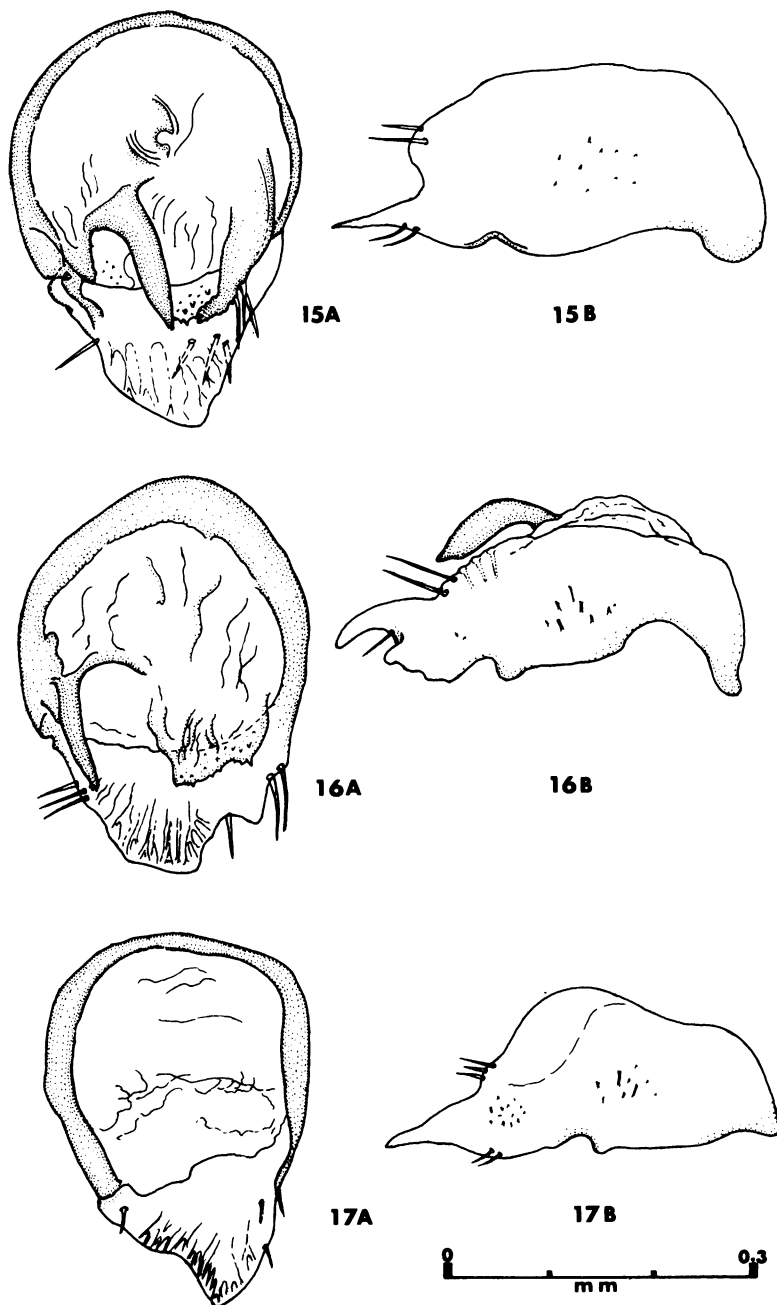
The type locality lies just below the Forest Service road about 0.35 mile southwest of Bearpen Gap, in moist deciduous forest along a moderate, stony slope. A series of wet-weather springs combine to maintain a high moisture content in the soil, which perhaps accounts for the relatively large number of *Arianops* taken here. A female *coweeta*, observed to be carrying something in its mandibles, was separately preserved; later examination revealed that the fragment was a partially eaten symphylan. The same specimen was lightly parasitized by a fungus of the order Laboulbeniales. A copulating pair of *coweeta* was taken August 14, 1969. The everted aedeagus and internal sac of the male member of the pair is illustrated in figure 14B.

***Arianops parki*, new species**  
 Figures 15A, 15B

**Etymology.** Named in honor of the late Prof. Orlando Park, Northwestern University, an eminent student of pselaphids.

**Diagnosis.** Similar to *neglecta* and *coweeta*, distinguished by large, sclerotized, digitiform copulatory sclerites protruding from aedeagal internal sac; apical shelf similarly triangular but not notably skewed to right.

**Description.** Length 2.9-3.2 mm. Head with lateral and occipital carinae obsolete, latter represented by feeble trace on neck; vertexal foveae



FIGS. 15A-17B. Aedeagi of *Arianops*. A. Dorsal view. B. Right lateral view. 15A, B. *A. parki*, new species, Leatherman Gap, North Carolina. 16 A, B. *A. truncata*, new species, Turkey Mountain, Georgia. 17A, B. *A. allatoona*, new species, Galts Landing, Georgia.

and circumambient sulcus as in *neglecta*; facial carina Y-shaped, not interrupted at middle, interantennal ridge portion sharply carinate. Pronotum without median fovea; two small foveae at base, basolateral fovea single and less elongate than in *neglecta*, small fovea above each coxa. Antenna as in *neglecta*. Male with third abdominal sternite bearing small, triangular median spine; mesotrochanter with small spine on posterolateral face. Aedeagus 0.43 by 0.31 mm. (holotype); closely similar to that of *neglecta*, but basal capsule slightly transverse, no spine on left wall, apical shelf triangular with apex approximately median rather than skewed to right, internal sac with apical spiny lobe, bifurcate sclerotized copulatory piece on left side and uniramous, finely serrulate copulatory piece on right side.

**Type Series.** Holotype male (the American Museum of Natural History) and one female paratype, Leatherman Gap on Cowee Bald Road, elevation 4200 feet, Macon and Swain counties, North Carolina, August 15, 1970, T. C. Barr, Jr., and T. C. Barr, III. Paratype in private collection of T. C. Barr, Jr.

**Material Seen.** The type series only, consisting of one male and one female.

**Discussion.** The type locality is on the crest of the Cowee Mountains, 21 miles north-northeast of the type locality of *A. coweeta* and 19 miles north-northwest of the Turtle Pond Creek (closest) locality where *A. neglecta* was collected. Sympatric and syntopic with *parki* at Leatherman Gap are *A. barbata*, *A. gigantea*, and *A. fovealis*. Most of these specimens were taken beneath large stones embedded in loose road metal, beneath the road immediately west of the gap.

#### ***Arianops truncata*, new species**

Figures 16A, 16B

**Etymology.** Latin *truncatus*, "cut off," referring to the truncate abdominal spine of the male.

**Diagnosis.** Resembling *neglecta* and *parki* in having Y-shaped facial carina, but differing from all species of group in broadly truncate, slightly emarginate spine on male third abdominal sternite.

**Description.** Length 2.9-3.1 mm. Head with-

out lateral vertexal carinae; occipital carina present; facial carina Y-shaped, prominent; vertexal foveae in small, more or less rounded, isolated depressions, not obviously connected by grooves to shallow anterior interantennal depression. Pronotum without median fovea; each side with small basal fovea, elongate basolateral fovea, and small fovea above procoxa. Antenna about as described for group, but VIII and IX longer than wide, X as long as wide, XI as long as three preceding segments combined. Male with third abdominal sternite bearing prominent, broadly truncate and slightly emarginate spine; mesotrochanter with small spine. Aedeagus 0.40 by 0.30 mm. (holotype); basal bulb rounded, somewhat flattened; apical shelf with major lobe on left side and shorter, smaller lobe on right side, margin with three long setae each side; no paramere; internal sac with prominent, digitiform copulatory piece protruding from left side, right lobe of sac membranous with a few minute spinules.

**Type Series.** Holotype male (the Field Museum of Natural History) and one female paratype, southeast side of Turkey Mountain along U.S. 76, 3 miles southeast of Dicks Creek Gap and 10 miles west of Clayton, Rabun County, Georgia, September 20, 1970, H. R. Steeves, Jr., and T. N. King, Jr. Paratype in private collection of T. C. Barr, Jr.

**Discussion.** In the facial carina and form of the aedeagus this species appears closest to *parki*, but the median abdominal spine of the male, the presence of a single copulatory piece, and the development of the apical shelf on the left side rather than the right all indicate genetic isolation. Although the few specimens available do not permit a discussion of the ranges of *parki* and *truncata*, it is pertinent to mention that their respective type localities are separated by the Little Tennessee River and the Nantahala Mountains, an area inhabited by *A. coweeta* and *A. nantahalae*. *Arianops truncata* is sympatric with *A. obliqua* (*henroti* group) at the type locality.

#### ***Arianops allatoona*, new species**

Figures 17A, 17B

**Etymology.** Named for the type locality, which is on the Allatoona Reservoir.

**Diagnosis.** Distinguished from other members

of *neglecta* group by proportionally wider pronotal base (0.85 as wide at base as maximum width), four basolateral foveae on each side of pronotum separated by extensions of basal microsculpture; male with spine on fourth abdominal sternite, no spine on mesotrochanter.

**Description.** Length 3.2 mm. (holotype). Head without lateral vertexal carinae; occipital carina very fine and beaded; vertexal foveae and circumambient sulcus as in *neglecta*; facial carina Y-shaped, interantennal and midfrontal ridges both carinate and forming sharp angle at juncture. Pronotum without median fovea; each side with small fovea at base, two separate basolateral foveae (not confluent), and small fovea above procoxa; basal band of transversely meshing microsculpture extending forward as finger-like ridges between foveae, this feature not found in other species of *neglecta* group; base width about 0.85 maximum width. Antenna approximately as described for group but segments almost submoniliform, III, IV, V, and VII subequal; also VI, IX, and X subequal but shorter than above segments; both IX and X slightly transverse, X with asymmetrical swelling below; XI as long as preceding three and one-half segments. Male with small, triangular median spine on fourth abdominal sternite, mesotrochanter with small spine. Aedeagus 0.37 by 0.26 mm. (holotype); basal capsule a little wider than long, somewhat flattened above; apical shelf short, lobed only on right but not skewed toward right, four setae on right side and one on left, two or three below; internal sac without tube or copulatory sclerite.

**Type Series.** Described on the unique male holotype (the American Museum of Natural History), Galts Landing on Allatoona Reservoir, elevation 1000 feet, 5 miles northeast of Acworth, Cherokee County, Georgia, June 24, 1965, T. C. Barr, Jr.

**Material Seen.** One male, the holotype.

**Discussion.** Although the absence of a median pronotal fovea and the form of the aedeagus strongly suggest that *allatoona* is correctly placed in the *neglecta* group, it is both morphologically and geographically the most aberrant species of the group. Near the southern end of the Unaka province at the terminus of the southern Appalachians, it represents the southernmost occurrence of a representative of *Arianops*. Galts Landing is

nearly 100 miles southwest of the Rabun Bald type locality at which *A. neglecta* is found.

The single specimen was obtained after several days of early summer rains, in thin woodland about 75 yards from the edge of the reservoir in a shallow, thinly wooded ravine under a small rock. About 30 anilline carabids were taken in association.

#### *cavernensis* group

**Diagnosis.** Size small to medium, 2.3-2.9 mm.; integuments rather pale, genital depressions in males not heavily sclerotized and blackened. Head without lateral vertexal carinae. Pronotum about 1.1-1.3 times longer than wide, usually without median fovea (variable in two species), without flanking spines, knobs, or ridges. Abdomen convex, 0.8 or more as deep as wide. Male with small, triangular, median spine on third or fourth abdominal sternite.

**Description.** Eye spine variable, ranging from fairly prominent and acute to very small, blunt tumulus; lateral vertexal carinae absent; interantennal ridge usually irregular and noncarinate, but distinctly and sharply V-shaped in two species. Pronotum 1.1-1.3 times longer than wide; without median fovea in most specimens, but minute fovea irregularly present in two species; each side with one, two, or three basolateral foveae, or these foveae completely absent. Antenna with segment I rather slender; II through VII obconic; VIII small, slender, and cylindrical; IX and X about as long as VII but one-third longer than VIII, both slightly swollen on ventral side; XI pedunculate at base, tapered at apex, as long as two and one-half to four preceding segments. Aedeagus 0.34-0.35 mm. long by 0.22-0.29 mm. wide; basal bulb moderately to strongly convex, usually a little wider than long; no parameres; apical shelf variously modified, corners reflexed in two species, entire shelf transversely doubled in another, setation sparse; internal sac with armature of multiple large spines in two species, minute spines on right apical lobe.

**Discussion.** The *cavernensis* group includes eight species, five of them known exclusively from caves and three from epigeal localities, under stones. Most of the species are rather rare, known from only one to three specimens, and

three of the cavernicolous species are known only from females. The cave species are probably trogllobites (obligatory cavernicoles), but, as all *Arianops* are eyeless, it is difficult to be certain of this. The cavernicoles may be more or less interstitial in habit, rarely venturing into large cavities penetrable by man, or rarely moving high enough in the soil so that they can be collected under stones. This occurrence in caves is such an unusual event (five of seven caves have yielded single specimens despite repeated searches) that it may be somewhat fortuitous. Evidence that at least some species of the group may be trogllobites, rather than wandering edaphobites, is the apparent restriction of *Arianops steevesi* to the interior of Horseshoe Cave, Alabama, and the occurrence of *A. extera* only under rocks outside the cave. The three epigeal species of the group (*kingi*, *extera*, and *sewaneae*) are more closely related to each other than to the cavernicoles, judging from the form of their aedeagi.

With the exception of *Arianops jeanneli*, from a cave in southwestern Virginia, all known members of the group are from central Tennessee and northern Alabama. The *cavernensis* group appears to me to be closer to the *neglecta* group than to other sections of the genus. In the *neglecta* group one finds lateral vertexal carinae obsolete, and most individuals lack a median pronotal fovea; males have a moderate, triangular spine on the third or fourth abdominal sternite and sometimes a minute spine on the mesotrochanter. These are characters shared in common with the *cavernensis* group and the closely similar *Arianops gigantea*.

Among the European Amauropsini the genus *Troglamaurops* Ganglbauer, a group of cavernicoles in the Balkan peninsula, is characterized by absence of ocular spines, absence of lateral vertexal carinae, and elongation of the appendages (Jeannel, 1948). Certainly the reduction of vertexal carinae is not necessarily associated with life in caves, because this character appears in several species that do not inhabit caves. Most members of the *cavernensis* group are rather slender and elongate whether they live in caves or not, and it is therefore difficult to attribute their elongate appendages solely to cave life. Reduction of pronotal foveae in the *cavernensis* group, which led Park (1951) to establish the subgenus

*Arispeleops* for the cave species, cannot be the direct result of cave life, either, because loss of the median fovea occurs elsewhere among non-cavernicole species of *Arianops*. The small, blunt, ocular tubercles of the cave species in this group (except *steevesi*) perhaps do represent an evolutionary parallelism between Balkan and North American cavernicole amauropsines. Even though the adaptive and/or developmental significance of the ocular spine is unknown in edaphobitic amauropsines, one can speculate that its adaptive significance may be altered in the cave environment.

#### *Arianops cavernensis* Park

*Arianops (Arispeleops) cavernensis* Park, 1951, p. 43 (type locality, "Salpetre Cave," Marshall County, Alabama [= Nyman's Cave = Gunter'sville Caverns]; type deposited in Alabama Museum of Natural History, Tuscaloosa); 1956, p. 86; 1960, p. 87. Nicholas, 1960, p. 152.

**Diagnosis.** Distinguished from other species of the group by the total absence of pronotal foveae.

**Description.** Length 2.3 mm. Head without lateral vertexal carinae; vertexal foveae reduced to pair of small pits, isolated from interantennal depression; face declivous and simple. Pronotum slightly longer than wide, without median, basal, or basolateral foveae. Antenna as described for group, segment XI as long as three preceding segments. Male unknown.

**Material Seen.** The unique female holotype.

**Discussion.** This small, slender species is characterized more by lack of distinguishing features than by diagnostic carinae or foveae. The single known specimen was collected by Walter B. Jones on June 18, 1938, in Nyman's Saltpeter Cave, Marshall County, Alabama. The cave has since been commercialized and is now known as Gunter'sville Caverns. The holotype was taken under a rock a short distance inside the cave (W. B. Jones, personal commun.).

#### *Arianops jeanneli* Park

*Arianops (Arispeleops) jeanneli* Park, 1956, p. 85 (type locality, Gilley's Cave, Lee County, Virginia; type deposited in Muséum National d'Histoire Naturelle, Paris); 1960, p. 87.

Nicholas, 1960, p. 152. Holsinger, 1963, p. 34.

**Diagnosis.** Distinguished from other species of group by having only one pair of minute, basolateral foveae; median and procoxal foveae absent.

**Description.** Length 2.5 mm. (unique holotype). Head without lateral vertexal or occipital carinae; vertexal foveae small and isolated; interantennal ridge ill-defined, face declivous. Pronotum slightly longer than wide, no median fovea, but site of fovea longitudinally elevated before base; one basolateral fovea each side. Antenna with all segments longer than wide, VIII smallest, IX and X larger, XI as long as preceding two and one-half segments. Male unknown.

**Material Seen.** I have not seen the unique female type.

**Discussion.** The description of this species places it in the *cavernensis* group as defined in the present paper, but it is the only species of the group known east of the Allegheny plateau. The single female was collected by J. Manson Valentine in August, 1931 (Park, 1956), in Gilleys Cave, the entrance of which lies immediately south of Pennington Gap, Lee County, Virginia.

*Arianops stygica* Park

Figures 18A, 18B

*Arianops (Arispeleops) stygica* Park, 1960, p. 67 (type locality, Cumberland Caverns, Warren County, Tennessee; type in Field Museum of Natural History). Nicholas, 1960, p. 152.

**Diagnosis.** Distinguished from all other species of group except *pecki* by eye tumulus, which is minute and blunt; from *pecki*, by reduced interantennal ridge, small and isolated vertexal foveae, and three basolateral foveae each side of pronotum.

**Description.** Length 2.8-2.9 mm. Head without lateral vertexal carinae; occipital carina short, prominent; vertexal foveae in small, rounded depressions not connected to anterior depression by grooves; interantennal area with low, lunate ridge, front simply declivous; eye spine a minute tumulus. Pronotum one and one-fourth times longer than wide, without median fovea; each side with one basal and two basolateral foveae. Antenna with segments VIII and IX longer than wide, X almost as wide as long, XI as long as

three preceding segments; VIII small, IX and X larger, IX swollen asymmetrically beneath, X feebly so. Male with third abdominal sternite bearing stout median spine; mesotrochanter with minute spine. Aedeagus 0.34 by 0.25 mm. (holotype); basal capsule subparallel, about as wide as long, strongly convex, right wall higher than left; apical shelf bilobed, deeply but very narrowly cleft near middle of hind margin, with blunt, oblique spine on ventral side at left corner, surface scabro-tuberculate; without obvious parameres; internal sac folded into dorsal longitudinal ribs, with single spine protruding from left hind margin and cluster of about eight stout, recurved spines from right hind margin.

**Material Seen.** Two males and one female, including the holotype.

**Discussion.** The holotype was taken June 23, 1957, by Leslie Hubricht and me from a damp, silty ledge near the nest of a cave rat [*Neotoma floridana* (Ord)], inside a small cave 50 yards southwest of the Historic Entrance to Cumberland Caverns, Warren County, Tennessee. The cave is locally known as Little Higginbotham Cave. I collected one male and one female in the same cave, about 20 feet from the spot where the holotype was found, under rocks partially embedded in the silt floor, July 8, 1972.

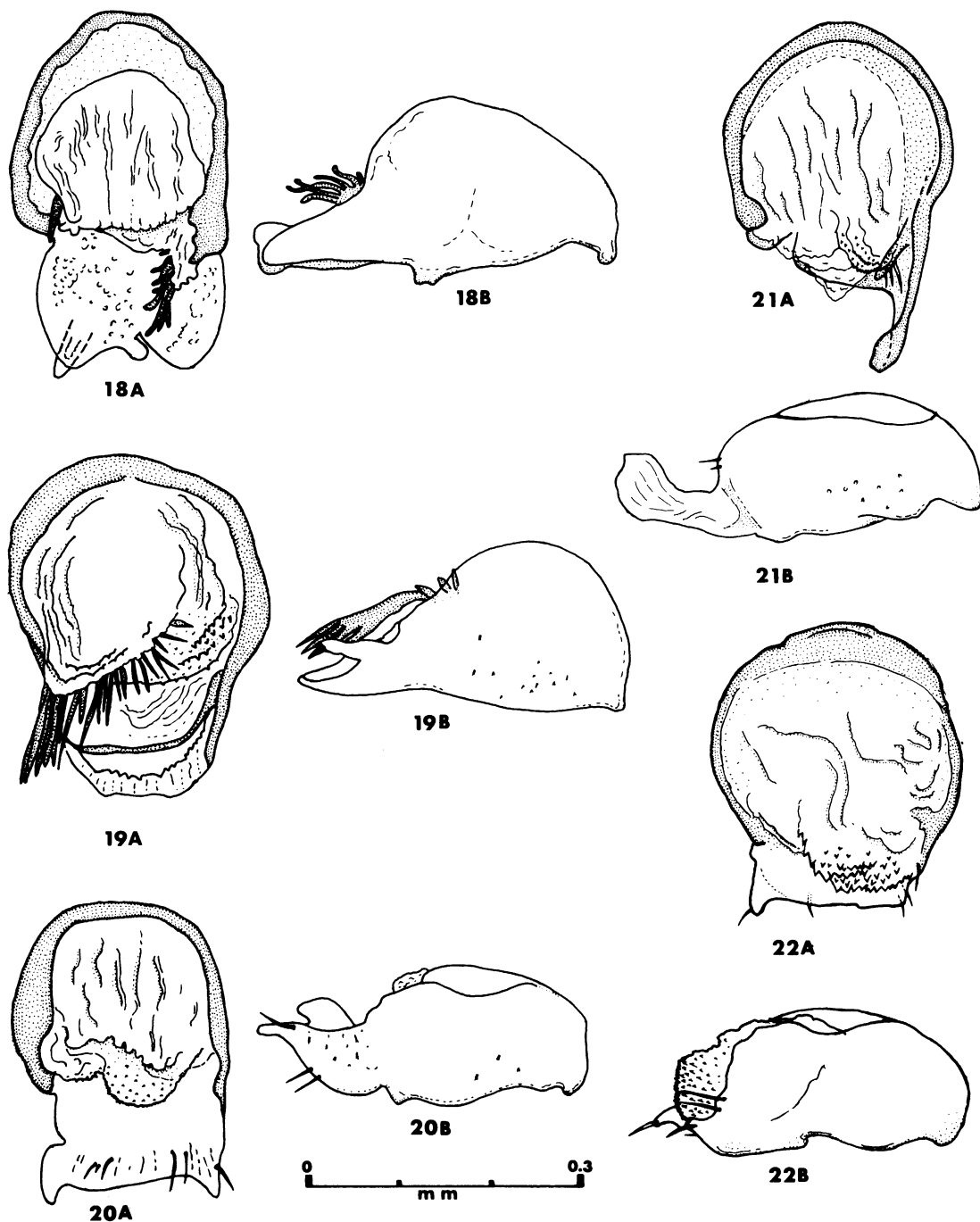
Geographically and morphologically *Arianops stygica* is closest to *A. pecki*. Its aedeagus is more like that of *A. steevesi*, a cavernicole, than the aedeagi of the three epigeal species of the group (*extera*, *sewanee*, and *kingi*). Certainly *stygica* is not a common cavernicole in the extensive Cumberland Caverns system, where I have collected cave beetles from time to time for nearly 20 years.

Park's (1960) total length measurement of 2.53 mm. for the holotype is a little short; it is 2.8 mm. long. The July, 1972, specimens measure 2.8 mm. and 2.9 mm., respectively.

*Arianops pecki*, new species

**Etymology.** Named in honor of Dr. Stewart B. Peck, discoverer of the species.

**Diagnosis.** Distinguished from all species of group except *stygica* by minute, blunt eye tumulus; from *stygica*, by V-shaped interantennal ridge, deep vertexal foveae connected to interantennal depression by grooves, and by having



FIGS. 18A-22B. Aedeagi of *Arianops*. A. Dorsal view. B. Right lateral view. 18A, *B. A. stygica* Park, Little Higginbotham Cave, Tennessee. 19A, *B. A. steevesi*, new species, Horseshoe Cave, Alabama. 20A, *B. A. extera*, new species, Horseshoe Cave Sink, Alabama. 21A, *B. A. sewanee*, new species, Sewanee, Tennessee. 22A, *B. A. kingi*, new species, Blount Mountain, Alabama.

only two pairs of basolateral foveae on pronotum.

**Description.** Length 2.7 mm. Head without lateral vertexal carinae; very short, fine occipital carina present; vertexal foveae prominent, deep, connected by distinct grooves to anterior head depression; interantennal ridge sharply defined and V-shaped but scarcely carinate, interrupted at middle, midfrontal ridge obsolescent; eye spine a minute tumulus. Pronotum with (one specimen) or without (two specimens) small, very shallow, median fovea in basal fourth; each side without basal or procoxal fovea but with two basolateral foveae indistinctly connected by fine groove. Antenna as described for group but rather slender. Male unknown.

**Type Series.** Holotype female (the Field Museum of Natural History), Henpeck Mill Cave, 1.7 miles northeast of Woodbury, Cannon County, Tennessee, August 9, 1967, S. B. Peck and A. Fiske. Two paratype females, one each from John Hollins Cave, 4 miles north of Henpeck Mill Cave, 1.5 miles northeast of Pleasant Ridge Church and School, Cannon County, Tennessee, August 9, 1967, S. B. Peck and A. Fiske, and Doolittle Cave, 1.6 miles northwest of Henpeck Mill Cave and 1.8 miles north of Woodbury on Doolittle Branch, Cannon County, Tennessee, May 24, 1972, S. and J. Peck. Paratypes in private collection of T. C. Barr, Jr.

**Material Seen.** The type series only, consisting of three females.

**Discussion.** All specimens are the same length and are closely similar except that the paratype from John Hollins Cave bears a small but distinct median fovea at the basal fourth of the pronotal disc. In the holotype and other paratype the site of this fovea is indicated by a minute depression, barely discernible at high magnification.

Henpeck Mill Cave consists of a low, wide, stream passage entered by a narrow, rocky crawlway (Barr, 1961, p. 100). The holotype was collected from beneath a stone on damp silt immediately inside the larger portion of the cave, about 75 feet from the entrance (S. B. Peck, *in litt.*). On three subsequent visits to the cave I found troglobitic species of *Pseudanophthalmus* (Carabidae) and *Ptomaphagus* (Leiodidae) relatively abundant in this area, but no pselaphids were encountered.

*Arianops pecki* shares with *A. stygica* a pair of minute tubercles at the site of the eyes instead of the usually more prominent ocular spines. The cluster of three caves from which *pecki* is known is about 23 miles northwest of the type locality of *stygica*, and is in a distinctly different cave region at the base of the Eastern Highland Rim.

#### ***Arianops steevesi*, new species**

Figures 19A, 19B

**Etymology.** Patronymic honoring Mr. Harrison R. Steeves, Jr., in recognition of his substantial contributions to the study of *Arianops*.

**Diagnosis.** Pronotum with three pairs of basolateral foveae as in *stygica* and *extera*; differing from *stygica* in more conspicuous, sharp eye spines and broad, shallow vertexal foveae; differing from *extera* in having marginal carina of first abdominal tergite subparallel to margin and spine on third abdominal sternite of male.

**Description.** Length 2.7-2.9 mm. Head without lateral vertexal or occipital carinae; vertexal foveae prominent, in broad, shallow depressions not distinctly connected to interantennal depression by grooves; interantennal ridge irregular and indistinct, face essentially declivous, midfrontal ridge obsolescent. Pronotum longer than wide, without median fovea but with median longitudinal ridgelike tumescence in basal fourth; each side with three basolateral foveae, outer two indistinctly connected by groove. Antenna about as described for group but slightly more robust and more heavily pubescent than in other species. Male with small, triangular spine on third abdominal sternite; mesotrochanter with minute spine. Aedeagus 0.35 by 0.29 mm. (paratype); basal capsule rounded and strongly convex, right rim higher than left; apical shelf with corners obliquely truncate and not reflexed, but with inner, apically denticulate shelf above it; without distinct parameres; internal sac with conspicuous, oblique fringe of large spines protruding from left two-thirds of apical margin, also armed with several rows of apiculate spines at right apex.

**Type Series.** Holotype male (the Field Museum of Natural History) and two female paratypes, Horseshoe Cave, 7.5 miles north of Princeton, Jackson County, Alabama, June 30, 1967, S. B. Peck and A. Fiske. Two male and five fe-



male paratypes, same locality, August 22, 1971, H. R. Steeves, Jr., and T. N. King, Jr.

**Material Seen.** The type series, consisting of three males and seven females, and one additional female not made a paratype.

**Discussion.** *A. steevesi* is the only species of the *cavernensis* group which is known from more than three specimens. It occurs under rocks, exclusively in the dark zone of Horseshoe Cave, although a noncavernicolous species, *A. extera*, has been taken outside under rocks in the sink surrounding the cave entrance.

A single large female (3.0 mm.) closely matching the description of *A. steevesi* as given above was collected in Williams Saltpeter Cave, 2 miles east of Hollytree, Jackson County, Alabama, August 26, 1967, by S. B. Peck and A. Fiske. I have assigned this specimen to *steevesi* but have not made it a paratype.

#### **Arianops extera, new species**

Figures 20A, 20B

**Etymology.** Latin *exterus*, external, outside, referring to the epigeal habitat of this species.

**Diagnosis.** Differing from all other species in group in having strongly oblique margins of first abdominal tergite, exposing sides of tergite when viewed from above; eye spines sharp, no occipital carina, pronotum with three pairs of basolateral foveae.

**Description.** Length 2.7-2.8 mm. Head without lateral vertexal or occipital carinae; vertexal foveae moderate, connected to shallow interantennal depression by shallow, rather narrow grooves; interantennal ridge forming low, V-shaped facial carina connected to faint mid-frontal carina. Pronotum longer than wide, without median fovea; each side with one very small parbasal and two distinct basolateral foveae, rough microsculpture of base invading space between basolaterals. Antenna with segments II through VII obconic, progressively shorter; VIII rounded, small; IX slightly longer than wide, X as long as wide, both IX and X slightly swollen on ventral side; XI as long as preceding three segments together. Abdomen a little depressed, marginal carina of first tergite conspicuously oblique, directly medially toward base at anterior end, sides of segment visible outside margination

when viewed from above (this feature not seen in any other described species of genus). Male with small tubercle in middle of fourth abdominal sternite; mesotrochanter with small spine. Aedeagus 0.33 by 0.26 mm. (holotype); basal capsule a little transverse and depressed, right rim higher than left; apical shelf with corners sharply reflexed, winglike, one seta at right corner and two pairs of setae beneath; without distinct paramere, tube, or copulatory piece; internal sac armed with minute spines on posterior lobe.

**Type Series.** Holotype male (the Field Museum of Natural History), outside entrance of Horseshoe Cave, in sink, Fannin Cove, 7.5 miles north of Princeton, Jackson County, Alabama, October 2, 1971, H. R. Steeves, Jr., and T. N. King, Jr. Two female paratypes, same data.

**Material Seen.** The type series only, consisting of one male and two females.

**Discussion.** *Arianops extera* was taken only under stones outside Horseshoe Cave, the interior of which is the type locality for *A. steevesi*. The cave opens in a huge, moist, wooded sink; the single male and one of the females were taken *in copulo* in the sink itself, and an additional female was taken under a rock above the sink (H. R. Steeves, Jr., *in litt.*). Whether the apparent habitat restrictions are valid for *steevesi* and *extera* can be ascertained only by further collections both inside and outside the cave. Although the two species are similar enough to be included within the same species group, they differ in a number of superficial characters and have decidedly different aedeagi.

#### **Arianops sewanee, new species**

Figures 21A, 21B

**Etymology.** Named for the type locality, noun in apposition.

**Diagnosis.** Resembles *extera* and *kingi* in having three pairs of basolateral foveae on pronotum, sharp eye spine, and no occipital carina; differs from *extera* in normal (i.e. not strongly oblique) margins of first abdominal tergite and Y-shaped, not carinate, facial ridge (V-shaped and carinate in *extera*); differs from *kingi* in shape of abdomen and antennal characters.

**Description.** Length 2.7 mm. Head without lateral or occipital carinae; vertexal foveae in

small, rounded depressions at bases of shallow grooves that are confluent with interantennal depression; facial ridge Y-shaped but low and not carinate; eye spine small but sharp and rather conspicuous. Pronotum 1/10 longer than wide; no median fovea; each side with one small basal and two basolateral foveae, anterior one larger; transverse microsculpture of base extending onto sides to margins of basolateral foveae. Antenna with segments II through VII obconic, VIII small and rounded; IX and X proportionally thicker than in *kingi*; XI as long as preceding three segments combined. Abdomen sides with normal curvature (unlike *kingi*), marginal carina of first tergite not oblique, sides of segment barely visible outside margination when viewed from above; longitudinal basal carina obsolete, inner lateral carina present. Male with blunt median projection on posterior margin of third abdominal sternite and median crenelated margin on fourth sternite; mesotrochanter without spine. Aedeagus 0.40 by 0.26 mm. (holotype); basal capsule rounded and a little depressed, right wall produced into conspicuous, spatulate flange reflexed upward and inward at apex; apical shelf very short, deeply notched on left side, broadly expanded and continuous with right flange on right side; internal sac with a few denticles on right apical lobe but without tube or special sclerites.

**Type Series.** Holotype male (the Field Museum of Natural History) and one female paratype, ravine at the north edge of Sewanee, 1000 feet west of Greens View, immediately below the Alto Road, elevation 1800 feet, Franklin County, Tennessee, June 11, 1972, H. R. Steeves, Jr., and T. N. King, Jr. Paratype in private collection of H. R. Steeves, Jr.

**Material Seen.** The type series only, consisting of one male and one female.

**Discussion.** *Arianops sewanee* is presumably related most closely to *A. kingi* and *A. extera*, judging from aedeagal similarities. These three species form an "epigeal subgroup" of the *cavernensis* group. It is not possible to state whether the cavernicolous species are all more closely related to each other than to the epigeal species, because the aedeagus has been examined in only two of the five cavernicolous species (*steevesi* and *stygica*).

The strongly oblique margins on the first tergite of the abdomen in *extera* and the subparallel sides of the same tergite in *kingi* serve to differentiate those two species from *sewanee*, in which the tergite is comparatively normal in shape, with an unusually well developed, subparallel, internal stria. The two specimens of *sewanee* were collected from beneath rocks in a shallow ravine near the top of the Cumberland plateau escarpment at the edge of the town of Sewanee.

***Arianops kingi*, new species**  
Figures 22A, 22B

**Etymology.** Patronymic honoring the discoverer, Mr. T. N. King, Jr.

**Diagnosis.** Differing from other species of group in shape of abdomen, subparallel for length of first tergite then rather abruptly convergent; segment XI of antenna unusually long, as long as preceding four segments; three foveae on each side of pronotum near base, feeble median fovea present or not.

**Description.** Length 2.5-2.7 mm. Head without lateral or occipital carinae; vertexal foveae in small, rounded depressions at bases of narrow, shallow grooves barely confluent with interantennal depression; facial ridge Y-shaped but low and not carinate; eye spine minute but sharp and conspicuous. Pronotum 1/10 longer than wide; no median fovea (two specimens) or very shallow, minute median fovea present (one specimen); each side with minute, barely discernible basal fovea, single small basolateral fovea, and rather prominent fovea above procoxa; basal transverse microsculpture extended forward onto sides to margin of basolateral fovea. Antenna with segments II to VII obconic, progressively shorter, VIII small and rounded; IX and X rounded and subequal, asymmetrically and feebly swollen beneath, IX more so than X; XI very large relative to preceding segments and as long as preceding four segments combined. Abdomen with sides subparallel, rather than curved as in all other species of genus, for length of first tergite, then strongly and abruptly convergent to apex; longitudinal basal carinae and inner submarginal stria of first tergite obsolete. Male without spine or tubercle at middle of third or fourth abdominal sternite but with crenelated area at

middle of fifth sternite; mesotrochanter without spine. Aedeagus 0.40 mm. long by 0.26 mm. wide (paratype), rounded and a little depressed; apical lobes of internal sac armed with numerous small denticles but tube or special sclerites absent; apical shelf short, corners reflexed, left corner slightly produced, seta at each corner and two setae on apical margin of right capsule wall.

*Type series.* Male holotype (the Field Museum of Natural History), Tidwell Hollow Nature Trail, about 2.5 miles southwest of Oneonta on the south side of the crest of Blount Mountain, elevation about 1200 feet, St. Clair County, Alabama, March 26, 1972, H. R. Steeves, Jr., and T. N. King, Jr. Two paratypes from same locality, a male on July 7, 1972, H. R. Steeves, Jr., and T. N. King, Jr., and a female, October 10, 1970, T. N. King, Jr.

*Discussion.* The type locality of this species is 25 miles south of that of *Arianops cavernensis*, the only other known species of the genus in the immediate vicinity. The peculiar shape of the abdomen of *A. kingi* gives it the superficial appearance of one of the European amauiropsines. The form of the aedeagus suggests that its closest known relatives are *A. extera* and *A. sewanee*. The male paratype, taken in early July, is a late teneral.

#### *gigantea* group

*Diagnosis.* Size very large for genus, 3.6-4.2 mm.; integuments normally dark, genital depression in males heavily sclerotized and blackened. Head without lateral vertexal carinae. Pronotum as long as wide, either without or irregularly with small, shallow, median fovea, sides without spines, ridges, or knobs. Abdomen convex, 0.8 as deep as wide. Male with small spine on third abdominal sternite.

*Description.* Eye spine prominent and acute; lateral vertexal carinae absent; interantennal ridge carinate, at least at sides. Pronotum without median fovea or irregularly with small, shallow, fovea; no spines, ridges, or knobs on pronotal disc; each side with one small paramedian basal fovea, one elongate and oblique basolateral fovea, and shallow, vestigial procoxal fovea. Antenna with segments II through VIII obconic, longer than wide, progressively shorter, VIII

smallest; IX and X a little longer than VIII, subequal in length, IX as wide as long, X slightly transverse, both swollen asymmetrically on lower side; XI as long as preceding three segments. Aedeagus 0.64 by 0.35 mm., larger than that of any other species of genus; basal capsule convex, longer than wide, without obvious paramere; apical shelf with oblique flanges beneath; internal sac with long, coiled tube, minutely spined posterior lobe, and thinly sclerotized left apical margin.

*Discussion.* This group contains a single large species, *A. gigantea*, known from one locality in the Cowee Mountains and another on Pisgah Ledge in southwestern North Carolina. The oblique flanges beneath the apical shelf of the aedeagus are unknown elsewhere in the genus, but the characters of obsolete lateral vertexal carinae, obsolescent median fovea of the pronotum, small secondary sex spine in the male, and also geographic proximity all suggest an affinity with the species of the *neglecta* group. *Arianops gigantea* is readily separated from species of the *neglecta* group on size alone, and the aedeagus is much larger and of a very different character from the aedeagi of species in the *neglecta* group.

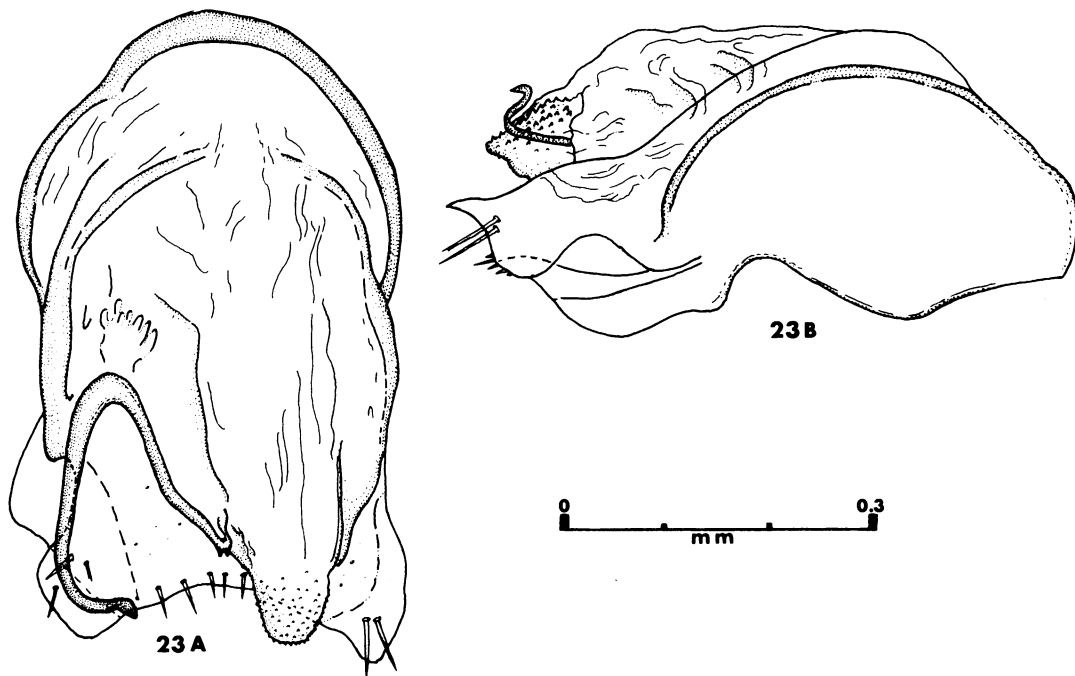
#### *Arianops gigantea*, new species

Figures 23A, 23B

*Etymology.* Latin *giganteus*, gigantic, referring to the unusually large size of this species.

*Diagnosis.* The group is monobasic at the present time.

*Description.* Length 3.6-4.2 mm. Head without lateral vertexal carinae; fine occipital carina present; vertexal foveae small, perforate, in broad, shallow depressions vaguely continuous by shallow grooves with rather deep interantennal depression; interantennal ridge carinate at sides, usually interrupted at middle, midfrontal ridge obsolescent. Pronotum with or without small, inconspicuous median fovea, flanks around fovea simply declivous; each side with small basal fovea, one rather shallow, elongate, oblique, basolateral fovea, and shallow, almost vestigial fovea above procoxa. Antenna as described for group. Male with broadly triangular median spine on third abdominal sternite; mesotrochanter with minute spine. Aedeagus 0.64 by 0.35 mm. (para-



FIGS. 23A, B. Aedeagus of *Arianops gigantea*, new species, Leatherman Gap, North Carolina. A. Dorsal view. B. Right lateral view.

type); basal capsule longer than wide, convex, dorsal aperture rather small; without distinct paramere; apical shelf broadly and shallowly emarginate, supported below by oblique longitudinal flange each side, corners produced, blunt, slightly reflexed, two setae at right corner, three at left, and five at middle of apical margin; internal sac with minutely spiny posterior lobe, tube conspicuous and coiled, protruding from extreme left margin of sac and adjacent to thinly sclerotized and apically toothed left margin of sac; no distinct copulatory piece.

**Type Series.** Holotype male (the American Museum of Natural History), Leatherman Gap, on Cowee Bald Road, elevation 4000 feet, Macon and Swain counties, North Carolina, August 18, 1969, T. C. Barr, Jr. One male and one female paratypes, same locality, August 15, 1970, T. C. Barr, Jr.

**Material Seen.** Three males and one female, the holotype, two paratypes, and one specimen not designated a paratype.

**Discussion.** The very large size of this species immediately sets it apart from other species of

the genus, with the possible exceptions of *laminata* and *barbata*. At present *laminata* is known only from eastern Buncombe County and is thus apparently allopatric. The Leatherman Gap locality, however, is one at which three other species of *Arianops* have been found other than *gigantea*: *fovealis* (*henroti* group), *parki* (*neglecta* group), and *barbata* (*alticola* group). *Arianops barbata* is a slender species, with the pronotum slightly longer than wide, a conspicuous median fovea on the pronotum, and a long, finely truncate and narrowly emarginate spine on the fourth abdominal sternite of males. The large aedeagus in *gigantea* is unique in size and form; the tube is unusually long and conspicuous, and the oblique, strutlike longitudinal flanges beneath the apical shelf are not present in any other known species of *Arianops*.

A single male *gigantea* was collected along the Buck Spring Trail, elevation 4500 feet, near Pisgah Lodge, Transylvania County, North Carolina, approximately 35 miles east of the type locality. Leatherman Gap is in the Cowee Mountains and Buck Spring is on the south side of Pisgah Ledge,

the northeast arm of the Great Balsam Mountains. The valley of the Tuckasee River lies between. The aedeagus of the Buck Spring specimen is virtually identical with that of the holotype *gigantea*, and I am convinced that these two males are conspecific. Subspecific designation, if any, of the Pisgah Ledge population must await discovery and study of additional specimens. The geographic range of *gigantea* is the most extensive known for any species of *Arianops*, but the species has not yet been taken at localities intermediate between the two extremes.

#### *henroti* group

**Diagnosis.** Size small to medium, 2.2-2.9 mm.; integuments normally pale, genital depression in males usually not heavily sclerotized and blackened, but seventh abdominal sternite often darker. Head (usually) with or without (one species) lateral vertexal carinae. Pronotum slightly longer (0.04-0.14) than wide, with or without small median fovea not flanked by spines or knobs. Abdomen depressed, only 0.6 as deep as wide. Male with small spine on third or fourth abdominal sternite.

**Description.** Eye spine small and acute; lateral vertexal carinae variously developed, from very long to absent; face declivous or with V- or Y-shaped facial ridge. Pronotum with small, shallow median fovea in some species but completely lacking this fovea in other species, disc without bilateral spines or knobs; each side with small paramedian basal fovea, two basolateral foveae, and in some species fourth fovea above procoxa. Antenna with segments II through VI submoniliform but slightly longer than wide, VII and VIII as long as wide, IX and X transverse and swollen beneath, XI a little longer than preceding three segments. Aedeagus variable in pattern, 0.26-0.47 mm. long by 0.17-0.23 mm. wide; one species with free left paramere, three species with right or left paramere apparently represented by long spine fused to basal capsule; four species with biramous copulatory piece.

**Discussion.** The six species included in this group are geographically distributed in the Snowbird, Cowee, and Nantahala mountains of southwestern North Carolina and the Blue Ridge of southwestern North Carolina and adjacent

Georgia. Superficially they are all quite similar in appearance, characterized by small size, slender, subparallel form, depressed abdomen, and pale color. Three species (*henroti*, *thornei*, *norithe*) have a similar aedeagal pattern and are consequently thought to be relatively recent descendants of a common ancestor. *Arianops fovealis*, although known only from females, is possibly a member of this subgroup. Two other species (*teyahalee*, *obliqua*) occur at the western and southern peripheries of the group range, respectively, and each has a distinctive and rather different aedeagal pattern of its own.

Members of the *henroti* group are relatively rare in comparison with other species groups inhabiting the southern Appalachians, yet four of the six species had already been collected prior to my intensive field work in 1969 and 1970. Henri Henrot collected the holotype of *henroti* in 1946, Harrison Steeves took a pair of *obliqua* in 1965, and I took one each *norithe* and *teyahalee* in 1960. A possible explanation for this apparent paradox of rarity coupled with early discovery may be that the normal habitat of species of the *henroti* group is the superficial layer of wet moss or humus, so that they are more readily collected in siftings or berlesates than other species and less frequently under deeply embedded stones.

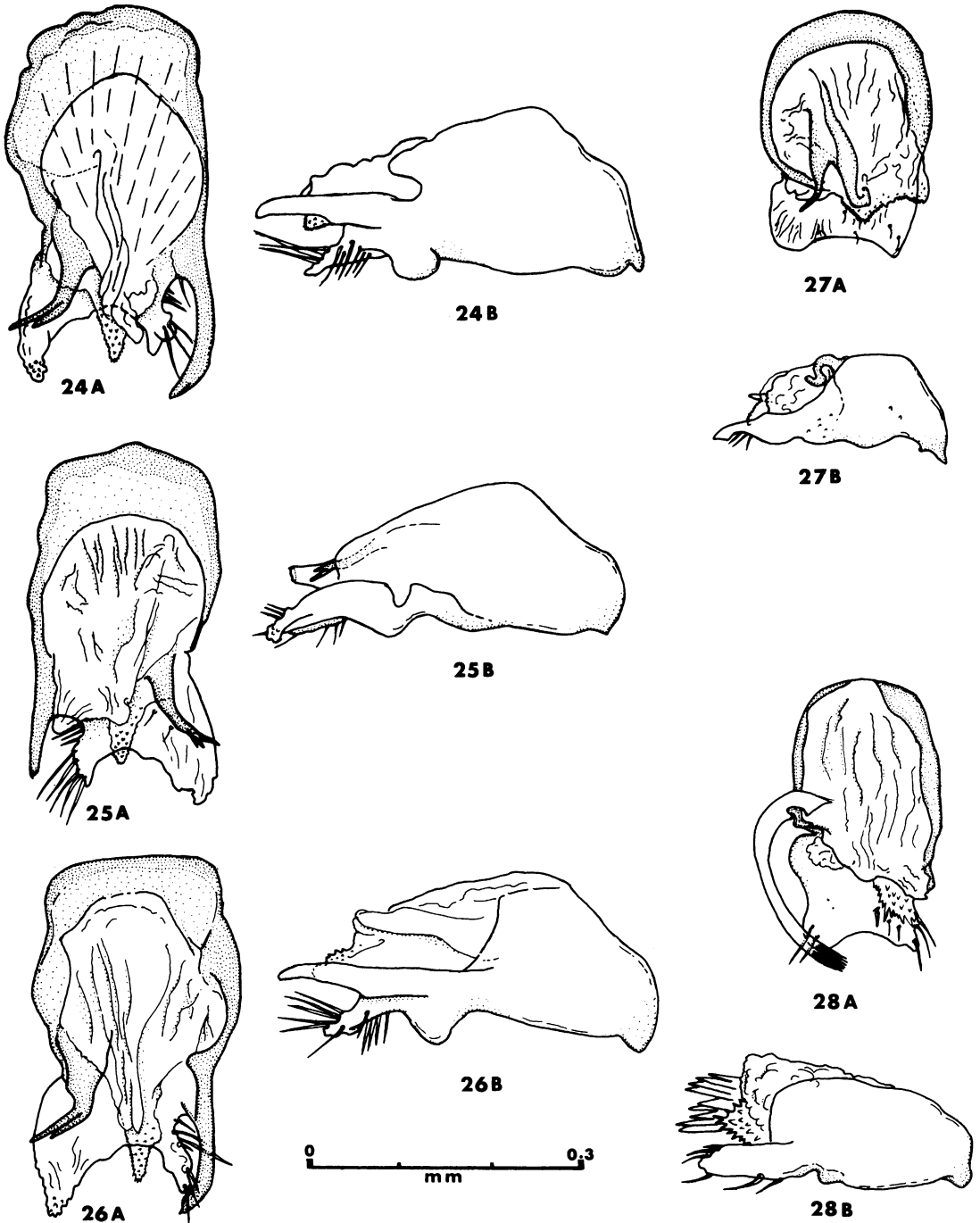
#### *Arianops henroti* Park

Figures 24A, 24B

*Arianops henroti* Park, 1956, p. 84 (type locality, Rabun Bald, Rabun County, Georgia; type deposited in Muséum National d'Histoire Naturelle, Paris).

**Diagnosis.** Distinguished from other species of group by presence of both lateral and occipital head carinae, former more strongly developed but scarcely attaining level of vertexal foveae; no median fovea on pronotum; long, spinelike right paramere fused to basal capsule of aedeagus.

**Description.** Length 2.5-2.6 mm. Head with lateral vertexal carinae extending to level of vertexal foveae but not beyond; occipital carina fine, beaded; vertexal foveae small, perforate, in shallow depressions extending obliquely forward where they become convergent, rather deep, sharply separated from antennal tubercles; inter-



FIGS. 24A-28B. Aedeagi of *Arianops*. A. Dorsal view. B. Right lateral view. 24A, B. *A. henroti* Park, Rabun Bald, Georgia. 25A, B. *A. thornei*, new species, Coweeta Hydrologic Laboratory, North Carolina. 26A, B. *A. norithe*, new species, Cheoah Bald, North Carolina. 27A, B. *A. obliqua*, new species, Unicoi Gap, Georgia. 28A, B. *A. teyahalee*, new species, Teyahalee Bald, North Carolina.

antennal ridge V-shaped but not sharply carinate, midfrontal ridge indistinct. Pronotum without median fovea, briefly elevated in midline near base; each side with basal fovea, two distinct basolateral foveae, and small procoxal fovea. Antenna as described for group. Male with small, sharp, median spine on fourth abdominal sternite and small median depression on fifth sternite; mesotrochanter with small spine. Aedeagus 0.45 by 0.23 mm. (topotype); basal capsule longer than wide, strongly convex, dorsal aperture comparatively small; right paramere a long spine fused to basal capsule; apical shelf deeply emarginate, almost bifurcate, left lobe with several knobs, right with dorsal rounded and ventral attenuate processes and bearing six long setae; internal sac with lower spiny lobe and coiled, tubelike portion; copulatory piece biramous, rami rather abruptly angled to left at their bases.

**Material Seen.** Two male topotypes; I have not seen the holotype.

**Discussion.** *Arianops henroti* is the smaller and less common of two syntopic species of *Arianops* occurring at Rabun Bald. Although Henrot found the holotype by sifting litter near the summit (Park, 1956), my series was taken about 0.35 mile southwest of Beegum Gap, on the west slope of Rabun Bald, at an elevation of approximately 3900 feet. The locality is immediately below an old road in a wooded ravine, whose steep slopes are covered with large stones beneath which two male *henroti* were captured. *Arianops neglecta* is a larger, more abundant, and apparently more widely distributed species that is sympatric and syntopic with *henroti*; it is readily distinguished from *henroti* by larger size, deeper abdomen, and the absence of lateral vertexal carinae.

The median antebasal "fovea" of the pronotum, which Park (1956) mentioned, is so vestigial that I have characterized *henroti* in the key as not having a fovea, although this feature may be irregular and possibly better developed in the holotype than in my two specimens. The presence of a fovea was emphasized by Park because he believed its absence was diagnostic of subgenus *Arispeleops*; elsewhere in the present paper I have shown this supposition to be untenable. Park also compared *henroti* with *amplyoponica* and *plectrops*, the only other noncavernicolous

species known at the time of his description; *henroti* in fact has close affinities not with the *amplyoponica* group but with the five species described below.

***Arianops thornei*, new species**  
Figures 25A, 25B

**Etymology.** Anagram of *henroti*.

**Diagnosis.** Similar to *henroti* but differing in shorter lateral vertexal carinae, absence of occipital and interantennal carinae, no median elevation near base of pronotum, and aedeagus a mirror image of that of *henroti*, long apical spine on left side instead of right.

**Description.** Length 2.4-2.6 mm. Head with lateral vertexal carinae short, not attaining level of vertexal foveae; occipital carina absent, replaced by shallow, narrow groove between foveae; foveae and circumambient sulcus as in *henroti*; interantennal and midfrontal ridges indistinct, face more or less declivous. Pronotum without median fovea on median longitudinal elevation near base; each side with basal, two basolateral, and procoxal foveae, basolaterals not so sharply distinct as in *henroti*. Antenna as in *henroti*. Male with small, sharp, median spine on fourth abdominal sternite and small median depression on fifth sternite; mesotrochanter with small spine. Aedeagus 0.40 by 0.22 mm. (paratype); closely similar to that of *henroti*, but reversed from right to left, left paramere a long spine fused to basal capsule, copulatory sclerite on right side, with three rami.

**Type Series.** Holotype male (the American Museum of Natural History) and four paratypes, Coweeta Hydrologic Laboratory, west side of Big Butt in upper Bearpen Creek basin, elevation 4800 feet, Macon County, North Carolina, August 17, 1969, T. C. Barr, Jr.

**Material Seen.** The type series only, consisting of four males and one female.

**Discussion.** The aedeagus of *thornei* is a mirror image of the pattern seen in *henroti* and *norithe*, and the long spine, apparently a paramere, is fused to the basal capsule on the left side instead of the right. Here in a single species group is the same reversal of aedeagal form to which Jeannel (1948) assigned generic significance in the diagnosis of his genus *Amauropidius*. In

*Arianops thornei* the form of the aedeagus and other, superficial characters are so close to those of *henroti* and *norithe* that there can be no question of generic separation, consequently the occurrence of aedeagal inversion in this species suggests that the phenomenon in and of itself is not necessarily of fundamental diagnostic or phylogenetic significance.

*Arianops thornei* was found at the type locality of *A. coweeta*, a larger species belonging to the *neglecta* group and having a more convex abdomen and no lateral vertexal carinae. About four specimens of *coweeta* to every one of *thornei* were found at this locality by turning large stones on a wooded slope near a spring.

#### ***Arianops norithe*, new species**

Figures 26A, 26B

*Etymology.* Anagram of *henroti*.

*Diagnosis.* Similar to *fovealis* and *obliqua* in presence of small median pronotal fovea, differing in short lateral vertexal carinae and declivous face; aedeagus closely similar to that of *henroti*.

*Description.* Length 2.9 mm. (holotype). Head with lateral vertexal carinae short, not attaining level of vertexal foveae; occipital carina fine and beaded; foveae and circumambient sulcus as in *henroti*; interantennal and midfrontal ridges indistinct, face more or less declivous. Pronotum with small, distinct, median fovea in basal fourth; each side with small basal, two basolateral, and indistinct procoxal foveae. Antenna as in *henroti*. Male with small median spine on fourth abdominal sternite and small spine on mesotrochanter. Aedeagus 0.46 by 0.23 mm. (holotype), closely similar to that of *henroti*, right corner of apical shelf more produced and bearing more setae.

*Type Series.* Holotype male (the American Museum of Natural History), summit of Cheoah Bald, elevation 5000 feet, Graham County, North Carolina, July 8, 1960, T. C. Barr, Jr., and M. C. Bowling.

*Material Seen.* The unique male holotype.

*Discussion.* *Arianops norithe* is a typical member of the *henroti* group, almost identical with *henroti* except for the median fovea on the pronotum, the shorter lateral head carinae, and the less distinct facial ridges. Although it may

eventually be possible to treat *henroti*, *thornei*, and *norithe* as geographic races of a single polytypic species, a number of specimens from several geographically intermediate localities should first be available before a more accurate understanding of these forms can be worked out.

The holotype was collected from beneath a thin moss carpet on a bank beneath *Kalmia latifolia* bushes, along the trail at the summit of the mountain. Cheoah Bald is the highest peak in the Cheoah Mountains, which occupy a somewhat isolated position between the Great Smoky and Snowbird mountains, from which they are separated by the deep valleys of the Little Tennessee, Cheoah, and Nantahala rivers.

#### ***Arianops fovealis*, new species**

*Etymology.* Latin adjective referring to the presence of a median fovea on the pronotal disc.

*Diagnosis.* Similar to *norithe* and *obliqua* in presence of pronotal median fovea, differing in longer but feebly developed and interrupted lateral vertexal carinae and feebly elevated, Y-shaped facial ridge; occipital carina strongly crested between foveae only.

*Description.* Length 2.3-2.6 mm. Head with lateral vertexal carinae extending beyond level of vertexal foveae but feebly and brokenly developed; occipital carina limited to sharp crest between vertexal foveae only, not extended onto neck; vertexal foveae and circumambient sulcus as in *henroti*; facial ridge vaguely Y-shaped but not carinate, interantennal ridge forming sharp point at intersection with midfrontal ridge. Pronotum with small, shallow, but distinct median fovea in basal fourth; each side with small basal, two basolateral, and no procoxal foveae. Antenna about as described for group except IX and X about as long as wide. Male unknown.

*Type Series.* Holotype female (the American Museum of Natural History), Leatherman Gap, on Cowee Bald road, elevation 4000 feet, Macon and Swain counties, North Carolina, August 19, 1969, T. C. Barr, Jr. One female paratype, Leatherman Gap Road, elevation 3600 feet, July 24, 1970, T. C. Barr, Jr. Paratype in private collection of T. C. Barr, Jr.

*Material Seen.* The type series only, consisting of two females.



*Discussion.* Although no aedeagus could be examined, the external features appear distinctive enough that this species can be recognized from the description offered. It is superficially most closely allied with *A. norithe*, a species that occurs 17 miles to the west of Leatherman Gap, across the valleys of the Little Tennessee and Nantahala rivers. The type locality of *A. fovealis*, Leatherman Gap, is remarkable in harboring four species of *Arianops*, all of them in different species groups: *fovealis*, *gigantea*, *barbata*, and *parki*.

***Arianops obliqua*, new species**

Figures 27A, 27B

*Etymology.* Latin *obliquus*, slanting, oblique, referring to the strongly oblique anterior portions of the circumambient sulcus.

*Diagnosis.* Distinguished by very long, conspicuous lateral vertexal carinae, long and crested occipital carina, and Y-shaped facial ridge; pronotum with or without feeble, irregular median fovea.

*Description.* Length 2.2-2.4 mm. Head with lateral vertexal carinae long, extending well beyond level of vertexal foveae; occipital carina long, crested; vertexal foveae small, perforate; interantennal depression rather deep, as in *henroti*, with strongly convergent sides; facial ridge Y-shaped, but not carinate. Pronotum with or without small, irregular, median fovea in basal fourth; each side with basal, two basolateral, and no procoxal foveae; disc briefly elevated in midline near base, about as in *henroti*. Antenna about as described for group but VI and VII subequal, rounded, and VIII-X distinctly transverse. Male with small, sharp, median spine on fourth abdominal sternite; mesotrochanter with small spine. Aedeagus 0.26 by 0.20 mm. (holotype); basal capsule small, rounded, convex, without parameres; apical shelf rather short, side margins forming reflexed blades, four setae beneath right corner, one small seta in middle, one under left corner; internal sac with dorsal longitudinal fold culminating in crooked tube, spiny lobe beneath; copulatory piece with one or two digitiform processes, abruptly narrowed and angled to left.

*Type Series.* Holotype male (the American Museum of Natural History) and one female paratype, Unicoi Gap, elevation 2900 feet,

Towns and White counties, Georgia, August 9, 1969, T. C. Barr, Jr. One male and one female paratype, Brasstown Bald Road, elevation 2450 feet, Union County, Georgia, October 23-24, 1965, H. R. Steeves, Jr., and J. D. Patrick, Jr.; two male paratypes from same locality, May 6, 1972, H. R. Steeves, Jr., and T. N. King, Jr.

*Material Seen.* Five males and two females, including the holotype, five paratypes, and one male not designated a paratype.

*Discussion.* *Arianops obliqua* has the most conspicuous lateral vertexal carinae of any species of the *henroti* group. The short basal carina on the pronotal disc terminates anteriorly in a minute, elliptical depression or a minute, deplanate area, features that probably represent an obsolescent median fovea. The species appears in couplets 8 and 12 of the key, reflecting this variation.

At the type locality this species was collected from under large rocks on a moderate slope in second-growth deciduous forest, on the east side of Unicoi Gap below the Appalachian Trail. The locality on the Brasstown Bald Road is approximately 5 miles northwest of Unicoi Gap. A seventh specimen, not made a paratype, was taken on the southeast side of Turkey Mountain, Rabun County, Georgia, September 20, 1970, by H. R. Steeves, Jr., and T. N. King, Jr. This is the type locality for *Arianops truncata*, a species of the *neglecta* group; the site is 11 miles northeast of Unicoi Gap on a steep slope beside U. S. 76, at an elevation of 2440 feet.

***Arianops teyahalee*, new species**

Figures 28A, 28B

*Etymology.* Cherokee proper name applied to the type locality.

*Diagnosis.* Distinguished by very short lateral vertexal carinae and spine on third abdominal sternite of male, with two tubercles and median depression on fourth sternite.

*Description.* Length 2.2-2.3 mm. Head with lateral vertexal carinae present only for very short distance from antennal tubercles; occipital carina present or not; vertexal foveae and circumambient sulcus as in *henroti*; face almost declivous, interantennal ridge low and transverse or vaguely V-shaped. Pronotum without median

fovea; each side with one basal and two basolateral foveae, procoxal fovea obsolete. Antenna as described for group. Male with small, median spine on third abdominal sternite, two small tubercles on either side of shallow median depression on fourth sternite; mesotrochanter with small spine. Aedeagus 0.31 by 0.17 mm. (holotype); basal capsule a little flattened, longer than wide, dorsal aperture large; left paramere large, free, arcuate, articulating with dorsal wall of capsule, terminating in nine slender processes; apical shelf feebly emarginate, deeply notched on left side at juncture with capsule, right side with three setae below and three at apex; internal sac with lower spiny lobe; no distinct copulatory piece evident.

*Type Series.* Holotype male (the American Museum of Natural History), 0.7 mile east of Tatham Gap at head of Panther Creek, elevation 4200 feet, near Teyahalee (= Joanna) Bald, Graham County, North Carolina, near Cherokee County line, August 15, 1969, T. C. Barr, Jr., and Melisa J. Barr. Paratype female, Teyahalee Bald, July 5, 1960, T. C. Barr, Jr., and M. C. Bowling. Paratype in private collection of T. C. Barr, Jr.

*Material Seen.* The type series only, consisting of one male and one female.

*Discussion.* This is the only known species of *Arianops* having a free paramere, which happens to be on the left side. External morphology rather clearly aligns *teyahalee* with other species of the *henroti* group, from which it is readily distinguished by the feebly developed lateral vertexal carinae and the secondary sex characters of the male. The basal capsule is longer than wide, as in the *henroti* superspecies (*henroti*, *thornei*, *norithe*, and possibly *fovealis*), but the dorsal

aperture is large, as in *obliqua*. The absence of a copulatory piece is unique among known species of the group.

The holotype male occurred under large stones on a gentle slope in a wooded ravine, where it was taken together with four *Arianops nantahalae joanna*.

#### AFFINITIES BETWEEN THE GROUPS

A discussion of speciation in *Arianops* is probably premature at the present time. Undoubtedly speciation has been intense, on a scale equaled perhaps only among the strictly troglotic beetles isolated in various cave systems. Ten species of *Arianops* are known from Macon County, North Carolina, the area most intensively collected for these insects. The information available for Macon County may be indicative of the maximum degree of speciation in the genus.

Turning to the species groups, one can speculate on their probable affinities. In drawing the following tentative conclusions, I have assumed that certain characters in *Arianops* are primitive: prominent eye spines, robust form with convex abdomen, lateral vertexal carinae, median fovea on the pronotum, prominent spine or shelf on the abdomen of males, and broad, essentially entire apical shelf of the aedeagus.

I regard the *henroti* group as the most aberrant of the species groups because of the distinctive habitus, possibly an adaptation to life in the smaller interstices of the superficial humus layers. The *amplyoponica* and *nantahalae* groups seem to me to be allied by the spines, ridges, and knobs of the pronotum and its deep median fovea, as well as the prominent lateral vertexal carinae. The *alticola* group poses a problem, as it

---

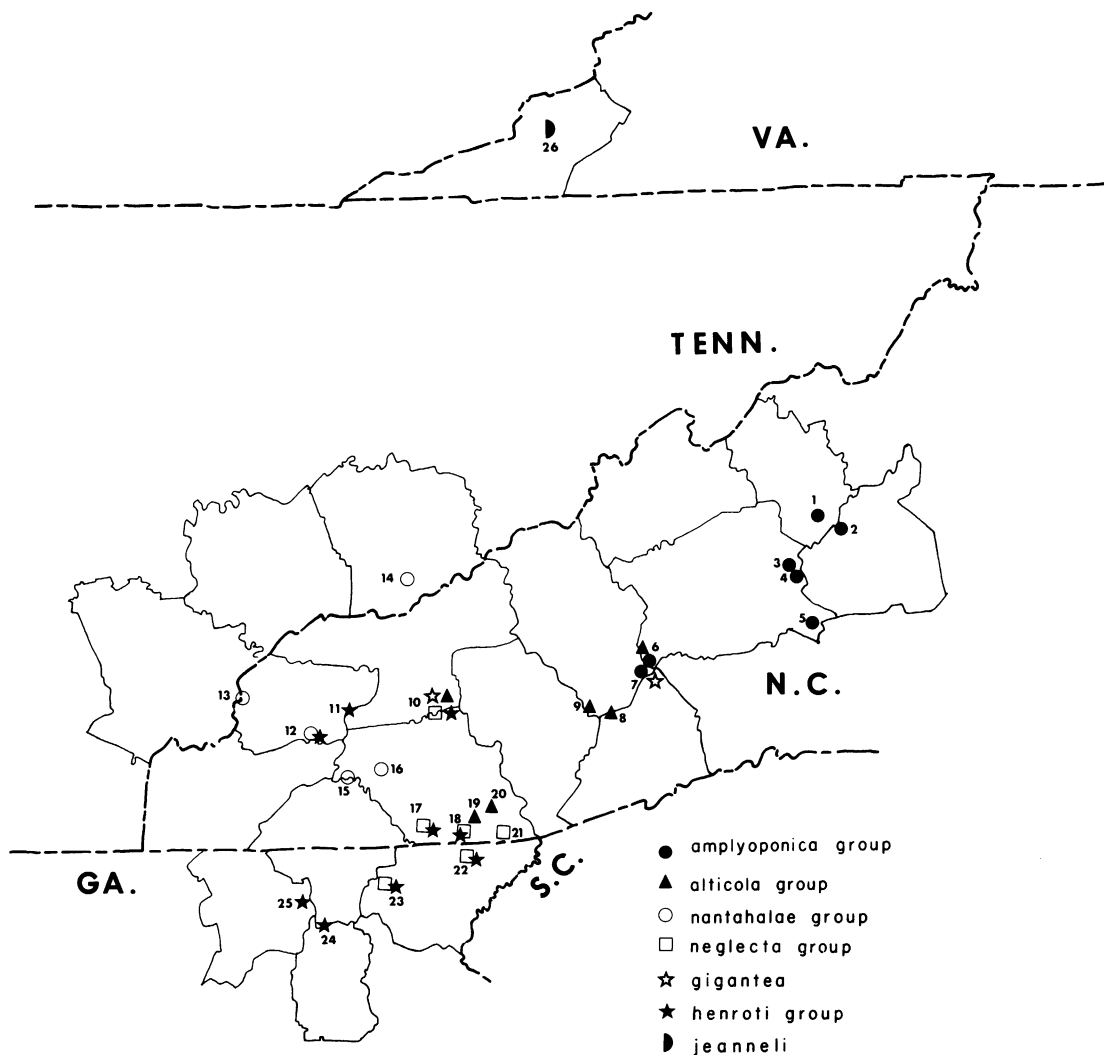
FIG. 29. Distribution of *Arianops* in the higher mountains of the southern Appalachians. Localities numbered as follows, with species found at each in parentheses: 1. Hamrick (*plectrops*). 2. Buck Creek Gap (*nodosa*). 3. Montreat (*plectrops*). 4. Round Knob (*plectrops*). 5. Round Mountain (*laminata*). 6. Mt. Pisgah (*spinicollis*, *alticola*). 7. Buck Spring Trail (*spinicollis*, *gigantea*). 8. Devils Courthouse (*alticola*). 9. Bearpen Gap (*alticola*). 10. Leatherman Gap (*barbata*, *fovealis*, *gigantea*, *parki*). 11. Cheoah Bald (*norithe*). 12. Teyahalee Bald (*nantahalae joanna*, *teyahalee*). 13. Johns Knob (*unicoi*). 14. Buckeye Nature Trail (*digitata*). 15. Old Road Gap (*nantahalae nantahalae*). 16. Dirty John Creek (*nantahalae nantahalae*). 17. Coweeta Hydrologic Laboratory (*coweeta*, *thornei*). 18. Turtle Pond Creek (*neglecta*, *henroti*). 19. Cliffside Lake (*alticola*). 20. Head of Buck Creek (*alticola*). 21. Satulah Mountain (*neglecta*). 22. Rabun Bald (*neglecta*, *henroti*). 23. Turkey Mountain (*truncata*, *obliqua*). 24. Unicoi Gap (*obliqua*). 25. Road to Brasstown Bald (*obliqua*). 26. Gilleys Cave (*jeanneli*).

has no lateral vertexal carinae and no pronotal spines or ridges. However, the habitus of both *alticola* and *barbata* is closest to that of species of the *amplyoponica* group, and both groups have very large, conspicuous abdominal spines in the males. Further, the rather heavy aedeagi of *alticola* and *barbata* are more similar to the aedeagi of the *amplyoponica* group than to any other group aedeagal pattern.

The remaining three groups—*neglecta*, *gigantea*, and *cavernensis*—constitute a third phyletic line within the genus. All species of these groups lack lateral vertexal carinae, the median fovea of

the pronotum is small, sometimes irregular, or absent, and the median abdominal spine of males is small. *Arianops gigantea* could be fitted into the *neglecta* group as simply a rather large, aberrant species were it not for the radically different aedeagus. The species of the *cavernensis* group are more slender than species of the *neglecta* group, and have reduced eye spines; the aedeagus, at least in most of those species in which it has been examined, retains the broad, often slightly bifurcate, apparently primitive form of the apical shelf.

Elsewhere (Barr, 1969) I have discussed the



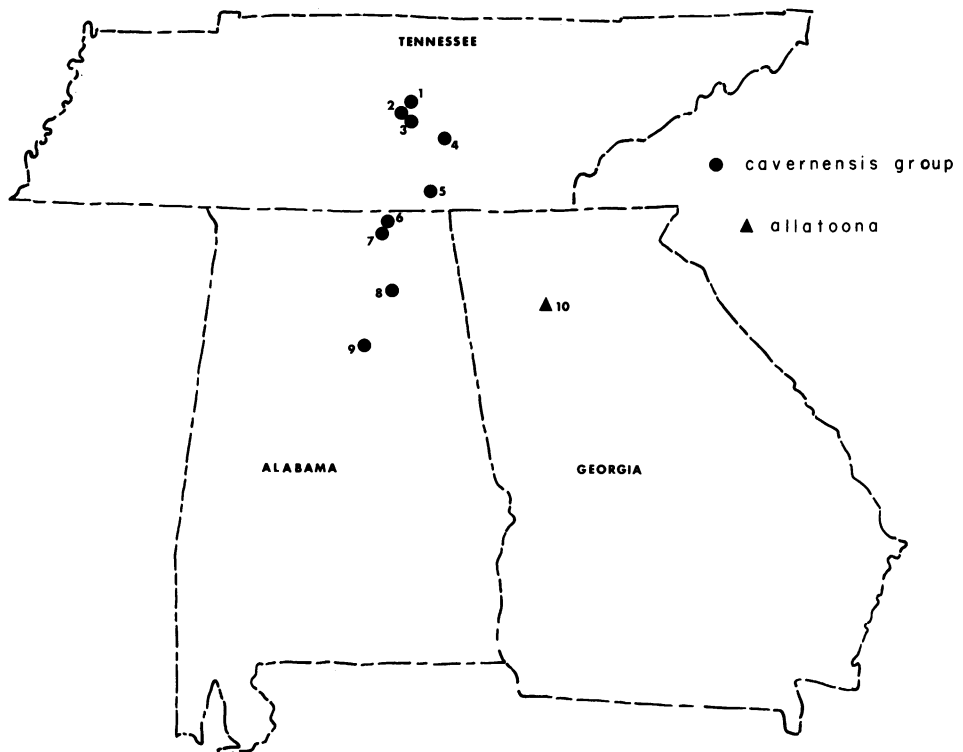


FIG. 30. Distribution of *Arianops* outside the higher mountains. Localities numbered as follows, with species found at each in parentheses: 1. John Hollins Cave (*pecki*). 2. Doolittle Cave (*pecki*). 3. Henpeck Mill Cave (*pecki*). 4. Cumberland Caverns (*stygica*). 5. Sewanee (*sewanee*). 6. Horseshoe Cave (*extera, steevesi*). 7. Williams Saltpeter Cave (*steevesi*). 8. Guntersville Caverns (*cavernensis*). 9. Blount Mountain (*kingi*). 10. Galts Landing (*allatoona*).

evolution and distribution of beetles of the family Carabidae in the southern Appalachians. There are some interesting zoogeographic parallels between carabids and the species of *Arianops*. (1) Overall diversity is greater south and west of the French Broad River valley: only the *amplyoponica* group is represented north of the French Broad, but south of the valley five additional groups occur. (2) Taxa in the Black and Great Craggy mountains are closely related to taxa which occur northward in the Appalachian Valley and Allegheny plateau: only the *amplyoponica* group, which is also represented in south-central Pennsylvania (and Arkansas), occurs in the Blacks and Great Craggies. (3) Some carabid taxa in the Blacks and Great Craggies "spill over" south of the French Broad valley only into the Mt. Pisgah area: again, the *amplyo-*

*ponica* group has a single species (*spinicollis*) on Mt. Pisgah.

At present there are no known pairs of vicar species of *Arianops*, with one member of the pair occurring in the North Carolina mountains and a closely related species occurring in the Allegheny plateau, nor is the burst of carabid diversity in the Great Smoky Mountains reflected as yet among known species of *Arianops*. Future collecting in the Smokies, in northwestern North Carolina, and in the Allegheny plateau, employing the special techniques necessary to find *Arianops*, should clarify patterns of speciation and distribution in this interesting pselaphid genus and contribute to a broader understanding of beetle zoogeography in the southern Appalachians.

## LITERATURE CITED

- Barr, Thomas C., Jr.  
 1961. Caves of Tennessee. Tennessee Div. Geol., Nashville, Bull. 64, vii + 567 pp., 1 pl., 150 figs.  
 1969. Evolution of the Carabidae (Coleoptera) in the southern Appalachians. In Holt, P. C. (ed.), The distributional history of the biota of the southern Appalachians. Virginia Polytech. Inst., Res. Monogr. 1, pp. 67-92.
- Barr, Thomas C., Jr., and Harrison R. Steeves, Jr.  
 1963. *Texamaurops*, a new genus of pselaphids from caves in central Texas (Coleoptera: Pselaphidae). Coleopt. Bull., vol. 17, pp. 117-120.
- Brendel, Emil  
 1893. Notes and descriptions of Pselaphidae. Trans. Amer. Ent. Soc., vol. 20, pp. 277-284.
- Brendel, Emil, and Henry F. Wickham  
 1890. The Pselaphidae of North America. Bull. Lab. Nat. Hist., State Univ. Iowa, vol. 1, pp. 216-304; vol. 2, pp. 1-84, pl. VI-XII.
- Casey, Thomas L.  
 1897. Coleopterological notices, VII. Ann. New York Acad. Sci., vol. 9, pp. 285-684.
- Holsinger, John R.  
 1963. Annotated checklist of the macroscopic troglobites of Virginia, with notes on their geographic distribution. Bull. Natl. Speleol. Soc., vol. 25, pp. 23-36.
- Jeannel, René  
 1948. Revision des *Amaurops* et genres voisins (Pselaphidae). Rev. Française d'Ent., vol. 15, pp. 1-19.  
 1950. Faune de France, 53. Coléoptères psélaphides. Paris, Paul Lechevalier, iv + 421 pp.
- Leng, Charles W.  
 1920. Catalogue of the Coleoptera of America north of Mexico. Mount Vernon, New York, x + 470 pp.
- Nicholas, Bro. G.  
 1960. Checklist of macroscopic troglotic organisms of the United States. Amer. Midland Nat., vol. 64, pp. 123-160.
- Park, Orlando  
 1951. Cavernicolous pselaphid beetles of Alabama and Tennessee, with observations on the taxonomy of the family. Geol. Surv. Alabama, Mus. Paper 31, 107 pp.  
 1953. Discrimination of genera of pselaphid beetles of the United States. Bull. Chicago Acad. Sci., vol. 9, pp. 299-331.  
 1956. New or little known species of pselaphid beetles from southeastern United States. Jour. Tennessee Acad. Sci., vol. 31, pp. 54-100.  
 1960. Cavernicolous pselaphid beetles of the United States. Amer. Midland Nat., vol. 64, pp. 66-104.









